Mangalam Campus
Mangalam Hills, Vettimukal P.O
Ettumanoor, Kottayam
Kerala-686631

MANGALAM COLLEGE OF ENGINEERING

Inspire | Imbibe | Innovate

Ph :+91-481-2710120, +91-481-2537053
+91-481-2533711, Fax: +91-481-2533700
Web : www.mangalam.ac.in
E-mail : info@mangalam.in

(Approved by AICTE, Affiliated to MGU / APJ Abdul Kalam Technological University, NAAC Accredited & ISO Certified Institution)

3.3.2 Number of research papers per teachers in the Journals notified on UGC website during the last five years (10)

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi) number		
						Link to website of the Journal	Link to article/paper/abstract of the article	Is it listed in UGC Care list/Scopus/ Web of Science/oth
Analysis of Pollution Trends in Subsurface Water At	Jetcy Elizabeth Philip, Kavya Prakash, Kelvin Jims, Libin Joseph, Senthilkumar R	Department of Civil Engineering	International Journal of Engineering Research & Technology	2021	2278-0181	https://www.ijert.org/icart-2021-volume-09-issue-09	https://www.ijert.org/analysis-of-pollution-trends-in-subsurface-water-at-poovanthuruth-	Google Scholar and Research g
Wastewater Treatment Technologies: A Review	Jayalekshmi S J, Minnu B, Jithin S, P E Muhammad Ajas, Dona Sunny	Department of Civil Engineering	International Journal of Engineering Research & Technology	2021	2278-0182	https://www.ijert.org/icart-2021-volume-09-issue-10	https://www.ijert.org/wastewater-treatment-technologies-a-review	Google Scholar and Research g
Experimental Study on Treating Dairy and Kitchen	Vilbin Varghese, Anjana Raj, Christeena Thomas, Aswathy V S, Athul Vinod	Department of Civil Engineering	International Journal of Engineering Research & Technology	2021	2278-0183	https://www.ijert.org/icart-2021-volume-09-issue-11	https://www.ijert.org/experimental-study-on-treating-dairy-and-kitchen-waste-water-using-	Google Scholar and Research g
Stability Analysis of Different Soil fill on Embankme	Mukthar V Basheer, Rajat Ravi, Sreedevi S, Sreelakshmi S, Vilbin Varghese	Department of Civil Engineering	International Journal of Engineering Research & Technology	2021	2278-0184	https://www.ijert.org/icart-2021-volume-09-issue-12	https://www.ijert.org/stability-analysis-of-different-soilfil-on-embankment-	Google Scholar and Research g
Environmental Noise Pollution Assessment and	Afeef Muhammed, Aravind J C, Betsy Sara Basil, B S Gayathri, Sankar	Department of Civil Engineering	International Journal of Engineering Research & Technology	2021	2278-0185	https://www.ijert.org/icart-2021-volume-09-issue-13	https://www.ijert.org/environmental-noise-pollution-assessment-and-mapping-of-	Google Scholar and Research g

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Design Optimization of X-Bracing using	Priya Venugopal, Revathy P, Sruthy K. P, Wilfred James, Sankar Bose	Department of Civil Engineering	International Journal of Engineering Research &	2021	2278-0186	https://www.ijert.org/icart-2021-volume-09-issue-14	https://www.ijert.org/design-optimization-of-x-bracing-using-sap2000	Google Scholar and Research gate
Study On Outrigger Structural System	Jeena Joshua, Adithya Vishwambharan	Department of Civil Engineering	International Journal of Engineering Research &	2021	2278-0187	https://www.ijert.org/icart-2021-volume-09-issue-15	https://www.ijert.org/study-on-outrigger-structural-system	Google Scholar and Research gate
Finite Element Modelling and Dynamic	Rahna Sajeeb, Adithya Viswambharan	Department of Civil Engineering	International Journal of Engineering Research &	2021	2278-0188	https://www.ijert.org/icart-2021-volume-09-issue-16	https://www.ijert.org/finite-element-modelling-and-dynamic-analysis-of-skew-bridge-	Google Scholar and Research gate
Review of Analysis of Irregular Building	Jerin M Jose, Kesiya Josy V, Likhith K V, Nayana P P, Adithya	Department of Civil Engineering	International Journal of Engineering Research &	2021	2278-0189	https://www.ijert.org/icart-2021-volume-09-issue-17	https://www.ijert.org/review-of-analysis-of-irregular-building	Google Scholar and Research gate
Waste Glass Powder as Partial Replacement of	Amurutha Raj, Mary D.C J, Abel Biju, Ajith C Jacob, Adithya Viswambaran	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0190	https://www.ijert.org/icart-2021-volume-09-issue-18	https://www.ijert.org/waste-glass-powder-as-partial-replacement-of-cement-review	Google Scholar and Research gate
Comparison of behavior of RCC and Steel Structure	Lavitha V and Gokul. P. V	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0191	https://www.ijert.org/icart-2021-volume-09-issue-19	https://www.ijert.org/comparison-of-behavior-of-rcc-and-steel-structure-using-	Google Scholar and Research gate
Numerical Analysis of Thin Plates using Finite Element	Arjun Prasad, Govind Shaji, Gokul P V	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0192	https://www.ijert.org/icart-2021-volume-09-issue-20	https://www.ijert.org/numerical-analysis-of-thin-plates-using-finite-element-software	Google Scholar and Research gate
Replacement of Coarse Aggregate with Plastic Fibers in	Vaishnavi A, Leskhmipriya Anil, Sooraj T Tharian, Praksh Mohan, Aswathy	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0193	https://www.ijert.org/icart-2021-volume-09-issue-21	https://www.ijert.org/replacement-of-coarse-aggregate-with-plastic-fibers-in-	Google Scholar and Research gate
Effect of Timber Members on Structures	Noel Johnson, Aswathy Soman	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0194	https://www.ijert.org/icart-2021-volume-09-issue-22	https://www.ijert.org/effect-of-timber-members-on-structures-under-seismic-	Google Scholar and Research gate

PRINCIPAL

Effect of Staircase on the Seismic Performance of	Kevin Kuruvila, Ann Mary Jose	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0195	https://www.ijert.org/icart-2021-volume-09-issue-23	https://www.ijert.org/effect-of-staircase-on-the-seismic-performance-of-	Google Scholar and Research gate
Comparison of Analysis of Normal Bridge and Horizontally	Mebin Mathew, Salini Theres Kurian	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0196	https://www.ijert.org/icart-2021-volume-09-issue-24	https://www.ijert.org/comparison-of-analysis-of-normal-bridge-and-horizontally-	Google Scholar and Research gate
Analysis of Building with Base isolation and	Sarah Mariam A, K S Selman, Nithya M, Shunmu Prasad, Salini Theres N	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0197	https://www.ijert.org/icart-2021-volume-09-issue-25	https://www.ijert.org/analysis-of-building-with-baseisolation-and-damper	Google Scholar and Research gate
Effects of Irregularities on the Seismic Response of	Paul Joseph, Reni Kuruvilla	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0198	https://www.ijert.org/icart-2021-volume-09-issue-26	https://www.ijert.org/effects-of-irregularities-on-the-seismic-response-of-a-high-	Google Scholar and Research gate
Study on Acceptability of Hyper loop in Kerala	Roshy Philip, Sherin Skaria, Tibin Gevarughese Kurian, Reni	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0199	https://www.ijert.org/icart-2021-volume-09-issue-27	https://www.ijert.org/study-on-acceptability-of-hyperloop-in-kerala	Google Scholar and Research gate
Investigation of Damages in Plan Irregular	Amith. M. M, D. Ramesh Kumar	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0200	https://www.ijert.org/icart-2021-volume-09-issue-28	https://www.ijert.org/investigation-of-damages-in-plan-irregular-buildings-due-to-	Google Scholar and Research gate
Seismic Response of RC Framed Building Resting on	Aswin S Nair, Geethu Lal	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0201	https://www.ijert.org/icart-2021-volume-09-issue-29	https://www.ijert.org/seismic-response-of-rc-framed-building-resting-on-sloping-	Google Scholar and Research gate
A Review on Impact of Heavy Vehicles on Highway	Arjun N. V, Neenu Vijayan, Swathy E.R , Timothy Ninan, Vaishnav V.K	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0202	https://www.ijert.org/icart-2021-volume-09-issue-30	https://www.ijert.org/a-review-on-impact-of-heavy-vehicles-on-highway-traffic	Google Scholar and Research gate
Micro-simulation Modelling in VISSIM for Long-	Alvin J James, Amal Prasad, Brinda P A, Reshma R, Arun Issac Varghese	Department of Civil Engineering	Published as conference Proceedings in	2021	2278-0203	https://www.ijert.org/icart-2021-volume-09-issue-31	https://www.ijert.org/microsimulation-modelling-in-vissim-for-long-term-	Google Scholar and Research gate

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of		
						Link to website of the Journal	Link to article/paper/abstract of the article	Is it listed in UGC Care list/Scopus/Web of Science/other, mention
A Multiple Regression Approach for Compressive Strength Modelling of Recovered Coarse Aggregate (RCA) Impregnated Concrete Matrix	Dr.G.K.Arunvivek, Dr.D.Rameshkumar Dr.D.Ambika	Department of Civil Engineering	Journal of Tierärztliche Praxis, Volume 40, pp.1188-1196. SCI Indexed	2020	0303-6286	https://tierarztliche.com	https://tierarztliche.com/gallery/v40.92.pdf	SCI
Sustainable Water treatement technologies : A review Tecnologias sustentables de tratamimieto de aguas una revision	Dr. Asha P Tom	Department of Civil Engineering	Sustainability Agri, Food and Environmental Reearch	2021	0719-3736	https://doaj.org	https://cuhso.uct.cl/index.php/safer/article/view/2474	citefactor index
IOT Based Smart Aquaponics System With Fuzzy Baseddecision Making System And Machine Learning Based Prediction	Gopika B, Dr. Vinodh P Vijayan	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology	July 2020	ISSN 2320 – 2602.		https://doi.org/10.30534/ijacst/2020/11972020	Google Scholar
A Combinatorial Optimized Knapsack Linear Space for Information Retrieval	Varghese S. Chooralil, Vinodh P. Vijayan, Biju Paul, M. M. Anishin Raj, B. Karthikeyan, G. Manikandan	Computer Science and Engineering	Journal of Computers, Materials & Continua, Tec science Press	2021			doi:10.32604/cmc.2021.012796	SCI
Energy Efficient Sustainable City Monitoring Using IOT Enabled Wireless Sensor Networks and Data Analytics	Vinodh P. Vijayan, Biju Paul,Varghese S. Chooralil,	Computer Science and Engineering	Journal of information Science and Engineering	2021			https://jise.iis.sinica.edu.tw/IISESearch/pages/View/PaperView.jsf?keyId=179_2408	SCIE
Challenges and its Solutions with Blockchain Technology Adoption in Enterprises	Ranju S. Kartha	Computer Science and Engineering	Turkish Online Journal of Qualitative Inquiry	2021			https://www.tojqi.net/index.php/journal/article/view/975/379	Google Scholar

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	2021			doi: 10.4108/eai.3-6-2021.170014	Scopus
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	#######			doi: 10.l144108/eai.3-6-2021.170014	Scopus
An Enhanced application for nutrition intake detection using DeepLearning and IoT	Akshatha Prabhakaran, Amrutha Surendran, Anjali K Rejive, Anjana Babu, Neethu Maria	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology	Jul/20	ISSN:2320-2602		http://www.warse.org/IJACST/static/pdf/file/ijacst08972020.p	Google Scholar
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	#######			doi: 10.4108/eai.3-6-2021.170014	Scopus
Result prediction system using machine learning	Megha S , Nitha Johny , Raicy Ann Mammen , Sandra M , Ms. Neena Joseph	Computer Science and Engineering	International Journal of Advanced Computer Science and Technology (IJACST)	July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst09972020.p	Google Scholar
AUTOMATIC ACCIDENT DETECTION USING DEVICE	Aneeta Mary Binny,Roopika Jacob,Stella Maria Jose	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology	July 2020	ISSN 2320 - 2602		10.30534/ijacst/2020/14972020	Google Scholar
REALTIME PATIENT MONITORING SYSTEM USING IoT	Abhirami Ravikumar,Amrutha V Shenoy,Annmary Joppan,Neema George	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology(IJACST)	July 2020	ISSN-2320-2602			Google Scholar

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	########				
NTEGRATED IAM ANAGEMENT YSTEM USING OT	Basil Thomas , Godson John , Jaimon Thomas , Vishnu Kumar , Simy Mary Kurian	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology(IJACST)	########	ISSN 2320 - 2602		CST/static/pdf/file/ijacst05972020.p	Google Scholar
nergy efficient lata aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	########			doi: 10.4108/eai.3-6-2021.170014	Scopus
Werable Device to track Covid 19 Symptoms	Sussana Sajan, Saran M S, Midhun Prasad, Minza Thazni, Gayathri R Krishna	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	Special Issue 2021	ISSN:2278-0181		https://www.ijert.org/research/wearable-device-to-track-covid-19-symptoms-IJERTCONV9IS07	Google Scholar
Gaze Based Password Entry using Android Pin Based Authentication Methods to Reduce shoulder Surfing Attacks	Devipriya S Kumar,Fincy Joseph,Mary Nimisha, Sreelakshmi S Nair,Gayathri R Krishna	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst06972020.pdf	Google Scholar
HELPMATE-A Women Safety Device Using IoT &Machine Learning	Sreelakshmi g Nair,Nandu Krishnan K M,Vishnu Raj P,Gayathri R Krishna	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst01972020.p	Google Scholar

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Wifi based ad-hoc network for disaster management	Joel Abraham, Denny Salu, Renjith CS, Tinu Thomas	Computer Science and Engineering	International journal of computing, communication and networking	April - June 2020	ISSN 2319-2720		http://www.warse.org/IJCCN/static/pdf/file/ijccn07922020.pdf	Google Scholar
Smart Techie: An Online Examination System with Improved Use of Descriptive Answering	Nishamol Shaji, Santhy Rachel Thomas, Shalu Treesa, Sneha Philip, Tinu Thomas	Computer Science and Engineering	International Journal of Information Systems and Computer Sciences	May- June 2020	ISSN 2319 – 7595		http://www.warse.org/IJISCS/static/pdf/file/ijiscs04932020.pdf	Google Scholar
Smart Ambulance with Patient Health Monitoring	Arya mol K S,Febin Jo Kurian,Albin Shaji ,Adarsh Venisdesh,Merlin Mary James	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	Jul-20	ISSN 2320-2602		http://www.warse.org/IJACST/static/pdf/file/ijacst04972020.pdf	Google Scholar
Fake news Detaction using Artificial Intelligence	Arjun Raj,Ajay Thambi,Aakash Kashyap,Merlin Mary James	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	Jul-20	ISSN 2320-2602		http://www.warse.org/IJACST/static/pdf/file/ijacst07972020.pdf	
DC Performance Analysis of III-V/Si Heterostructure Double Gate Triple Material PiN Tunneling Graphene Nanoribbon FET Circuits with Quantum Mechanical Effects	Dr.T.D Subash	ELECTRONICS & COMMUNICATION ENGINEERING	Journal of Computational Electronics (Springer)	2021	1569 - 8025	10.1007/s10825-020-01649-5	10.1007/s10825-020-01649-5	
"Utilizing Radiant Nanoparticles in Silicon for Balanced White Color Adapters"	Dr.T.D Subash	ELECTRONICS & COMMUNICATION ENGINEERING	Journal of Silicon (Springer)	2020	1876-990X	10.1007/s12633-020-00739-0	10.1007/s12633-020-00739-0	
A Novel Approach to White Light Radiation From Silicon Based Tunnel Junction LEDs"	Dr.T.D Subash	ELECTRONICS & COMMUNICATION ENGINEERING	Journal of Silicon (Springer)	2020	1876-990X	10.1007/s12633-020-00599-8	10.1007/s12633-020-00599-8	
"Security Improvement in Block Chain Technique enabled Peer to Peer Network"	Dr.T.D Subash	ELECTRONICS & COMMUNICATION ENGINEERING	Peer-to-Peer Networking and Applications (Springer),	2020	1936-6450	10.1007/s12083-020-00971-w	10.1007/s12083-020-00971-w	

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

"InAs/Si Hetero-junction channel to enhance the performance of DG-TFET with Graphene Nanoribbon: An Analytical Model"	Dr.T.D Subash	ELECTRONICS & COMMUNICATION ENGINEERING	Journal of Silicon (Springer),	2020	1876-990X	https://link.springer.com/article/10.1007/s12633-020-00546-7	https://link.springer.com/article/10.1007/s12633-020-00546-7	
Improved DC Performance Analysis of a Novel Asymmetric Extended Source Tunnel FET (AES-TFET) for Fast Switching Application	Dr.T.D Subash	ELECTRONICS & COMMUNICATION ENGINEERING	Journal of Silicon (Springer),	2021	1876-990X	10.1007/s12633-021-01147-8	10.1007/s12633-021-01147-8	
COVID 19 an infectious disease influenced in modern era - recent survey in India"	Eugene Peter	EEE	Materialstoday: Proceedings (Elseiver)	2020-2021	Volume 43, Part 6, Pages 3325-3960 (2021)	https://www.sciencedirect.com/journal/materials-today-proceedings/vol/43/part/P6	https://www.sciencedirect.com/science/article/pii/S2214785320376598	https://www.scopus.com/sourceid/21100370037?origin=resultslist
Utilizing Radiant nanoparticles in silicon for Balanced white colour adapters	Eugene Peter	EEE	Silicon	2020-2021	vol.11, no.5,pp.00633,ISSN:1876-990X	https://link.springer.com/journal/12633:	https://link.springer.com/article/10.1007/s12633-020-00739-0	https://www.scijournal.org/impact-factor-of-silicon-neth.shtml
Characterization of tensile fracture in squeeze casted Al-Si piston alloy	Dr.Pratheesh K	MECHANICAL	International Journal of cast Metals Research	2021	1.7E+07	https://www.tandfonline.com/journals/ycmr20	https://www.tandfonline.com/doi/abs/10.1080/13640461.2021.1889163?journalCode=ycmr20	
enhanced mechanical and tribological properties and microstructural charecteristics of B4C Particles Re-inforced Composite: A short review	Dr.Pratheesh K	MECHANICAL	Johnson Matthey Technology review	2021	2.1E+07	https://www.technology.matthey.com	https://www.technology.matthey.com/article/66/2/186-197/	

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Comparison of Mechanical and wear properties between LM6, LM6/B4C and LM6/B4C/Gr aluminium metal matrix composites	Dr.Sreekumar V	MECHANICAL	Materials Today Proceedings-Elsevier	2021	2214-7853	https://www.sciencedirect.com	https://www.sciencedirect.com/science/article/pii/S2214785321004314	
Fabrication &analysis of LM13/B4C/Gr hybrid metal matrix composites	Dr.Sreekumar V	MECHANICAL	Materials Today Proceedings-Elsevier	2021	2214-7853	https://www.sciencedirect.com	https://www.sciencedirect.com/science/article/pii/S2214785321042784	
Capacity approach for air pollution control in automotive engines through MFAC of hydrocarbons	Dr.Libin P Oommen	MECHANICAL	Environmental Science and Pollution Research	2021	1614-7499	https://www.springer.com/journal/11356/	https://pubmed.ncbi.nlm.nih.gov/33392993/	
Characterization of tensile fracture in squeeze casted Al-Si piston alloy	Dr. Manoj George	MECHANICAL	International Journal of cast Metals Research	2021	1.7E+07	https://www.tandfonline.com	https://www.tandfonline.com/doi/full/10.1080/13640461.2021.1889163	
Machinable green bodies by dry pressing of alumina powder using natural rubber latex as a cross-linkable binder	Dr. Praveen Wilson	MECHANICAL	Powder Technol	2021	0032-5910	https://www.journals.elsevier.com/powder-technology	https://www.sciencedirect.com/science/article/abs/pii/S0032591021001649	
Thermally Insulating Robust Carbon Composite Foams with High EMI Shielding from Natural Cotton	Dr. Praveen Wilson	MECHANICAL	Journal of Materials Science & Technology	2021	1E+07	https://www.journals.elsevier.com/journal-of-materials-science-and-technology	https://www.sciencedirect.com/science/article/abs/pii/S1005030221004060	
Carbon foams with low thermal conductivity and high EMI shielding effectiveness from sawdust	Dr. Praveen Wilson	MECHANICAL	Industrial Crops and Products	2020	0926-6690	https://www.journals.elsevier.com/industrial-crops-and-products	https://www.sciencedirect.com/science/article/abs/pii/S0926669019310866	

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

wealth:Lightweight, mechanically strong and conductive carbon aerogels from waste tissue paper for electromagnetic shielding and CO2 adsorption	Dr. Praveen Wilson	MECHANICAL	Chemical Engineering Journal	2020	1385-8947	https://www.journals.elsevier.com/chemical-engineering-journal	https://www.sciencedirect.com/science/article/abs/pii/S1385894719320315	
Preparation of ceramic foam spheres by injection molding of emulsions	Dr. Praveen Wilson	MECHANICAL	Journal of Asian Ceramic Societies	2020	2187-0764	https://www.tandfonline.com/journals/tace20	https://www.tandfonline.com/doi/full/10.1080/21870764.2019.1695558	
Nanowire-decorated SiC foam from tissue paper and silicon powder by filter-pressing	Dr. Praveen Wilson	MECHANICAL	International Journal of Applied Ceramic Technology	2020	1.7E+07	https://ceramics.onlinelibrary.wiley.com/	https://ceramics.onlinelibrary.wiley.com/doi/abs/10.1111/ijac.13412?af=R&utm_source=researcher_app&utm_medium=referral&utm_campaign=RESR_MRKT_Researcher_inbound&sid=researcher	
Organisational Citizenship Behaviour: Relationship with Job Satisfaction	Dr. Sibu C. Chithran	Management Studies	Journal of Management and Innovative Information Technology	2021	2395-4981			National Journal
Analysis of Work Family Conflict Dynamics with Reference to Women Managers in Banking Sector	Dr. Sibu C. Chithran	Management Studies	Test Engineering and Management	2020	0193-4120	http://www.testmagzine.biz/index.php/testmagzine	http://www.testmagzine.biz/index.php/testmagzine/article/view/4001	Journal with h-index & SCImago Rank

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

3.2 Number of research papers per teachers in the Journals notified on UGC website during the last five years (10)

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi)		
						Link to website of the Journal	Link to article/paper/abstract of the article	Is it listed in UGC Care list/Scopus/Web of Science/other, mention
IOT Based Smart Aquaponics System With Fuzzy Baseddecision Making System And Machine Learning Based Prediction	Gopika B, Dr. Vinodh P Vijayan	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology	July 2020	ISSN 2320 - 2602		https://doi.org/10.30534/ijacst/2020/11972020	Google Scholar
A Combinatorial Optimized Knapsack Linear Space for Information Retrieval	Varghese S. Chooralil, Vinodh P. Vijayan, Biju Paul, M. M. Anishin Raj, B. Karthikeyan, G. Manikandan	Computer Science and Engineering	Journal of Computers, Materials & Continua, Tec science Press	2021			doi:10.32604/cmc.2021.012796	SCI
Energy Efficient Sustainable City Monitoring Using IOT Enabled Wireless Sensor Networks and Data Analytics	Vinodh P. Vijayan, Biju Paul,Varghese S. Chooralil,	Computer Science and Engineering	Journal of information Science and Engineering	2021			https://jise.iis.sinica.edu.tw/JISESearch/pages/View/PaperView.jsf?keyId=179_2408	SCIE
Challenges and its Solutions with Blockchain Technology Adoption in Enterprises	Ranju S. Kartha	Computer Science and Engineering	Turkish Online Journal of Qualitative Inquiry	2021			https://www.tojqi.net/index.php/journal/article/view/975/379	Google Scholar
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	2021			doi: 10.4108/eai.3-6-2021.170014	Scopus
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	June 2021			doi: 10.I14108/eai.3-6-2021.170014	Scopus
An Enhanced application for nutrition intake detection using DeepLearning and IoT	Akshatha Prabhakaran, Amrutha Surendran, Anjali K Rejive, Anjana Babu, Neethu Maria John	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology	Jul-20	ISSN:2320-2602		http://www.warse.org/IJACST/static/pdf/file/ijacst08972020.pdf	Google Scholar
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy, Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	June 2021			doi: 10.4108/eai.3-6-2021.170014	Scopus
Result prediction system using machine learning	Megha S , Nitha Johny , Raicy Ann Mammen , Sandra M , Ms. Neena Joseph	Computer Science and Engineering	International Journal of Advanced Computer Science and Technology (IJACST)	July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst09972020.pdf	Google Scholar
AUTOMATIC ACCIDENT DETECTION USING DEVICE	Aneeta Mary Binny,Roopika Jacob,Stella Maria Jose	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology	July 2020	ISSN 2320 - 2602		10.30534/ijacst/2020/14972020	Google Scholar
REALTIME PATIENT MONITORING SYSTEM USING IoT	Abhirami Ravikumar,Amrutha V Shenoy,Annmary Joppan,Neena George	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology(IJACST)	July 2020	ISSN-2320-2602			Google Scholar
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy We	3 June 2021			doi: 10.4108/eai.3-6-2021.170014	Scopus
INTEGRATED DAM MANAGEMENT SYSTEM USING IOT	Basil Thomas , Godson John , Jaimon Thomas , Vishnu Kumar , Simy Mary Kurian	Computer Science and Engineering	International Journal of Advances in Computer Science and Technology(IJACST)	1 July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst05972020.pdf	Google Scholar
Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization	Neethu Maria John, Neena Joseph , Nimmymol Manuel , Sruthy Emmanuel and Simy Mary Kurian	Computer Science and Engineering	EAI Endorsed Transactions on Energy	3 June 2021			doi: 10.4108/eai.3-6-2021.170014	Scopus

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Internal Quality Assurance Cell (IQAC)
Mangalam College of Engineering
Kottayam, India - 686 631

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING

Werable Device to track Covid 19 Symptoms	Sussana Sajan, Saran M S, Midhun Prasad, Minza Thazni, Gayathri R Krishna	Computer Science and Engineering	International Journal of	Special Issue 2021	ISSN:2278-0181		https://www.ijert.org/research/wearable-device-to-track-covid-19-symptoms-IJERTCONV9IS07008.pdf	Google Scholar
Gaze Based Password Entry using Android:Pin Based Authentication Methods to Reduce shoulder Surfing Attacks	Devipriya S Kumar,Fincy Joseph,Mary Nimisha, Sreelakshmi S Nair,Gayathri R Krishna	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst06972020.pdf	Google Scholar
HELPMATE-A Women Safety Device Using IoT &Machine Learning	Sreelakshmi g Nair,Nandu Krishnan K M,Vishnu Raj R,Gayathri R Krishna	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	July 2020	ISSN 2320 - 2602		http://www.warse.org/IJACST/static/pdf/file/ijacst01972020.pdf	Google Scholar
Wifi based ad-hoc network for disaster management	Joel Abraham, Denny Salu, Renjith CS, Tinu Thomas	Computer Science and Engineering	International journal of computing, communication and networking	April - June 2020	ISSN 2319-2720		http://www.warse.org/IJCCN/static/pdf/file/ijccn07922020.pdf	Google Scholar
Smart Techie: An Online Examination System with Improved Use of Descriptive Answering	Nishamol Shaji, Santhy Rachel Thomas, Shalu Treesa, Sneha Philip, Tinu Thomas	Computer Science and Engineering	International Journal of Information Systems and Computer Sciences	May- June 2020	ISSN 2319 – 7595		http://www.warse.org/IJISCS/static/pdf/file/ijiscs04932020.pdf	Google Scholar
Smart Ambulance with Patient Health Monitoring	Arya mol K S,Febin Jo Kurian,Albin Shaji ,Adarsh Venisdesh,Merlin Mary James	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	Jul-20	ISSN 2320-2602		http://www.warse.org/IJACST/static/p	Google Scholar
Fake news Detection using Artificial Intelligence	Arjun Raj,Ajay Thambi,Aakash , Kashyap,Merlin Mary James	Computer Science and Engineering	International Journal of Advances in Computer Science & Technology(IJACST)	Jul-20	ISSN 2320-2602		http://www.warse.org/IJACST/static/pdf/file/ijacst07972020.pdf	

Internal Quality Assurance Cell (IQAC)
Mangalam College of Engineering
Kottayam, India - 686 631

for HOD

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
EDAPPALLY P.O.

ISSN 2320 - 2602

Volume 9 No.7, July 2020
International Journal of Advances in Computer Science and Technology
Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst11972020.pdf
https://doi.org/10.30534/ijacst/2020/11972020

IOT BASED SMART AQUAPONICS SYSTEM WITH FUZZY BASED DECISION MAKING SYSTEM AND MACHINE LEARNING BASED PREDICTION

Gopika B[1], Dr. Vinodh P Vijayan[2]
[1] M.Tech Student, Department of Computer Science and Engineering, Mangalam Campus, Ettumanoor, Kottayam ,India, gopikabinshy@gmail.com
[2]Associate Professor and HOD, Department of Computer Science and Engineering, Mangalam Campus, Ettumanoor, Kottayam ,India, vinodhpvijayan@yahoo.com

ABSTRACT

Aquaponics is an emerging area in food production method which combines traditional hydroponics with aquaculture in a symbiotic environment that facilitates a sustainable system with necessary input as all the water and nutrients within are re-circulated in order to grow terrestrial plants and aquatic life. When aquaponics system meets with technology it seems to produce some remarkable outputs which makes it efficient and productive technology. In Iot Based Smart Aquaponics System with Fuzzy Logic, we take different readings regarding the pH level, temperature, moisture content and the level of the water by using different sensors. Readings from each of these sensors are stored in the server for future use. Also these values are used by the fuzzy controller which controls the overall working of the system in drastic condition. Iot eliminates the gap between the physical world and digital world. In order to introduce technologies to the traditional aquaponics system, we use of Arduino, Fuzzy controller and Internet of Things.

Key words : Aquaponics, Arduino, IOT, fuzzy logic, Machine Learning, SVM, Matlab

1. INTRODUCTION

Aquaponics is a new cultivation technology and so many of us are not more aware about that. It is an emerging technology which combines both aquaculture (rearing of fish) and hydroponics (the process of cultivation of plants without soil) together into a single system. How it is possible? This is a system which includes a fish tank as a part of aquaculture and a growing bed for cultivation of plants. Excreta of the fish are used as fertilizer for the growth of plants. For that, water from the fish tank is passed to the growing bed. In the growing bed, microorganisms present in the roots of plants breaks the toxic contents present in the waste water, purifies it and get pumped back to the fish tank. This is a cyclic process. The problem is that, as it is a cyclic process we have no idea about the quality of water. It does not give any guarantee that the water which gets pumped back into the fish tank is free from toxic contents. If there exist any presence of harmful substances in the water then it results for the death of aquatic animals in the tank. In the paper "IoT based Aquaponics Monitoring System" by Abhay Dutta,[1] they used different features to monitor pH value, temperature and humidity level, water level using the specific sensors has been done and then after perceiving those values from the sensors, the values were displayed through a 16*2 Liquid Crystal Display as well as on the web by the application of Internet of Things. To connect the sensors with the internet, the database server and application server can be managed so as to display the information regarding the sensors. In order to introduce technology to the traditional aquaponics system, they use Raspberry Pi microcomputer and Internet of Things in the system has been done.

In "IoT Fuzzy Logic Aquaponics Monitoring and Control Hardware Real-Time System" by Adnan Shaout and Spencer G. Scott [2], they introduced fuzzy logic for the evaluation of input and to generate their specific output. Instead of Raspberry Pi, they used Arduino Uno R3 board for their hardware. In our paper we are combing Aquaponics system with fuzzy logic and Internet Of Things along with machine learning for decision making. SVM classifier is used as the classifier. Also we are using the same Arduino Uno R3 board as our hardware. Here we use different sensors for reading values like pH value, Temperature level, water level and Moisture content. These values can be monitored by the client (user) over mobile application through Internet Of Things.

The paper aims to design an aquaponics monitoring and control system that is accurate, low maintenance, low cost and convenient. The main objective of this paper was to create a system that removes the trouble of maintenance from the user.

As we mentioned earlier, Arduino Uno R3 board is selected for the implementation of its hardware section. It was found to have drawbacks because of the programming language which we use is abstracted to high level. Therefore we use matlab for better efficiency. Sensors sense the data at every 30secomds. Fuzzy logic is used to evaluate the input and automatically provide the proper outputs.

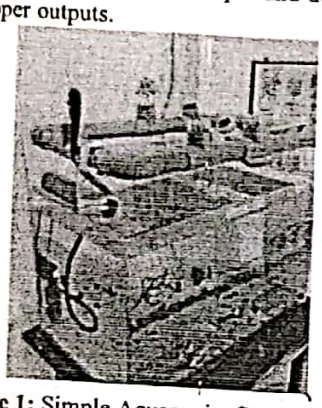


Figure 1: Simple Aquaponics System

2. LITERATURE REVIEW

Dr. J Rakocy along with his friends started a research in the usage of deep water culture hydroponics grow bed in an extensive aquaponics system and found rapid growth of root in the system. Also they found that the system runs fit with low pH value [3]. Aquaponics is an inexhaustible way for cultivating organic vegetables and fruits without the use of any chemical fertilizers. It is technique which is tot lly eco-friendly [4].

Aquaponics is one of the developing technologies whose main intention is to reuse the nutrients pulled out by fishes in the fish tank and is utilized for the growth of plants. This will helps to avoid the use of toxic pesticides, fertilizers and insecticides [5]. An Arduino Uno Microcontroller will provide an accurate control over the aquaponics cycle. It will helps us to control the system from anywhere in the world [7]. Wang proposed a method about different sensors and about their controlling. This is an interactive application in which the data is occupied by a webcam. Also as mentioned that this is an interactive method, the users can continuously monitor and control the system.

Arduino is used in its hardware system [9]. Cho Zin Myint and his friends present a new sensor interface device for monitoring the quality of water. It works in an IoT environment. It also include Zigbee based wireless communication module. FPGA (Field Programmable Gate Array) is the core component in his proposed system [10]

3. ARCHITECTURE

Coming to the architecture side we have a fish tank, different sensors, grow bed, embedded section, fresh water tank etc. As we mentioned earlier water in the fish water gets contaminated due to the presence of fish waste material. Therefore we need to purify them for the healthy growth of aquatic lives in it. Also we need to maintain a particular water level in the tank. An ultrasonic sensor is connected with the fish tank which checks the water level which is connected to an Arduino UNO R3. Also it contains other sensors like pH sensor, Temperature and Humidity sensors. Senses read the data in every 30seconds. All the readings are passed into the Arduino board. Inorder to provide more reliability Matlab is used for programming phase.

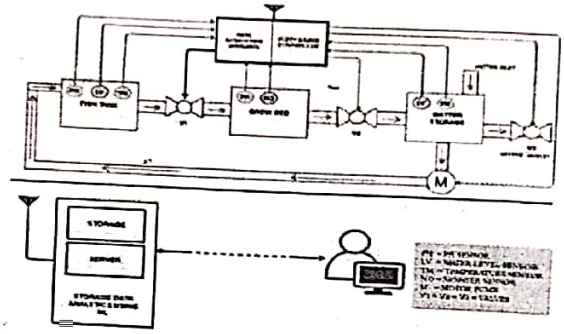


Figure 2: General architecture of the system

At first consider the situation in a fish tank. Sensors read the value of water level, pH and temperature from the fish tank at every 30 seconds. These values are evaluated by fuzzy based controller and the results get displayed in the 16*2 lcd display. Valve is placed outside the fish tank. Whenever the pH of the water is high, a buzzer sound will be produced as the output and a trigger message is triggered to open the valve so the water will flows towards the grow bed for purification. In the same time, ultrasonic sensor senses the water level and if it is below 40% a notification will be send to the user both through the lcd display and to their phones.

Thus the user can automatically give instruction to pump water from the second water tank which has purified water to the fish tank. Plants in the grow bed will absorb the water coming from the fish tank. It breaks down the toxic content present in it thereby control its pH content. Moisture sensor senses the moisture content in the soil. When the amount of water in the soil is below the required value then water is sprayed into the soil. After purification pH of the water is again calculated before leaving them to the tank. Water is allowed to pass in the second tank only it satisfies the required pH value.

Machine learning is an idea to learn from examples and experience without being explicitly programmed. Instead of writing code we feed data to the generic algorithm and it builds logic based on the data given. Working of the system depends on the output of Fuzzy system. Output data gets stored in the server. As the sensor senses the data at each 30seconds, huge amount of data gets stored in the server. Machine learning makes prediction on the basis of this data and makes changes by giving a new rule condition to the fuzzy system.

3.1 Block Diagram

All the values are evaluated by the fuzzy inference system (Fuzzy based controller). Their output from the fuzzy inference system is displayed in an LCD monitor, which helps the user to monitor and to take necessary actions if they are around. Also the values are stored in the server so that the user can also monitor and control the system from anywhere around the world.

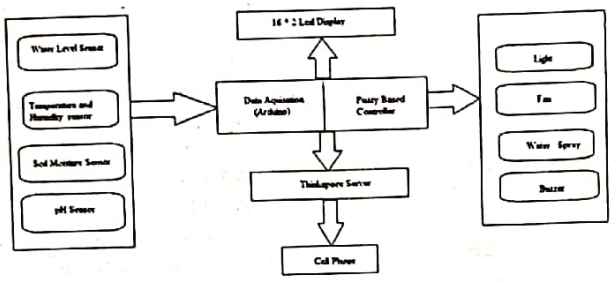


Figure 3: Block Diagram

An LED light (light), buzzer, water spray and a heater is also been placed in the system for representing the outputs. pH of the water from the fish tank will be labelled by 3 membership functions in the fuzzy inference system. It can be acidic, neutral or basic. Most commonly the water from the fish tank will be acidic in nature.

Buzzer will get triggered once when the pH level is acidic and twice when it shows basic in nature. It does not provide any sound when the pH is of required form. Similarly when the temperature of the water and moisture of the soil is also represented using 3 membership functions (high, normal, low). Temperature is controlled using a fan and if the moisture value is beyond the expected value in the soil then it is cleared by using a water sprayer.

For knowing the water level we are using ultrasonic sensors. LED's are used to determine their values. They are represented in percentage. We consider 5 different ranges of membership function for representing the water levels. So when the output is 40% ie., only 40% of water is left in the tank then 2 led lights will glow each indicating 20%.

3.2 Internal Design

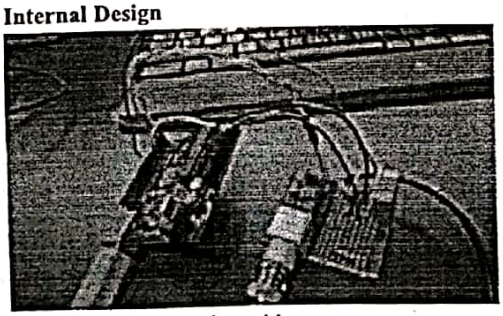


Figure 4: Arduino with sensors

Thinkspace server is an open source cloud platform which is mainly used for projects which works with the application of Internet of Things. It will help us to collect and store sensor data in cloud platform. It can also been defined as an application of IoT. Our device or application can communicate with ThingSpeak using a RESTful API, and we can either keep our data private or public. In addition to this, ThingSpeak can also been used to analyze and act on our data. The main use of this application is to collect data from sensors and retrieve it whenever user wants.

The Arduino is a widely used controller board with ATMEL328P microcontroller. It has 20 input/output pins. The Arduino has a widespread support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.

pH Sensor, we can use pH1000 polycarbonate pH sensor. It is sensor which is mostly used in laboratories. They provide reliable and stable readings.

Ultrasonic Sensor (HC-SR04) along with the help of some LED's, we can sense the amount of water present in a tank in percentage. LED's represents the percentage of water in the water tank. Here we are using 5 LED's. Each one will represent a percentage of 20%.

Temperature and Humidity Sensor / module (DHT 22) are very cheap in cost with great performance. It is an advanced version of DHT11. Its temperature measuring range varies from -40 to +125 degree Celsius with 0.5 degree accuracy. It also has better humidity measuring range from 0 to 100% with 2 to 5% of accuracy. DHT22 consist of a humidity sensing component and an NTC temperature sensor or Thermistor an IC for measuring the humidity. The thermistor is a variable resistor that changes the resistance with the change in its temperature.

Moisture Sensor, FC-28 is used to measure soil moisture. It checks the moisture content on the roots of plants which get cultivated in the growing bed. It can be used to save water which is present in grow bed with the help of Arduino. It consists of two parts, a main sensor and a control board. The main sensor board is two-layered that goes into the soil. It also has 2 male headers which are connected to the control board. The control board is an amplifier or a converter which convert analog signal into digital signal. Digital data is controlled by a potentiometer which is in-built in the control board. The output of the sensor will be either 0 or 1. This output is passed into the Arduino. The control board also consist of 2 LED's. Among them one is a power-on LED and the other one works with the digital output pin.

4. EXPERIMENTATION AND RESULTS

According to our project we can conclude it by the following results. Every living thing in the Aquaponics system, whether it be the fish, the plants, or the bacteria, they requires an optimal pH value, Temperature value, water level and an appropriate humidity range for its existence. Therefore continuous monitoring of these values are essential for their survival otherwise it may result for the death of aquatic organisms.

From the project we can find that the ideal pH value required lies in between 6.8 and 7.4. We need to consistently monitor and adjust the pH level to ensure that our system works properly. When pH is low then we need to increase the alkalinity of the water. This can be done by combining calcium carbonate and potassium carbonate in equal amount of water. If pH is high then increase the acidity of the water to reduce the pH value.

Adequate water supply should be there in the system. About 40% of water should be there in the tank else the amount of oxygen dissolved in the water gets lowered which affects the life of fish in tank drastically.

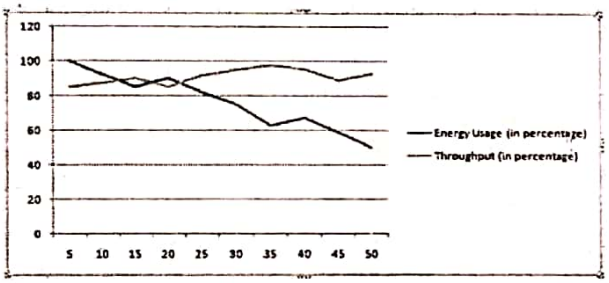


Figure 4: Graph showing energy usage and throughput of the system

Fishes can be categorized into 3 sections; cold water living fish, cool water fish and warm water fish. Tropical fishes can sustain their life with a temperature value of 22-32 degree Celsius. But for cold water fish they vary to 10-18 degree Celsius. Rise in temperature as well as intensity can cause for the solubility of many toxic contents in water. Dissolved oxygen is largely inclined by various factors like pH, temperature and water quality. The optimal temperature required for an aquaponics is the following; for fish it should be 10-32 degree Celsius and the temperature required for the grow bed will be a value around 22 degree Celsius. The relative humidity required will be 45-55%.

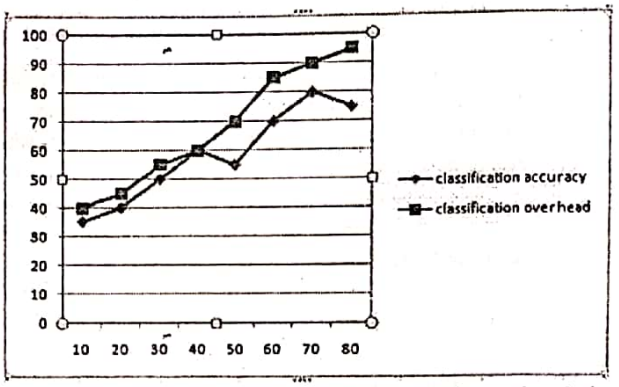


Figure 5: Graph showing accuracy and overhead in percentage

Figure 4 shows the overall energy usage and throughput of the system with a time period of 5 minutes in the x-axis and percentage of its utilization in the y-axis. We can see that as time increases energy usage decreases as well as the throughput will increases. Figure 5 shows the graph of overhead and accuracy of the system with Machine Learning in percentage. As the amount of data trained gets increased, its accuracy and overhead also gets increased.

5. CONCLUSION

IOT enabled aquaponics system could improve its real time monitoring due to live capturing of data through sensors. The water level, pH, temperature content are immediately stabilized through fuzzy based decision making system where human expert knowledge is incorporated in the decision making algorithm. The huge data collected through a long time monitoring is used for prediction through application of svm based in improved overall system performance for a long period of time. The measured parameters like energy consumption and throughput (fig 4) shows that system posses improved load balancing. The measurement of classification accuracy and classification overhead is an evidence for improved system prediction and it ultimately yields a secure aquaponics system.

REFERENCES

1. Abhay Dutta "IoT based Aquaponics Monitoring System", 1st KEC Conference Proceedings| Volume I, September 2018
2. Adnan Shaout and Spencer G. Scott "IoT Fuzzy Logic Aquaponics Monitoring and Control Hardware Real-Time System", The International Arab Conference on Information Technology Yassmine Hammamet, Tunisia December 22-24, 2017
3. J. E. Racoky, "Aquaculture- Aquaponics system," Agricultural Statement Experiment, 2003.
4. C Somerville, M Cohen, E Pantanella, A Stankus and A Lovatelli, Small-Scale Aquaponic Food Production, Integrated Fish and Plant Farming, FAO, Fisheries and Aquaculture Technical Paper, 2014.

5. DC Love, JP Fry, L Genello, ES Hill and KSJ Adam Frederick and Ximin Li, An International Survey of Aquaponics Practitioners, PLoS One, 2014, 9, e102662.
6. Vinodh P Vijayan, Deepti John, Merina Thomas, Neetha V. Maliackal, Sara Sangeetha Vargheese "Multi Agent Path Planning Approach to Dynamic Free Flight Environment" *International Journal of Recent Trends in Engineering (IJRTE), ISSN 1797-9617 Volume 1, Number 1, May 2009, Page(s): 41-46*
7. R. Kretzinger, "DIY aquaponic Balcony Garden," [Online]. Available: https://rik94566.wordpress.com. [Accessed 11 2017].
8. V P Vijayan, Biju Paul "Multi Objective Traffic Prediction Using Type-2 Fuzzy Logic and Ambient Intelligence" *International Conference on Advances in Computer Engineering 2010 , Published in IEEE Computer Society Proceedings, ISBN: 978-0-7695-4058-0, Print ISBN: 978-1-4244-7154-6*
9. D Wang, J Zhao, L Huang and D Xu, Design of a Smart Monitoring and Control System for Aquaponics Based on Openwrt, 5th International Conference on Information Engineering for Mechanics and Materials, 2015.
10. Cho Zin Myint*, Lenin Gopal*, and Yan Lin Aung "Reconfigurable Water Quality Monitoring using IoT" 978-1-5090-5507-4/17/$31.00 ©2017 IEEE ICIS 2017, May 24-26, 2017, Wuhan, China
11. Juby Joseph, Vinodh P Vijayan" Misdirection Attack in WSN Due to Selfish Nodes; Detection and Suppression using Longer Path Protocol" *International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 7, July 2014, pp. 825-829, ISSN: 2277 128X*
12. Vijayan V P, Gopinathan E "Improving Network Coverage and Llife-Time in a Cooperative Wireless mobile Sensor Network "Fourth International Conference on Advances in computing and communications (ICACC)Aug,2014. Published in **IEEE Computer Society Proceedings. Print ISBN: 978-1-4799-4364-7,INSPEC** Accession Number: 14630874, DOI:10.1109/ICACC.2014.16 PP. 42-45

Vol.66, No.3, 2021, pp.2891-2903, doi:10.32604/cmc.2021.012796 OPEN ACCESS ARTICLE

A Combinatorial Optimized Knapsack Linear Space for Information Retrieval

Varghese S. Chooralil[1], Vinodh P. Vijayan[2], Biju Paul[1], M. M. Anishin Raj[3], B. Karthikeyan[4,*], G. Manikandan[4]

1 Rajagiri School of Engineering & Technology, Kochi, 682039, India
2 Mangalam College of Engineering, Kottayam, 686631, India
3 Department of CSE, Viswajyothi College of Engineering & Technology, Vazhakulam, 686670, India
4 School of Computing, SASTRA Deemed To Be University, Thanjavur, 613401, India
* Corresponding Author: B. Karthikeyan. Email: bkarthikeyan@it.sastra.edu

Received 12 July 2020; Accepted 17 October 2020; Issue published 28 December 2020

Abstract

Key information extraction can reduce the dimensional effects while evaluating the correct preferences of users during semantic data analysis. Currently, the

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettumanoor

Computers, Materials & Continua
DOI:10.32604/cmc.2021.012796
Article

Tech Science Press

A Combinatorial Optimized Knapsack Linear Space for Information Retrieval

Varghese S. Chooralil[1], Vinodh P. Vijayan[2], Biju Paul[1], M. M. Anishin Raj[3], B. Karthikeyan[4,*] and G. Manikandan[4]

[1]Rajagiri School of Engineering & Technology, Kochi, 682039, India
[2]Mangalam College of Engineering, Kottayam, 686631, India
[3]Department of CSE, Viswajyothi College of Engineering & Technology, Vazhakulam, 686670, India
[4]School of Computing, SASTRA Deemed To Be University, Thanjavur, 613401, India
*Corresponding Author: B. Karthikeyan. Email: bkarthikeyan@it.sastra.edu
Received: 12 July 2020; Accepted: 17 October 2020

Abstract: Key information extraction can reduce the dimensional effects while evaluating the correct preferences of users during semantic data analysis. Currently, the classifiers are used to maximize the performance of web-page recommendation in terms of precision and satisfaction. The recent method disambiguates contextual sentiment using conceptual prediction with robustness, however the conceptual prediction method is not able to yield the optimal solution. Context-dependent terms are primarily evaluated by constructing linear space of context features, presuming that if the terms come together in certain consumer-related reviews, they are semantically reliant. Moreover, the more frequently they coexist, the greater the semantic dependency is. However, the influence of the terms that coexist with each other can be part of the frequency of the terms of their semantic dependence, as they are non-integrative and their individual meaning cannot be derived. In this work, we consider the strength of a term and the influence of a term as a combinatorial optimization, called Combinatorial Optimized Linear Space Knapsack for Information Retrieval (COLSK-IR). The COLSK-IR is considered as a knapsack problem with the total weight being the "term influence" or "influence of term" and the total value being the "term frequency" or "frequency of term" for semantic data analysis. The method, by which the term influence and the term frequency are considered to identify the optimal solutions, is called combinatorial optimizations. Thus, we choose the knapsack for performing an integer programming problem and perform multiple experiments using the linear space through combinatorial optimization to identify the possible optimum solutions. It is evident from our experimental results that the COLSK-IR provides better results than previous methods to detect strongly dependent snippets with minimum ambiguity that are related to inter-sentential context during semantic data analysis.

Keywords: Key information extraction; web-page; context-dependent; non-integrative; combinatorial optimization; knapsack

1 Introduction

Due to the wide popularity of user reviews in online media, a vast amount of content has been generated over the past several years. An approach to disambiguate the context-based sentiment polarity of words, as an information recovery problem was presented in [1,2]. The recommendation of web pages plays a major role in the web space. Better web page recommendations can be provided through semantic enhancement, as presented in [1–3]. The evaluation of information technology retrieval plays a crucial role in adjudicating documents. A multi-armed bandit model is presented in [4] for a pooling-based evaluation, which will minimize the assessment effort. However, the increase in the reviews has resulted in a substantial reduction of the hit rate. To improve the hit rate, a machine learning approach was presented in [5,6]. A box clustering segmentation model is presented in [7,8] using a clustering algorithm as an accurate reference algorithm.

Semantic data analysis is a field of study in which specific data in a particular domain are analyzed by inputting a query from the search engine. Existing applications have shown that there is vast market potential for semantic data analysis [9] and that the knowledge extracted from users remains the key in many sectors of the society. Multilingual semantic analysis has provided insight into emotional classification, resulting in the improvement in classification performance.

Multiple stages of semantic composition for context-sensitive scalar objectives using the time window model is presented in [10], which shows semantic improvement processing. Another restrictive vs. non-restrictive nominal modification model based on prenominal adjectives was investigated in [11]. A potential study of negative polarity sensitivity is designed in [12] through semantic assertion.

The main goal of this work is to build up a combinatorial optimization method considering inter-sentential context at the bottom level of granularity using linear space with a knapsack called Combinatorial Optimized Linear Space Knapsack for Information Retrieval (COLSK-IR). Instead of relying on snippet and manually labeled datasets to capture diverse kinds of non-integrative terms, the planned method suggests an individual snippet influence term and a query influence by using a combinatorial factor determination.

2 Related Works

Key information extraction is a fundamental technique in the evaluation of information retrieval evaluation and has attracted attention for decades. Based on news corpora, multi-word expression extraction using context analysis and model-based analysis is provided in [13]. While keyword query warrants conventional users to explore an enormous amount of data, the ambiguity of keyword query makes it difficult to efficiently answer keyword queries, specifically for short and vague keyword queries.

In [14] XML keyword search diversification model is presented to improve the precision of query diversification. However, the XML keyword search diversification model does not generally work well for long and complex queries. To address this issue, a key concept identification approach is explored in [15] to improve the query retrieval rate.

Query facets provide us with essential knowledge related to a query and hence are used to enhance the search experience in several ways. An automatic mining model through extraction and grouping of frequent lists is presented in [16], resulting in the mining of better query facets. A new optimized Monte Carlo algorithm is designed in [17] to significantly reduce the number of iterations and computational complexity.

Another graph-based approach to build automatically a taxonomy, resulting in the maximization of the overall associative strength is presented in [18]. A semantic-based, analysis architecture to explore more complex semantic data models based on a case study in commodity pricing is investigated in [19]. The advancement of semantics is an important research area which is significantly challenged by the lack of

ubiquitous metrics to address precision and abnormality pertinent to each domain [20]. However, the search efficiency was compromised with domain-independent text and structural similarity measures.

To enhance the efficiency of latent semantic models in web search, meta-features are created in [21], which uses feature vectors. With a feature vector, a model's forecast for a given query document pair is then passed to the overall ranker in addition to the models' scores. This in turn results in improved performance of latent semantic models. A language-independent framework to retrieve high precision queries using the traditional bootstrapping approach is presented in [22]. A Context Aware Time Model (CATM) in [23] provides an insight to the user actions at varying time intervals.

Our study covers both the detection of strongly dependent snippets and the reduction in ambiguity related to inter-sentential context to test whether the sarcastic use of the word has an influential factor in the COLSK-IR method. The work also covers the knapsack-based combinatorial optimization for semantic data analysis as a possible way to obtain an evidence for an effective semantic linear space representation.

3 Combinatorial Optimized Linear Space Knapsack for Information Retrieval

The contextual polarity of a word [6] is taken into consideration by many factors. For example, it could be difficult to detect a sarcastic use of the word "great" in the sentence "That's great!" without considering [24,25] inter-sentential context. With respect to this lack of difference between snippet, term, influence and query influence, this paper presents a combinatorial optimization method using linear space with knapsack, called Combinatorial Optimized Linear Space Knapsack for Information Retrieval (COLSK-IR).

The basic idea behind the COLSK-IR method is presented with a set of items, where weight and value are available for all. The combinatorial optimization model measures the number of item to be included in a set so that the calculated weight is always below or same as the given limit and the total value is as large as possible. The block diagram of COLSK-IR is shown in Fig. 1. The initial process starts with the fetching of web snippets from the web page content to meet the criteria for obtaining an optimal solution. This method detects non-integrative queries using total weight and total value as a combinatorial optimization problem.

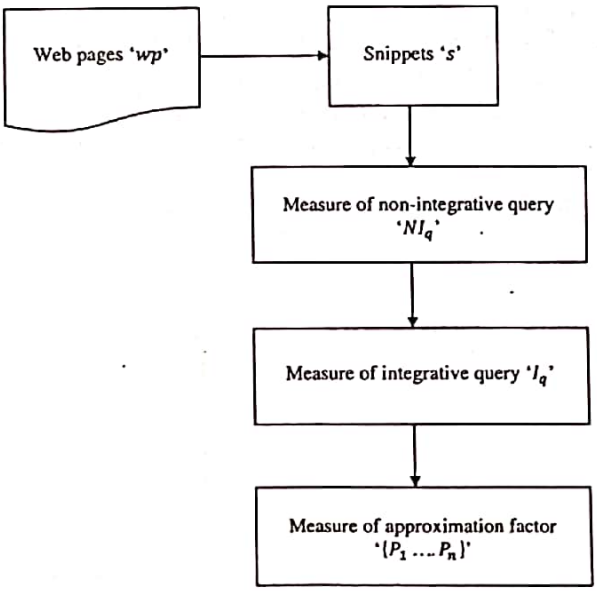


Figure 1: Block diagram of COLSK-IR

3.1 *Non-Integrative Perturbed Approximation*

The basic COLSK-IR method consists of substituting a keyword 'k_i' from a web page 'wp' by a synonym 'S_j' and measuring the semantic separation '|' of the replacement keyword 'k_i'' from the novel snippet 's.' If their meanings differ, it is more likely that the original snippet is non-integrative. However, if their meanings do not differ, then the original snippet is less likely to be non-integrative. We express this perturbation as follows. Let 'wp' represent the web page of query 'q' containing prearranged set of snippets or terms 'n', where 's' is the snippet conveyed from 'n' number of snippets.

$$wp_q\ (s,\ n) \tag{1}$$

Let 'n'', represent the ordered snippets, where one of them has been replaced by another snippet 's' and 'n'' is the perturbation of 'n.' The non-integrative 'NI' and the integrative 'I' of query 'q' can be expressed as a function and is given below:

$$|\ wp_q\ (s,\ n);\ wp_q\ (s,\ n') \tag{2}$$

$$NI_q = fun\ \left(|wp_q\ (s,\ n);\ wp_q\ (s,\ n'),\ n' \in \{s_1,\ s_2,\ \ldots, s_n\}\ \right) \tag{3}$$

$$I_q = g(NI_q) \tag{4}$$

The iterative procedure '$g()$' involved in the above function is expressed as given below. Let 's' represent a snippet, performed on a query 'q', and let '$s + \varepsilon Q$' represent a new operation that varies slightly from the first, in which 'ε' represents a small threshold constant. If 'q' is a query, then '$sq = Tq$', where 'T' is said to be the threshold constant. The perturbed problem of determining a function 'g' as given below:

$$(s + \varepsilon Q)g = Tg \tag{5}$$

$$(s - T)g = -\varepsilon Qg \tag{6}$$

Then the function 'g_1' that satisfies the equation '$(s - T)g = -\varepsilon Qg$' is called the first approximation to 'g.' The function 'g_2' that satisfies the equation '$(s - T)g_2 = -\varepsilon Qg_2$' is called the second approximation to 'g' and so on, with the 'nth' approximation 'g_n' satisfying '$(s - T)g_n = -\varepsilon Qg_{n-1}$'.

If the sequence '$g_1,\ g_2,\ g_3,\ \ldots, g_n$' converges to a specific function, that function is then said to be the essential solution to the problem. The largest value of 'ε' for which the sequence converges is called the radius of convergence of the solution. Thus, the non-integrative nature of the context-dependent term increases with semantic separation but the integrative nature of context-dependency decreases with semantic separation. The perturbation sets for query 'q' are comprised of snippets '$s_1,\ s_2,\ \ldots s_n$', where 'S_j' is a synonym of 's_j' and is expressed as given below:

$$\{P_1 \ldots P_n\} = \left\{ \begin{array}{c} S_1 s_2 \ldots . s_n \\ s_1 S_2 \ldots s_n \\ . \\ . \\ . \\ s_1 \ldots s_{j-1}\ S_j\ s_{j+1} \ldots . s_n \\ . \\ . \\ . \\ s_1 \ldots s_{n-1} \ldots . S_n \end{array} \right\} \tag{7}$$

With the perturbed sets obtained from (7), linear space is generated for semantic data analysis. Let '$\overrightarrow{LS}\ (q)$' and '$\overrightarrow{LS}\ (P_i)$' represent the linear space of query 'q' and its perturbation 'P_i,' respectively. The semantic separation '|' between query 'q' and its perturbation 'P_i' is constructed as the distance between their linear space, with 'Dis' representing the distance containing the snippets '$s_1, s_2, \ldots, s_n$' of 'k' equivalent snippets. Then the function '$fun\ ()$' in (3) of a query 'q' is comprised of snippets '$s_1, s_2, \ldots, s_n$' and is expressed as given below:

$$fun\ () = \frac{1}{nk} \sum_{i=1}^{k} \sum_{j=1}^{n} Dis\left(\overrightarrow{LS}\ (q),\ \overrightarrow{LS}\ (P_{ij})\right) \tag{8}$$

From (8), 'P_{ij}' represents the perturbation '$s_1 \ldots s_{j-1} S_{ij} s_{j+1} \ldots s_n$' and '$S_{ij}$' is the '$ith$' synonym of snippet '$s_j$' obtained from (7). Once all the snippets are extracted from the query 'q', for corresponding web page 'wp,' the individual snippet influence term and query influence are obtained. The block diagram for Combinatorial Factor (CF) determination is shown in Fig. 2.

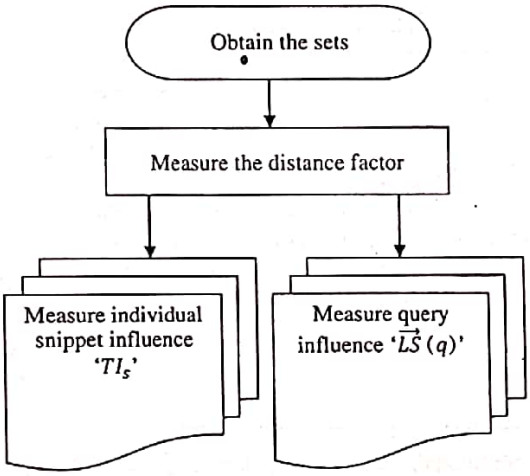


Figure 2: Block diagram of combinatorial factor determination

As shown in Fig. 2, once all the snippets are extracted from the query 'q', for corresponding web-page 'wp' the block diagram of CF determination consists of the perturbation sets obtained during the initial process. With this, the distance factor is computed for extracting equivalent snippets. Finally, the CF individual snippet influence and query influence are obtained. The individual snippet influence in linear space is evaluated and is expressed as given below:

$$TI_s = \log(f_{is}) * \log\left(\frac{n}{wp(s)}\right) \tag{9}$$

From (9), 'TI' represents the term influence of snippet 's' of 'ith' query, 'f' represents the term frequency of snippet 's' of web page 'wp' and 'n' represents the total number of snippets in web page 'wp'. Having built such a linear space representation for each '$s \in q$', the linear space of the entire query influence in the proposed work is constructed as their point-wise multiplication for effective semantic linear space representation. This is expressed as given below:

$$\overrightarrow{LS}\ (q) = \overrightarrow{LS}\ (s_1)\ \gamma \odot \ldots \odot \overrightarrow{LS}\ (s_n) \tag{10}$$

$$\overrightarrow{LS}\ (q) = (a_1, \ldots, a_b) \odot (b_1, \ldots, b_n) \tag{11}$$

$$\overrightarrow{LS}\ (q) = (x_1 * y_1, \ldots, x_n * y_n) \tag{12}$$

The linear spaces of the snippets on non-integrative queries that will commonly occur in non-identical contexts will have entries with low absolute values. However, for integrative queries, substituting a snippet with its synonym yields constructions that are likely to occur in a number of contexts that are different from the original. They have dissimilar contextual statistics and thus greater distance '*Dis.*' Fig. 3 shows the Linear Space Context Dependent algorithm.

Input: web page 'wp', snippets '$s_1, s_2, \ldots, s_n$', keyword 'k', number of snippets 'n', query 'q'

Output: detection of strongly dependent snippets from query

```
1: Begin
2:     For each Web Page 'wp'
3:         For each Snippets 'S'
4:             For each query 'q'
5:                 Measure the non-integrative key using (3)
6:                 Measure the integrative key using (4)
7:                 Obtain the perturbation sets for query 'q' using (7)
8:                 Measure the individual snippet influence using (9)
9:                 Measure the query influence using (12)
10:            End for
11:        End for
12:    End for
13: End
```

Figure 3: Algorithm for the linear space context dependent algorithm

The algorithm for strongly identifying the dependent query terms with the aid of non-integrative nature is analyzed and shown in Fig. 4. Individual words in a query do not have a greater influence. However, their meanings differ according to the context. The proposed method uses the non-integrative nature of the query to detect strongly dependent snippets from the given query. Both the influence of snippets and the frequency of snippets are measured to identify strongly dependent snippets with the aid of linear space. This reduces the ambiguity related to inter-sentential context.

3.2 Combinatorial Optimization

With the combinatorial optimized factors, although ambiguity related to inter-sentential context is reduced, the time required to evaluate a query increases. To address this, a knapsack-based combinatorial optimization for semantic data analysis is constructed. Selecting the strongly dependent snippets and inter-sentential context into the cache is a '$0-1$' knapsack problem.

Given a knapsack with capacity 'c', 'n' items '$c_1, c_2, \ldots, c_n$', having individual snippet influence 'TI_s' and overall query influence '$\overrightarrow{LS}\ (q)$', take the items that maximize the individual snippet influence without exceeding 'c'. A snippet can be selected only if the fractions of items cannot be taken. As the greedy strategy does not always guarantee an optimal solution for the knapsack problem, the proposed work describes how to

formulate the selection of strongly dependent snippets and inter-sentential context as a combinatorial optimization problem. We formulate the knapsack combinatorial optimization problem as an integer programming problem, as given below.

Input: capacity 'c', items 'n', individual snippet influence 'TI_s', overall query influence '$\overrightarrow{LS}(q)$'.
Output: Time-optimized semantic data analytics
1: Begin 2: For each Web Page 'wp' 3: For each Snippets 'S' 4: For each query 'q' 5: Obtain the maximization formulates using (13) 6: Design the constraints using (14) 7: End for 8: End for 9: End for 10: End

Figure 4: Algorithm for the Knapsack combinatorial optimization algorithm

$$Max \sum_{i=1}^{n} TI_s s_i \tag{13}$$

$$Subject\ to \sum_{i=1}^{n} \overrightarrow{LS}(q) s_i \leq c,\ where\ s_i \in s_1, s_2, .., s_n \tag{14}$$

From (13), '$\sum_{i=1}^{n} TI_s s_i$' is the objective function, '$\overrightarrow{LS}(q) s_i \leq c$' and '$s_i \in s_1, s_2, .., s_n$' are the constraints, where 's_i' represents a snippet. A solution is to set the snippets 's_i,' a solution that satisfies all the constraints and one that yields maximum objective function value.

The objective behind the design of the proposed work is the consideration of optimal solutions. From (14), the proposed work states that the total snippets cannot exceed the query size or capacity 'c,' whereas (14) states that each snippet is either selected or discarded. Fig. 4 shows the Knapsack Combinatorial Optimization algorithm.

For example, consider a Tripadvisor dataset consisting of reviews randomly selected from several accommodations. In order to obtain the maximization, formulates (13) are used according to the design constraints from (14), with consideration of two snippets: Room file snippets and value file snippets. With these design constraints, optimal solutions are identified, thereby meeting the objectives.

4 Experimental Settings

The queries were simulated and the performance was measured. The COLSK-IR method was evaluated [26] against PolaritySim [6] and DomainOntoWP [13] using the number of reviews as the measurement of our web page performance. We experimented with review sizes of 15, 30, 45, 60, 75, 90, 105, 120, 135 and 150, with 512 bytes of review on the Tripadvisor dataset, which included an overall review of 200 randomly selected accommodations.

The dataset of approximately 200 reviews was taken from Tripadvisor.com through a random selection. It covered all five satisfaction levels (40 reviews in each level) consisting of 1,382 criticisms, 211

non-criticisms and 97 criticisms with errors. The information was collected from Tripadvisor and Edmunds. Tripadvisor had 259,000 reviews.

The experiment was conducted based on factors such as number of reviews, non-integrative key extraction time, recall rate, precision and semantic data analysis efficiency. To evaluate the performance of the COLSK-IR method, two metrics were introduced to measure the semantic data analysis and compared with the existing methods: Polarity Similarity (PolaritySim) and Domain Ontology of Web Pages (DomainOntoWP).

5 Discussion

The performance of COLSK-IR for semantic data analysis was compared with the Polarity Similarity (PolaritySim) and Domain Ontology of Web Pages (DomainOntoWP). The experiments measured the effectiveness of non-integrative key extraction time, precision rate and recall for 150 reviews, using the method described in Section 3.

5.1 Non-Integrative Key Extraction Time

The non-integrative key extraction time measured the time required to extract the non-integrative key (i.e., extracted keys) with respect to the total number of reviews in web pages. The non-integrative key extraction time is measured as given below.

$$NI - KE_t = r_i * Time\ (NI_q) \tag{15}$$

From (15), '$NI - KE_t$' refers to the non-integrative key extraction time using the number of reviews 'r_i' for the extracted keywords 'k_i' respectively, measured in terms of milliseconds (ms). Tab. 1 shows the non-integrative key extraction time of the proposed COLSK-IR and the PolaritySim and DomainOntoWP methods. The proposed COLSK-IR method outperformed the existing methods in terms of non-integrative key extraction time.

Fig. 5 shows the results of non-integrative key extraction time vs. the varying number of reviews. To better distinguish the efficacy of the proposed COLSK-IR method, the experimental results are shown in Tab. 1, where it is compared against PolaritySim and DomainOntoWP.

Results are presented for 10 numbers of reviews. The non-integrative key extraction time for these 10 numbers of reviews measures the time taken for convergence on different reviews as in (1). The reported results confirm that with the increase in the number of reviews, the non-integrative key extraction time also increases. The process is repeated for 150 reviews for conducting experiments, as illustrated in Fig. 5. The proposed COLSK-IR method performs relatively well when compared to the PolaritySim and DomainOntoWP methods. The COLSK-IR method offers better changes using its iteration procedure, which considers perturbation as a factor for semantic data analysis by 21% when compared to PolaritySim. Moreover, the approximation factor with perturbation sets in the COLSK-IR method considers both the non-integrative and integrative snippets to reduce the convergent time on semantic data analysis by 45% when compared to DomainOntoWP.

5.2 Precision Rate

Precision rate refers to the number of relevant snippets extracted with respect to the number of returned snippets, i.e.,

$$P = \sum_{i=1}^{n} \left(\frac{Rel(s_i)}{n} \right) * 100 \quad (16)$$

From (16), the precision rate 'P' is obtained, using the relevant snippets extracted, as are '$Rel(s_i)$' and the total number of extracted snippets, 'n' from web pages. Tab. 2 shows the precision rate of the proposed COLSK-IR method for 150 reviews and comparisons made against PolaritySim [2] and DomainOntoWP [13].

Table 1: Non-integrative key extraction time obtained using COLSK-IR, PolaritySim and DomainOntoWP

No. of reviews	Non-integrative key extraction time (ms)		
	COLSK-IR	PolaritySim	DomainOntoWP
15	4.15	7.45	8.3
30	7.13	10.13	12.54
45	11.17	13.14	17.43
60	15.32	17.21	24.24
75	20.13	22.14	30.16
90	28.32	31.32	36.25
105	33.14	35.79	42.39
120	36.14	39.32	43.21
135	38.25	41.15	45.61
150	41.43	44.23	49.12

Table 2: Precision rate obtained using COLSK-IR, PolaritySim, and DomainOntoWP

No. of reviews	Precision rate (%)		
	COLSK-IR	PolaritySim	DomainOntoWP
15	77.51	67.94	61.28
30	74.31	64.30	58.22
45	72.54	62.52	56.44
60	70.38	60.35	54.27
75	68.25	58.22	52.14
90	82.99	72.96	66.87
105	89.95	80.92	74.83
120	90.14	82.14	78.32
135	92.23	87.13	82.14
150	94.14	89.13	86.27

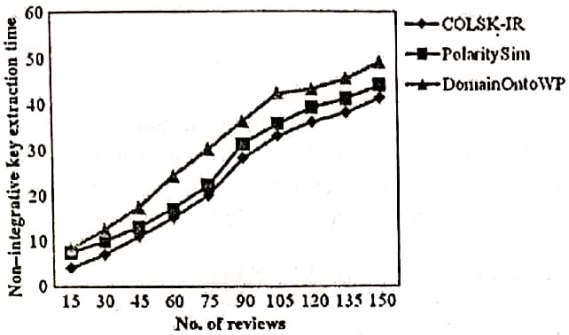


Figure 5: Measure of non-integrative key extraction time

To increase the precision of semantic data analysis for web pages, first approximation, second approximation, and '*nth*' approximation are considered, as shown in Fig. 6. With this, the radius of convergence of the solution that converges to a specific function with approximation factor is included, resulting in the optimal solution according to the number of reviews.

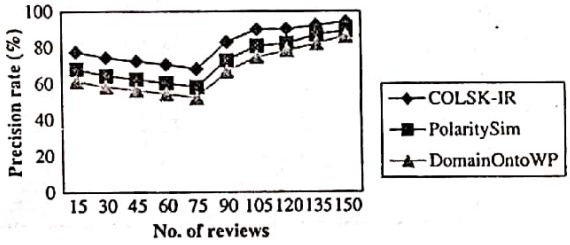


Figure 6: Measure of precision rate

In the experimental setup, the number of reviews ranged from 15 to 150. The results for 10 different types of reviews collected from Tripadvisor and Edmunds are shown in Fig. 7. The precision rate of our COLSK-IR method is comparable to that of the state-of-the-art methods. The precision rate is the ratio of the relevant snippets extracted to the overall snippets considered for semantic data analysis.

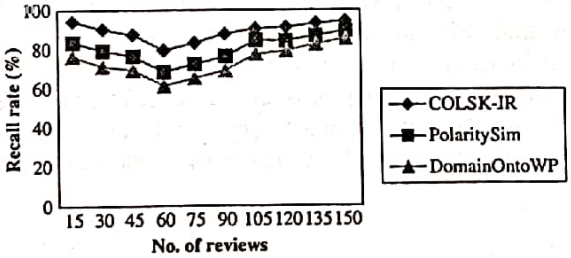


Figure 7: Measure of recall rate

5.3 Recall

Recall rate measures the number of relevant snippets extracted with respect to the number of relevant snippets, i.e., the number of extracted relevant snippets returned by the web page '*wp*' with regard to the '*Rel* (*s*)' returned relevant snippets.

$$R = \sum_{i=1}^{n} \left(\frac{Rel(s_i)}{Rel\ (s)} \right) * 100 \quad (17)$$

From (17), the recall rate 'R' is obtained, using the relevant extracted snippets, '$Rel(s_i)$' and the total number of relevant snippets, 's' from web pages. Here we try to show the examples of reviews yielding the highest and lowest recall rates using the methods COLSK-IR, PolaritySim, and DomainOntoWP methods. Tab. 3 shows the tabulation of recall rates using these three methods.

Table 3: Recall rate obtained using COLSK-IR, PolaritySim, and DomainOntoWP

No. of reviews	Recall rate (%)		
	COLSK-IR	PolaritySim	DomainOntoWP
15	94.36	83.51	76.29
30	90.16	79.29	71.23
45	87.29	76.42	69.36
60	79.33	68.46	61.40
75	83.29	72.42	65.36
90	87.90	76.25	69.19
105	90.43	84.56	77.50
120	91.18	84.13	79.13
135	93.14	86.78	82.45
150	94.18	89.13	85.10

Fig. 7 shows the recall rates for the three methods for reviews increasing in number from 15 to 150. The recall rate improvement of COLSK-IR over PolaritySim and DomainOntoWP decreases gradually as the number of reviews increases, though not linearly. It can be inferred that a further increase is found between the reviews in the range of 75 and 150 because of the presence of noise prior to the key information extraction during semantic data analysis.

As shown in Fig. 7, for example, when the number of reviews is 15, the percentage improvement of COLSK-IR method is 11% compared to PolaritySim is 11% and 19% compared to DomainOntoWP. When the number of reviews is 75, the improvement is around 13% compared to PolaritySim and 22% compared to DomainOntoWP. The reason for this is the application of Combinatorial Factor determination. The knapsack combinatorial optimization problem as an integer programming problem is extended to formulate the selection of strongly dependent snippets and inter-sentential context as a combinatorial optimization problem that extends the recall rate by 17% compared to DomainOntoWP.

6 Conclusion

This paper proposes a Combinatorial Optimized Linear Space Knapsack for Information Retrieval (COLSK-IR) to overcome the difficulty of detecting strongly dependent snippets and reducing the ambiguity related to inter-sentential context. This paper shows how this method can be extended to incorporate the time required to evaluate a query for efficient semantic data analysis based on the knapsack problem. This paper provides two algorithms: Linear Space Context Dependent and Knapsack Combinatorial Optimization. The Linear Space Context Dependent algorithm manages and identifies

strongly dependent snippets based on the influence and frequency of snippets. The Knapsack Combinatorial Optimization algorithm reduces the ambiguity related to inter-sentential context by formulating an integer programming problem to determine the optimal solutions. The experimental results show that the COLSK-IR provides better performance than the state-of-the-art methods in terms of the parameters such as non-integrative key extraction time, precision and recall rate.

Funding Statement: The author(s) received no specific funding for this study.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

References

[1] S. Chen, B. Song, L. Fan, X. Du and M. Guizani, "Multi–modal data semantic localization with relationship dependencies for efficient signal processing in EH CRNs," *IEEE Transactions on Cognitive Communications and Networking*, vol. 5, no. 2, pp. 347–357, 2019.

[2] O. Vechtomova, "Disambiguating context-dependent polarity of words: An information retrieval approach," *Information Processing & Management*, vol. 53, no. 5, pp. 1062–1079, 2017.

[3] T. T. S. Nguyen, H. Y. Lu and J. Lu, "Web-page recommendation based on web usage and domain knowledge," *IEEE Transactions on Knowledge and Data Engineering*, vol. 26, no. 10, pp. 2574–2587, 2014.

[4] D. E. Losada, J. Parapar and A. Barreiro, "Multi-armed bandits for adjudicating documents in pooling-based evaluation of information retrieval systems," *Information Processing & Management*, vol. 53, no. 5, pp. 1005–1025, 2017.

[5] T. Kucukyilmaz, B. B. Cambazoglu, C. Aykanat and R. Baeza-Yates, "A machine learning approach for result caching in web search engines," *Information Processing & Management*, vol. 53, no. 4, pp. 834–850, 2017.

[6] X. Xie, X. Cai, J. Zhou, N. Cao and Y. Wu, "A semantic-based method for visualizing large image collections," *IEEE Transactions on Visualization and Computer Graphics*, vol. 25, no. 7, pp. 2362–2377, 2019.

[7] D. Song, Y. Luo and J. Heflin, "Linking heterogeneous data in the semantic web using scalable and domain-independent candidate selection," *IEEE Transactions on Knowledge and Data Engineering*, vol. 29, no. 1, pp. 143–156, 2017.

[8] J. Zeleny, R. Burget and J. Zendulka, "Box clustering segmentation: A new method for vision-based web page preprocessing," *Information Processing & Management*, vol. 53, no. 3, pp. 735–750, 2017.

[9] K. Becker, V. P. Moreira and A. G. L. dos Santos , "Multilingual emotion classification using supervised learning: Comparative experiments," *Information Processing & Management*, vol. 53, no. 3, pp. 684–704, 2017.

[10] J. Ziegler and L. Pylkkänen, "Scalar adjectives and the temporal unfolding of semantic composition: An MEG investigation," *Neuropsychologia*, vol. 89, pp. 161–171, 2016.

[11] T. Leffel, M. Lauter, M. Westerlund and L. Pylkkänen, "Restrictive *vs.* non-restrictive composition: A magnetoencephalography study," *Language Cognition and Neuroscience*, vol. 29, no. 10, pp. 1191–1204, 2014.

[12] M. Xiang, J. Grove and A. Giannakidou, "Semantic and pragmatic processes in the comprehension of negation: An event related potential study of negative polarity sensitivity," *Journal of Neurolinguistics*, vol. 38, pp. 71–88, 2016.

[13] M. Nuo, C. Lun and H. Liu, "Tibetan multi-word expressions identification framework based on news corpora," *Natural Language Understanding and Intelligent Applications*, vol. 10102, pp. 16–26, 2016.

[14] J. Li, C. Liu and J. X. Yu, "Context-based diversification for keyword queries over XML data," *IEEE Transactions on Knowledge and Data Engineering*, vol. 27, no. 3, pp. 660–672, 2015.

[15] W. Zhang, Z. Ming, Y. Zhang, T. Liu and T. Chua, "Capturing the semantics of key phrases using multiple languages for question retrieval," *IEEE Transactions on Knowledge and Data Engineering*, vol. 28, no. 4, pp. 888–900, 2016.

[16] Z. Dou, Z. Jiang, S. Hu, J. R. Wen and R. Song, "Automatically mining facets for queries from their search results," *IEEE Transactions on Knowledge and Data Engineering*, vol. 28, no. 2, pp. 385–397, 2016.

[17] E. Serra and F. Spezzano, "An effective GPU-based approach to probabilistic query confidence Computation," *IEEE Transactions on Knowledge and Data Engineering*, vol. 27, no. 1, pp. 17–31, 2015.

[18] Y. B. Kang, P. D. Haghigh and F. Burstein, "TaxoFinder: A graph-based approach for taxonomy learning," *IEEE Transactions on Knowledge and Data Engineering*, vol. 28, no. 2, pp. 524–536, 2016.

[19] A. Behnaz, A. Natarajan, F. A. Rabhi and M. Peat, "A semantic-based analytics architecture and its application to commodity pricing, enterprise Applications, markets and Services in the Finance Industry, FinanceCom 2016," in *Lecture Notes in Business Information Processing*, vol. 276. Cham: Springer, 2016.

[20] T. G. Stavropoulos, E. Kontopoulos, A. M. Peñuela, S. Tachos, S. Andreadis *et al.*, "Cross-domain semantic drift measurement in ontologies using the semadrift tool and metrics," *3rd Workshop on Managing the Evolution and Preservation of the Data Web, CEUR Workshop Proceedings*, Portoroz, Slovenia, 1824, 2017.

[21] A. Borisov, P. Serdyukov and M. de Rijke, "Using metafeatures to increase the effectiveness of latent semantic models in web Search," in *International World Wide Web Conf. Committee, ACM*, Montréal, Québec, Canada, 2016.

[22] L. Bing, Z. Zhang, W. Lam and W. W. Cohen, "Towards a language-independent solution: Knowledge base completion by searching the web and deriving language pattern," *Knowledge-Based Systems*, vol. 115, pp. 80–86, 2017.

[23] A. Borisov, I. Markov, M. de Rijke and P. Serdyukov, "A context-aware time model for web search," in *Proc. of the 39th Int. ACM SIGIR Conf. on Research and Development in Information Retrieval*, Pisa, Italy, pp. 205–214, 2016.

[24] M. Thomas and V. S. Chooralil, "Security and privacy via optimised blockchain," *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 8, no. 3, pp. 415–418, 2019.

[25] V. P. Vijayan, D. John, M. Thomas, N. V. Maliackal and S. S. Vargheese, "Multi agent path planning approach to dynamic free flight environment," *International Journal of Recent Trends in Engineering and Technology*, vol. 1, no. 1, pp. 41–46, 2009.

[26] V. P. Vijayan and B. Paul, "Multi objective traffic prediction using type-2 fuzzy logic and ambient intelligence," *Int. Conf. on Advances in Computer Engineering*, pp. 309–311, 2010.

JISE

[1][2][3][4][5][6][7][8][9][10][11][12][13]

Journal of Information Science and Engineering, Vol. 37 No. 2, pp. 413-423

Energy Efficient Sustainable City Monitoring Using IoT Enabled Wireless Sensor Networks and Data Analytics

VINODH P. VIJAYAN[1], BIJU PAUL2 AND VARGHESE S. CHOORALIL[2]
[1]*Department of Computer Science*
Mangalam College of Engineering
Kottayam, 686631 India
[2]*Department of Information Technology*
[3]*Department of Computer Science*
Rajagiri School of Engineering and Technology
Kochi, 682030 India
E-mail: vinodhpvijayan@yaoo.com; bijuathappadath@gmail.com; varghesea.kutty@gmail.com

As the population in the city is increasing rapidly over the years, due to the scarcity resources and unhealthy ecosystem the demand for sustainable city increases. Sustainable city enables all its citizens to meet their own needs with minimal natural resources and to live a good quality of life, without degrading the existing natural resources or the lives of other people now or in the future. Once after building

JOURNAL OF INFORMATION SCIENCE AND ENGINEERING 37, 413-423 (2021)
DOI: 10.6688/JISE.202103_37(2).0009

Energy Efficient Sustainable City Monitoring Using IoT Enabled Wireless Sensor Networks and Data Analytics

VINODH P. VIJAYAN[1], BIJU PAUL[2] AND VARGHESE S. CHOORALIL[2]
[1]*Department of Computer Science*
Mangalam College of Engineering
Kottayam, 686631 India
[2]*Department of Information Technology*
[3]*Department of Computer Science*
Rajagiri School of Engineering and Technology
Kochi, 682030 India
E-mail: vinodhpvijayan@yaoo.com; bijuathappadath@gmail.com; varghesee.kutty@gmail.com

As the population in the city is increasing rapidly over the years, due to the scarcity resources and unhealthy ecosystem the demand for sustainable city increases. Sustainable city enables all its citizens to meet their own needs with minimal natural resources and to live a good quality of life, without degrading the existing natural resources or the lives of other people now or in the future. Once after building sustainable city with green building, energy efficient and eco-friendly ecosystem it is important to monitor the same to keep the city sustainable. An Energy efficient Wireless sensor network with internet connectivity improves the regular monitoring, the frequent data received from various monitoring sensors are considered as informative database for future prediction, these huge information can be used for alerting critical situations through data analytics. The integration of various technology yield performance degradation due the energy usage and computational overhead, which can be improved through application of an optimization technique like genetic algorithm.

Keywords: IoT, WSN, energy efficient, green city, data analytics, genetic algorithm, PSO, hybrid optimization

1. INTRODUCTION

Sustainable city is going to be a great demand in the upcoming century as whole world focus on sustainable solutions for all real-world problems. Monitoring and maintaining the sustainable city with energy efficient system is great challenge than building the city. So, monitoring a sustainable city using energy efficient and IOT enabled wireless sensor network will improve overall performance of the eco system.

Fig. 1 shows the concept of green city where various ecosystems are connected with variety of sensors, which collect the required data in regular intervals. The heterogeneous nature of the sensors makes the system accurate but the aggregation become complex.

The city contains various types of places or stations and geographical eco system with different expectation about its energy efficient operations and eco friendliness. The various places are categorized based on its sensitivity towards parameters like environmental pollution, sound pollution, air pollution, water pollution, temperature and humidity *etc.* Similarly, each place is assigned with fitness functions and ideal fitness values. The Genetic

Received October 30, 2019; revised February 3, 2020; accepted April 1, 2020.
Communicated by Jimson Mathew.

Algorithm based optimization is used to schedule the sensors to operate on energy efficient and coverage optimized scenario. Hence the geographic aware scheduling of sensors is essential for optimum solution.

The overall setup of the smart green city with deployment of sensors in critical areas are shown in Fig. 1. A fruitful design of energy efficient and IoT enabled Wireless Sensor Network is built as the basic hardware infrastructure to monitoring sustainable city. The system also performs the data analytic on the large amount of data collected from various sensors, the same is used for accurate prediction of upcoming environmental conditions of the city.

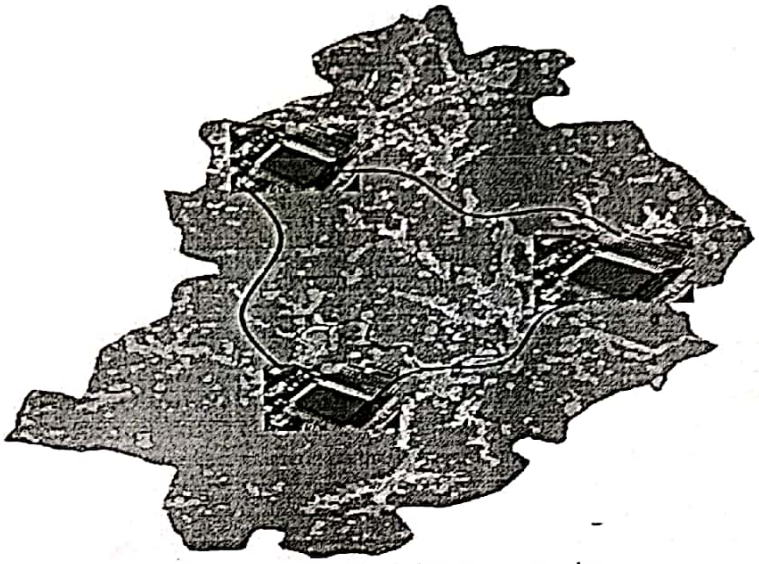


Fig. 1. Green city with wireless sensor networks.

The whole city is covered with IoT enabled sensors based on the parameters to be monitored. The sensors could be temperature sensor, humidity sensors, PH level measuring sensors, fire detection, Camera for video/images, microphone for audio *etc.* As the sensors connectivity is done through IoT, the multimedia communication gives good Quality of Service (QoS) parameters. Due to the IoT based connectivity, access to sensors and devices are easy and also gives good performance in case of scalability.

As the large number of sensors are periodically collects the information, the amount of data received at the central database is going to be huge. The major challenge is to segregate the fruitful information in order to predict the critical issues expected to be happen. Suitable classification technique is applied on the received data to separate the useful information from the periodic data received.

The collected and stored information base is considered as big data and this is considered for detailed data analytics in order to identify the overall the scenario in the eco system, help us to predict the future performance, which helps the authority plan the necessary precautions and theirs by ensure the best performance of the sustainable city.

2. LITERATURE SURVEY

According to the United Nation's report the global population will rise to 70% in urban [1] area by 2050. The energy usage of wireless sensor networks deployed in the green city for monitoring can be improved by cooperative approach among sensors. As the cooperative [1, 8] approach enables the nodes to share the information collected, the coverage and average life time of the network [8, 12] also improved

Energy harvesting [2] of sensor networks in green cities include data collection [11] from smart building, street lights, parking yard *etc.* As it is a long term process a threshold-based scheduling [2] policy for energy harvesting will improve the long-term average usage. As a result of optimal threshold, the memory usage and complexity of the algorithm also improved.

Energy usage of mobile devices [3] in the green city need to optimized as it will adversely affect the energy consumption [11], radiation, overall temperature *etc.* of the eco system. An energy efficient Wireless sensor [12] networks which sense information from smart transportation, and smart buildings *etc.* where environments are continuously changing are affected by dynamic change of transmitting power [4], which may adversely impact on the throughput of the network. The overall throughput of the network is improved by two operation harvest and transmission is harmonized well. WiFi coverage and energy management [5] is essential in green city as large number of devices and access points (AP) are connected and continuously operating in the networks.

Bigdata approach with cooperate sensing is incorporated into sensors in a cloud environment [6] for sensing huge real time data. Another approach is ASC where an agent is included into sensor-cloud for transmission of sensed data and that can be considered as big data. The third approach SSC [6] where social network is integrated into sensor- cloud for sharing big data. The application of IoT or IOT enabled sensor network always makes the network scalable and it also yield good interoperability [7] among different devices.

It is expected that more than 50 billion devices with internet usage capability is going to be connected to internet by the year 2020. As this large no of internet driven devices are generating huge volume of data [8], their by energy usage, it is important apply green approach [9] to bigdata especially in energy aware applications like green city. The Internet of Things (IoT) applications [10] like smart parking, waste management, and traffic congestion management [13] *etc.* used in smart cities enable the sensor network to collect huge amount of data. A proper energy aware data aggregation technique is essential to collect fruitful data effectively else it may induce huge overhead.

Over the last two decades WSN become one of the most popular implementation due to its inherent nature of Energy Efficiency (EE) [14] even in a relatively long transmission through muti-hop mechanism. The routing and data aggregation techniques are well conservative in terms of energy at the same time it yield relatively good reliability due to its fault tolerant nature. Hence the approach of energy efficiency along with fault tolerance in a multi hop based cluster environment [15] will be able to provide improved service.

3. THE ENERGY EFFICIENT MONITORING OF GREEN CITY

The concept of green city is mainly affected by energy usage hence the new sys- tem implemented for monitoring the environment should not be expensive in terms of energy.

Since the large and variety of sensors are deployed to collect heterogeneous data from various parts of the city, the improper schedule of these sensors may adversely affect the energy efficiency of the system. Since coverage and sensor network life time is inversely proportional, a proper optimum scheduling is essential. The parameters that is considered for optimizing the scheduling is energy of individual nodes, average network life time, coverage of the network, load balancing factor *etc.* Fig. 2 shows the system operation where optimum scheduling of sensors provides energy efficient operation and all collected data is used for prediction after classifying fruitful information.

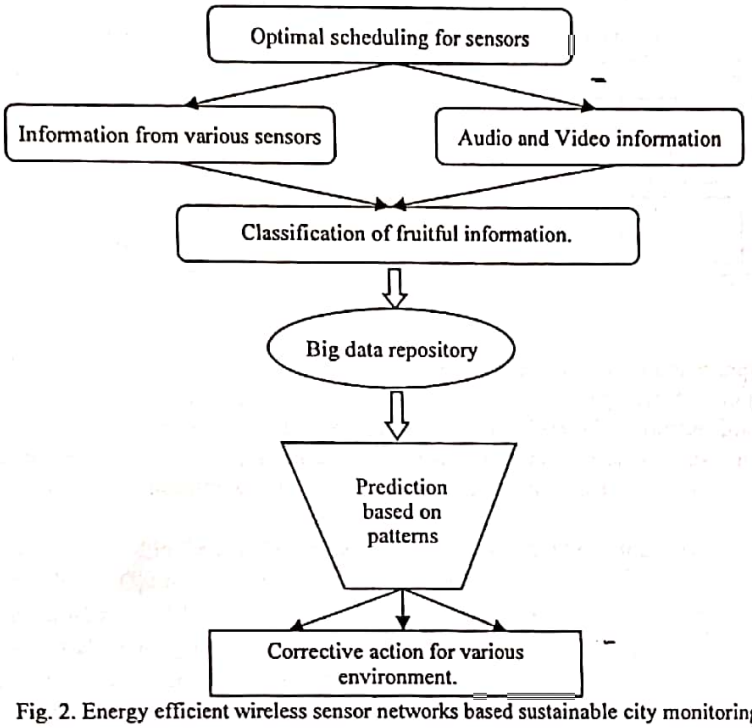


Fig. 2. Energy efficient wireless sensor networks based sustainable city monitoring.

Since optimization is essential for the effective scheduling a Genetic algorithm (GA) based optimal scheduling (GAOP), Neuro-Genetic based optimal scheduling (NGOP) and Particle Swam based Optimization (PSOP) is implemented and compared against the performances.

3.1 Genetic Algorithm (GA) Based Optimal Scheduling (GAOP)

The genetic approach always proved to be an effective load balancing technique in the heterogeneous environment with energy and coverage are the parameters considered for the optimization. The chromosome with interference free node in the network is selec-

ted for genetic operation like mutation and crossover with reference to the parameters to be optimized. Fig 3 shows genetic operation in stepwise towards optimization and the optimization result always depends on the ratio of local and global parameters in the chromosome, crossover probability P_c, and Mutation probability P_m.

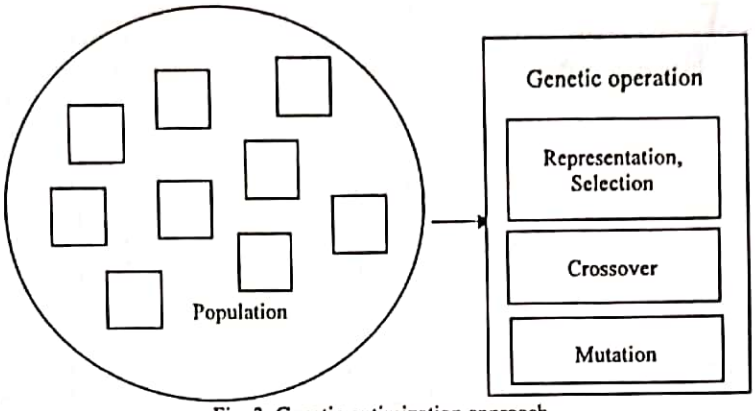


Fig. 3. Genetic optimization approach.

The approach of applying genetic based optimization in GAOP method improved the overall load balancing factor of the network, this approach is very effective in geographically distributed sensor network. The efficiency of the network is further improved by removing interference nodes from the overall network using a binary search approach, which will also reduce the search complexity to algorithmic scale.

The steps involved in Genetic Optimization applied to GAOP method.
//Genetic based Optimization procedure.
Input: Initialize the Chromosome with suitable technique.
Step 1: Initialize the generation count and fitness function.
Step 2: Use suitable selection procedure.
//Crossover
Step 3: Suitable pair of chromosome is selected and applied the crossover.
Step 4: Fitness is calculated from all offspring.
//Mutation
Step 5: Suitable mutation technique is applied based on the mutation probability P_m.
Step 6: Remove the chromosome with less fitness and node with interference.
Output: Energy & Coverage optimized collision free sensor network with balanced node.

3.2 Neuro-Genetic Optimization Procedure (NGOP)

This is a hybrid approach where Artificial Neural Network (ANN) and Genetic Optimization is blended together to yield improved performance. The ANN based classification

or prediction is used to identify network configuration with improved performance and load balancing. The traditional algorithms for weight balancing of ANN is not expected to yield good results as the number of parameters involved are more and heterogeneous in nature. The GA based weight balancing of ANN provides excellent results in terms of classification overhead and accuracy.

To illustrate the above concept, assume that we have to setup an ANN with 4 input nodes, 3 hidden layer nodes and one output node. This implies that there will be 10 weights to be adjusted for effective training. The chromosome is represented as shown Table 1 where local and global parameters are included with suitable participation to ensure global optimum.

Table 1. Chromosome Structure used with hybrid optimization.

W11	W12	W13	W21	...	W21	W31
G 0	G 1	G 2	G3		G10	G 11
84321	46234	78901	32104	...	87640	14261

The Neuro-Genetic approach improves the required parameters like load balancing, average life time and coverage of network as required. The improved load balancing in geographical distributed environment gives overall system performance and their by huge amount of fruitful information could be aggregated. The overhead in packet transmission is significantly reduced due to removal of duplicate packets.

3.3 Particle Swarm Optimization for Scheduling (PSOP)

The GA based approach always start giving improved performance in the early stages of iteration but it does not guarantee these improved performance in a varying node environment hence optimization is replaced with Particle Swarm Optimization (PSO) based approach where improved performance is expected in later iterations with long term improvement. The inherent properties of PSO like Cohesion, alignment and separation *etc.* is extremely suitable for a heterogonous WSN scenario.

Procedures of the Global Version: The algorithm for PSO based approach is as follows.

Step 1: Initialize an array of the population of particles with random positions and velocities in D dimensions in the problem space.

Step 2: Each particle fitness calculation using suitable method.

Step 3: Calculated fitness value may be compared with reference Value 'pbest'. Update the value of 'pbest' based on the current value in 'D' dimensional space.

Step 4: Update 'gbest' by comparing current value.

Step 5: Update the particle position and velocity using Eqs. (1) and (2).

$$V_{id} = V_{id} + C_1 r_1 (P_{id} - X_{id}) + C_2 r_2 (P_{gd} - X_{id}) \quad (1)$$

$$X_{id} = X_{id} + V_{id} \quad (2)$$

'V' represent velocity of particles, 'X' represents position of particles, 'P_i' represents previous best, 'P_g' represents global best, 'r' is a random constant and 'C' is a constant

known as social parameter. It is evident that due to difference in operational principle GA based approach and PSO based approach yield different results in various contexts.

4. EXPERIMENTAL EVALUATION

Genetic algorithm based optimal scheduling (GAOP), Neuro-Genetic based optimal scheduling (NGOP) and Particle Swam based Optimization (PSOP) in wireless network is implemented and network performance is measured through simulation using NS-2 network simulator. The network layout size is fixed to a value of 1000 × 1000 for simulation and the available trace file is observed for the collision process during data transmission. The simulation is repeated for varying number of nodes and the corresponding trace file is used for data collection and inference.

Random Waypoint Model (RWM) is developed and used so that all the nodes move randomly, which gives improved similarity with real-time situation. The route discovery is done with an average number of 80 nodes. Dynamic Source Routing (DSR) is the routing protocol used and since nodes are moving randomly it is observed that lot of packet drop is happened due to congestion in the network. All the nodes in the network moved randomly by the speed of the movement is fixed by parameters in the simulation tool or it moved with a predefined speed.

The random movement and corresponding progression seem to be constant over the period of simulation. The speed of movement is varied from 5.0m/s to 40 m/s for each node. The information received from trace file is utilized to evaluate load balancing efficiency, packet delivery ration, routing overhead *etc.*

Table 2. Measure of packet delivery ratio.

Node density	Packet Delivery Ratio (%)		
	GAOP	NGOP	PSOP
10	72.5	66.3	60.3
20	65.3	59.1	53.1
30	61.4	54.2	46.2
40	55.2	49	43
50	60.26	66.33	52.33
60	44.55	38.53	32.53
70	40.25	34.23	29.23
80	40.72	33.7	33.7

Fig. 4 and Table 2 shows the network performance in terms of packet delivery ratio plotted against varying no of nodes. It is evident from the plot that consistency of Genetic algorithm-based approach GAOP gives a better average performance comparing with the other two techniques. The hybrid approach NGOP gives a random high performance at certain optimum values but poor consistency. The third technique PSO yields only poor performance due to its complexity and delay in reaching optimum value.

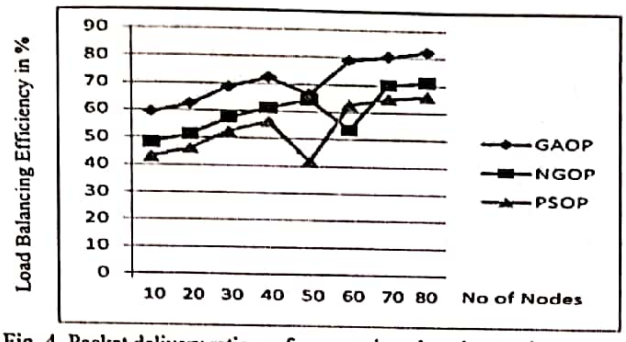


Fig. 4. Packet delivery ratio performance based on the varying no of nodes.

Fig. 5 and Table 3 show the performance of the in terms of overhead or load balancing against varying no of nodes. Genetic algorithm based approach is best in load balancing also because of the improved performance of genetic operators. The Hybrid approach NGOP is performing average due to the operational overhead, it loses the load balancing in certain situation, which may ultimately cause system crash. The PSO based approach is a distributed approach and due to the operational complexity this technique also performing poor in terms of load balancing.

Table 3. Measure of load balancing efficiency.

Node density	Load Balancing efficiency in terms of load balancing factor (%)		
	GAOP	NGOP	PSOP
10	59.35	48.15	43.1
20	62.45	51.25	46.2
30	68.55	57.35	52.3
40	72.35	61.15	56.1
50	66.45	64.24	41.59
60	78.85	53.45	62.6
70	80.25	70.05	65
80	82.13	71.08	66.03

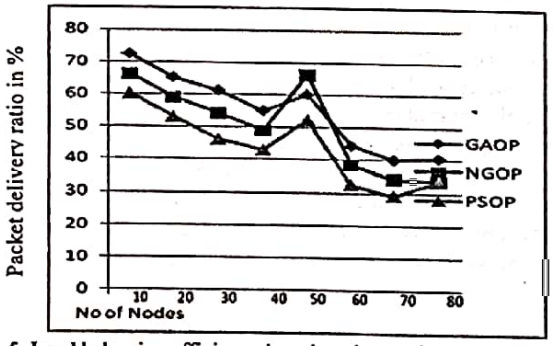


Fig. 5. Load balancing efficiency based on the varying no of nodes.

Classification of data collected from sensors are processed using machine learning approach. The performance of classification is essential as it seriously affect overall system performance. The performance of classification is tested using Weka tool where data set is prepared in Attribute Relation File Format (ARFF) and classification performed using Random Tree method. Table 4 shows the classification summary with accuracy in percentage, various parameters and performance measure indicate that this particular classification provides relatively good accuracy. Table 5 shows the detailed analysis on accuracy in terms of True positive (TP), False Positive (FP) and precision.

Table 4. Classification summary.

Correctly Classified Instances	44	83.0189 %
Incorrectly Classified Instances	9	16.9811 %
Kappa statistic	0.3057	
Mean absolute error	0.1896	
Root mean squared error	0.3912	
Relative absolute error	58.8354 %	
Root relative squared error	102.8465 %	
Total Number of Instances	53	

Table 5. Detailed accuracy of random tree classifier.

	TP Rate	FP Rate	Precision
	0.531	0.098	0.586
	0.902	0.469	0.881
Weighted Avg.	0.826	0.392	0.820

5. CONCLUSION

The bio-inspired computing and hybrid approach to monitor the sustainable city along with data analytics and prediction is compared against various performance measures. The performance of the system optimized through different approaches and performance is measured in terms of the packet delivery ratio and load balancing. The genetic algorithm-based approach performs 10%, 15% better that other approaches in case of packet delivery ratio and load balancing respectively. The GA based approach gives improved performance due to the effectiveness of genetic operators used and the performance is stable for varying no of nodes of sensor networks. PSO based approach shows improvement in certain context but performance is not stable for a varying number of nodes especially for small network. The hybrid approach always gives an average performance but the performance gave a random improvement for certain eco system. The data analytics performance measured in terms of classification accuracy and the Random Tree method provided an accuracy of approximately 83%, which is fairly good in case of large and frequent data collected.

REFERENCES

1. W. Lu, Y. Gong, X. Liu, J. Wu, and H. Peng, "Collaborative energy and information transfer in green wireless sensor networks for smart cities" *IEEE Transactions on Industrial Informatics*, Vol. 14, 2018, pp. 1585-1593.
2. L. Huang, S. Bi, L. P. Qian, and Z. Xia, "Adaptive scheduling in energy harvesting sensor networks for green cities" *IEEE Transactions on Industrial Informatics*, Vol. 14, 2018, pp. 1575-1584.
3. Q. Xu, Z. Su, Q. Zheng, M. Luo, and B. Dong, "Secure content delivery with edge nodes to save caching resources for mobile users in green cities," *IEEE Transactions on Industrial Informatics*, Vol. 14, 2018, pp. 2550-2559.
4. F. Shan, J. Luo, W. Wu, F. Dong, and X. Shen, "Throughput maximization for the wireless powered communication in green cities," *IEEE Transactions on Industrial Informatics*, Vol. 14, 2018, pp. 2560-2569.
5. Y. Zhang, C. Jiang, J. Wang, Z. Han, J. Yuan, and J. Cao, "Green Wi-Fi implementation and management in dense autonomous environments for smart cities," *IEEE Transactions on Industrial Informatics*, Vol. 14, 2018, pp. 1552-1563.
6. C. Zhu, H. Zhou, V. C. M. Leung, K. Wang, Y. Zhang, and L. T. Yang, "Toward big data in green city," *IEEE Communications Magazine*, Vol. 55, 2017, pp. 14-18.
7. B. Ahlgren, M. Hidell, and E. C.-H. Nga, "Internet of Things for smart cities: Interoperability and open data," *IEEE Internet Computing*, Vol. 20, 2016, pp. 52-56.
8. V. S. Chooralil, V. P. Vijayan, B. Paul, M. M. A. Raj, B. Karthikeyan, and G. Manikandan, "A combinatorial optimized knapsack linear space for information retrieval" *Journal of Computers, Materials & Continua*, Vol. 66, 2021, pp. 2891-2903.
9. J. Wu, S. Guo, J. Li, and D. Zeng, "Big data meet green challenges: Big data toward green applications," *IEEE Systems Journal*, Vol. 10, 2016, No. 2550530.
10. G. Bresson, Z. Alsayed, L. Yu, and S. Glaser, "Simultaneous localization and mapping: A survey of current trends in autonomous driving," *IEEE Transactions on Intelligent Vehicles*, Vol. 2, 2017, pp. 194-220.
11. O. L. Alcaraz López, H. Alves, R. D. Souza, S. Montejo-Sánchez, and E. M. García Fernández, "Rate control for wireless-powered communication network with reliability and delay constraints," *IEEE Transactions on Wireless Communications*, Vol. 18, 2019, pp. 5791-5805.
12. V. P. Vijayan and N. Kumar, "Coverage and lifetime optimization of WSN using evolutionary algorithms and collision free nearest neighbour assertion," *Pertanika Journal of Science & Technology*, 2016, pp. 371-379.
13. J. Srinivas, A. K. Das, N. Kumar, and J. J. P. C. Rodrigues, "Cloud centric authentication for wearable healthcare monitoring system," *IEEE Transactions on Dependable and Secure Computing*, Vol. 17, 2020, pp. 942-956.
14. M. Beldjehem, "Toward a multi-hop, multi-path fault-tolerant and load balancing hierarchical routing protocol for wireless sensor network," *Scientific Research, Wireless Sensor Network*, Vol. 2013.

Vinodh P. Vijayan, Head of Department, Computer Science, Mangalam College of Engineering, Kottayam, India has completed bachelor degree in Electronics and Communication Engineering, Post Graduation in Computer Science Engineering and Ph.D. in Computer Science and Engineering in the area of wireless sensor networks and soft computing. His research area or research includes soft computing, robotics, bio-inspired computing, fuzzy systems.

Biju Paul is working as an Associate Professor at Department of Information Technology, Rajagiri School of Engineering Technology, Cochin, India. He has completed his BE in Computer Science and Engineering from Bharathiar University in 2001. Subsequently, he secured his Master in Internet Computing from University of Wales Newi, UK. He was awar-ded with Ph.D. for his research in wireless sensors networks from Vels University in 2017.

Varghese S Chooralil is currently working as an Assistant Professor in Department of Computer Science, Rajagiri School of Engineering and Technology, Cochin, Inidia. He has completed M.Tech from Department of Computer Science, CUSAT in 2012 and B.Tech (Computer Science) from CUSAT in 2005. He completed his research degree from Vels University Chennai in the area of data analytics.

Turkish Online Journal of Qualitative Inquiry (TOJQI)

Volume 12, Issue 5, June 2021, 1236 - 1246

Research Article

Challenges and its Solutions with Blockchain Technology Adoption in Enterprises

Ranju S. Kartha [1]

Abstract

Blockchain is going to be a very critical technology for future development of the world. This technology is useful in storing immutable data ensuring that no one will alter data. Since it is decentralized and traceable, no central authority can control it, making it less corruptible. The enterprises are starting to use Blockchain to achieve operational efficiency by automating business process or digitizing records, tracking and tracing physical and digital assets and securing sharing of information. The number of threat vectors grows exponentially as blockchain networks become more complex. While it significantly reduces traditional risk it also creates new risks. This paper highlights the risks and challenges with blockchain adoption, also proposes some of the solutions. Blockchain is an inter-organizational technology, so how do this technology bring people from different organization together is the biggest challenge. There are many other issues like interoperability, latency issues, smart contract vulnerabilities, security concerns and throughput issues etc But people are still exploring and finding new ways of implementing blockchain technology in daily life due to its versatility resulting in new and innovative applications. So blockchain technology is revolutionary with the potential to improve or develop new systems in different industries and areas.

Keywords: Blockchain Technology, Consensus Algorithm, Decentralized Application, Distributed Ledgers, Immutability, Smart Contracts.

Introduction

Digital transformation is the prerequisite of the organization to remain competitive in the fast-changing world. Blockchain changed the thinking of people and business, it is a revolutionary technology that is going to remake the future. Big companies as well as business have felt the importance of this new technology. So many of the biggest organizations and business owners are focusing on blockchain. With blockchain, people from all around the world can exchange information quickly, effectively, securely and efficiently. That is why businesses and banks are trying to adopt this new technology to work effectively and improve their transactions. This technology which fundamentally influences the way that our economy, governance systems and business functions and changes our conceptual understanding of trade, ownership and trust.

[1]Dr., Mangalam College of Engineering, Ettumanoor, Kerala, Computer Science and Engineering Department, ranju.kartha@mangalam.in

Received: , Accepted:

Blockchain is definitely needed as this is the age of smartphones and world wide web. The rest of this paper is organized as follows: Section 2 describes the need of blockchain technology in today's world. Section 3 comprises the working of blockchain technology and section 4 addresses risk and challenges with adoption of blockchain technology in various enterprises. Section 5 proposes some of the solution to prevent risks in blockchain adoption and Section 6 presents the conclusion and future scope.

Need of Blockchain Technology

In today's world, advanced digital transactions take place every moment of each day- orders, payments, account tracking and much more. With Often It is observed that the world is standing up to modern challenges in the midst of COVID-19. The challenges include:

- Trust Deficit
- Fake Menace
- Anonymity
- Access to quality capital
- Supply chain agility and resiliency
- Need constant reconciliation
- No single version of truth

Trust

Trust is a desire, where a person will have an expectation that the person on other side will work with integrity. Nowadays we are facing a huge amount of trust deficit- when we are buying a product, we are not sure about how it is come. We are not sure about the source of the news article we read, there are many fake menaces which is going on in and around us and government is finding hard to detect. In the case of a company, it is coordinated with supplier, bank, customer, auditor and insurer. Each entity maintains its own set of accounts and it has separate transactions. But everything has to be subject to reconciliation, so there is no single version of truth. Blockchain is an evolution of ledger technology. It is maintaining a record of transactions in our lives. So, we can track the ownership of assets before/ during/ after any transaction in a secure and transparent way.

Fake Menace

Nowadays, because of the use of smart phones the world captures over 1 trillion computerized images and recordings annually. There are countless applications are available for any of us to download and use to edit manipulate and alter images and even videos. Today's world people depend on social media pictures and recordings more than ever before and on the other side we don't believe them. Due to the transparency, traceability and decentralization nature of the Blockchain, it can be conceivable to check the realness of the data or the source of information and build trust in news shown on the Web. The Blockchain in news industry enables the content to be produced and distributed over the internet in an immutable and secure way (Akash 2020).

Anonymity

It refers to data obtained from respondents who are totally unknown to those concerned with the survey. Anonymity is essential as it offers protection to those who are most at risk of experiencing retaliation for their action or beliefs such as those who support potentially controversial organizations. Blockchain provides anonymity which means nobody knows

how many blockchain assets we have and who we traded with. In blockchain technology only the person with private key can access all of the transfer information.

Access to Quality Capital

Most of the small businesses needs additional capital to start to grow to reach their potential but there are some barriers. Blockchain provides significant benefits to businesses by enabling easier, cheaper, and faster access to capital through programmable digital assets and securities (ConsenSys 2020).

Supply chain Agility and resilience

Supply chain resilience is an approach that assists a country to make sure that it has diversified its supply risk across many supplying nations rather than being dependent just one or few. While globalization has provided unlimited opportunities, it has also increased competition complexity and vulnerability. Blockchain technology could make supply chain management simpler and more transparent. Using this technology companies can manage and monitor risks within the supply chain ensure quality of delivered parts and track delivery status. Companies can also use smart contracts to manage and pay for supply chains autonomously. Smart contact could assist with shipping and logistics tracking valuable products as they travel around the world. Using blockchain technology, companies have a complete picture of their products at all stages of the global supply chain bringing transparency to the production process while reducing the cost of manufactured goods.

Need Constant Reconciliation

Disruption in the finance industry has become the new normal, and migrating to a growth mindset is the most effective way for accounting and finance professionals to prepare for what's ahead (Blackline 2017). Account reconciliation are an effective way to keep a digital eye on everything from household budgets to the finances of publicly traded companies. Most of the companies uses double entry accounting to perform an account reconciliation. But double entry accounting system has many problems such as complexity, cost, accuracy and time spent doing and verifying entries. A blockchain is a distributed, digital ledger which represents a significant innovation by offering a disinter-mediated solution to record keeping and growth of the digital economy. Since the blockchain is a shared ledger that processes transactions in real time, it has the potential to improve accounting efforts by lowering overall costs which are associated with reconciliation of ledgers, it makes reconciliation untenable.

No Single Version of Truth

In computerized business management, single version of the truth, is a technical concept describing the data warehousing ideal of having either a single centralized database, or at least a distributed synchronized database, which stores all of an organization's data in a consistent and non-redundant form (Wikipedia 2019). In today's world with the growing complexity of our technology, it getting harder to find and maintain the single version of truth. It is one of the important requirements in digital transformation. Blockchain technology provides a single version of the truth of an agreement, by validating all digital transactions using consensus algorithm within the network (Sally 2019).

Blockchain Technology

Blockchain is a decentralized digital public ledger used to record transactions across many computer systems implemented in such a way that any record cannot be altered or changed without changing all the subsequent blocks. It is a new way of securing trust, transferring the

values and storing the data. Blockchain is a digital record of transactions and its name comes from its structure, in which individual records called blocks, are connected together in a single list called chain. It's a new type of database, where information held on a blockchain exists as a distributed shared ledger, so the records are truly public and easily verifiable.

In this technology, there is no one has control of ledger, no one can falsify anything on the chain, there is no double spending is possible and finally anyone's identity can be kept completely secret. There no centralized version of information exists for the hacker to corrupt. It is additionally less vulnerable since it uses consensus algorithms to validate each transaction. Following are the four key features of this technology:

Distributed Ledgers

Blockchain is a decentralized distributed ledger, every transaction goes through the blocks and which is distributed across a number of systems in a real time basis over a peer-to-peer network. So, the ledgers are stored and maintained by all the participating nodes in the network.

Immutability

Each block header has a field that references the previous block hash key, thus forming a continuous chain of blocks. If anyone tries to tamper any block, then the whole blockchain will get dissolved, so the blockchain is immutable.

Privacy

Blockchain uses cryptographic hash functions, public and private key cryptographic techniques to ensure secure, authenticated and verifiable transactions.

Trust/Consensus

No one can alter the data without everyone finding out, it uses consensus algorithm to validate data. The consensus mechanism is used to decide which block will be added to the network. A transaction is valid only when, more than 50% of the nodes in the network should agree the consensus about its validity (Bellini 2020).

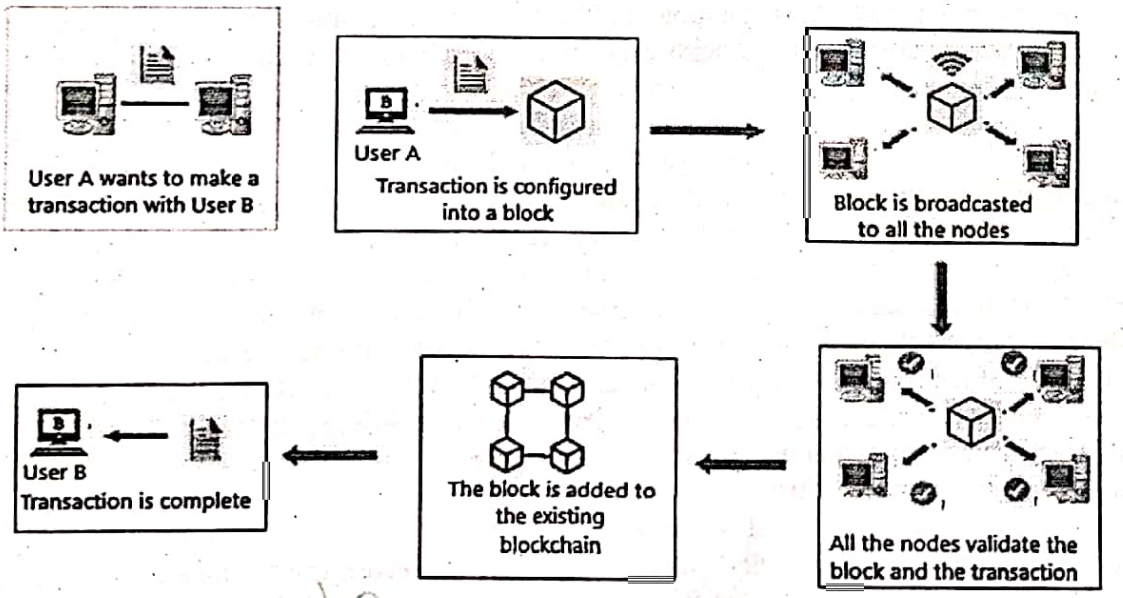


Figure 1. How Blockchain works

In Figure. 1, user A wants to make a transaction with user B, whenever a new transaction occurs, it creates a new block with new data which is broadcast to peer-peer network consisting of computers, known as nodes. Using known algorithms, the nodes in the network validates the transaction and the user's status. A verified transaction might involve records, cryptocurrency, contracts or other information. Once verified, the transaction is combined with other transactions to create a new block of data for the ledger.

The new block is added to the existing blockchain which is permanent and unaltered. The block thus created is identified using a unique code called hash. Each block has a block header and block data. Block header contains hash of the current block, timestamped batches of recent valid transactions and hash of the previous block. The block data having list of validated and authenticated transactions, thus forming a contiguous chain of blocks called blockchain. Blockchain network uses consensus mechanism which is agreed upon a signal value of truth that gets added to the blockchain.

The pillars of the blockchain structure are the contents of the block loop connection, validating the new block with the P2P consensus and verifying the communication with the encrypted signature (Cheng 20217). Blockchains are consumers of advanced cryptographic primitives including cryptographic hashing and digital signature. In blockchain technology all transactions are chained together by their hash value, once committed to the chain all records are immutable. It is impossible to alter a previous record without altering every party's chain. If one node compromised, it can no longer participate in the chain until it regenerates, the true chain from the other participants.

With blockchain, every time an asset is used or consumed, the owner of the asset signs the transfer with a private cryptographic key. In order to initiate the transaction, the owner requires both the asset and the private key. After broadcasting, anyone in the network can use owner's public key to guarantee the digital signature coming from private cryptographic key is authentic. Thus, blockchain will check the validity of the key and ownership of the asset. Therefore, even if the asset is cloned, it cannot be used without the private key. Once the transaction has been committed to the chain, the owner of the asset will have changed. This means, each node that receives a second transaction requesting the transfer of ownership, it will check that there was a previous transaction that already transferred the asset and will reject that transaction. This will prevent double spending. So cryptographic system plays an important role in the inner working of blockchain technology and public key encryption scheme serves as the premise for blockchain transactions.

In blockchain system consensus mechanisms are used to ensure records are true and honest. There are various consensus mechanisms, the difference is the way the consensus is reached. Cryptocurrencies like bitcoin and Ethereum use a Proof- of-Work mechanism. Each transaction in the network is validated by having people solving a complicated math puzzle attached to it. This is done by powerful computers and are known as miners. A reward in the form of a cryptocurrency is issued to the first minor who cracks the puzzle. The minor who has first solved the hash puzzle is allowed to broadcast the block in the network. The block also includes the solution to the puzzle, also called nonce in the block header. Other miners on the network will receive the block and they validate this block before they append it to their chain of blocks.

Blockchain technology is providing cybersecurity and protecting precious data against attacks. Communication reliability and safety will also significantly improve with this

technology. Peer-to-peer ride sharing apps allow the owners to pay automatically and the reduction in complicated bureaucracy is also one of the achievements of blockchain. With blockchain, corruption can be easily be traced instead of traditional systems which are very slow. With blockchain sensitive medical information about patient is stored in a decentralized database that is accessible to the authorized doctors. So, treating health problems with Blockchain will become easy and convenient. Hence, this technology ensures that each and every deal is a real one.

Risks And Challenges in Blockchain Technology

Every technology has advantages but simultaneously also possess some limitations that need to be considered while using that technology. In today's world Healthcare systems, Banking, Cyber Security, Real estate, Automotive industry, Bitcoin, Voting, Payment and Transactions and Smart Cities etc. uses blockchain technology. This paper points out some of the real barriers to greater adoption of blockchain technology.

Distributed Ledgers

Many industries especially big enterprises they need to follow particular regulatory compliance and whenever we deal with blockchain, we will keep that in mind. Countries like US take a lead on how regulation on cryptocurrencies should take place within the united states framework. So, the enterprises need to adopt new smart regulatory hands-off approach for implementing blockchain technologies in their financial services and other sectors (Yeoh 2018).

Scalability

Blockchain is a decentralized secured network, whenever a new transaction is created it needs to propagate to the network, it reduces the transaction speed. Scalability is an important issue in blockchain because of the limitation in the size of the block that can hold data and block creation time. Even if the block creation time is reduced, it is quite difficult to solve due to the security issues. There is a limit to block size due to the transmission overload of the network, even if the size can be increased by a certain amount.

Integration with the legacy system

Blockchain is running on the latest technology due to which its too difficult to get it synced with older systems as those systems or software need to be modified to incorporate the changes due to which overhead cost is increased to meet the blockchain requirements. Thus, it might take a lot of funds or human expertise and also it is a time-consuming process. To solve this issue, the enterprises must find way to sync their existing system with blockchain solutions.

Less Privacy

In blockchain the identities of users are anonymous, but still with the transaction patterns it is feasible to connect the user's identity with that address and can get information about the user.

Potential security threats

Real time transaction is a biggest challenge in blockchain technology. Private blockchains are generally smaller and easily disrupted by traditional DDoS. Assets can be compromised when it is moved between blockchains, this causes interoperability risk. If the private keys used to sign the transactions placed on blockchain are not managed properly, it will result in

severe security attacks. Traditional measures like load balance, redundancy and anti-DDoS measures can solve the above issues.

51% Attack

Government and enterprises need to control their data access for their security purpose, it is a great concern while they adopting blockchain technology. Since the blockchain is transparent, it is difficult to implement with sensitive data. Blockchain is the network of people. Blockchain work under the assumption that honest nodes control the network. A miner's performance is based on the amount of computational power they have and this is usually referred to as hash rate or hashing power. Miners usually grouped together in mining pool so they can combine their mining power and become more efficient. If attacker nodes collectively control more computational power than the good ones in the network is so-called 51% attack. The attacker would be able to prevent new transactions from gaining confirmations to slow down or even completely prevent transactions between users. He would be also able to perform double spending. For preventing the above attack, organizations must ensure that there is no single miner or a group of miners or mining pools that are capable of controlling more than 50% of the network's mining hash rate. Random mining group selection technique can reduce the mining power of each miners and defend against 51% attack (Yang 2019).

Selfish Mining or block withholding

Miner attacker can produce their own blockchain privately by leveraging miner's power. A selfish miner achieves this by not announcing block to the network and receiving reward when they have discovered a block. So, the blockchain grow much faster and much longer as soon as attackers can present their blockchain to the public consensus mechanism. Using this block withholding strategy, the attacker can gain profit with 25% of total computational power.

Complexity

Since blockchain includes lots of mathematical complex calculations it is difficult to understand by beginners. If the blockchain makes the consensus mechanisms more complex, it may introduce new level of risks. Data integrity is directly linked to the security of the consensus mechanisms. So, enterprises need custom consensus mechanisms that requires thorough thinking to avoid the complexity in blockchain.

Initial costs for setup

For setting up blockchain in an organization in first time is very expensive as it is installed for specific enterprise and therefore the initial cost is very high. After setting up, only few resources are available, so the organization should need some experts to fulfill demand. So, they are paying high to hire the resources which are qualified.

Consumption of Energy

Miners spend a very large amount of mining power to solve the computations using proof-of-work algorithm to validate each and every transaction in the blockchain. This process is highly energy consuming.

Lack of in-house capabilities

Lots of enterprise deciding not to do anything with blockchain because of lack of in-house capabilities including skills and understanding. They believe that local expertise is not enough to implement blockchain system in their enterprise. User awareness program, traditional end-

point security measures, security update and anti-virus solutions are essential to solve this issue.

The adoption of blockchain with other technologies in an organization, there is a need of redesigning business and application workflow as well as adoption by all users.

Solutions and Discussions

Despite the challenges it has wide ranging possibilities and potential to enhance the quality-of-service delivery, while improving confidentiality and integrity of data. While adopting blockchain technology organizations mainly focusing on:

Private blockchain

It is actually deployed internally in the organization; it cannot be accessible by everybody whoever having internet access. Private blockchains are smaller and centralized networks and their membership is limited and closely operated and controlled by one entity. It can be able to mine the blocks in one minute or we can set fixed time duration. By comparing with the public blockchain, it is secure and scalable.

Permissioned blockchain

In this case it can control who has access or who can do changes in the blockchain. Each node in blockchain need permission to read the information on the blockchain, that limit the participants that can made transaction on the blockchain. Permissioned blockchain are large distributed network however they may or may not be based on open-source code. They operate under the leadership of a known entity that determines the role that individuals can play within the network.

Integration with multiple chain

Lots of enterprises currently leveraging multiple clouds and build integration and working together in one ecosystem.

Consortium blockchain

In this, the power does not reside with a single authority, it operated under the leadership of a group. There are two types of nodes in the network, validator nodes and member nodes. Here the control over the network is given only to a few predetermined nodes called validator nodes and only these nodes can take part in consensus mechanisms. The read access is public or restricted to a set of participants, this entirely depends upon the blockchain. So, it is s partially decentralized network, which is faster and provides higher scalability and transaction privacy.

Decentralized Application (Dapp)

It is an open-source application that operates autonomously on a decentralized public blockchain. It cannot be controlled any single entity, and it generates and uses tokens by following a standard cryptographic algorithm.

Consensus Algorithms

Enterprises uses blockchain with various consensus algorithms to protect themselves against 51% attack, such as Proof of Work, Proof of Stake and Delegated Poof of Stake. These algorithms make it very impractical for an attacker to successfully conduct a 51% attack. Blockchain uses a specific set of rules for generating new blocks, one of the rules to create a

new block must be proportional to the total computing power of the proof of work mechanism.
This means that we actually own to have the computing power required to create a new block, which makes it very difficult and costly for an attacker to do. Since mining is so intense, the miners have a very strong incentive to keep mining honest rather than attempting a 51% attack or sybil attack.

Figure 2. **Layers of blockchain architecture**

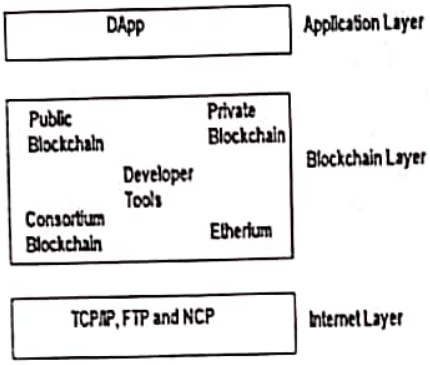


Figure 2 shows the layered architecture of blockchain- Application Layer, Blockchain layer and Internet Layer. The TCP/IP protocol is a set of rules that the end points in the telecommunication connection be used, when they communicate.

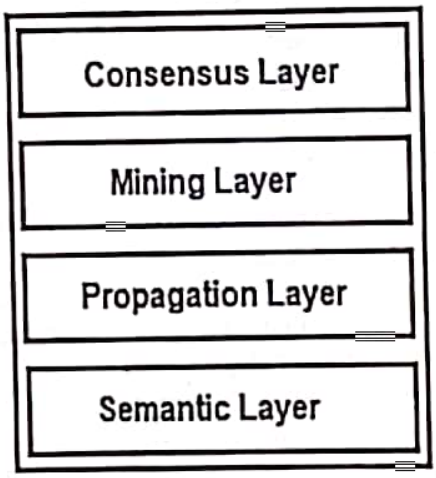


Figure 3. **Blockchain Layer**

This paper proposes four layers inside the blockchain layer, that is shown in Figure 3. Consensus layer - decides on the methods of consensus and network participation where the network rules are applied to regulate the participants. Mining layer - will perform the mining operation, Propagation layer - manages the distribution of blocks and Semantic layer - decides how the newly created block related to the previous block in the network. Consensus layer decides on the methods of consensus and network participation where the network rule are applied to regulate the participants. There is a client application DApp that will invoke the smart contract and it will execute all nodes in the network. Client application can get all the

transactions in the blockchain. It can also integrate other applications to trigger blockchain activity directly, for instance we can connect to IoT device to blockchain. Blockchain based solutions often bring together in many enterprises, which requires the development of common standards for data storage, processing and protection. This paper proposes some of the security measures to solve the risks and challenges in the blockchain technology.

- Every enterprise must have some expertise, they should have deep knowledge in blockchain technology.
- Define the organization goals, that should be synced with security goals of blockchain technology.
- Choose the type of the blockchain according to their need in their enterprise.
- Next is to find the risk and challenges in blockchain technology in their organization by performing risk assessment mechanisms.
- Define the security governance and control to prevent the risks in blockchain adoption in various application.
- The enterprises have to choose the security vendors to implement proper security measures. If an organization chooses the right architecture at the beginning, then the blockchain can foster privacy.
- After the implementation of security measures, the proper audit should be done regularly and monitor all the transactions properly.
- The software behind a blockchain has to be written perfectly, a coding error could make the blockchain vulnerable to attacks.

Conclusions

Blockchain is definitely a breakthrough in the digital financial world and it is going to be the stronger technology for future generations. So blockchain technology is revolutionary with the potential to improve or develop new systems in different industries and areas. This technology has already made great changes in the financial as well as the other fields in the world. In the future it is expected to grow more and surely its future is bright. Due to its immutability, traceability and transparency, blockchain can helps in reducing cost, inefficiencies and security threats. It creates new risks, while it significantly reduces some of the traditional risk. This new technology may involve unforeseen risks, so professionals must anticipate risk like never before and gear up for the same. The blockchain technology integrating with other existing systems is the key part of enterprise applications. It's a comparatively young technology and that undergoes rapid improvement and a few of the most important problems are still remain today.

References

1. Akash Takyar, Blockchain in fake news - transforming news industry, https://www.leewayhertz.com/blockchain-fake-news/
2. Blackline Magazine, August 24, (2017), https://www.blackline.com/blog/rpa/why-care-about-blockchain-now/
3. Bellini E, Y. Iraqi and E. Damiani,(2020) "Blockchain-Based Distributed Trust and Reputation Management Systems: A Survey", IEEE Access, vol. 8, pp. 21127-21151.
4. Cheng S, B Zeng and Y Z Huang, (2019) "Corrigendum: Research on application model of blockchain technology in distributed electricity market", IOP Conf. Ser.: Earth Environ. Sci. 93, 012065.
5. ConsenSys, Blockchain in Institutional Capital Markets, https://consensys.net/blockchain-use-cases/capital-markets/

6. Sally Jasmin Sarma, May 24, (2018), Blockchain: A single version of the truth of an agreement, https://medium.com/@sally.sarma01/blockchain-a-single-version-of-the-truth-of-an-agreement-217637665ddf
7. Smetanin S., A. Ometov, M. Komarov, P. Masek, Y. Koucheryavy, "Blockchain Evaluation Approaches: State-of-the-Art and Future Perspective", *Sensors (Basel)*, 2020, *20*, 3358.
8. Wang L, X Shen, J Li, J Shao, Y Yang, (2019), "Cryptographic primitives in blockchains", Journal of Network and Computer Applications, Volume 127, Pages 43-58.
9. Wikipedia, July 1, (2019), Single version of the truth, https://en.wikipedia.org/wiki/Single_version_of_the_truth.
10. Yang X., Y. Chen and X. Chen, (2019), "Effective Scheme against 51% Attack on Proof-of-Work Blockchain with History Weighted Information," *IEEE International Conference on Blockchain*, Atlanta, GA, USA, pp. 261-265.
11. Yeoh, P., (2017), "Regulatory issues in blockchain technology", Journal of Financial Regulation and Compliance, Vol. 25 No. 2, pp. 196-208.
12. Zhang R. , R. Xue, L. Liu, (2019), "Security and Privacy on Blockchain", *ACM Computing. Surveys*. Article 1.
13. Zheng, H. Xie,X. Dai, Chen, H. Wang, (2017), "An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends", IEEE International Congress on Big Data, Honolulu, HI, USA, pp 557-564.
14. Zheng Z., S Xie, Hong-Ning Dai, X Chen, H Wang, (2018), "Blockchain challenges and opportunities: a survey", International Journal of Web and Grid Services (IJWGS), Vol. 14, No. 4.

EAI Endorsed Transactions
on Energy Web

Research Article EAI.EU

Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization

Neethu Maria John[1,*], Neena Joseph[1], Nimmymol Manuel[1], Sruthy Emmanuel[1] and Simy Mary Kurian[1]

[1]Department of CSE, Mangalam College of Engineering, Kottayam, Kerala

Abstract

The present pandemic demands touchless and autonomous, intelligent surveillance system to reduce human involvement. Heterogeneous types of sensors are used to improve the effectiveness of this surveillance system and a cooperative approach of such sensors will make the system further efficient due to variation in users such as corporate office, universities, manufacturing industries etc. The application of effective data aggregation technique on sensors is essential as the energy utilization of the system degrades the lifetime, coverage and computational overhead. The application of bio-inspired optimization technique like Particle Swarm Optimization for scheduling leads to improved performance of the system as the nature of the system is heterogeneous and requirement is multi-objective. Similarly the application of Support vector Machine as a classification and prediction algorithm on the huge data collected periodically makes the system further autonomous and intelligent.

Keywords: IT-enabled social transformation, Intelligent systems, Cooperative surveillance system, Data aggregation, Machine Learning, Particle Swarm Optimization.

Received on 16 May 2021, accepted on 01 June 2021, published on 03 June 2021

doi: 10.4108/eai.3-6-2021.170014

*Corresponding author. Email:johnneethumaria@gmail.com

1. Introduction

The sensors in a surveillance system is a form of ad hoc network, consisting of light-weighted wireless nodes known as sensor nodes that sense environmental conditions in various forms like pressure, temperature, fire, movement, image etc. The data aggregation from these large number of sensor nodes are tedious task in terms of computational power and energy usage due to the heterogeneous nature of sensors. The cooperation among sensors is important for effective data aggregation among sensors during required time intervals. All the sensors are expected to send their data to based node periodically. The surveillance sensor system is having application like climate monitoring, building monitoring, physical condition monitoring, defense monitoring etc. But this huge network always suffers from limitations [1] like resources, storage capacity, memory, computational power etc.

Fig 1. Shows the general structure of intelligent surveillance system where all types of sensor nodes in the network is interrelated with each other or communicating via transitional sensor nodes. Sensor nodes that generate data analyze and broadcast sensed data packets to sink nodes based on their sensing mechanisms. Since the base station can be set up very far away from the sensor nodes, this method is fundamentally straight distribution. The energy utilization of data aggregation is more crucial for

nodes which is very far from base station s this kind of nodes need to broadcast data over a long distance ,this problem can be solved by classifying nodes such a way that aggregator [2] node and collection nodes. Hence, not all the nodes will broadcast rather only few nodes will transfer data to base station other nodes only collect the data.

Since the majority of sensors used in networks are resource-constrained and battery-powered, energy consumption must be kept to a minimum for longer life time. Data aggregation strategies are used to save resources, reduce energy consumption, and minimize excessive network traffic. Lot of work has been happening in this area of energy usage during data aggregation as energy usage and lifetime of a network is the major factors which decide the efficiency of the network. The transmission of redundant data also creates worst energy usage because the redundant data are generated periodically. Efficient data collection with removed redundant data and less energy usage technique is essential for the improved performance of a network as a whole.

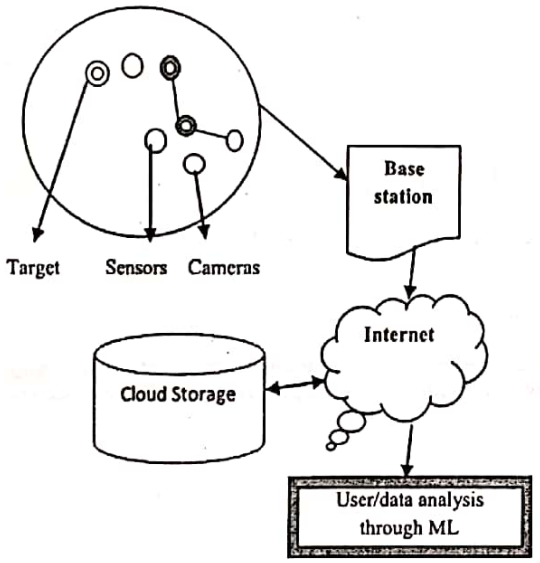


Figure 1. Basic architecture of intelligent surveillance system

The data aggregated [2] through aggregator node reaches at base node and it can be further send to user end through internet. As the surveillance is aperiodic work and sensing has to be done in frequent interval, there will be huge data generated through sensing process. This large information is stored in cloud server and data analytics is done in the data for effective prediction.

2. Background Work

The Existing Energy-efficient Routing Algorithm to Prolong [6] Lifetime is excellent technique for routing in large number of wireless sensor nodes, which is also efficient in terms of packet delivery ratio even though nodes are in heterogeneous nature. But this algorithm shows poor packet delivery ratio for a scalable network, which also suffers from low throughput when network is expanded to a large one. The data aggregation [7] support for this algorithm is also a question as it equally depends on the coverage and lifetime requirement of the network.

The more distributed approach like Ant Colony Optimisation can be utilised for effective data aggregation as it also improves overall system performance but the overhead in computational complexity is a matter of concern as the frequent pheromone updating is demanded by this protocol. Infrastructure based Data Gathering Protocol (IDGP) [8] is solution for distributed approach even though it demands huge computational power and which also degrade system lifetime. The comparison of this to protocol shows that data aggregation always create a trade off between lifetime and coverage similarly it also create a trade off between computational power and system performance.

Data aggregation always offers performance degradation due to black hole nodes and multipath [12] transmission. The presence of black hole node will ensure that data are not received the destination node, which also forwards wrong data to the destination. Multipath transmission creates a lot of duplicate packets which also become a reason for excess power [5] usage ultimately it will degrade system lifetime.

The data aggregation technique that decreases a large amount of broadcast is the most sensible application in WSN. Innovative concealed data aggregation methods are used to extensive homomorphic communal encryption techniques. The data aggregation [15] and authentication protocol, called DAA, incorporates fake data detection with data aggregation and confidentiality. The Queen-MAC protocol are used to schedule [21] the node wakeup times, reduce the inactive listening and traffic and increase the throughput as well as network lifetime.

In a heterogeneous environment of sensor nodes the broadcast and multicast based algorithm also need special attention [19] as it suffers from lot of power consumption especially due to data link layer or link layer issues. The modulation technique and demodulation technique used along with multiplexing in the lower level, the type of antenna for power dissipation etc will also create lot of life time related issues. The approaches with hybrid modulation and efficient encoding can solve the issues, which can be also used for improving security in lower layers.

The energy utilization is a major problem of wireless sensor. The author introduced the effective algorithm based on signal coverage of effective communication. There are two derived algorithm are used, to [20]

guarantee local energy balanced consumption ascribed to the deployment using multi-hop partition subspace clustering algorithm. Second one coverage probability by using distributed locating deployment based on efficient communication coverage probability. As a result DLD-ECCP protocol used to save the hardware resource and energy utilization in wireless sensor network.

The wireless sensor networks are created by associated sensors that each have the capability to gather, process, and store ecological information in addition to communicate with others through inter-sensor wireless communication. The wireless sensor network used this characteristic in broad level applications such as ecological monitoring, battlefield observation, nuclear, biological, and chemical (NBC) attack detection etc. The critical are and common area are illustrious sufficiently. The author introduced the approximation algorithm for critical-square-grid coverage [21] and to be used to cover the grid based area in entire network. As a result the author provides the better resolution for critical-square-grid coverage.

The cluster scheduling and collision avoidance are major problems of in large-scale cluster-tree wireless sensor networks. The author introduced the Time-Division Cluster Scheduling (TDCS) mechanism [22] dependent on the cyclic expansion of Resource Constrained Project Scheduling with Temporal Constraints (RCPS/TC) for clustering tree wireless sensor network with limited communication errors. The objective to aspired all end-to-end deadlines of a predefined set of time limited data flows as reduce the energy utilization of the nodes by setting the TDCS period as long as probable. Because of each cluster is active only once during the time period. The end-to-end delay of an agreed flow may span over various time periods when there are the flows with reverse direction.

3. Energy efficient cooperative data aggregation

3.1. Different types of data aggregation process

Data aggregation is key performance deciding technique in sensor network as it also depends on nature of the routing algorithm used; the same will deeply affect the network life time and coverage parameters. In order to proceed with network aggregation, the sensor nodes can route packets based on the data packet substance and choose the next hop. The network layout separates data aggregation mechanisms based on the routing protocol. In wireless sensor networks, there are four different types of data aggregation methods are used mainly.

Figure 2 shows various data aggregation methods which are frequently used with sensor networks. These techniques are mainly compared with respect to lifetime of a sensor node, coverage and throughput or packet delivery ration.

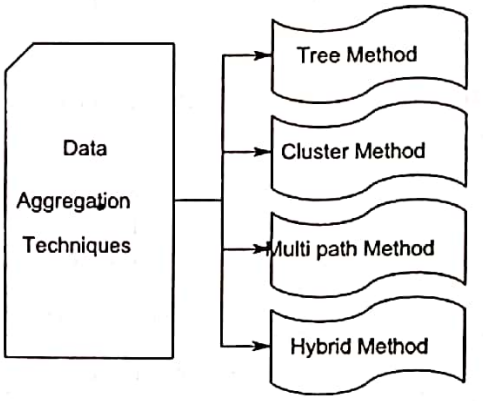


Figure 2. Various data aggregation methods

3.1.1 Tree based method

The tree-based method is useful for aggregation because it allows you to create an aggregation tree. The tree is a least spanning tree, with the base station acting as the root and the sender nodes acting as the leaves. The data stream starts with the leaves node awake and ends with the root base station. The key disadvantages of this approach are that wireless sensor networks are not immune to failure in the event of data packet loss.

3.1.2 Cluster based method

In large-scale energy control sensor networks, it is ineffective for sensors to broadcast data to the base station in an unwavering manner. The cluster-based approach is a hierarchical method that divides the entire network into several cluster classes. Each cluster has a cluster head that is chosen by the cluster members either by priority or through an election algorithm. The cluster head is in charge of aggregating data obtained from cluster members nearby and broadcasting the result to the sink node. The cluster heads may communicate directly with the sink using extended range communication or multi-hopping between cluster heads.

3.1.3 Multi path method

The downside of using a tree-based approach is that the system's robustness is limited. To overcome this limitation, a new method was developed that distributes incompletely aggregated data to a single parent node in the aggregation tree; a node can send data over multiple paths. Every node has the ability to send data packets to one or more of its neighbours. As a result, data packets flow from the sender node to the sink node through multiple paths, with several intermediate nodes in

between. These techniques were used to make the device more stable, but they added some additional overhead.

3.1.4 Hybrid method

The Hybrid method was able to distinguish between tree, cluster-based, and multipath systems. In which the data aggregation formation can be controlled based on the exact network location as well as a variety of performance data.

3.2. Data aggregation techniques with energy conversion

The difference with the general hypothesis that sensing is unrelated to energy consumption is that a hopeful class of applications is basically sensing regulated. In reality, the energy consumption of the sensing subsystem may not only be associated, but it may also be better than the radio's or even better than the rest of the sensor node's energy consumption. This can be applied to a variety of factors, including

1. Power-starved transducers are sensors that need a lot of power to complete their sampling mission.
2. High-level rate and high-level resolution AD converters are typically needed by sensors such as acoustic and seismic transducers. The converters' power consumption can be used to estimate the most significant power consumption of the sensing subsystem.
3. Active sensors are a new type of sensor that uses active transducers to obtain data about the sensed reality. In order to obtain information about the experimental quantity, sensors must send out an intrusive signal in this case.
4. Purchase period is lengthy and the acquisition time may be in the hundreds of milliseconds or level seconds range. As a result, even if sensor power consumption is limited, the energy devoted by the sensing subsystem can increase,

3.3. Data aggregation techniques with network lifetime

Battery-powered sensors can be used as long as they can link collected data to a privilege node. Sensing and communications decreased energy consumption [23, 24], allowing for more effective power management and scheduling. When ground access to the controlled area is not permitted, one alternative is to coordinate the sensors remotely from a plane to observe a series of targets with well-known locations. A high sensor inhabitant density in the drop zone will then be rewarded for overcoming exact sensor location. This would increase the likelihood of the goal coverage area being reached. For processing, the data collected from the sensors is sent to an inner node.

3.4. Energy efficient and coverage improved data aggregation and data analytics

Figure 3 shows the overall process involved in the system where data from heterogeneous sensors are collected by corresponding sensors with initial configuration there could be traditional technique to improve lifetime of the sensor [25] or coverage of the sensor. Now the collected data will be sent to cloud storage through the internet. This huge data collected [16, 22] from sensors can be e used for prediction through any suitable machine learning technique. The application of support vector machine as a classification technique will improve overall system performance as support vector classification is very effective on heterogeneous data with large number of features. Support vector can yield high classification accuracy as well as precision as it will increase the dimensionality of features available. Now the end user can get fruitful results on surveillance based on the classification and prediction.

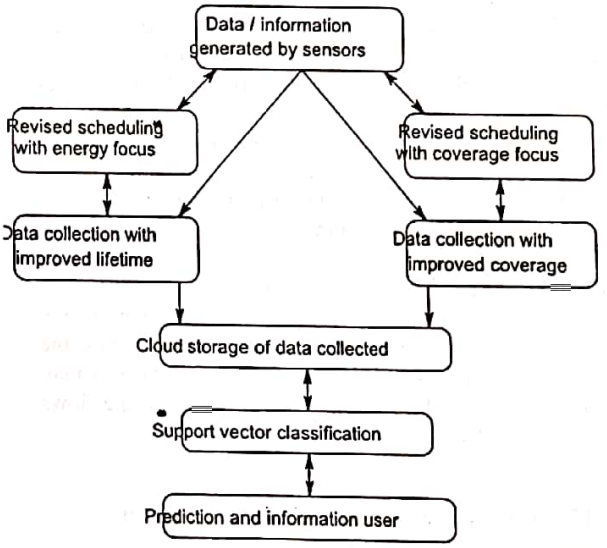


Figure 3. Energy and coverage improved data aggregation

Even though the system yields quality output, still system performance is poor due to poor handling of sensors lifetime and coverage[9] parameters. The lifetime and coverage always have a trade off as improving one parameter will reduce the value of another parameter [10]. Now application of an effective scheduling [14, 17, 18] is essential to schedule various sensors based on its application and environment to yield good life time as well as coverage [13] parameters. Particle Swarm Optimization (PSO) is applied as an effective optimization tool which can optimize both the coverage as well as energy usage according to the scenario.

3.5. Particle swarm optimization (PSO)

In order to further improve the coverage and network lifetime, Particle Swarm Optimization (PSO) [3] based scheduling is essential where all the necessary parameters are considered for optimization. PSO is utilized among sensor nodes in the heterogeneous network where essential parameters of individual sensor are considered. Once all particles are initialized with required value, an iterative optimization procedure is initiated and the optimization will be done on sensors scheduling. Process of PSO algorithm is shown in figure 4.

Input: An array of the population of particles from D dimensions in a problem space
Output: Improved load balancing among sensor nodes in WSN
Step 1:Begin **Step 2: For each particle** **Step 3: Evaluate fitness function in D variables** **Step 4: Compare each particle's fitness evaluation with its *'pbest'*** **Step 5: If current fitness value is better than *'pbest'*** **Step 6: Save the current value as *'pbest'*** **Step 7: End If** **Step 8:End For** **Step 9: Compare fitness evaluation with population's overall previous best** **Step 10:If current value is better than *'gbest'*** **Step 11: Save current value as *'gbest'* to current particle's array index and value** **Step 12: End If** **Step 13: Modify velocity and position of each particle.** **Step 14: Repeat until stop condition is met** **Step 15: End**

Figure 4. Process of PSO optimization

Figure 4 illustrates the PSO based optimization [4] to generate better scheduling of sensor nodes to improve performance without compromising lifetime and coverage. Based on the fitness value of neighbour nodes and other relevant parameters, the PSO-based approach achieves effective scheduling for transmitting data packets from source to destination. As a result, the network's lifespan and coverage are consciously increased.

3.6. Support vector machines (SVM)

For both linear and nonlinear data, SVM is a reasonably good classification [5] tool. The original training data is transformed into a higher dimension using a nonlinear mapping. With the new dimension, it searches for the linear optimal separating hyperplane (i.e., "decision boundary"). With an appropriate nonlinear mapping to a sufficiently high dimension, data from two classes can always be separated by a hyperplane. SVM finds this hyperplane using support vectors ("essential" training tuples) and margins. The training can be slow in SVM but accuracy is high owing to their ability to model complex nonlinear decision boundaries. Hence SVM is used for both classification and numeric prediction. SVM achieve a classification or regression decision based on the value of the linear combination of input features.

Figure 5 shows the general philosophy of SVM where the goal is to generate mathematical functions that map input variables to desired outputs for classification or regression type prediction problems. First, SVM uses nonlinear kernel functions to transform non-linear relationships among the variables into linearly separable feature spaces. Then, the maximum-margin hyperplanes are constructed to optimally separate different classes from each other based on the training dataset. A hyperplane is a geometric concept used to describe the separation surface between different classes of things. In SVM, two parallel hyperplanes are constructed on each side of the separation space with the aim of maximizing the distance between them. A kernel function in SVM uses the kernel trick (a method for using a linear classifier algorithm to solve a nonlinear problem)

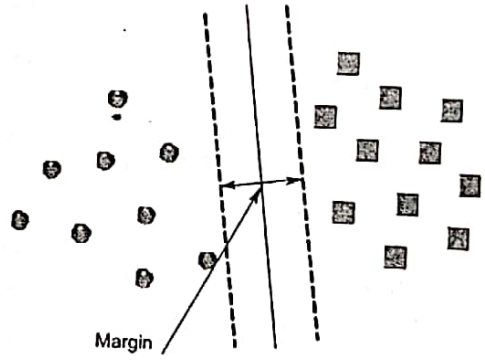


Figure 5. General philosophy of SVM

4. Experimentation and performance evaluation

4.1. Metric evaluation of data aggregation in wireless sensor network

Maximum Amount Shortest Path (MASP) is a data gathering and collection technique that increases throughput while lowering energy consumption to maximize sensor node allocation. With MASP and Shortest Path Tree (SPT), the maximum amount shortest path decreases energy consumption while increasing throughput. The Energy-efficient Routing Algorithm to Prolong Lifetime (ERAPL) [6] routing protocol is used to

save energy and extend the network's lifetime. This protocol uses with Data Gathering Sequence (DGS), used to avoid shared transmission and loop transmission between nodes.

Responding to continuous queries using data aggregation in lively data sets is the low-cost level [7] with scalable technique. The query cost model can be used to estimate the number of messages needed to satisfy the incoherency limits set by the source. The data collection route for sink node uses an Infrastructure-based Data Gathering Protocol (IDGP) [8]. The K-hop relay method is used to route data to a mobile sink node with the fewest number of hops possible. The data gathering protocol outperformed the others in terms of fewer hops and a shorter data gathering route to the sink node.

High probability's data distribution mechanism avoids the black holes created by these attacks. The arbitrarily multipath routes are generated using this mechanism [12]. The routes that have been developed are also extremely dispersive and energy efficient, allowing them to avoid the black whole attacks. This mechanism used to the optimization with reduce the energy level and to provide the security control.

To mitigate the effects of interference, combine scheduling with broadcast power management. The power regulation aids [5] in shortening the schedule length as compared to single frequency scheduling. Broadcasting on different frequencies is more professional.

4.2. Energy and lifetime parameter in sensor network

The combine-skip-substitute (CSS) method is used to find the optimal solution in small range of the lower bound. The combine-skip-substitute schemes are used to achieve the efficiency and correctness. The Data Routing for In-Network Aggregation (DRINA) [11] is used to reduce number of messages for conception a routing tree. This method maximizes the number of overlapping routes, high data aggregation, reliable transmission and data aggregation technique.

To schedule node wakeup times, minimize inactive listening, traffic, and increase latency, distribution ratio, and [21] network lifetime, an adaptive quorum-based MAC protocol is used. The optimal routing and data aggregation scheme are used achieved to enhance the lifetime of network as well as optimizing data aggregation and routing. The optimal routing and data aggregation methods to reduce the data traffic level as well as increase the network lifetime.

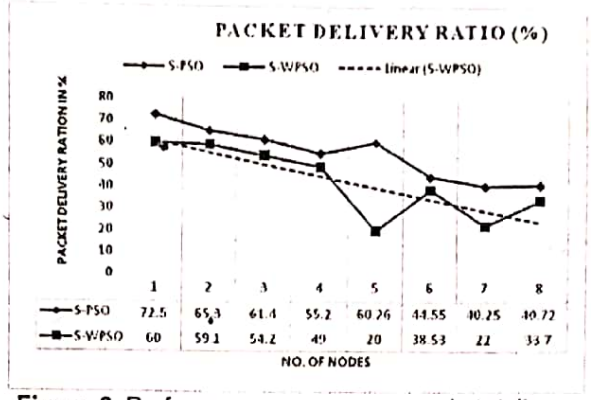


Figure 6. Performance measure on packet delivery ratio

The performance measures of network are carried out using simulation tool where prototyping of network is done with various types of nodes/ heterogenous parameters. The figure 6 shows performance of network in terms of packet delivery ratio for a varying number of nods. The performance is measured with scheduling using Particle Swarm Optimization (S-PSO) and scheduling using without Particle Swarm Optimization (S-WPSO). Scheduling with PSO offers always efficient packet delivery ratio compared with scheduling without PSO. Aathe number of nodes varies the PSO-based scheduling is still effective and the same is able to provide stable packet delivery ratio.

Table 1. Measure of load balancing efficiency

Node density	Load Balancing efficiency in terms of load balancing factor (%)	
	S-PSO	S-NPSO
10	59.35	48.15
20	62.45	51.25
30	68.55	57.35
40	72.35	61.15
50	80.00	64.24
60	78.85	53.45
70	80.25	70.05
80	82.13	71.08

Table 1 is the load balancing performance measure with respect to scalable networks. The load balancing efficiency is calculated with and without PSO based optimization and scheduling.

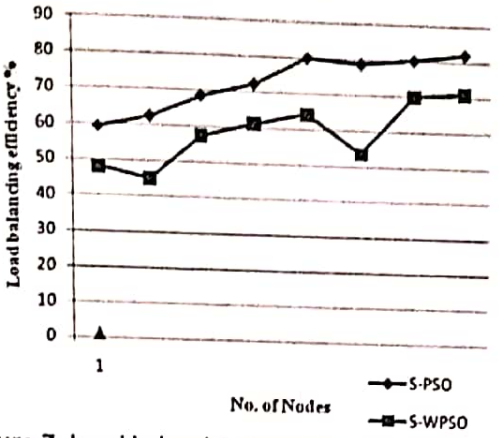


Figure 7. Load balancing efficiency of various nodes

Figure 7 shows the graph plotted with reference to load balancing efficiency of the network. As the network is heterogeneous and large, the performance measure on load balancing is important and the same shows the overall network performance, which also indirectly contribute to the computing performance or the computational requirement of the network and the same parameters also affect the lifetime of the network. It is evident from the graph that the PSO based scheduling could attain excellent load balancing efficiency compared with the traditional technique and there is almost 20% improvement in performance for a varying number of nodes with heterogeneous nature.

Table 2. Classification overview

Correctly Classified Instances	5433	84.32 %
Incorrectly Classified Instances	1010	15.67 %
Kappa statistic	0.4057	
Mean absolute error	0.1596	
Root mean squared error	0.2512	
Relative absolute error	28.8354 %	
Root relative squared error	12.8465 %	
Total Number of Instances	6443	

Classification on data acquired from the heterogeneous sensors is pre-processed and classified using Support Vector Machine (SVM) for effective prediction. The performance of classification need to be measured as it utterly affects overall system performance and the same is essential for improved prediction. The performance of the classifier is measured using Weka tool where the collected data is converted Attribute Relation File Format (ARF).

Table 3. Detailed accuracy of SVM

	TP Rate	FP Rate	Precision
	0.831	0.098	0.786
	0.902	0.469	0.881
Weighted Avg.	0.826	0.292	0.820

Table 3 shows the SVM based classification summary which enables us to evaluate various parameters like classification accuracy, overhead etc. Table 3 gives a detailed analysis on classification with measure on parameters like True positive (TP), False Positive (FP) and precision.

5. Conclusion

Autonomous nature of cooperative surveillance system is essential due to current covid pandemic situation. a surveillance system with heterogeneous sensors always perform poor due to lack of efficient data aggregation technique. The data aggregation through scheduling of heterogeneous sensors with particle Swarm Optimization technique could achieve excellent performance in terms of packet delivery ratio and network throughput. The performance measures also shows that the efficient scheduling achieved improved load balancing which also reduced computational complexity of a system and ultimately improved the life time of the system. The autonomous surveillance system always demands for prediction based on the huge data collected, the application of classification technique like support vector offer improved prediction based on available data features. The dimensional expansion on data features could improve classification accuracy even though it slightly increased the classification overhead. the application of PSO -based scheduling on heterogeneous sensors made the surveillance system Cooperative and the application of SVM based classification improved the system learning approach and the system became true autonomous.

References

[1] J. Yan, R. Qiao, L. Tang, C. Zheng and B. Fan, "A fuzzy decision based WSN localization algorithm for wise healthcare," in China Communications, vol. 16, no. 4, pp. 208-218, April 2019, doi: 10.12676/j.cc.2019.04.016.

[2] R. Nagesh, S. Raga and S. Mishra, "Elimination of redundant data to enhance wireless sensor network performance using Multi level data aggregation technique,"2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kanpur, India, 2019, pp. 1-5, doi: 10.1109/ICCCNT45670.2019.8944647.

[3] Q. Zhao and C. Li, "Two-Stage Multi-Swarm Particle Swarm Optimizer for Unconstrained and Constrained Global Optimization," in IEEE Access, vol. 8, pp. 124905-124927, 2020, doi: 10.1109/ACCESS.2020.3007743.

[4] Y. Xiaojing, J. Qingju and L. Xinke, "Center Particle Swarm Optimization Algorithm," 2019 IEEE 3rd Information Technology, Networking, Electronic and Automation Control Conference (ITNEC), Chengdu, China, 2019, pp. 2084-2087, doi: 10.1109/ITNEC.2019.8729510.

[5] S. Yang, W. Min, L. Zhao and Z. Wang, "Image Noise Reduction via Geometric Multiscale Ridgelet Support Vector Transform and Dictionary Learning," in IEEE Transactions on Image Processing, vol. 22, no. 11, pp. 4161-4169, Nov. 2013, doi: 10.1109/TIP.2013.2271114.

[6] Yi-hua Zhu, Wan-deng Wua, Jian Pan and Yi-ping Tang, "An energy-efficient data gathering algorithm to prolong lifetime of wireless sensor networks," Computer Communications., Elsevier Journal., 2010

[7] Rajeev Gupta, and Krithi Ramamritham, "Query Planning for Continuous Aggregation Queries over a Network of Data Aggregators", IEEE Transactions on Knowledge and Data Engineering, Vol. 24, No. 6, June 2012

[8] Jang-Ping Sheu, Prasan Kumar Sahoo, Chang-Hsin Suand Wei-Kai Huc, "Efficient path planning and data gathering protocols for the wireless sensor network", Computer Communications, Elsevier Journal, 2010

[9] Tao Shu, Marwan Krunz, and Sisi Liu, "Secure Data Collection in Wireless Sensor Networks Using Randomized Dispersive Routes," IEEE Transactions on Mobile Computing, Vol. 9, No. 7, July 2010

[10] Ozlem DurmazIncel, Amitabha Ghosh, Bhaskar Krishnamachari, and Krishna ant Chintalapudi, "Fast Data Collection in Tree-Based Wireless Sensor Networks", IEEE Transaction on Mobile Computing., 2012

[11] Leandro Aparecido Villas, Azzedine Boukerche, Heitor, "DRINA: A Lightweight and Reliable Routing Approach for In-Network Aggregation in Wireless Sensor Networks", IEEE Transactions on Computers, Vol. 62, No. 4, April 2013

[12] Yuan, Zhan, Wang, "Data Density Correlation Degree Clustering Method for Data Aggregation in WSN", IEEE Sensors Journal, Vol.14, No.4 , April 2014

[13] Bhasker, "Genetically derived secure cluster-based data aggregation in wireless Sensor networks", IEEE Transaction on Information Security, Vol. 8,No.1, Jan. 2014

[14] Habib, Marimuthu, "Data aggregation at the gateways through sensors' tasks scheduling in wireless sensor networks", IEEE Transaction on Wireless Sensor Systems, (Volume: 1,Issue: 3), September 2011

[15] Suat Ozdemir, Hasan and Çam, "Integration of False Data Detection with Data Aggregation and Confidential Transmission in Wireless Sensor Networks", IEEE/ACM Transactions on Networking, Vol. 18, No. 3, June 2010

[16] Hongxing Li, Chuan Wua, Qiang-Sheng Hua and Francis, "Latency-minimizing data aggregation in wireless sensor networks under physical interference model", Journal of Elsevier, AdHoc networks, 2014

[17] Sabrina Sicari, Luigi Alfredo Grieco, Gennaro Boggia, "Dynamic Data Aggregation Scheme for Privacy Aware Wireless Sensor Networks", Journal of Elsevier, 2012

[18] Xiao Hua Xu, Xiang-Yang Li, Peng-Jun Wan, and Shao Jie Tang, "Efficient Scheduling for Periodic Aggregation Queries in Multihop Sensor Networks", IEEE/ACM Transactions on Networking

[19] Koushik Sinha, Bhabani Sinha and Debasish Datta, "An Energy-Efficient Communication Scheme for Wireless Networks: A Redundant Radix-Based Approach", IEEE Transactions on Wireless Communications, Vol. 10, No. 2, February 2011

[20] Gao, Xiang, Vanq, Yintang, Zhou, Duan, "Coverage of communication-based sensor nodes deployed location and energy efficient clustering algorithm in wireless sensor network", Journal of Systems Engineering and Electronics, Vol. 21, No.4, Aug. 2010

[21] Wei-ChiehKe, Bing-Hong Liu and Ming-Jer Tsai, "Efficient Algorithm for Constructing Minimum Size Wireless Sensor Networks to Fully Cover Critical Square Grids", IEEE Transactions on Wireless Communications, Vol. 10, No. 4, April 2011

[22] Hanzalek, "Jurčik, "Energy Efficient Scheduling for Cluster-Tree Wireless Sensor Networks With Time-Bounded Data Flows: Application to IEEE 802.15.4/ZigBee", IEEE Transactions on Industrial Informatics, Vol. 6,No. 3, Aug. 2010

[23] Haibo Zhang, Hong Shen, "Balancing Energy consumptiom to Maximize network lifetime in data gathering sensor networks", IEEE transactions on parallel and distributed systems, Vol. 20, No. 10, Oct 2009

[24] Gholam Hossein Ekbatanifard, Reza Monsefi, Mohammad, Yaghmace, Seyed Amin Hosseini, "Queen-MAC: A quorum-based energy-efficient medium access control protocol for wireless sensor networks," Computer Networks, Elsevier Journal, 2012

[25] Abdel Salam,Olariu, "Toward Adaptive Sleep Schedules for on balancing energy consumption in Wireless Sensor Network", IEEE Transactions on Computers, Vol. 61,No. 10, Oct. 2012

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst08972020.pdf

https://doi.org/10.30534/ijacst/2020/08972020

An Enhanced Application for Nutrition Intake Detection using Deep Learning and IoT

Akshatha Prabhakaran[1], Amrutha Surendran[2], Anjali K Rejive[3], Anjana Babu[4],Neethu Maria John[5]

[1]B.Tech student,India,akshathap09@gmail.com, [2]B.Tech student,India,amruthasure12@gmail.com,

[3]B.Tech student,India,anjalirejive98@gmail.com, [4]B.Tech student,India,anjana.babu9cse@gmail.com,

[5]Assistant Professor,India,neethu.john01@mangalam.in

ABSTRACT

Now-a-days our world relays more or less on junk food. Due to the practice, many health issues have been reported in the recent past. This occurs mainly due to poor nutrition. Hence ensuring proper nutritional intake is the dire need of the hour. Maintaining a perfect diet, helps in improving the overall well being, also aids in fighting malnutrition and reduces the risk of chronic illness and diseases. This paper presents an IoT based application for sensing nutritional intake using deep learning techniques which is fully automated. For this, a deep learning is used. It is a convolution neural network. It contains 2 or more layers performing data transformation. YOLO and clarifia algorithms are used here. This electronic product comprises of Wi-fi enabled sensors to quantify the nutrients contained in the diet wherein a camera is used to capture the food items, which serves as the input to the sensors. The user can also input details regarding his /her ailments so as to receive suggestions about the captured food items; that is, whether the meal is appropriate to the user. A smart phone application to retrieve all the nutritional data about the food ingredients. Here, an IoT platform is used to analyse and store the sensed information.

Key words : Internet of Things (IoT), Consumer Electronics, Smart Healthcare, Smart Home, Food Monitoring, Nutrition Monitoring.

1.PROPOSING SYSTEM

This paper deals with an IoT system incoperated with deep learning algorithms so as to monitor the nutrient intake as per the given input item..This system can be deployed either using software or along the support of hardware components. Here, we use pi-cam, load sensor and the microcontroller named Raspberry pi as hardware component. For montoring the value of a food item say, an apple, the image captured by the pi-cam is served as one of the input. This image is processed by the Raspberry pi and is sent as the mail of the intended user. The second input is the value of the weight of the item as calculated by the load sensor. Now the dimension or character recognition is done by a library called load encoder which gives an integer value which is characterised as the weightage of the particular food. Hence, the weightage and weight indicated as (x1and x2) given as data set is checked against the values of weight and weightage of the given food. For this, we use decision tree regression which is one type of predictive problem solving method under machine learning. The regression tree allows output as integer values out of continuous input variables. Thus, the y value corresponding to the x1 and x2 values is obtained which gives the final output, that is, the particular nutritional value contained in the food item.

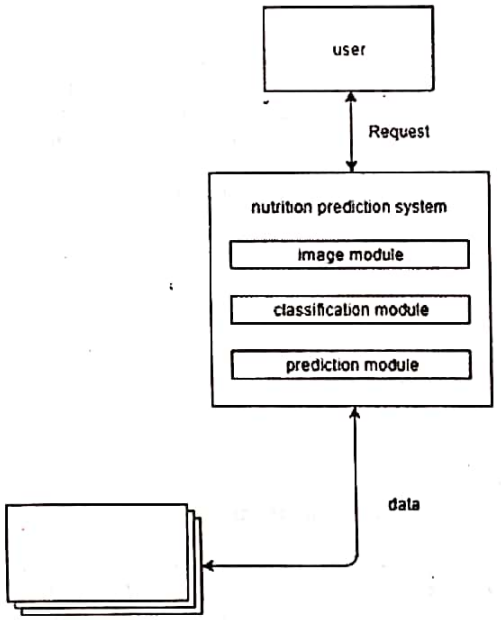


Figure 1: System architecture

2. RELATED WORKS

Research on existing calorie intake using the concept of proportionality of food bite count to the calorie intake. A micro electro mechanical gyroscope was used to track wrist motion (equal to bite count) which turned out to be inaccurate and insensitive during uncontrolled meal sittings. it was affordable and convenient. However, it was more prone to error while an individual tries to examine calorie intake due to varying serving sizes [1].Research on food image classification using multiple kernel learning was used to estimate weight of food items by combining image features to determine the type. However, practically it failed to show high performance [2]. Research on smart log addresses the low performance of the existing systems, which uses deep learning mechanisms to predict nutritional data of future meals. This system involved a weighing sensor to sense the weight of the input. However, it does not give any information whether the meal can be consumed by the user or individual using it which makes the system less persuasive [3].Research on personalised nutrition by prediction of glycemic response, it analysis the blood sugar level and obesity of the food intake by the person. connected to device which takes blood sugar level in each 5 minutes for an entire week and they uses a mobile app which records all the action of the person. Using all data an algorithm is generated to predict the blood sugar level according to the intake of the food by the disciplines. Using this prediction a good diet plan is given to the disciplines. This makes life to become healthier and changes the lifestyle[4]. This paper deals with a fully automated IoT system to determine the nutrition intake of a diet using a 5 layer perceptron layer neural network and Baysian network which comes under deep learning techniques .The system uses a cellular phone camera to capture the images of the input diet which is then sensed using different Wi-fi enabled sensors to sense the nutrient content which is then analysed and stored for future predictions with the aid of deep learning. This system also suggests if the food item is appropriate for the user as per his health conditions. The information is stored in cloud for analysis and storage for references. The system is highly convenient and affordable.

3. EXPERIMENTAL ANALYSIS

A) Data acquisition of nutrition detector

Data acquisition for the nutrition detector consists of some hardware and software designs. Raspberry pi, Raspberry pi cam, load cell, HX711 are some of the hardware components.

Raspberry pi is a latest model with 64 bit quad- core processor, dual band with 2.4 GHz and 5 GHz of wireless LAN, faster ethernet etc. it is small and powerful. ie, it act as a small computer all the nutrition value of the food item are stored in the Raspberry pi. In our proposed system the Raspberry pi is connected to the load cell and camera module. Load cell is used to measure the weight of the food item. Raspberry pi cam which is known as camera module is used to capture the image of the food item. Here the nutrition value is predicted on the basis of image captured by the pi cam. the nutrition value of 50+ items are stored in the Raspberry pi.

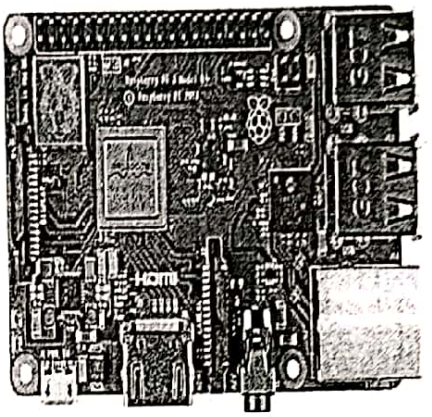


Figure 2: Raspberry Pi

Load cell is the one of the most basic and important component in the proposed system. It is a type of transducer. It converts a force into electrical signal which can be measured and standardized. The signal changes depends up on the force applied on the load cell. Here we use load to measure the weight of the food

Figure 3: Load cell

item. It is made up of aluminium alloy and it is capable of to take the reading upto 1 Kg. there are many types load cell. For eg: strain gauge, pneumatic etc.

Raspberry pi camera module V2 is a high definition image capturing device with 8 megapixel sony IMX219 image sensor. It uses CSI interface designed specially for cameras. This can be used for various other applications. Raspberry pi camera supported with raspberry pi and jetson nano.

Figure 4: Camera module

HX711 is a dual channel 24 bit precision and A/D pressure sensor load cell amplifier. This is connects the load cell and raspberry pi. It act as a amplifier. When the load cell measures the weight of the food item, it is converted in the electrical signal. This may not be accurate, sometimes it varies also. To get an accurate value we use HX711, this retrieves the output from the load cell the it performs amplification and produce accurate weight measurement of the food item. The produced output is given to the Raspberry pi module and obtains the nutrition value of the corresponding food item.

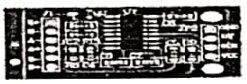


Figure 5: HX711

Software technologies

In our proposed system we use some software technologies:

- Machine learning
- Deep learning
- Programming language: python
- IoT

Machine learning is one of the application of artificial intelligence. It introduces the ability to learn automatically about the system.

Machine learning is a specified algorithm which builds a mathematical model based on training data. Machine learning is used to make prediction or decision by studying the previous data or a system. Machines are of 3types:

Supervised learning is used to built a mathematical model from set of data which contains both input and output. Supervised learning means learning is done by the training a data set which as an input and desired output. Simple example is teacher teaches he student. There are 2 types of supervised learning algorithms ie, classification algorithm and regression algorithm. Classification algorithm is used to predict a set of value. Regression algorithm is used to predict multiple values for a set of data. In unsupervised learning also mathematical model is built from data set which contains only input. Clustering and association are the methods used for unsupervised learning. The goal of the unsupervised learning is to predict the model by learning more about the given data input.

There is no correct answer and no supervisor. In reinforcement learning the prediction of a model is done by predicting the output of a data, which has no environment or a state. It uses dynamic programming technique. It does not assume the exact mathematical model.

Deep learning is another subset of artificial intelligence. Artificial neural networks are used in modern deep learning. Deep learning means the data transformed into number of layers. It can be constructed using greedy layered method. Unsupervised learning tasks use more deep learning methods. There are many applications such as image recognition, visual art processing, natural language processing.

Python is a high level programming language, open source, objects oriented, interactive language. It contains classes, data types, modules and interfaces to many system calls and libraries. Python is used widely in machine learning.

It is very easy to learn but it is slower than other languages. The capacity of data handling is large. In our proposed system pandas and MatPlotlib libraries are used. MatPlotlib is a python library with numerical mathematic expression NumPy. Pyplot is a module that has a MATLAB like interfaces. NumPy means numerical python. It has N-dimensional array objects and sophisticated function. Eg: linear algebra, matrices. Pandas is a open source data, fastest, manipulation tool. it is another kind of library.

B) Analysis of data in nutrition detector

In nutrition detector, to provide a efficient nutrition value prediction we use YOLO algorithm (you only look once). It is an object recognition algorithm and its main function is image classification. There are many images or objects, it should be classified using object recognition. To perform object recognition few steps are should be followed:

1. Classify the image: the first important step is to classify the object. When the object image is displayed it should be identified and perform classification method.

2. Location of object: when the object is classified the next step is to identify the location of the object that were it is placed. Sometimes there will be multiple

objects in the image by this information appropriate action should be taken.

3. Detection of object: when the object location is identified next is to detect the object. For detection here we use a tool known as bounding boxes. It use to select only the particular image and by this image the object is detected.

C) Model testing

In our proposed system we have imported some python libraries. It also an API interface Pandas, Seaborn and MatPlotlib. Which is easy to perform. Here we import label encoder from the library SkLearn. It is used to convert the catogarical values ie, the object name intoin integers. Run the label encoder and stores the labels. Input the data ie, attributes it will be stored. We can check information of the stored data. This is known as data preprocessing. Now the categorical values are converted into integer. The integer values are stored in array.

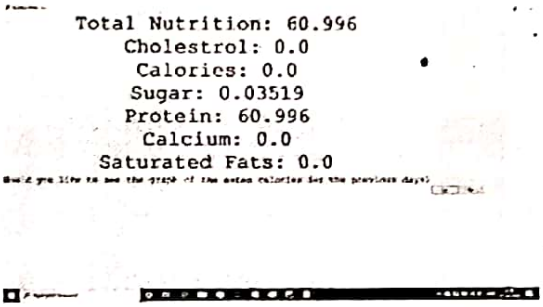


Figure 6: Output

Next we perform data classification. From library SkLearn.Tree we import decisiontreeRegressor to predict the object.

It is use predict more Y value by imputing 2 X values. The predicted output is stored as Y value and object name is stored as X value. In machine learning to train a data set, it should be splitted as 80% to training and 20% for testing. This is known as train test split method.

4.RESULT

This diet monitoring system helps fitness freaks or patients in determining tha calorie intake of the diet by providing all the nutrient content information or about the calories contained in the particular diet. Rather it also provides an entire sophisticated graph structure containing all the statistical information so as to check whether the entire diet plan was an ideal one or not. This system makes greats use of the machine learning and IoT techniques the process of classification of the food consumed with the aid of decision tree regression methods etc.

5.CONCLUSION

Here we presented a healthified nutrition prediction design. The design is highly efficient with diet monitoring. The algorithms used to implement the nutrition detector is decision tree regression algorithm and clarify algorithm. Using the image nutrition value is detected .the picture is passed through raspberry pi and to the loader sensor .the loader sensor defines the wait of the corresponding input. The weight and weightage value is compared with the value that stored in the dataset using decision tree regression algorithm. It provides the accurate nutrition value. This design becomes essential to our improves lifestyle. It provides to maintain a good diet in our day to day life.

REFERENCES

1. Y.Dong, A.Hoover, J.Scisco, and E.Muth, "A New Method for Measuring Meal Intake in Human via Automated Wrist Motion Tracking," Applied Psycho. and Biofeedback,vol.37, no.3, pp.205-215, 2012.
2. T.Joutou and K.Yanai, " A Food image recognition system with multiple kernel Learning," in Proc. IEEE Int. Conf. Image Proc., 2009, pp.285-288.
3.P.Sundaravadivel,K.Kesavan,L.Kesavan,S.P.Mohanty, E.Kougianos and M.K.Ganapathiraju, "Smart-Log: An Automated Predictive Nutrition Monitoring System For Infants Through IoT" in Proc.IEEE Int. Conf. Consum. Election., 2018.
4.Prof.Eran Segal and Dr.Eran Elinav, " personalized nutrition by prediction of glycemic response", http://doi.org/10.1016/j.cell.2015.11.0001.
5. Ajeet Ram Pathak, Manjusha Pandey, Siddarth Rautaray, " Application of Deep Learning for Object Detection", http://doi.org/10.1016/j.procs.2018.05.144.
6.T.Vu, F.Lin, N.Alahurafa and W.Xu," Wearable Food Intake Monitoring Technologies: A Comprehensive Review,"Computer, vol.6, no.4, 2017.
7. J.Wang, Z.Zhang, B.Li, S.Lee and R.Sherrat, "An Enhanced Fall Detection System for Elderly Person Monitoring using Consumer Home Networks," IEEE Trans. Consum. Electron., vol.60, no.1, pp.22-29, Feb 2014.
8. H.Kalantarian, N.Alshurafa and M.Sarrafzadeh, "A Survey of Diet Monitoring Technology," IEEE Pervasive Comput., vol.16, no.1, pp.57-65, Jan 2017.
9.P.Sundaravadiel, E.Kougianos, S.P.Mohanty and M.Ganapathiraju, "Everything You Wanted to Know about Smart Healthcare," IEEE Consum. Electron. Mag., vol 8, no.1, pp.18-28, Jan 2018.
10. O.Beijborn, N.Joshi, D.Morris, S.Saponas and S.Khullar, "Menu-Match:Restaurant-Specific Food Logging from Images," in Proc. IEEE Winter Conf. Appl. Of Comput. Vis., 2015.

Article

Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization

June 2021 · EAI Endorsed Transactions on Energy Web 9(37):170014

DOI:10.4108/eai.3-6-2021.170014

Authors:

Neethu John | Neena Joseph | Nimmymol Manuel | Sruthy Emmanuel | Simy Kurian

PRINCIPAL
MANGALAM COLLEGE OF ENGINEERING
Ettimadai

EAI Endorsed Transactions
on Energy Web

Research Article EAI.EU

Energy efficient data aggregation and improved prediction in cooperative surveillance system through Machine Learning and Particle Swarm based Optimization

Neethu Maria John[1,*], Neena Joseph[1], Nimmymol Manuel[1], Sruthy Emmanuel[1] and Simy Mary Kurian[1]

[1]Department of CSE, Mangalam College of Engineering, Kottayam, Kerala

Abstract

The present pandemic demands touchless and autonomous, intelligent surveillance system to reduce human involvement. Heterogeneous types of sensors are used to improve the effectiveness of this surveillance system and a cooperative approach of such sensors will make the system further efficient due to variation in users such as corporate office, universities, manufacturing industries etc. The application of effective data aggregation technique on sensors is essential as the energy utilization of the system degrades the lifetime, coverage and computational overhead. The application of bio-inspired optimization technique like Particle Swarm Optimization for scheduling leads to improved performance of the system as the nature of the system is heterogeneous and requirement is multi-objective. Similarly the application of Support vector Machine as a classification and prediction algorithm on the huge data collected periodically makes the system further autonomous and intelligent.

Keywords: IT-enabled social transformation, Intelligent systems, Cooperative surveillance system, Data aggregation, Machine Learning, Particle Swarm Optimization.

Received on 16 May 2021, accepted on 01 June 2021, published on 03 June 2021

doi: 10.4108/eai.3-6-2021.170014

*Corresponding author. Email:johnneethumaria@gmail.com

1. Introduction

The sensors in a surveillance system is a form of ad hoc network, consisting of light-weighted wireless nodes known as sensor nodes that sense environmental conditions in various forms like pressure, temperature, fire, movement, image etc. The data aggregation from these large number of sensor nodes are tedious task in terms of computational power and energy usage due to the heterogeneous nature of sensors. The cooperation among sensors is important for effective data aggregation among sensors during required time intervals. All the sensors are expected to send their data to based node periodically. The surveillance sensor system is having application like climate monitoring, building monitoring, physical condition monitoring, defense monitoring etc. But this huge network always suffers from limitations [1] like resources, storage capacity, memory, computational power etc.

Fig 1. Shows the general structure of intelligent surveillance system where all types of sensor nodes in the network is interrelated with each other or communicating via transitional sensor nodes. Sensor nodes that generate data analyze and broadcast sensed data packets to sink nodes based on their sensing mechanisms. Since the base station can be set up very far away from the sensor nodes, this method is fundamentally straight distribution. The energy utilization of data aggregation is more crucial for

nodes which is very far from base station s this kind of nodes need to broadcast data over a long distance ,this problem can be solved by classifying nodes such a way that aggregator [2] node and collection nodes. Hence, not all the nodes will broadcast rather only few nodes will transfer data to base station other nodes only collect the data.

Since the majority of sensors used in networks are resource-constrained and battery-powered, energy consumption must be kept to a minimum for longer life time. Data aggregation strategies are used to save resources, reduce energy consumption, and minimize excessive network traffic. Lot of work has been happening in this area of energy usage during data aggregation as energy usage and lifetime of a network is the major factors which decide the efficiency of the network. The transmission of redundant data also creates worst energy usage because the redundant data are generated periodically. Efficient data collection with removed redundant data and less energy usage technique is essential for the improved performance of a network as a whole.

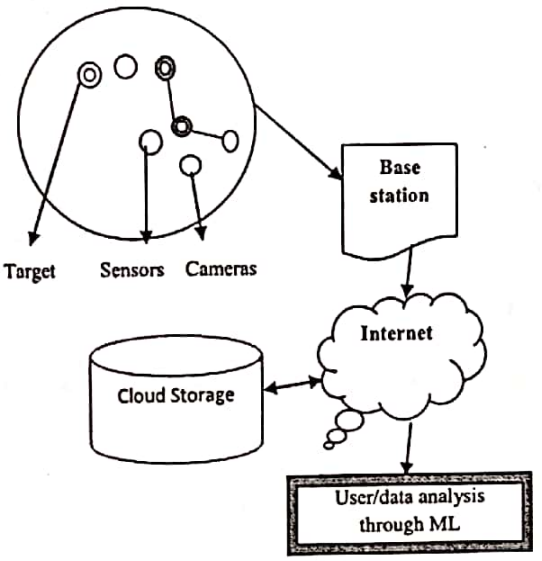


Figure 1. Basic architecture of intelligent surveillance system

The data aggregated [2] through aggregator node reaches at base node and it can be further send to user end through internet. As the surveillance is aperiodic work and sensing has to be done in frequent interval, there will be huge data generated through sensing process. This large information is stored in cloud server and data analytics is done in the data for effective prediction.

2. Background Work

The Existing Energy-efficient Routing Algorithm to Prolong [6] Lifetime is excellent technique for routing in large number of wireless sensor nodes, which is also efficient in terms of packet delivery ratio even though nodes are in heterogeneous nature. But this algorithm shows poor packet delivery ratio for a scalable network, which also suffers from low throughput when network is expanded to a large one. The data aggregation [7] support for this algorithm is also a question as it equally depends on the coverage and lifetime requirement of the network.

The more distributed approach like Ant Colony Optimisation can be utilised for effective data aggregation as it also improves overall system performance but the overhead in computational complexity is a matter of concern as the frequent pheromone updating is demanded by this protocol. Infrastructure based Data Gathering Protocol (IDGP) [8] is solution for distributed approach even though it demands huge computational power and which also degrade system lifetime. The comparison of this to protocol shows that data aggregation always create a trade off between lifetime and coverage similarly it also create a trade off between computational power and system performance.

Data aggregation always offers performance degradation due to black hole nodes and multipath [12] transmission. The presence of black hole node will ensure that data are not received the destination node, which also forwards wrong data to the destination. Multipath transmission creates a lot of duplicate packets which also become a reason for excess power [5] usage ultimately it will degrade system lifetime.

The data aggregation technique that decreases a large amount of broadcast is the most sensible application in WSN. Innovative concealed data aggregation methods are used to extensive homomorphic communal encryption techniques. The data aggregation [15] and authentication protocol, called DAA, incorporates fake data detection with data aggregation and confidentiality. The Queen-MAC protocol are used to schedule [21] the node wakeup times, reduce the inactive listening and traffic and increase the throughput as well as network lifetime.

In a heterogeneous environment of sensor nodes the broadcast and multicast based algorithm also need special attention [19] as it suffers from lot of power consumption especially due to data link layer or link layer issues. The modulation technique and demodulation technique used along with multiplexing in the lower level, the type of antenna for power dissipation etc will also create lot of life time related issues. The approaches with hybrid modulation and efficient encoding can solve the issues, which can be also used for improving security in lower layers.

The energy utilization is a major problem of wireless sensor. The author introduced the effective algorithm based on signal coverage of effective communication. There are two derived algorithm are used, to [20]

guarantee local energy balanced consumption ascribed to the deployment using multi-hop partition subspace clustering algorithm. Second one coverage probability by using distributed locating deployment based on efficient communication coverage probability. As a result DLD-ECCP protocol used to save the hardware resource and energy utilization in wireless sensor network.

The wireless sensor networks are created by associated sensors that each have the capability to gather, process, and store ecological information in addition to communicate with others through inter-sensor wireless communication. The wireless sensor network used this characteristic in broad level applications such as ecological monitoring, battlefield observation, nuclear, biological, and chemical (NBC) attack detection etc. The critical arc and common area are illustrious sufficiently. The author introduced the approximation algorithm for critical-square-grid coverage [21] and to be used to cover the grid based area in entire network. As a result the author provides the better resolution for critical-square-grid coverage.

The cluster scheduling and collision avoidance are major problems of in large-scale cluster-tree wireless sensor networks. The author introduced the Time-Division Cluster Scheduling (TDCS) mechanism [22] dependent on the cyclic expansion of Resource Constrained Project Scheduling with Temporal Constraints (RCPS/TC) for clustering tree wireless sensor network with limited communication errors. The objective to aspired all end-to-end deadlines of a predefined set of time limited data flows as reduce the energy utilization of the nodes by setting the TDCS period as long as probable. Because of each cluster is active only once during the time period. The end-to-end delay of an agreed flow may span over various time periods when there are the flows with reverse direction.

3. Energy efficient cooperative data aggregation

3.1. Different types of data aggregation process

Data aggregation is key performance deciding technique in sensor network as it also depends on nature of the routing algorithm used; the same will deeply affect the network life time and coverage parameters. In order to proceed with network aggregation, the sensor nodes can route packets based on the data packet substance and choose the next hop. The network layout separates data aggregation mechanisms based on the routing protocol. In wireless sensor networks, there are four different types of data aggregation methods are used mainly.

Figure 2 shows various data aggregation methods which are frequently used with sensor networks. These techniques are mainly compared with respect to lifetime of a sensor node, coverage and throughput or packet delivery ration.

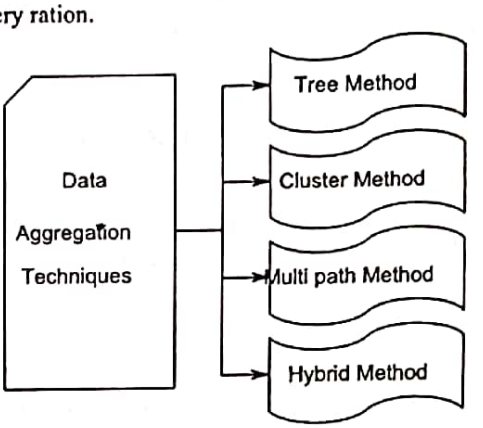


Figure 2. Various data aggregation methods

3.1.1 Tree based method

The tree-based method is useful for aggregation because it allows you to create an aggregation tree. The tree is a least spanning tree, with the base station acting as the root and the sender nodes acting as the leaves. The data stream starts with the leaves node awake and ends with the root base station. The key disadvantages of this approach are that wireless sensor networks are not immune to failure in the event of data packet loss.

3.1.2 Cluster based method

In large-scale energy control sensor networks, it is ineffective for sensors to broadcast data to the base station in an unwavering manner. The cluster-based approach is a hierarchical method that divides the entire network into several cluster classes. Each cluster has a cluster head that is chosen by the cluster members either by priority or through an election algorithm. The cluster head is in charge of aggregating data obtained from cluster members nearby and broadcasting the result to the sink node. The cluster heads may communicate directly with the sink using extended range communication or multi-hopping between cluster heads.

3.1.3 Multi path method

The downside of using a tree-based approach is that the system's robustness is limited. To overcome this limitation, a new method was developed that distributes incompletely aggregated data to a single parent node in the aggregation tree; a node can send data over multiple paths. Every node has the ability to send data packets to one or more of its neighbours. As a result, data packets flow from the sender node to the sink node through multiple paths, with several intermediate nodes in

between. These techniques were used to make the device more stable, but they added some additional overhead.

3.1.4 Hybrid method

The Hybrid method was able to distinguish between tree, cluster-based, and multipath systems. In which the data aggregation formation can be controlled based on the exact network location as well as a variety of performance data.

3.2. Data aggregation techniques with energy conversion

The difference with the general hypothesis that sensing is unrelated to energy consumption is that a hopeful class of applications is basically sensing regulated. In reality, the energy consumption of the sensing subsystem may not only be associated, but it may also be better than the radio's or even better than the rest of the sensor node's energy consumption. This can be applied to a variety of factors, including

1. Power-starved transducers are sensors that need a lot of power to complete their sampling mission.
2. High-level rate and high-level resolution AD converters are typically needed by sensors such as acoustic and seismic transducers. The converters' power consumption can be used to estimate the most significant power consumption of the sensing subsystem.
3. Active sensors are a new type of sensor that uses active transducers to obtain data about the sensed reality. In order to obtain information about the experimental quantity, sensors must send out an intrusive signal in this case.
4. Purchase period is lengthy and the acquisition time may be in the hundreds of milliseconds or level seconds range. As a result, even if sensor power consumption is limited, the energy devoted by the sensing subsystem can increase,

3.3. Data aggregation techniques with network lifetime

Battery-powered sensors can be used as long as they can link collected data to a privilege node. Sensing and communications decreased energy consumption [23, 24], allowing for more effective power management and scheduling. When ground access to the controlled area is not permitted, one alternative is to coordinate the sensors remotely from a plane to observe a series of targets with well-known locations. A high sensor inhabitant density in the drop zone will then be rewarded for overcoming exact sensor location. This would increase the likelihood of the goal coverage area being reached. For processing, the data collected from the sensors is sent to an inner node.

3.4. Energy efficient and coverage improved data aggregation and data analytics

Figure 3 shows the overall process involved in the system where data from heterogeneous sensors are collected by corresponding sensors with initial configuration there could be traditional technique to improve lifetime of the sensor [25] or coverage of the sensor. Now the collected data will be sent to cloud storage through the internet. This huge data collected [16, 22] from sensors can be e used for prediction through any suitable machine learning technique. The application of support vector machine as a classification technique will improve overall system performance as support vector classification is very effective on heterogeneous data with large number of features. Support vector can yield high classification accuracy as well as precision as it will increase the dimensionality of features available. Now the end user can get fruitful results on surveillance based on the classification and prediction.

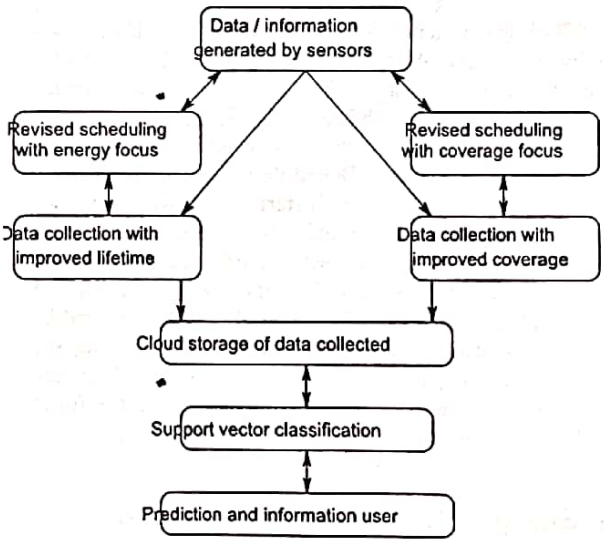


Figure 3. Energy and coverage improved data aggregation

Even though the system yields quality output, still system performance is poor due to poor handling of sensors lifetime and coverage[9] parameters. The lifetime and coverage always have a trade off as improving one parameter will reduce the value of another parameter [10]. Now application of an effective scheduling [14, 17, 18] is essential to schedule various sensors based on its application and environment to yield good life time as well as coverage [13] parameters. Particle Swarm Optimization (PSO) is applied as an effective optimization tool which can optimize both the coverage as well as energy usage according to the scenario.

3.5. Particle swarm optimization (PSO)

In order to further improve the coverage and network lifetime, Particle Swarm Optimization (PSO) [3] based scheduling is essential where all the necessary parameters are considered for optimization. PSO is utilized among sensor nodes in the heterogeneous network where essential parameters of individual sensor are considered. Once all particles are initialized with required value, an iterative optimization procedure is initiated and the optimization will be done on sensors scheduling. Process of PSO algorithm is shown in figure 4.

Input: An array of the population of particles from D dimensions in a problem space
Output: Improved load balancing among sensor nodes in WSN
Step 1:Begin **Step 2: For each particle** **Step 3: Evaluate fitness function in D variables** **Step 4: Compare each particle's fitness evaluation with its '*pbest*'** **Step 5: If current fitness value is better than '*pbest*'** **Step 6: Save the current value as '*pbest*'** **Step 7: End If** **Step 8:End For** **Step 9: Compare fitness evaluation with population's overall previous best** **Step 10:If current value is better than '*gbest*'** **Step 11: Save current value as '*gbest*'to current particle's array index and value** **Step 12: End If** **Step 13: Modify velocity and position of each particle.** **Step 14: Repeat until stop condition is met** **Step 15: End**

Figure 4. Process of PSO optimization

Figure 4 illustrates the PSO based optimization [4] to generate better scheduling of sensor nodes to improve performance without compromising lifetime and coverage. Based on the fitness value of neighbour nodes and other relevant parameters, the PSO-based approach achieves effective scheduling for transmitting data packets from source to destination. As a result, the network's lifespan and coverage are consciously increased.

3.6. Support vector machines (SVM)

For both linear and nonlinear data, SVM is a reasonably good classification [5] tool. The original training data is transformed into a higher dimension using a nonlinear mapping. With the new dimension, it searches for the linear optimal separating hyperplane (i.e., "decision boundary"). With an appropriate nonlinear mapping to a sufficiently high dimension, data from two classes can always be separated by a hyperplane. SVM finds this hyperplane using support vectors ("essential" training tuples) and margins. The training can be slow in SVM but accuracy is high owing to their ability to model complex nonlinear decision boundaries. Hence SVM is used for both classification and numeric prediction. SVM achieve a classification or regression decision based on the value of the linear combination of input features.

Figure 5 shows the general philosophy of SVM where the goal is to generate mathematical functions that map input variables to desired outputs for classification or regression type prediction problems. First, SVM uses nonlinear kernel functions to transform non-linear relationships among the variables into linearly separable feature spaces. Then, the maximum-margin hyperplanes are constructed to optimally separate different classes from each other based on the training dataset. A hyperplane is a geometric concept used to describe the separation surface between different classes of things. In SVM, two parallel hyperplanes are constructed on each side of the separation space with the aim of maximizing the distance between them. A kernel function in SVM uses the kernel trick (a method for using a linear classifier algorithm to solve a nonlinear problem)

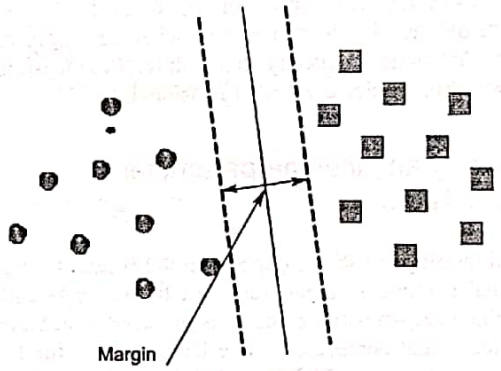


Figure 5. General philosophy of SVM

4. Experimentation and performance evaluation

4.1. Metric evaluation of data aggregation in wireless sensor network

Maximum Amount Shortest Path (MASP) is a data gathering and collection technique that increases throughput while lowering energy consumption to maximize sensor node allocation. With MASP and Shortest Path Tree (SPT), the maximum amount shortest path decreases energy consumption while increasing throughput. The Energy-efficient Routing Algorithm to Prolong Lifetime (ERAPL) [6] routing protocol is used to

save energy and extend the network's lifetime. This protocol uses with Data Gathering Sequence (DGS), used to avoid shared transmission and loop transmission between nodes.

Responding to continuous queries using data aggregation in lively data sets is the low-cost level [7] with scalable technique. The query cost model can be used to estimate the number of messages needed to satisfy the incoherency limits set by the source. The data collection route for sink node uses an Infrastructure-based Data Gathering Protocol (IDGP) [8]. The K-hop relay method is used to route data to a mobile sink node with the fewest number of hops possible. The data gathering protocol outperformed the others in terms of fewer hops and a shorter data gathering route to the sink node.

High probability's data distribution mechanism avoids the black holes created by these attacks. The arbitrarily multipath routes are generated using this mechanism [12]. The routes that have been developed are also extremely dispersive and energy efficient, allowing them to avoid the black whole attacks. This mechanism used to the optimization with reduce the energy level and to provide the security control.

To mitigate the effects of interference, combine scheduling with broadcast power management. The power regulation aids [5] in shortening the schedule length as compared to single frequency scheduling. Broadcasting on different frequencies is more professional.

4.2. Energy and lifetime parameter in sensor network

The combine-skip-substitute (CSS) method is used to find the optimal solution in small range of the lower bound. The combine-skip-substitute schemes are used to achieve the efficiency and correctness. The Data Routing for In-Network Aggregation (DRINA) [11] is used to reduce number of messages for conception a routing tree. This method maximizes the number of overlapping routes, high data aggregation, reliable transmission and data aggregation technique.

To schedule node wakeup times, minimize inactive listening, traffic, and increase latency, distribution ratio, and [21] network lifetime, an adaptive quorum-based MAC protocol is used. The optimal routing and data aggregation scheme are used achieved to enhance the lifetime of network as well as optimizing data aggregation and routing. The optimal routing and data aggregation methods to reduce the data traffic level as well as increase the network lifetime.

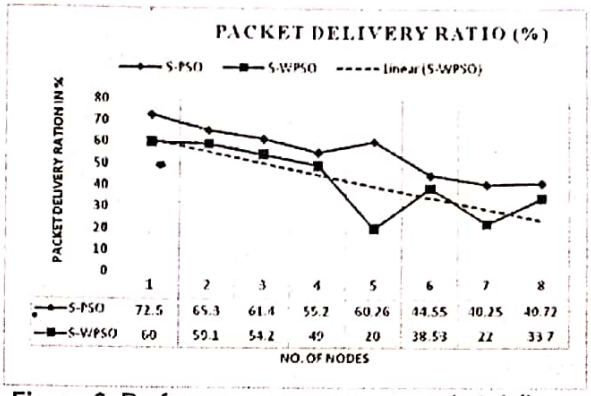


Figure 6. Performance measure on packet delivery ratio

The performance measures of network are carried out using simulation tool where prototyping of network is done with various types of nodes/ heterogenous parameters. The figure 6 shows performance of network in terms of packet delivery ratio for a varying number of nods. The performance is measured with scheduling using Particle Swarm Optimization (S-PSO) and scheduling using without Particle Swarm Optimization (S-WPSO). Scheduling with PSO offers always efficient packet delivery ratio compared with scheduling without PSO. Aathe number of nodes varies the PSO-based scheduling is still effective and the same is able to provide stable packet delivery ratio.

Table 1. Measure of load balancing efficiency

Node density	Load Balancing efficiency in terms of load balancing factor (%)	
	S-PSO	S-NPSO
10	59.35	48.15
20	62.45	51.25
30	68.55	57.35
40	72.35	61.15
50	80.00	64.24
60	78.85	53.45
70	80.25	70.05
80	82.13	71.08

Table 1 is the load balancing performance measure with respect to scalable networks. The load balancing efficiency is calculated with and without PSO based optimization and scheduling.

[3] Q. Zhao and C. Li, "Two-Stage Multi-Swarm Particle Swarm Optimizer for Unconstrained and Constrained Global Optimization," in IEEE Access, vol. 8, pp. 124905-124927, 2020, doi: 10.1109/ACCESS.2020.3007743.

[4] Y. Xiaojing, J. Qingju and L. Xinke, "Center Particle Swarm Optimization Algorithm," 2019 IEEE 3rd Information Technology, Networking, Electronic and Automation Control Conference (ITNEC), Chengdu, China, 2019, pp. 2084-2087, doi: 10.1109/ITNEC.2019.8729510.

[5] S. Yang, W. Min, L. Zhao and Z. Wang, "Image Noise Reduction via Geometric Multiscale Ridgelet Support Vector Transform and Dictionary Learning," in IEEE Transactions on Image Processing, vol. 22, no. 11, pp. 4161-4169, Nov. 2013, doi: 10.1109/TIP.2013.2271114.

[6] Yi-hua Zhu, Wan-deng Wua, Jian Pan and Yi-ping Tang, "An energy-efficient data gathering algorithm to prolong lifetime of wireless sensor networks," Computer Communications., Elsevier Journal., 2010

[7] Rajeev Gupta, and Krithi Ramamritham, "Query Planning for Continuous Aggregation Queries over a Network of Data Aggregators", IEEE Transactions on Knowledge and Data Engineering, Vol. 24, No. 6, June 2012

[8] Jang-Ping Sheu, Prasan Kumar Sahoo, Chang-Hsin Suand Wei-Kai Huc, "Efficient path planning and data gathering protocols for the wireless sensor network", Computer Communications, Elsevier Journal, 2010

[9] Tao Shu, Marwan Krunz, and Sisi Liu, "Secure Data Collection in Wireless Sensor Networks Using Randomized Dispersive Routes," IEEE Transactions on Mobile Computing, Vol. 9, No. 7, July 2010

[10] Ozlem DurmazIncel, Amitabha Ghosh, Bhaskar Krishnamachari, and Krishna ant Chintalapudi, "Fast Data Collection in Tree-Based Wireless Sensor Networks", IEEE Transaction on Mobile Computing., 2012

[11] Leandro Aparecido Villas, Azzedine Boukerche, Heitor, "DRINA: A Lightweight and Reliable Routing Approach for In-Network Aggregation in Wireless Sensor Networks", IEEE Transactions on Computers, Vol. 62, No. 4, April 2013

[12] Yuan, Zhan, Wang, "Data Density Correlation Degree Clustering Method for Data Aggregation in WSN", IEEE Sensors Journal, Vol.14, No.4 , April 2014

[13] Bhasker, "Genetically derived secure cluster-based data aggregation in wireless Sensor networks", IEEE Transaction on Information Security, Vol. 8,No.1, Jan. 2014

[14] Habib, Marimuthu, "Data aggregation at the gateways through sensors' tasks scheduling in wireless sensor networks", IEEE Transaction on Wireless Sensor Systems, (Volume: 1,Issue: 3), September 2011

[15] Suat Ozdemir, Hasan and Çam, "Integration of False Data Detection with Data Aggregation and Confidential Transmission in Wireless Sensor Networks", IEEE/ACM Transactions on Networking, Vol. 18, No. 3, June 2010

[16] Hongxing Li, Chuan Wua, Qiang-Sheng Hua and Francis, "Latency-minimizing data aggregation in wireless sensor networks under physical interference model", Journal of Elsevier, AdHoc networks, 2014

[17] Sabrina Sicari, Luigi Alfredo Grieco, Gennaro Boggia, "Dynamic Data Aggregation Scheme for Privacy Aware Wireless Sensor Networks", Journal of Elsevier, 2012

[18] Xiao Hua Xu, Xiang-Yang Li, Peng-Jun Wan, and Shao Jie Tang, "Efficient Scheduling for Periodic Aggregation Queries in Multihop Sensor Networks", IEEE/ACM Transactions on Networking

[19] Koushik Sinha, Bhabani Sinha and Debasish Datta, "An Energy-Efficient Communication Scheme for Wireless Networks: A Redundant Radix-Based Approach", IEEE Transactions on Wireless Communications, Vol. 10, No. 2, February 2011

[20] Gao, Xiang, Vanq, Yintang, Zhou, Duan, "Coverage of communication-based sensor nodes deployed location and energy efficient clustering algorithm in wireless sensor network", Journal of Systems Engineering and Electronics, Vol. 21, No.4, Aug. 2010

[21] Wei-ChiehKe, Bing-Hong Liu and Ming-Jer Tsai, "Efficient Algorithm for Constructing Minimum Size Wireless Sensor Networks to Fully Cover Critical Square Grids", IEEE Transactions on Wireless Communications, Vol. 10, No. 4, April 2011

[22] Hanzalek, Jurčik, "Energy Efficient Scheduling for Cluster-Tree Wireless Sensor Networks With Time-Bounded Data Flows: Application to IEEE 802.15.4/ZigBee", IEEE Transactions on Industrial Informatics, Vol. 6,No. 3, Aug. 2010

[23] Haibo Zhang, Hong Shen, "Balancing Energy consumptiom to Maximize network lifetime in data gathering sensor networks", IEEE transactions on parallel and distributed systems, Vol. 20, No. 10, Oct 2009

[24] Gholam Hossein Ekbatanifard, Reza Monsefi, Mohammad, Yaghmaee, Seyed Amin Hosseini, "Queen-MAC: A quorum-based energy-efficient medium access control protocol for wireless sensor networks," Computer Networks, Elsevier Journal, 2012

[25] Abdel Salam,Olariu, "Toward Adaptive Sleep Schedules for on balancing energy consumption in Wireless Sensor Network", IEEE Transactions on Computers, Vol. 61,No. 10, Oct. 2012

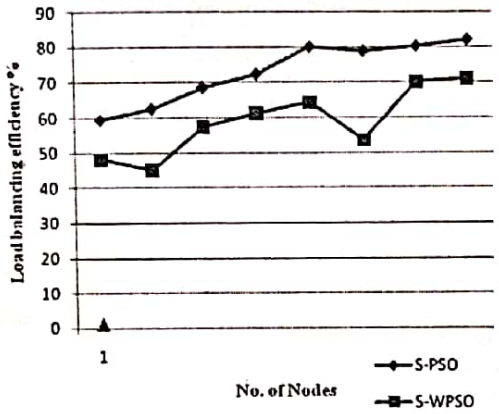


Figure 7. Load balancing efficiency of various nodes

Figure 7 shows the graph plotted with reference to load balancing efficiency of the network. As the network is heterogeneous and large, the performance measure on load balancing is important and the same shows the overall network performance, which also indirectly contribute to the computing performance or the computational requirement of the network and the same parameters also affect the lifetime of the network. It is evident from the graph that the PSO based scheduling could attain excellent load balancing efficiency compared with the traditional technique and there is almost 20% improvement in performance for a varying number of nodes with heterogeneous nature.

Table 2. Classification overview

Correctly Classified Instances	5433	84.32 %
Incorrectly Classified Instances	1010	15.67 %
Kappa statistic	0.4057	
Mean absolute error	0.1596	
Root mean squared error	0.2512	
Relative absolute error	28.8354 %	
Root relative squared error	12.8465 %	
Total Number of Instances	6443	

Classification on data acquired from the heterogeneous sensors is pre-processed and classified using Support Vector Machine (SVM) for effective prediction. The performance of classification need to be measured as it utterly affects overall system performance and the same is essential for improved prediction. The performance of the classifier is measured using Weka tool where the collected data is converted Attribute Relation File Format (ARF).

Table 3. Detailed accuracy of SVM

	TP Rate	FP Rate	Precision
	0.831	0.098	0.786
	0.902	0.469	0.881
Weighted Avg.	0.826	0.292	0.820

Table 3 shows the SVM based classification summary which enables us to evaluate various parameters like classification accuracy, overhead etc. Table 3 gives a detailed analysis on classification with measure on parameters like True positive (TP), False Positive (FP) and precision.

5. Conclusion

Autonomous nature of cooperative surveillance system is essential due to current covid pandemic situation. a surveillance system with heterogeneous sensors always perform poor due to lack of efficient data aggregation technique. The data aggregation through scheduling of heterogeneous sensors with particle Swarm Optimization technique could achieve excellent performance in terms of packet delivery ratio and network throughput. The performance measures also shows that the efficient scheduling achieved improved load balancing which also reduced computational complexity of a system and ultimately improved the life time of the system. The autonomous surveillance system always demands for prediction based on the huge data collected, the application of classification technique like support vector offer improved prediction based on available data features. The dimensional expansion on data features could improve classification accuracy even though it slightly increased the classification overhead. the application of PSO -based scheduling on heterogeneous sensors made the surveillance system Cooperative and the application of SVM based classification improved the system learning approach and the system became true autonomous.

References

[1] J. Yan, R. Qiao, L. Tang, C. Zheng and B. Fan, "A fuzzy decision based WSN localization algorithm for wise healthcare," in China Communications, vol. 16, no. 4, pp. 208-218, April 2019, doi: 10.12676/j.cc.2019.04.016.

[2] R. Nagesh, S. Raga and S. Mishra, "Elimination of redundant data to enhance wireless sensor network performance using Multi level data aggregation technique," 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kanpur, India, 2019, pp. 1-5, doi: 10.1109/ICCCNT45670.2019.8944647.

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst09972020.pdf

https://doi.org/10.30534/ijacst/2020/09972020

RESULT PREDICTION SYSTEM USING MACHINE LEARNING

Megha S [1], Nitha Johny[2], Raicy Ann Mammen[3], Sandra M[4], Ms. Neena Joseph[5]

[1]Department of Computer Science, India, smegha4321@gmail.com

[2] Department of Computer Science, India, nithajohny277@gmail.com

[3] Department of Computer Science, India, annraicy@gmail.com

[4] Department of Computer Science, India, sandramprasanth55@gmail.com

[5]Faculty Department of Computer Science, India, neena.joseph@mangalam.in

ABSTRACT

Higher education institutions are often very curious about the success rate of the students throughout their study. Classification and prediction of student's performance in examination are the typical challenges for educators. Machine learning is expected in the near future to provide various venues and effective tools to improve the education in general.The proposed system is an academic result analysing and predicting software using machine learning algorithms. The system is implemented as a UI application. Datasets are processed in the TensorFlow framework. The dataset containing internal exam marks, attendance percentage, timely submission of assignments, previous semester university result etc will be the input. The results can be predicted as whether pass or fail for each subject. SVM algorithms are used for processing the data and more accurate result will be outputted. Front-end and back-end are developed in Python language, where Flask is used in front-end.

Key words: Machine Learning, UI application, Sklearn, Flask.

1. INTRODUCTION

Education is the cornerstone of the society. Hence every educational organizations intend to teach and train in a way that each student can perform well. Inspite of having the uniform platform to learn in schools or colleges, the performance of students varies enormously. This can be ascribed to difference in cognition level, motivation levels and environmental factors. Now with increased computational power it is also simpler to train machines the various nuances of the teaching learning domain. Here we are using machine learning to identify the performance of a student. Machine learning has been successfully applied in the domain of educational data mining (EDM) which includes domains like performance prediction, student modeling, analysis and visualization of student data, recommendation system, student learning curve analysis etc.

Based on the past examination results and the class assessments, it is possible to forecast the future development of the students. It is a challenging and important as it involves the large volume of data in educational databases and the result could impact the future development of a young kid. A good and accurate prediction can bring the benefits and impacts to students, educators and academic institutions. Various types of data mining techniques have been used for performance prediction from decades including Decision Tree, Naive Bayes, K-Nearest Neighbor and Support Vector Machine (SVM). However, with the rise of artificial intelligence and deep learning application, and also using AI engine such as Google TensorFlow for pattern recognition has now been rising its importance.

Artificial intelligence in general, and, machine learning (ML), in particular, has the potential to revolutionize Science-Technology-Engineering-Math (STEM) education. The main venues to improve education using ML algorithms-based techniques include but are not limited to cases such as 1) customizable student learning experience; 2) student path prediction; 3) better organization of learning content, curriculum and learning process; 4) automatic and unbiased grading system; 5) overall feedback on both students' and teachers' performance; 6) suggested learning path; 7) matching students and teachers; 8) educational experiments. The model creates a solid foundation for the conceptual modeling and software engineering of smart learning analytics (SLA) systems that would have and actively use the unique features of smart university, smart education, and smart classroom, including 1) adaptively, 2) sensing, 3)

inferring, 4) anticipation, 5) self-learning, and 6) self-organization. In this, we will investigate how to use artificial intelligence and deep learning algorithm for pattern recognition and correlation of assessment results. There are also some more traditional data mining techniques that have been used to predict student's performance.

1.1 Machine Learning Overview

Machine learning is a new approach to learn and analyze complex and huge data. It is based on algorithms that can learn from data without relying on the conventional programming, i.e., rules-based programming. The primary aim is to allow the machines like computers, etc., to learn automatically without human intervention or assistance and adjust actions accordingly [1]. It emerged individually as a scientific discipline in the late 1990s as steady advances in digitization and cheap computing power enabled data. Scientists have stopped building finished models and have plunged into a novel adventure in training computers, through which an unmanageable volume of data and complexity of the big data can be processed and analyzed using the potentiality of machine learning. But, using classical algorithm of machine learning, text is considered as a consequence of keywords; instead, an approach based on semantic analysis mimics the human ability to understand the meaning of a text. Hence, machine learning is an emerging trend in the era of information technology.

1.2 Confusion Matrix Classifier

A confusion matrix is a summary of prediction results on a classification problem. The number of correct and incorrect predictions are summarized with count values and broken down by each class. This is the key to the confusion matrix. The confusion matrix shows the ways in which your classification model is confused when it makes predictions. It gives us insight not only into the errors being made by a classifier but more importantly the types of errors that are being made. The number of correct and incorrect predictions are summarized with count values and broken down by each class. This is the key to the confusion matrix. Out of all positive classes, how much we predicted correctly , it should be as high as possible [2]. This matrix shows the ways in which your classification model is confused when it makes predictions. It gives an insight not only into the errors being made by our classifier but more importantly the types of errors that are being made. It is this breakdown that overcomes the limitation of using classification accuracy alone. Confusion matrix can be calculated by following process: 1) Test a dataset or validate dataset with expected outcome values, 2) Make a prediction for each row in test dataset, 3) Predicts the count from the expected outcomes.

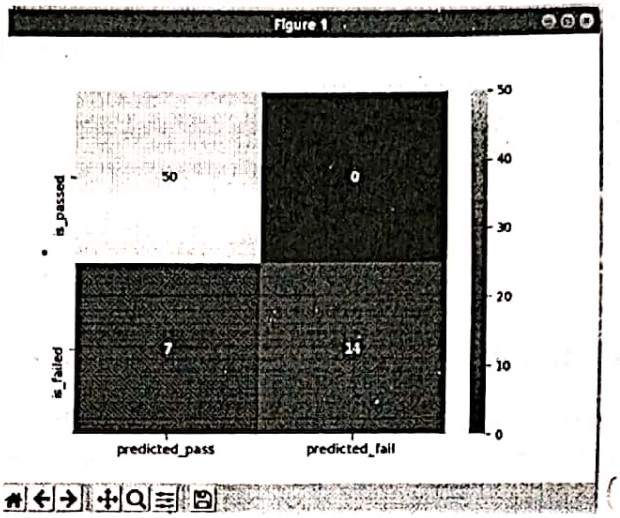


Figure 1: Confusion Matrix of our system

1.3 Support Vector Machine Overview

Support Vector Machine is a supervised machine learning algorithm that can be used for both classification or regression challenges. However, it is mostly used in classification problems. In the SVM algorithm, we plot each data item as a point in n-dimensional space with the value of each feature being the value of a particular coordinate. Here in this, we need not have to add this feature manually to have a hyper-plane, the SVM algorithm has a technique called the kernel trick. The SVM kernel is a function that takes low dimensional input space and transforms it into a higher-dimensional space. It does some extremely complex data transformations, then finds out the process to separate the data based on the output we have provided. The main reason for us to choose SVM as our algorithm as by the reasons, 1) effective in high dimensional space [3], 2) it is effective as in our case we have more number of dimensions than number of samples, 3) memory efficient as there uses subset as training points, and 4) it has a versatile nature.

We are using Python as our system language. As in Python, scikit-learn is a widely used library for implementing machine learning algorithms. SVM is also available in the scikit-learn library and we follow the same structure for using it. We are using this classifier as it works really well with a clear margin of separation, is effective in high dimensional spaces, is effective in cases where the number of dimensions is greater than the number of samples and moreover it uses a subset of training points in the decision function called

support vectors, so it is also memory efficient. Here we are using previous year pass out students result as a subset of training to analyze the results of the students which we desired to find out whether a student will pass or not in the upcoming examination.

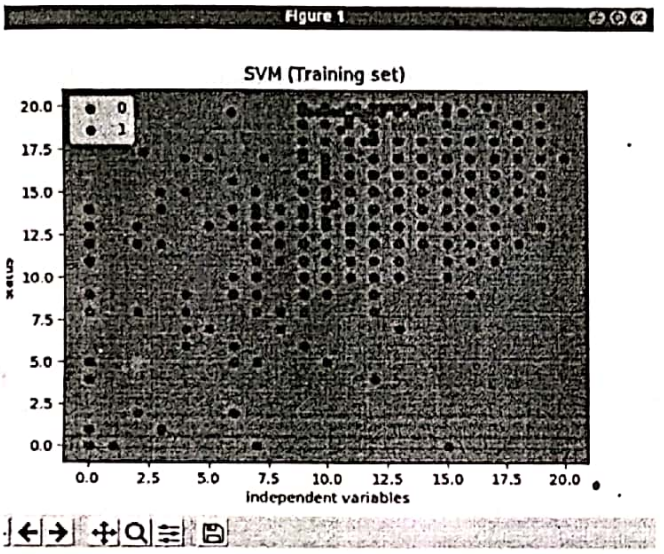


Figure 2: Training set in SVM

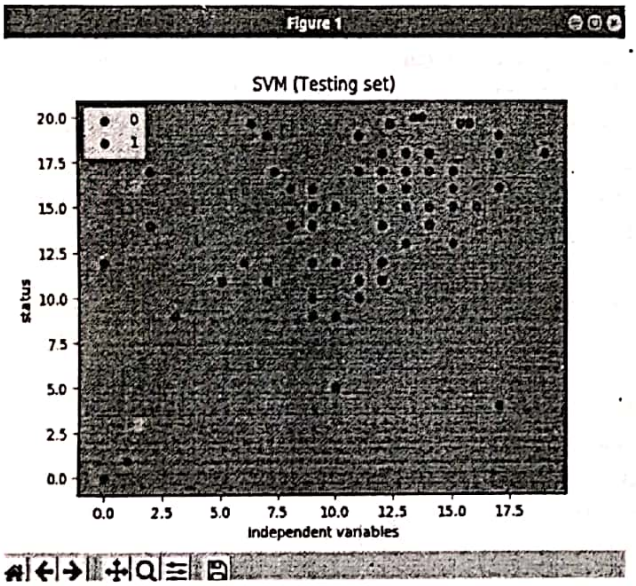


Figure 3: Testing set in SVM

2. LITERATURE SURVEY

In LMS, every action is stored and evaluated as its insight can be obtained into students' behavior online, which can be used to increase the capability of learning as well as teaching. The learning analytics which is the analytics of LMS data is defined to be the collection and reporting measurement of data about the learners and the purposes of understanding and learning their concept and in which environments it occurs. LMS data is used in the field of learning analytics for the prediction of student performance model with the prediction of their grades as well as how many are at the risk of failing a course [4]. This is an important step in learning analytics, as it informs the implementation of interventions, such as personalized feedback.

Studies predicting student success in offline education have typically collected measurements using validated questionnaires, interviews, and observational techniques, with relevant theoretical concepts in mind so that the measurement can be geared towards the concepts that the researcher thinks need to be measured. The use of LMSs allows for tracing and analyzing students' online behavior without the necessity of time-consuming data-collection. However, LMSs provide raw log data that are not concrete measurements of previously outlined theoretical concepts. It is therefore important to understand whether and how these data can be used for learning analytics. Moreover, the question is whether there is actually a single best way to predict students' performance across a diverse set of courses and by evaluating their performance. Studies that have used similar methods and predictors models. Even within an institution that is using the same LMS, such differences have been found in the prediction models of the nine blended courses. Thus, the effects of LMS behavior on student performance might differ per institution or even per course. Indeed, a study using 29 courses (204 offerings, 352 unique students), has found that the variance in students' performance (final grade), was accounted for by individual differences (18 percent) as well as course offerings (22 percent) [4].

In addition, most studies focus on predicting student performance after a course has finished, establishing how well student performance could have been predicted with LMS usage data, but at a point in time where the findings cannot be used for timely intervention anymore. As LMS data provide information during the whole course, it seems useful to determine whether data from only the first weeks of a course are enough for accurate prediction of student performance. In the current study, the authors add to the analysis of the portability of prediction models and the accuracy of timely prediction. First, we provide an overview of the theoretical arguments used in learning analytics and the predictors that have been used in recent studies. The predictive value of these

predictors will be examined in 17 blended, undergraduate courses taught at the same institution (Eindhoven University of Technology). This allows us to establish the effects of different types and degrees of LMS usage while controlling at least to some extent for contextual effects. Furthermore, the portability of the prediction models across the 17 courses, i.e., the effect of course, is analyzed. For this, they replicate the study of Ga'sevi'c et al within another institution with a larger sample of more similar courses [5]. Moreover, to ensure the comparability of findings, they only use predictors that are available for all courses. In addition, they analyze whether it is possible to identify students at-risk early on in a course, and to what extent these models can be used to generate targeted interventions.

It is increasingly evident that a large number of college students do not complete the courses on which they enroll, mainly for courses with lower entry requirements. Enrolment numbers to tertiary education are increasing, as is the academic and social diversity which is in the student population. This adds to the challenge of both identifying students at risk of failing and providing appropriate supports and learning environments to enable all students to perform optimally. Learning is a latent variable that is typically measured as academic performance in assessment work and examinations [6]. Factors impacting academic performance have been the focus of the research area for many years. It continues as an active research topic, indicating the inherent difficulty in generating models of learning, particularly in tertiary education. Such education providers collect an increasing volume of data on their students. Therefore, the application of data mining to educational settings is emerging as an evolving and growing research discipline. Learning Analytics (LA) and Educational Data Mining (EDM)aim to better understand students and how they are learning through the use of data analytics on educational data [6]. The objective of this paper is to investigate the accuracy of classification models that identify students at risk of failing in the first by analyzing their academic performance. This study considers both linear and non-linear classification models. Model accuracy which is estimated using cross-validation was compared to model performance when tested on students from a different group. Participating students were from a diverse student population that included mature students, students having disabilities, and students from disadvantaged socio-economic backgrounds. Academic performance was measured as Grade Point Average (GPA), an aggregate score of both semester 1 and semester 2 module grades that were compiled from both the end of term module exams and continuous assessment work.

Student's performance prediction seen to be of dire importance to most academic institutions for higher learning. This may lead to many kinds of research in prediction works that included many students from different backgrounds and academic areas such as MBA students, nursing students and that of Computer background students. Because the predicators variables or the independent values were mostly dealt with demographic profiles. Data collected was mostly from survey forms based on the students' recent background education, residency region, gender and Scholastic Aptitude Test (SAT) scores. Statistical Packages for Social Sciences (SPSS) have been very popular among past researchers that utilize Linear Regression, Data Mining techniques, and Decision Trees. Artificial Neural Network (ANN) came into the picture for student's performance prediction quite recently [7]. These NN models were also considered as demographic backgrounds as inputs to the model. The study presented here with because only considering the Grade Point (GP) of fundamental subjects scored by the students in the first semester as the inputs without considering their former background education or family background. Once the students are accepted into the Program based on merits set by the Faculty of Electrical Engineering UiTM, then everyone should help to be offered to help students to perform in their study before graduation so as to provide them with basic keys into their future lives. Thus such novel effort from academic lecturers is in line with the philosophy of the Universities which states that every individual student has the ability to attain excellence through the transfer of knowledge and the assimilation of moral values so as to they become professional graduates capable for developing knowledge, self, society, and worldwide. The paper describes the development of ANN to predict the performances of bachelor degree engineering students based on the intakes from Matriculation and Diploma level entries. Data of Matriculation and Diploma level intake students were compiled in Excel format which included student reg no, gender, CGPA at semester eight, GP of subjects scored at semester one to semester three for Matriculation students [7]. For the Diploma students, the Grade Points of subjects start with semester three onwards. Such students have a direct entry into the semester three of the Program due to credit exemption for courses in semester one and two. Such data were collected from the Students Information Management- System (SIMS) in UiTM developed to store students' academic information until graduation. Such software helps academic advisors to

keep track of students' achievement right from the very start of Program.

Many studies have predicted that the future performance of companies for the purposes of making investment decisions. Most of them are based on the qualitative judgments of experts in related industries, who are considered as various financial and firm performance information. However, the qualitative judgments are very highly subjective and are limited in the sense that conclusions come at a significant cost in terms of time and money. With the recent developments in technology, researchers have begun to using machine learning techniques to predict corporate performance. For example, the artificial neural networks, which have relatively good predictive ability in various fields, are widely used in various studies.

However, the models are based on the artificial neural networks often suffer from the problem of overfitting in training data. However, for training a deep neural network takes more time, and the propagation of errors, based on the backpropagation algorithm, back to the input layers can be very difficult. The results of many studies have been shown that prediction models constructed using a support vector machine (SVM), as suggested by Vapnik, have good predictive performance and very fast learning speed [8]. As a result, many researchers have investigated using an SVM machine to predict the corporate performance and stock prices. Recently, the artificial neural network-based for predicting the models have been again attracting attention owing to the development of many parallel processing technology, as well as the algorithms that overcome the limitations of deep neural networks. The algorithm which is used to train a deep neural network is the deep belief network (DBN). A DBN performs the pretraining through unsupervised learning using the restricted Boltzmann machine (RBM) and using fine-tunes the network via supervised learning on training data [8]. In addition, the convolutional neural networks, which are widely used in image processing and voice recognition, demonstrate good performance which is widely used in constructing the classification models in various fields. In order to construct the corporate performance prediction models, the predictors are needs to predict the performance of companies. Most of the corporate performance prediction models use the company's financial performance data and financial indicators as the predictors. However, there is a recent increase in the proportion of technology-intensive firms whose technological capability significantly increases their corporate performance. Thus, in order to predict the corporate performance more accurately, it is most necessary to use both a company's financial information and technical information as predictors. As a result, there are many recent studies that have proposed indicators that show the technological competitiveness of the company. Many of these studies apply for patent data, because they are easier to use in more quantitative analyses, have an internationally uniform structure, and citation information. Among the recent studies predict a company's performance, there are less than construct a prediction model using patent data and the deep learning algorithm. In this, we propose a deep neural network-based performance prediction model that uses the company's financial and technical indicators as predictors. The proposed model includes the unsupervised learning phase, using an RBM, in which the training uses the entire training data set [8]. Then, there is a very fine-tuning phase, which uses the backpropagation algorithm and a relatively up-to-date training data set.

3. SYSTEM ENVIRONMENT AND DESIGN

The objective of this work is to create a web service for the prediction of students results based on their criteria such as their attendance, series exams scores, assignment scores, previous academic scores, etc. It is decided to use Flask web framework for frontend. While using Flask, the front will comprise of HTML, JavaScript, and CSS. Additionally, Python programming tool and Machine Learning Studio are used for the complete execution of the work.

The steps to be followed for the students result prediction are given as follows:

A. Data Set Preparation:

A data set is prepared in the form of csv file to give training to the machine and testing it.

B. Training Model:

Train the machine model based on the data set. The train model has two inputs: 1) SVM algorithm, 2) data provided by the user.

C. Classifier Model:

Here we are using confusion matrix as our classification model on our set of testing data. As this will easily identify any confusion between two classes.

D. Evaluation Model:

This model evaluates the score result and calculate the machine learning parameters: true positive, true negative,

false positive, false negative, receiver operating characteristic (ROC), precision, accuracy, recall and F1 score.

E. Web service deployment and publishing

The entire model is deployed in the form of web service so that HOD or class in charge or even other faculty members can access this system.

4. SYSTEM EVALUATION

We are publishing our model as web services that can be easily be consumed by custom apps or business intelligence (BI) tools such as Excel. To develop a predictive analysis model, we can typically use data from one or more resources transform and analyse that data through various data manipulation and statistical functions and generate a set of results.

Let A be true positive, B be false negative, C be false positive and D be false negative. Then accuracy, recall, precision and F1 score can be calculated using the formulae given below:

$$\text{Accuracy} = (A+D)/(A+B+C+D) \quad \text{—— (1)}$$

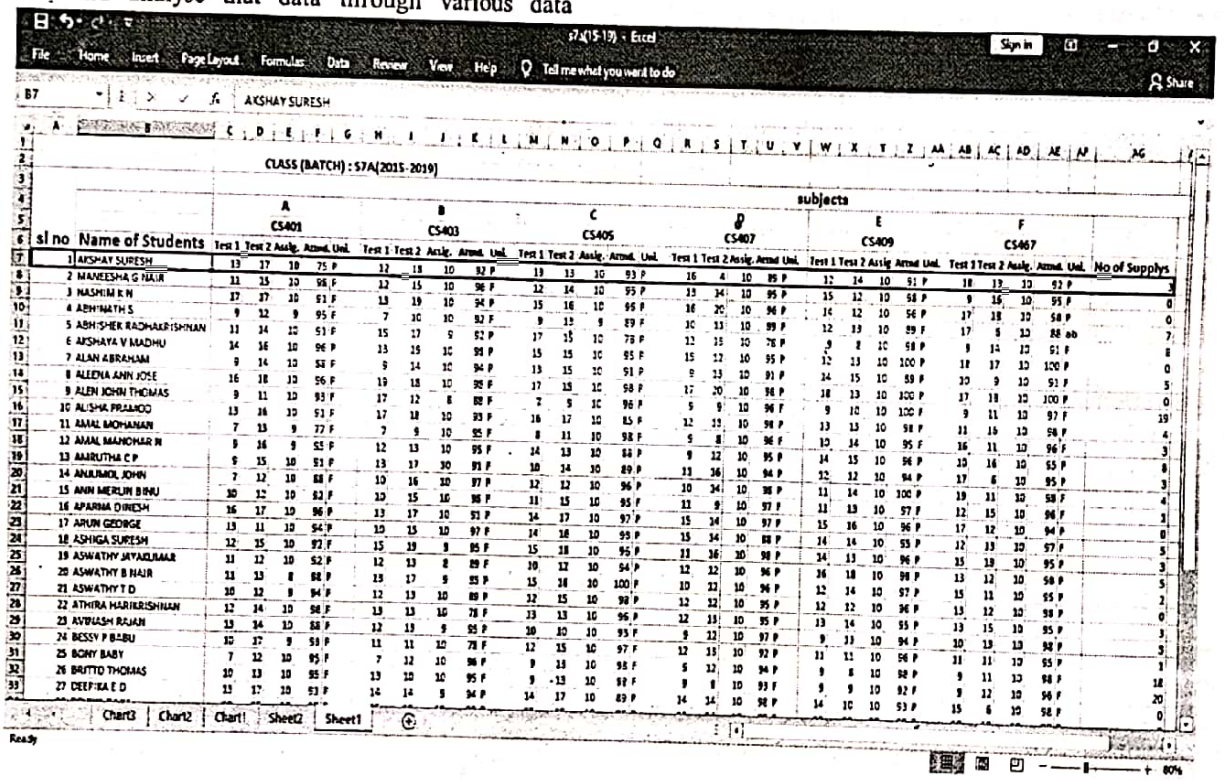


Figure 4: A database sheet that is used as a training set for the system

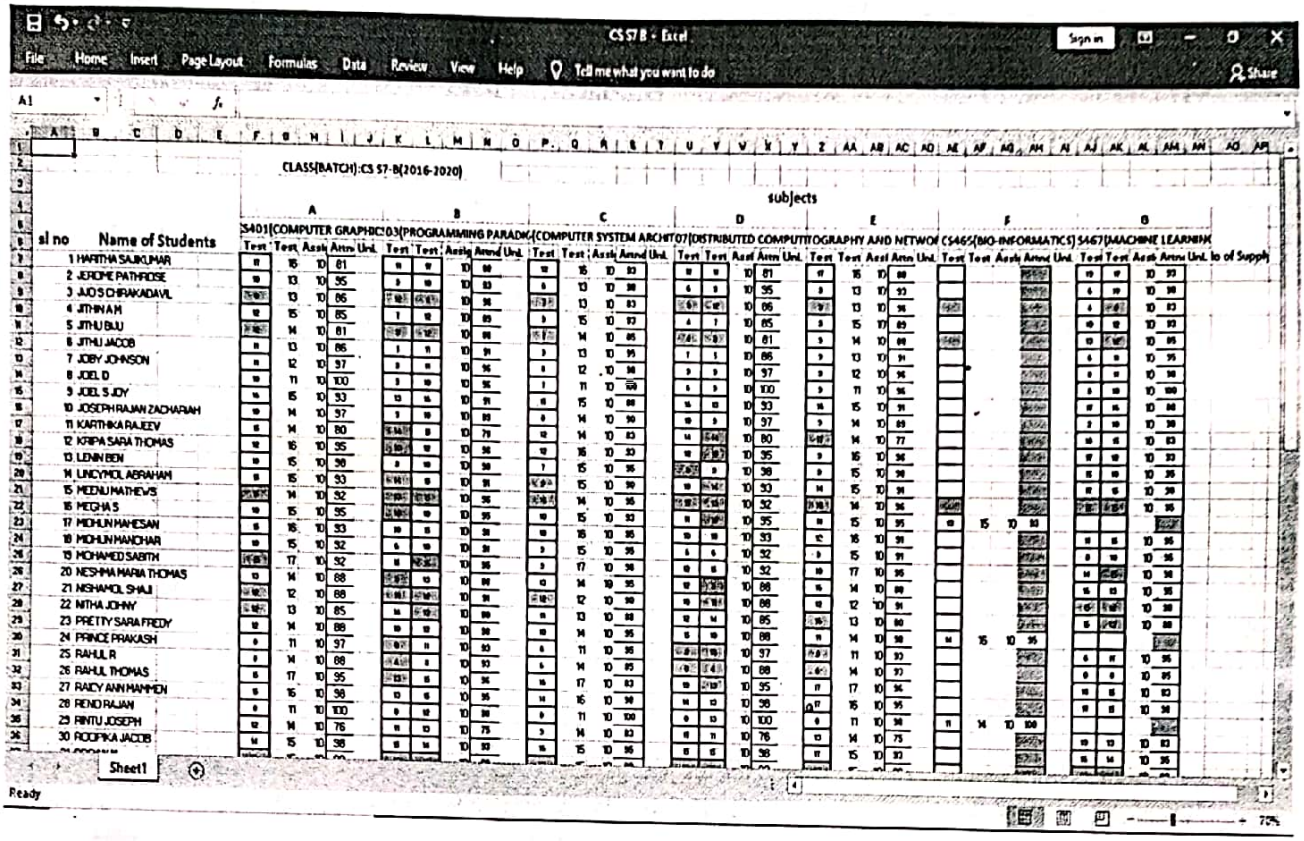


Figure 5: A sample database sheet for student data entry

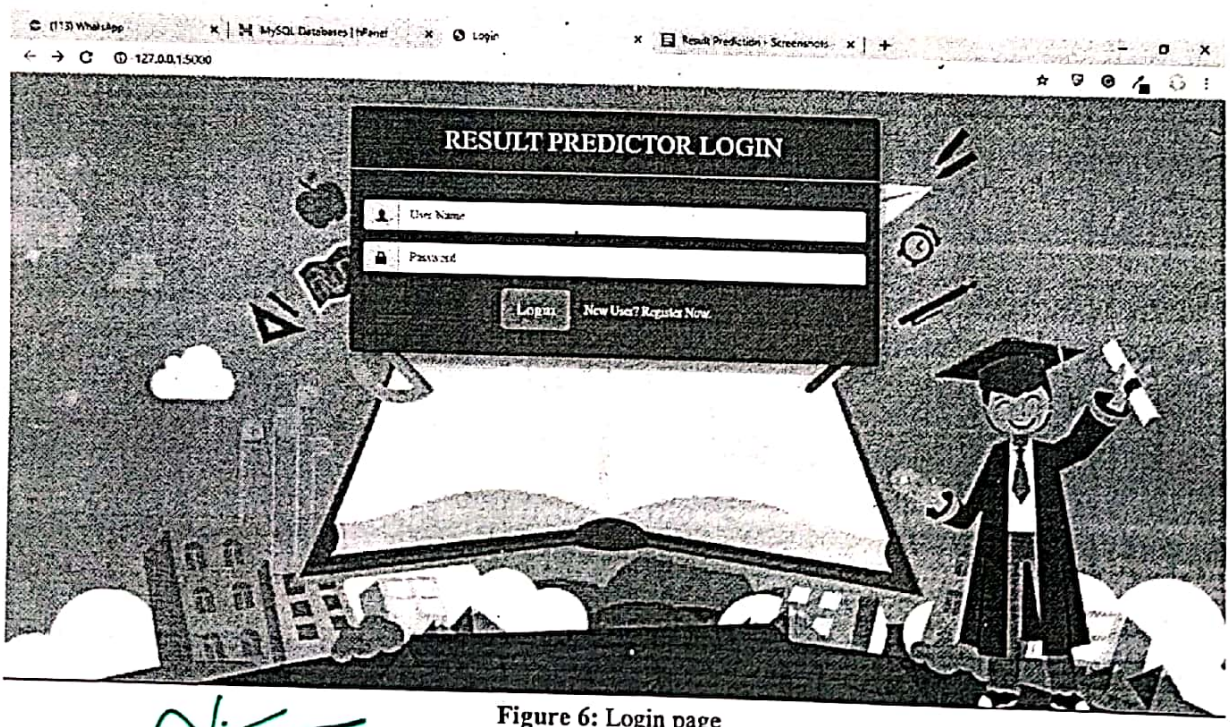


Figure 6: Login page

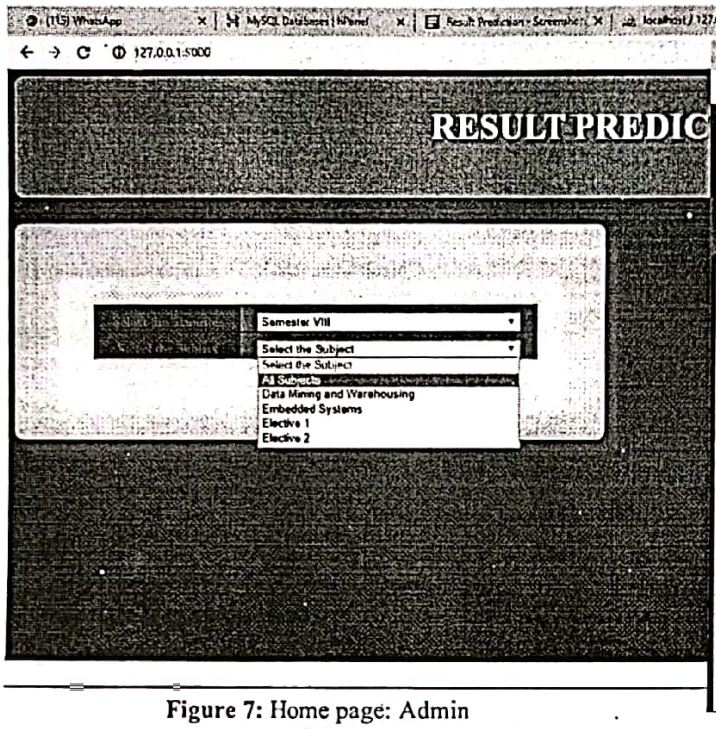


Figure 7: Home page: Admin

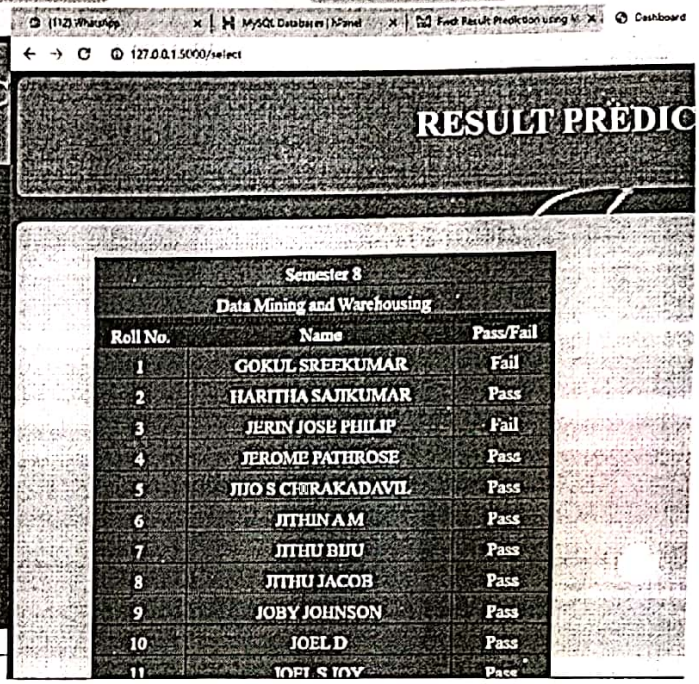


Figure 9: Result page- Admin view (subject wise)

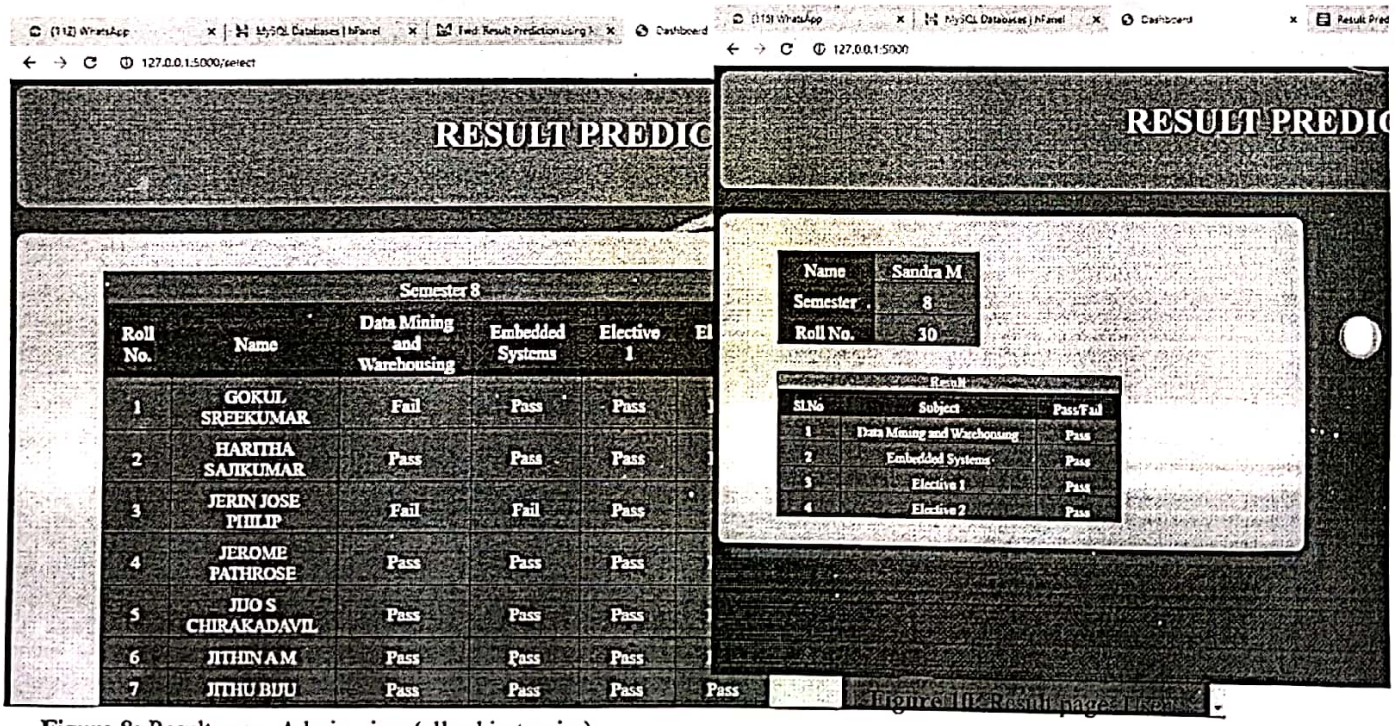


Figure 8: Result page- Admin view (all subjects wise)

Recall = A/(A+D) —— (2)

Precision = A/(A+C) —— (3)

F1 score = (2*Recall*Precision)/(Recall + Precision) — (4)

Initially a csv file is created for training the system. For this we have taken the database sheet of our pass out seniors. The sheet was created with the fields: 1) Student full name, 2) Subject wise: a) Two series scores, b) Assignment scores, and c) Attendance, and 3) University result. Similarly, the file which need to be get predicted is created in the exact format that of the training set except the university result column which is to be predicted by the system. The pass prediction is done based on the academic criteria which has to be manually entered. The figure 4 shows a sample database sheet which is used to train the system and figure 5 shows a sample database sheet for student data entry.

5. CONCLUSION AND FUTURE SCOPE

The accuracy of the system is given as 0.901 or 90%. The above obtained research outcomes and findings enabled us to make many conclusions. The proposed software shows improvement in prediction the academic results of students in a very efficient manner where the involvement of manual work is very less. The outcomes of formative and summative surveys of students clearly shows students interest in ML-based predictive analytics of student academic performance in a course. This would be helpful for the students, teachers and the overall educational institutions and make awareness on those students who are not met and they can keep their focus on those students who are not eligible. This work tries to improve students' quality of education.

However, to have a deeper insight on the educational data and academic performances, we also need to have more social psychological investigations that are beyond our scope. In the future, we intent to collect and analyze more data, in order to refine our findings and extracts more valuable information to improve by adding more techniques and incorporating more machine learning approaches

ACKNOWLEDGEMENT

We thank the faculty members of department of Computer Science and Engineering, Mangalam College of Engineering for providing us the data required.

REFERENCES

1. https://expertsystem.com/machine-learning-definition/
2. https://towardsdatascience.com/understanding-confusion-matrix-a9ad42dcfd62
3. https://scikit-learn.org/stable/modules/svm.html.
4. Rianne Conijn, Chris Snijders, Ad Kleingeld, Uwe Matzat, "Predicting Student Performance from LMS Data: A Comparison of 17 Blended Courses Using Moodle LMS. October 2016IEEETransactions on Learning Technologies PP (99):1-1
5. Amirah Mohamed, Shahiri Wahidah, "A Review on Predicting Student's Performance Using Data Mining Techniques", Procedia Computer Science, Volume 72, 2015, Pages 414-422, https://www.sciencedirect.com/science/article/pii/S1877050915036182
6. G. Gray, C. Mc Guinness, P. Owende, An application of classification models to predict learner progression in tertiary education, in: Advance Computing Conference (IACC), 2014IEEE International, IEEE, 2014, pp. 549–554.
7. P. M.Arsad, N.Buniyamin, J.-l. A. Manan, A neural network students' performance prediction model (nnsppm), in: Smart Instrumentation, Measurement and Applications (ICSIMA), 2013 IEEE International Conference on, IEEE, 2013, pp. 1–5.
8. Joonhyuck Lee, Dongsik Jang and Sangsung Park, "Deep Learning-Based Corporate Performance Prediction Model Considering Technical Capability" MDP http://www.mdpi.com/2071-1050/9/6/899/pdf.

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst14972020.pdf

https://doi.org/10.30534/ijacst/2020/14972020

AUTOMATIC ACCIDENT DETECTION USING DEVICE

Aneeta Mary Binny[1], Roopika Jacob[2] , Stella Maria Jose[3], Ms.Sujitha M[4]

[1]Department of Computer Science, India, aneetamb1998@gmail.com

[2]Department of Computer Science, India, roopikarosa@gmail.com

[3]Department of Computer Science, India, marya.stella17@gmail.com

[4]Faculty Department of Computer Science, India, m.sujitha@mangalam.in

ABSTRACT

Safe journey is a big concern nowadays. As a result of road accidents, many people lose their lives due to delayed medical assistance. Early detection and timely action will help a lot in such situations. There exist many accident prevention systems which can prevent accidents to a certain extent. Here we propose an idea that helps to detect accidents, avoid falling in digs and humps as well as alert the first responders (hospitals and police) of these accidents. A device which consists of Gyroscope and Accelerometer is embedded in the automobile. The user has set an intensity value beforehand and when the intensity of the hit exceeds this particular value, an alert message will be sent to the nearby hospital and police station along with the user's location. It also alerts the user about humps, digs and even hairpin and dangerous bends. This paper proposes a method to increase the efficiency of one of the most vital parts of this sequence called the 'emergency response.' This process also assists the paramedics in deciding which hospital is best equipped to handle the severity of the wounds incurred, prepare for extrication if necessary and gather other resources to conduct a complete and thorough evaluation of the victim. The research presented in this paper is motivated by the fact that emergency medical service personnel would perform better if equipped with the knowledge of the kind of accident they are dealing with before arriving at the accident scene. Here we propose an idea that helps to identify humps, digs and even hairpin and dangerous bends. A device is attached to the automobile for detecting the accidents. An alert message is sent to the authority when an accident has occurred and thereby providing medical services as fast as possible.

Key words: IoT- Internet of Things, Gyroscope, Accelerometer, Android

1.INTRODUCTION

1.1 IOT

An IoT system consists of sensors/devices which "talk" the cloud through some kind of connectivity. Once the data is sent to the cloud, software processes it and then might decide to perform an action, such as sending an alert or to detect the automatically adjusting the sensors/devices without the need of the user. The Internet of things is a system of interrelated devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Figure 1: IOT Diagram

Road accidents have been one of the top contributors towards human fatality for decades. Traffic accidents are the leading cause of mortality for individuals. This paper proposes a method to increase the efficiency of one of the most vital parts of this sequence called the 'emergency response.' This process also assists the paramedics in deciding which hospital is best equipped to handle the severity of the wounds incurred, prepare for extrication if necessary and gather other resources to conduct a complete and thorough evaluation of the victim. The research presented in this paper is motivated by the fact that emergency medical service personnel would perform better if equipped with the knowledge of the kind of accident they are dealing with before arriving at the accident scene. Here we propose an idea that helps to identify humps, digs and even hairpin and dangerous bends. A device is attached to the automobile for detecting the accidents. An alert message is sent to the authority when an accident has occurred and thereby providing medical services as fast as possible.

1.2 ANDROID APPLICATION

Android software development is the process by which new applications are created for devices running the

Android operating system. Google states that "Android apps can be written using Kotlin, Java, and C++ languages" using the Android software development kit, while using other languages is also possible. An Android app is a software application running on the Android platform. Because the Android platform is built for mobile devices, a typical Android app is designed for a smartphone or a tablet PC running on the Android OS. Android Studio is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, mac OS and Linux based operating systems.

2.MOTIVATION

Although different governmental and non-governmental organizations all around the world carry out workshops and other training programs to make people aware of the effect of careless driving, yet this whole process has not been very successful till the day we live. In Our Country, deaths due to International Conference of Soft Computing and Pattern Recognition traffic accidents became a major problem adding to those emergency actions by hospitals or police that are not provided at the place of accident at required time, ignoring the fact that these people's lives could have been saved. Basically, in the event of a road accident, the Real Time Traffic Accident Detection System proposed can intelligently inform the site of the accident through a wireless interface, reporting it to the proper authorities. Also, informing the type and the amount of emergence services needed, and approximately the number of injured people.

3.RELATED WORK

The implementation of an automatic road accident detection and information communication system in every vehicle is very crucial. This paper presents a brief review on automatic road accident detection techniques used to save affected persons. An automatic road accident detection technique based on low cost ultrasonic sensors is also proposed. Statistics show that the leading cause of death by injury is road traffic accidents. A survey report by the World Health Organization highlights that every year more than 30,000 people in Pakistan die due to road traffic accidents. There are a number of causes for which an accident can occur, some of them are; lack of training institutes, use of mobile phone while driving, unskilled drivers, driving while intoxicated, bad road condition, overloading, and poor traffic management. However, most of the time it has been observed that the deaths occurred in the road accident are due to the late arrival of the ambulance to the accident spot. Although in most cases the injury is not severe and we could save the affected lives, however, due to late arrival of the rescue team, the injuries turn fatal[1]. The number of fatal and disabling road accidents are increasing day by day and is a real public health challenge. Many times, in the road accidents, human lives will be lost due to delayed medical assistance. Hence road accident deaths are more prominent. There exist many accident prevention systems which can prevent accidents to certain extent, but they do not have any facility to communicate to the relatives in case an accident happens.

In this paper, the authors made an attempt to develop a car accident detection and communication system which will inform the relatives, nearest hospitals and police along with the location of the accident. Previous research has shown that the installation of airbags in vehicles significantly reduces crash related deaths, but these analyses have used statistical techniques which were not capable of controlling for other major determinants of crash survival. (ABS): The most effective chassis control system for improving vehicle safety during severe braking is anti-lock braking system (ABS). Anti-lock braking mechanism prevents the locking of wheels at the time of panic braking to maintain a tractive contact with the road and thereby decreasing the braking distance of the vehicle. Anti-lock Braking can prevent accidents, but it will not communicate. The automatic Accident prevention systems have recently been a part of many modern cars to reduce injuries and casualties on the road. However, these systems are limited to high-end luxury vehicles only, due to high cost of components and equipment. In this paper we have developed an affordable and reliable system using Arduino UNO R3 [2]. Major accidents on highways, freeways and local roads can lead to huge social and economic impacts. Minor accidents may be resolved by the passengers themselves and do not require escorting to hospitals whereas major accidents where airbags are deployed require immediate attention of authorities. Automatic Smart Accident Detection (ASAD) is an auto-detection unit system that immediately notifies an Emergency Contact through a text message when an instant change in acceleration, rotation and an impact force in an end of the vehicle is detected by the system, detailing the location and time of the accident. The idea is that as soon as an accident is detected by the system, the authorities should immediately be notified to prevent further car congestion as well as allow the passengers to be escorted to the hospital in a timely fashion. The system involves the use of fuzzy logic as a decision support built into the smartphone application that analyzes the incoming data from the sensors and makes a decision based on a set rules [3]. Road accidents are one of the leading causes of mortality. While most accidents merely affect the exterior of the cars of the drivers involved, some of them have led to serious and fatal injuries. It is imperative that the Emergency Medical Services (EMS) are given as much information about the crash site as possible before their arrival at the scene. In this paper, a mobile phone application is developed that, when placed inside a car, intelligently classifies the type of accident it is involved in and notifies the EMS team of this classification along with

the car's GPS location. The classification mechanism is through a collection of data sets from a simulation of three types of collisions, which creates a knowledge base for an artificial intelligence-based classifier software.

4.SCOPE

Road traffic injury is a major global public health problem. Rapid motorisation in low and middle- income countries along with the poor safety quality of road traffic systems and the lack of institutional capacity to manage outcomes contribute to a growing crisis. The system helps in early detection of accidents. Accident rates could thus be reduced to much lower levels. IoT is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human to human or human to computer interaction. Devices and objects with built-in sensors are connected to an IoT platform, which integrates data from the different devices and applies analytics to share the most valuable information with applications built to address specific needs. These powerful IoT platforms can pinpoint exactly what information is useful and what can safely be ignored.

5.PROBLEM STATEMENT

Road accidents are a major cause for concern in the present times. Despite rules and regulations and fines, the death toll and casualty rate caused by road accidents alone are still astounding. There is an urgent need for solutions that increase efficiency of emergency response in these situations. Although car manufacturing companies offer viable solutions with their built-in accident notification systems, these are expensive and could be rendered obsolete with changing technology. Continuous growth of population all over the world creates a great challenge to the transport management systems. The conventional methods are no longer effective enough for solving complex and challenging transportation management problems.

More economical, more efficient and thus more intelligent methods have to be developed to deal with these challenging problems. Knowledge from different research areas is needed for developing these systems. Very often complex transportation systems require integration of different methods from different branches of science. Due to the increased amount of vehicles, it is necessary to take effective steps in order to control the traffic and hence avoid all types of loses that is caused due to traffic. The study aimed at detecting accidents and providing necessary medical services and thereby reducing accidents, congestion of traffics etc. A problem statement is a concise description of an issue to be addressed or a condition to be improved . It identifies the gap between the current state and desired state of a process or product. Traffic density now a day is huge. Accident detection and rescue system is essential for every vehicle. To scale well and to reach to masses, its architecture should address 4 V's of Big Data. System development should not be a one time job. It should improve continuously.

6.PROPOSED APPROACH

The proposed system consists of a database shared between the hospital, police and user. The parties can store as well as retrieve information from it. When there is an emergency, notifications will be sent to both emergency services and police so that they can reach the location in time. Thus, it helps to detect accidents.

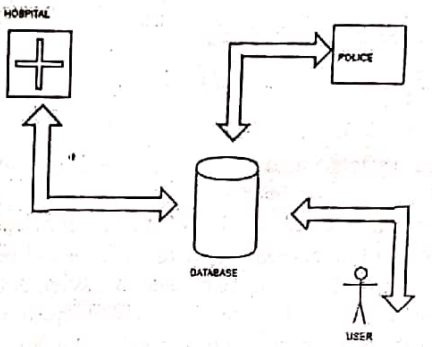


Figure 2: System Architecture

System designing in terms of software engineering has its own value and importance in the system development process as a whole The device which consists of gyroscope and accelerometer is embedded to the automobile, which in turn sends an alert message to nearby emergency departments when an accident occurs. The user has set an intensity value beforehand and when the intensity of the hit exceeds this particular value, an alert message will be sent to the nearby hospital and police station. On the receiver side, the emergency departments get the notification on their application and a response is sent immediately. The emergency departments will be able to track the location of the person. Thus, help is provided to the user.

7.TESTING

Testing is the process of evaluating a system with the intent to find whether it satisfies the specified requirements or not. Software testing is the process of evaluating a software item to detect differences between given input and expected output. Testing assesses the quality of the product.

TCID	FEATURE TESTED	TEST PROCEDURE	EXPECTED RESULT	ACTUAL RESULT	STATUS
1	Create Account	Enter the username and password , click the create account button	Display the account creation page	Displayed the account creation page	successful
2	Login	Enter the username and password , login button	Display the account creation page	Displayed the login page	successful
3	Detection of digs based on intensity values	The intensity value is compared with the actual set intensity value	If it is greater then set the intensity value	Digs are detected	successful
4	Detection of humps	The intensity value is compared with the actual set intensity value	If it is greater then set the intensity value	Humps are detected	successful
5	Alert message to first responders	When the vehicle is met with an accident an alert message is send	Send alert message	Alert message is send to the first responders	successful

Table 1: Test Cases

8.RESULT

In the proposed system, a device is attached to the automobile.

The components in the device will help detect an accident and it will notify the first responders so that help could be prevented to the affected person. It is easy to implement, accurate and cost effective. The system is very helpful as accidents are a common occurrence these days and delayed responses often result in deaths. Iot is a trending topic in the world of technology and it plays a major part in the system. The system responds well to the given dataset and hence it could be considered successful.

9.RESULT ANALYSIS

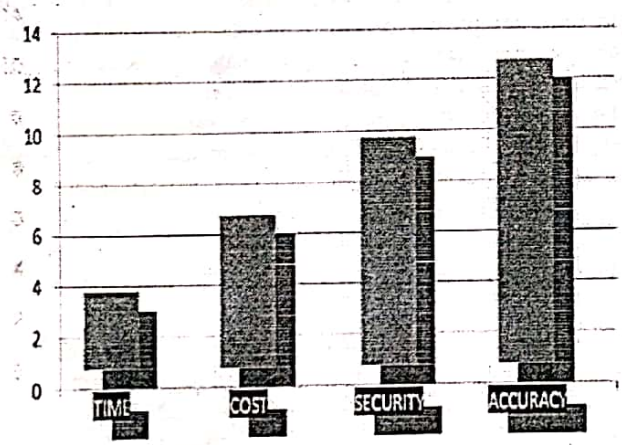


Fig 3: Result Analysis

10. CONCLUSION

The proposed system deals with the detection of accidents. It can also detect humps, dangerous curves and can notify the user about it. The system can also detect occurrence of accidents and send alerts to nearby emergency services like police stations, hospitals etc. The emergency departments can then track the location of the accident and send help immediately. In the future, the system can be modified in such a way that it will be also helpful to prevent accidents and not just detect them.

REFERENCES

1. A. Zualkernan, F. Aloul, F. Basheer, G. Khera and S. Srinivasan, **"Intelligent accident detection classification using mobile phones,"** 2018 International Conference on Information Networking (ICOIN), Chiang Mai, 2018, pp. 504-509,
2. U. Khalil, T. Javid and A. Nasir, **"Automatic road accident detection techniques: A brief survey,"** 2017 International Symposium on Wireless Systems and Networks (ISWSN), Lahore, 2017, pp. 1-6,
3. N. R. Vatti, P. L. Vatti, R. Vatti and C. Garde, **"Smart Road Accident Detection and communication System,"** 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), Coimbatore, 2018, pp. 1-4
4. A. Ali and M. Eid, **"An automated system for Accident Detection,"** 2015 IEEE International Instrumentation and Measurement Technology Conference (I2MTC) Proceedings, Pisa, 2015, pp. 1608-1612
5. V. K. Kota, N. K. Mangali, T. K. Kanakurthi, A. R. Kumar and T. Velayutham, **"Automated accident detection and rescue system,"** 2017 International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), Chennai, 2017, pp. 1437-1441

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst10972020.pdf

https://doi.org/10.30534/ijacst/2020/10972020

REALTIME PATIENT MONITORING SYSTEM USING IoT

Abhirami Ravikumar[1],Amrutha VShenoy[2],Annmary joppan[3], Neema george[4]

[1]B.Tech, Mangalam College of engineering kottayam, abhiramiravikumar89@gmail.com

[2]B.Tech, Mangalam College of engineering kottayam, amruthashenoy07@gmail.com

[3]B.Tech, Mangalam College of engineering kottayam,annmaryjoppan1998@gmail.com

[4]Assistant professor,Mangalam College of engineering kottayam, neema.george@mangalam.in

ABSTRACT

The study helps to improve the scope of IoT in Healthcare with a diverse range of enhancements. The study proposes Textile- based Wearable System Technology, Unobtrusive Biosensors, Intelligent Medical Boxes, and a Cloud Computing Architectural Framework amongst other technologies and advancement that would propel the Health Care Industry to unparalleled heights in terms of efficiency and Patients Comfort. The paper proposes to revolutionize the industry by real time exchange of data to seamlessly and proactivelyoffer prediction, diagnosis and remedies. The framework this paper proposes is aptly called the Internet of Medical Things (IoMT) which opens a whole new avenue for the Patient-Health Care provider Interface (PHI) and Wearable Health Technology(WHT).

Key words: IoMT, Cloud, IoT, HealthIndex, ThingSpeak, Smart Sensors, Arduino

1. INTRODUCTION

India, today, is confronted by an issue of the disproportionate ratio between Doctors and Patients. According to a latest report from the MCI (Medical Council of India), there are only a paltry 10 lac 40 thousand specialists registered in RIM (Register of India Medical). This relates to a specialists to patient ratio of around 1:1568 as compared to the WHO's (World Health Organization) ratio standard- 1:1000. One of key visions of the healthcare industry is to offer better healthcare to all people irrespective of where they are or what time it is. This should be done in a way which is more patient friendly and economic. To augment the patient care efficiency, we need to improve the patient-monitoring instruments. The healthcare industry, as of now, faces 2 issues in patient-monitoring- first, the need of doctors and care takers to be there at the bedside of the patient and second ,the patients limited to be dandwired to large monitoring machines.[1][12]

In order to accomplish malleable, mobile and responsive care of the patient, the problems which have been mentioned above need to be solved and because of the advancements in the fields of telecommunications and bio-instrumentation, it is even more practical to design a home-based monitoring system measuring the vital signs to display, accumulate, store and transmit the physiological data of the patient to the healthcare provider present in any location at any point in time.[15]

Surprisingly, inhabiting e-healthcare tactic has been achieved through wired conversations within notable fields, for example, network protocol and database in the healthcare sectors. There is an upsurge in use of the mobility characteristics[13][14] and wireless communication by the healthcare system and related advancements have allowed smart devices and appliances with appraising energy to take advantage of wireless sensor nodes. [2]

Aligned with the trend, a number of Internet of Medical Things (IoMT) devices measuring body conditions of humans have been introduced. The existing system is very isolated and outdated which causes lapses in communication, delayed responses, inaccurate data collection and processing, and miscommunication.[2]

2. RELATED WORKS

Mr.G.subramanya sharma and P.raga lavima discuss regarding the potential ZigBee possesses for the transfer of sensor values effectively in their paper. However, the ZigBee fails in the case where a continuous real time transfer of information is

required. [3]. Reduction of the sampling rate resolves the difficulty but at the same time affects the signal quality.

Geng yang, matti mäntysalo, li xie discussed an intelligent home- centric health platform with IoT which flawlessly links smart sensors for physiological monitoring and intelligent medical packing for daily medication organization [4]. Recently, the bio-patches (used in unobstrusive bio-sensors) have a lamination, that is, a skinny plastic insulation coating on the bio-patch to guard the conductive traces and for the exploration of new application scenarios to improve the electrical and mechanical reliability for this IoMT platform are open issues to workon.

Nigel H. Lovellv et. al. [7] displayed an approach for the procurement, retrieval, and storage of bio- medical signals through the web. The remote patient is to be monitored to record their pulse, blood-pressure, breath via a health-terminal. The records are conveyed to the hospital and stored at the database.

R. Shaikh et. al. used an ARM processor based approach, which worked in real-time for the collection and monitoring of ECG, temperature, and heartbeat data of patients [9].

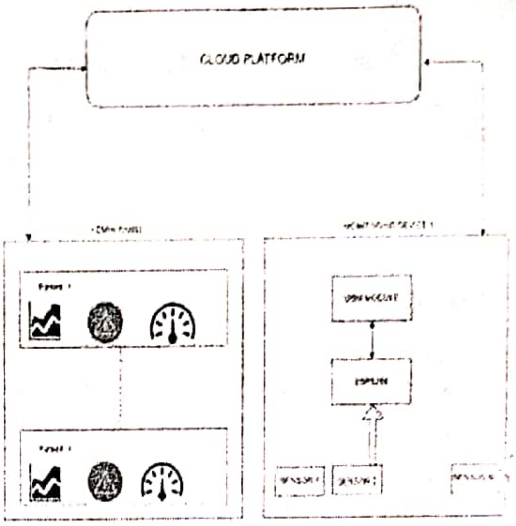
Current apprises of patients were sent to the healthcare provider using GSM and ZigBee wireless technology so that the healthcare providers can take the necessary action in time. A Wireless-Body Area Sensor Networks (or WBASNs for short) approach with the usage of ZigBee was described to monitor the location and health of the patient in[10].

A module, based on Radio Frequency, to collect the real-time data of soldiers in the combat zone was discussed by G. Raj et. al.[11].

3. PROPOSED SYSTEM

This proposed system consists of 3 modules: Cloud platform, admin panel, monitoring device. In monitoring devices it consist of various sensors , the microcontroller and a GSM module. And in admin panel it is having the number of patients.

In the cloud platform the database is recorded regarding the patients health details.



The GSM module is used to send SMS to doctors with the values of the report and the cloud is the database system which stores the health report of the patient's, from here using GSM sends it. The technology used here is IoT and the arduino IDE is used for programming and the proteus software is used for circuit designing.

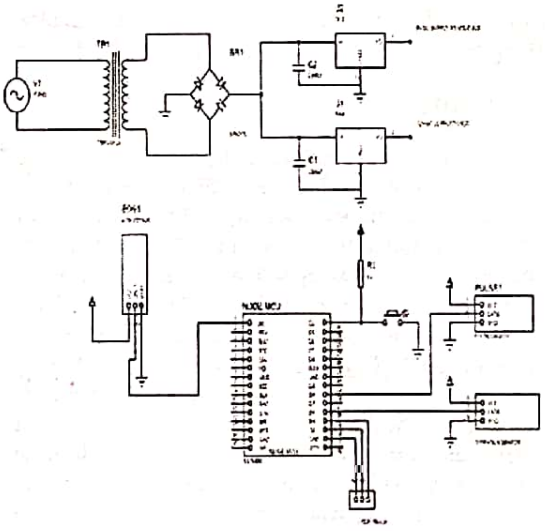


Figure 1: The architecture

Body Temperature Sensor

Arguably one of the most accurately affordable body temperature sensor, the DS18B20 was used to measure real-time temperature of the body (accurate to +- 0.5°C about the range of -10°Centigrate to 85°Centrigrate). These sensors may be placed at diverse places on the body such as under-arms, the forehead and, even, under- the-tongue due to its water-proof abilities. It comes with 3 wire, namely, VCC, GND, and DATA, attached to a single wire. These may also be integrated into clothing using textile based system technology. [3]

Table 1: Specification of The Body Temperature Sensor

Power Supply Range:	3.0V to 5.5V
Operating Temperature Range:	-55^0 C to $+125^0$C (-67 F to +257F)
Storage Temperature Range:	-55^0 C to $+125^0$C (-67 F to +257F)
Accuracy over the range of -10C to +85C	$\pm 0.5^0$ C
Size of Sheath:	6*50 mm
Connector:	RJ11/RJ12, 3P-2510, USB
Pin Definition	RED: VCC YELLOW: DATA BLACK: GND
Cable Length :	1 meter, 2m, 3m, 4m are available

Generally, these body temperature sensors contain a silicon sequential number, therefore, a great number of these sensors can subsist on the same single-wire conveyance. This allows us to put the DS18B20 in a broad domain of places. The body temperature sensor has various irreplaceable applications such as integrating HVAC natural controls, measuring the temperatures inside assemblies, equipment or devices, and procedure examination and control.[5]

Pulse Rate Sensor

A heart rate sensor attachment for Arduino, the Pulse Sensor Amped is basically a visual heart-rate sensor with noise-cancellation & enhancement technology allowing us to get effective readings of the heartbeat easily. Also, since the Pulse Sensor Amped tests control with current of 4mA drawn at a voltage of 5V, therefore, it is highly usable in mobile applications. To obtain the heartbeat of any person, you simply need to connect the sensor to the fingertip or the cartilage of the ear to the 5V pin, Arduino can be enabled to measure the heart rate of a person. The illustration code for Arduino Uno is easily accessible and in addition to that ,a sketch from Processing for displaying heart-rate data along with computing them to the respective heart- indexes. [5]

Features:

a. Diameter: 25/4'' (~= 16millimetres)
b. Thickness: 0.12'' (~=3millimetres)
c. Current Consumption = ~4mA at5V
d. Voltage =3V-5V
e. Cable Length = 24"(~609mm)

Essentially, the Heart Rate sensor is a Photo-Plethysmograph (PPG) that may be used to measure the levels of blood oxygen (SpO2). PPG provides us with the heart rate data represented by a voltage swing (analog).[5]

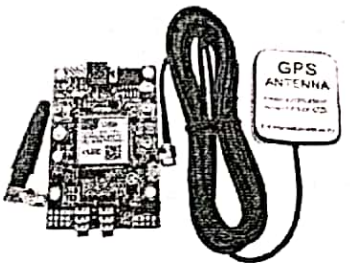
The Pulse Sensor can be used to measure:-

1. Pulse with the live heartbeat waveform
2. Heartbeat with thepulse.
3. Heartrate updated with eachbeat.
4. Time between theheart-beats

ECG Measuring Sensor

Utilised for the analysis of the ECG and the EMG, The AD8232 is an Arduino module used to monitor the Heart Rate. The Electrocardiogram sensor comes with 3 tips that can be positioned on different spots upon the body like the torso, limbs et cetera. The heart, through the heart muscle, is responsible for the emission & for generating the electric signals; it contracts and relaxes regularly for pumping of blood throughout every subsequent heart-beat. Depolarization is referred to as an instantaneous change inside the cell where the electric change

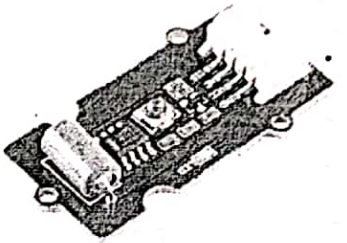
allows it to become positive till a brief period has elapsed. It begins with the pacemaker, which contrasting every former nerve cells that requires a stimulus to fire, spread out via the AVC node to the package of this fiber cells in the sinoatrial nerve (SAN) and to the fibers of purkinje and spiral down towards west via the ventricles. The SAN may be deemed self- oscillating/self-firing as it frequently emits the depolarization release and after that again repolarizes so that it can fire again. The SAN or the Sinoatrial Nerve may be likened to the functioning of the relaxation oscillators (RO). As a matter of fact, in pacemakers, the use of ROs is seen, which behave astonishingly similar to the SAN. The existing cell boundaries behave similar to the charge capacitors, the only difference being that the rate of charging and discharging is much slower in the existing cells which may be credited to the sluggish nature of the existing cells. The Electrodes which are placed in the bodyof the patient detect the miniscule changes in electrode potential that ascend



from the depolarization of the heartmuscles through each heartbeat on the skin in contrast to an antiquate tripled ECG, that perceives the electrodes positioned on the limbs and torso of the patient. In this, we have utilized the AD8232 heartbeat monitor kit (single lead) with Arduino Uno. This kit is suitable because it contains all the essential equipment. The Arduino Uno is only used to provide 3.3 volts of power-supply (to the board) and to transmit data to the private system (desktop/laptop). We can also utilize the energy from the ECD board through two AA-batteries and then view the same picture by attaching the oscilloscope. A computer deprived of the AC power is utilized for security causes. The ECG sensor contains everything that's essential for the extraction, amplification, and filtration of the small bio-potential. The EMG recordings for the electrical activity of muscles is processed as an analytical method. [5]

Vibrator Sensor

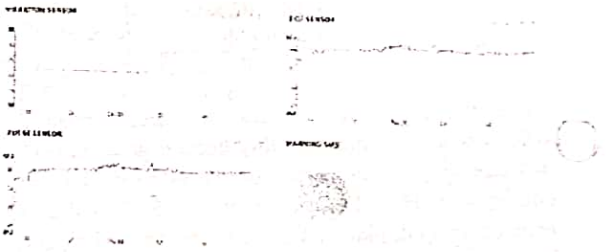
The Grove - Vibration Sensor (SW-420) is a high sensitivity non-directional vibration sensor. When the module is stable, the circuit is turned on and the output is high. When the movement or vibration occurs, the circuit will be briefly disconnected and output low. At the same time, you can also adjust the sensitivity according to your own needs.



GSM Module (SIM808A)

GSM Module is an entire Quad-Band GSM/GPRS module which mixes GPS technology for satellite navigation. The compressed design which integrated GPRS and GPS during a SMT package will significantly save both time and costs for patrons to develop GPS enabled applications. Featuring an industry standard interface and GPS function, it allows variable assets to be tracked flawlessly at any location and anytime with signal coverage.

4. EXPERIMENT AND RESULT



5. CONCLUSION

A system having increased functionality and efficiency is made with the help of the concept of Health Indexes, Arduino Uno, Respective Biosensors and ThingSpeak Server and Application Website.Space is maximised for critical cases which require immediate physical attention and care in hospitals

and clinics while the cases which just require regular check-ups are managed by the proposed system. An alert is sent to emergency contacts and respective

healthcare providers in case the Health Indexes exceed the normal values thereby leading to better prognosis thus preventing the illness before it takes an extreme form. The parameters measured have minimum error as everything is computed using the software thus minimising the ambet of human calculation error. Real Time Data is being provided to the hospice care specialists which enables them to make informed decisions and provide prediction-based remedies. The patient has the experience of special quality attention and is prioritised in the Health IoT framework. The framework leads to timely interventions, pre-emptive treatment, and improved accuracy in diagnosis and effective outcomes which further lead to a desirable rise in accountability thus, increasing the overall patient experience. Security and Data Theft is an issue which persists even after the inclusion of the unique API key. Also, for more patients, big data handling might be required to handle the enormous amount of data that is generated. For IoMT to become commercially and publicly available, a more user- friendly UI is desirable. A dynamic multimedia interface would also help to increase usage. Exploring various other sensors which can be attached to sensors other than the Arduino could also be looked into. Another area to be looked into could include these sensors to be integrated into apparel (such as ECG sensor in gloves) and the data be transmitted through Bluetooth (using the ESP8266, perhaps) so that it becomes much more convenient. Lastly, many other user-friendly automated functions could be added to the project (such as automatic ambulance calling in case of emergencies) so that it becomes even smarter.

REFERENCES

[1] S. Ananthula et. al., "Internet of tings (IoT) based smart health care system," 2016SCOPES Paralakhemundi, 2016

[2] S. F. Khan, "Health care monitoring system in IoTby using RFID," 6th ICITM,Cambridge,2017P.Raga Lavima and G.Subramanya,"An Internet of T Based Intelligent Medicine Box", IJCSMC, vol.4, issue.10, October2015

[3] LiXieet.al."AHealth-IoTPlatformBased on the Integration of Intelligent Packaging, Unobtrusive Bio-Sensor and Intelligent MedicineBox"

[4] S.P.Kumaret.al."Smarthealthmonitoring system of patient through IoT,"I-SMAC, Palladam, 2017

[5] www.thingspeak,com

[6] N. Lovel, F. Magrabi, B. G. Celler," Web based Acquisition, Storage, and Retrievalof Biomedical Signals", IEEE Engineering in Medicine and Biology Magazine, 2001,vol. 20, no. 3,38-44

[7] Jun Dong et al., "A Remote Diagnosis Service Platform for Wearable ECG Monitors"inIEEEIntelligentSystemsvol.27, pp. 36-43,2012

[8] Rubina A. Shaikh et al., "Real time Health Monitoring System of Remote Patientusing Arm7," IJICA, vol. 1, no. 3-4, pp.102- 105,2012

[9] Dineshkumar Jaiswal et al., "Real Time Tracking and Health Monitoring ofSoldiers using ZigBee Technology: a Survey," IJIRSET, vol. 4, issue no.7, pp. 5561-5574, 2015

[10] Dr. S. Sindhuja Banu et al., "GPS Based Soldier Tracking and Health Indication System with Environmental Analysis," IJERSTE, vol. 2, issue no. 12, pp.46-52,2013.

[11] T. Choudhury, SC. Gupta et al "Internet of Things and its applications in E-Learning" 3rd International Conference, CICT, 2017.

[12] T. Choudhury et al "Smart city implementation model based onIoT" ICBDAC, 2017 IEEE Conference.

[13] T. Choudhury, P. Kumar et al "Crop productivity based on IoT" Smart Tech IEEE Conference, 2017

[14] [15]T. Choudhury, P. Kumar et al "Privacy and Security of Cloud-Based Internet of Things" (IoT). 40-45, CINE.2017

[15] [16]T. Choudhury et al "Prediction for big data and IoT"ICTUS 2017.

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst05972020.pdf

https://doi.org/10.30534/ijacst/2020/05972020

INTEGRATED DAM MANAGEMENT SYSTEM USING IOT

Basil Thomas [1], Godson John [2], Jaimon Thomas [3], Vishnu Kumar [4], Simy Mary Kurian [5]

[1] Mangalam College of Engineering, Kottayam, India, basilthomas812@gmail.com

[2] Mangalam College of Engineering, Kottayam, India, godsonjohn707@gmail.com

[3] Mangalam College of Engineering, Kottayam, India, jaimonthomas96@gmail.com

[4] Mangalam College of Engineering, Kottayam, India, vishnuvayalumkal@gmail.com

[5] Mangalam College of Engineering, Kottayam, India, simy.kurian@mangalam.in

ABSTRACT

Dams are the best infrastructures to save water resources and it plays a major role in our life as they are used for purposes such as water supply, irrigation, flood control and mainly the generation of electricity. There are thousands of dams all over the world and most of the countries are still using manual systems for controlling and monitoring them. The manual method consumes a lot of effort and cost, provides less monitoring quality and also it's a failure in effective flood management. This paper aims to present a new solution which is to implement an automated system instead of a manual system that provides effective dam monitoring and flood management, by considering the possibilities of the Internet of Things (IoT) application within the specified system for dam management.

Key words: Internet of Things (IoT), Microcontroller, GSM Module, Ultrasonic Sensor, Cloud Platform.

1. INTRODUCTION

The technological advancement of the current era aims to serve and make human life more comfortable. Dams are the major source of water supply and power generation in many countries and they can have an important role in controlling the complex floods in nature. In most of the countries, the techniques used for monitoring the dams are quite basic and traditional. Dam monitoring is a multistep phenomenon that needs improvisation.

In Kerala, the floods happened in recent years lead to the opening of more than 20 dams which badly affected the people living nearby. This made us think that an integrated dam management system designed scientifically would've reduced the effects and the dam monitoring technique needs to be improvised. There are only a few dams in which automated systems are used and most of the dams today are monitored manually. The manual method consumes a lot of effort and cost and they provide less monitoring quality for measuring the dam parameters such as Water Level, Gate Position, and Water Discharge, etc. The parameters of the dam can be monitored effectively by implementing the Integrated Dam Management System (IDMS) by using the advanced concept of Internet of Things (IoT). The concept is used to control and monitor the dam with the help of a web-based dashboard. The proposed system uses Microcontroller (NodeMCU), Ultrasonic Sensor (HC SR04), Vibration Sensor (SW-420), Water Level Sensor, Ph Sensor, GSM Module (SIM808A) and Ubidots Cloud Platform. The Nodemcu is the main controlling unit, which reads the data from the peripheral sensors and processes as per the predefined code and generates appropriate control signals. The NodeMCU has an inbuilt wifi module which helps in connecting the controller to the cloud platform with the help of a stable internet connection.

Apart from an efficient system for controlling and monitoring the dam parameters, the development of this project focuses on flood management. Real-time monitoring and analysis of past data enable the system to detect current threats and to predict future conditions. By this project, each and every variation in dam conditions will be informed to the authorities, thereby allowing them to take necessary actions at the right time and nearby people will be informed in time via SMS in case of any threats, thus saving lots of lives and making human life more comfortable.

2. LITERATURE SURVEY

The proposed system uses ATMEGA328, Ultrasonic sensor, Water level sensor, Bluetooth & LCD Display in hardware level. The system is built to ensure the safety of people and to reduce man labor. The system uses the Arduino Integrated Development Environment (IDE) written in java. The

system acts as an alert to an abnormality in water level in reservoirs, the system switches ON the shutter and releases excess water at abnormal conditions. The future works of the system include checking the water level in dams and passing notifications to the authorities [1].

The system mainly uses Raspberry Pi. The system monitors every variation of water level in dams and informs the same to the authorities. This would help to prevent unpleasant scenarios saving human life from danger. Float sensors monitor the water level and take necessary actions in accordance with any place. The sensors forward the information to Raspberry Pi and Raspberry Pi unit checks the water level and upload the status to the web [2].

The system can be called as a modern way of a warning system. The system mainly aims at creating a prototype system that reduces human interactions by developing an integrated system between software and hardware using IoT. The system uses Microcontroller, height sensors and Wi-Fi modules are used at the gate of the sensor. The proposed system updates the water level at twitter every 5minutes and sends data to authority every respective minute at the normal water level. When there is an abnormality at water the sensors send data every 5seconds to warn the authority about the situation to take adequate actions [3].

The proposed system decreases human obstruction and continuously monitors the water level of the dam and takes necessary actions. The system passes messages to open or close the shutter whenever necessary with respect to the water levels. The system aims at nodal communication of dams where each dam is considered as nodes and consequently associated with a central command center. These nodes are connected with Wi-Fi. The command center decides whether to keep the gates open or shut. Another function of the central command center is to direct the water flow considering water level in various dams to avoid risk [4].

The system proposes remote monitoring and controlling of dams that uses remote control technology linked to web technology. This uses a thin client and server application and has suggested using HTTPs communication. A real-time system has been used for monitoring the water conditions every minute and the alert system sends an e-mail to the concerned authority. The proposed system facilitates reduced complexity in controlling or monitoring the dams as it uses advanced technology to control the dam remotely [5].

3. PROPOSED WORK

Here the concept is to control and monitor the dam with the help of a web based dashboard.The system consists of a central controller and a set of peripheral sensors. The data from these sensors are read by the controller and processed according to the predefined code and appropriate control signals are generated. The system can be connected to the internet with the help of a stable internet connection which helps in viewing and analyzing dam parameters through a web portal.

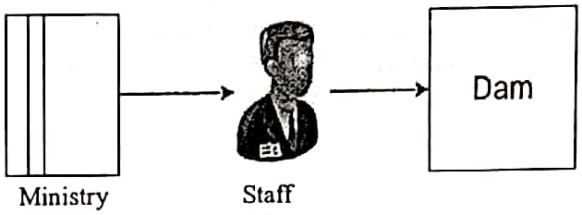


Figure 1: Current system

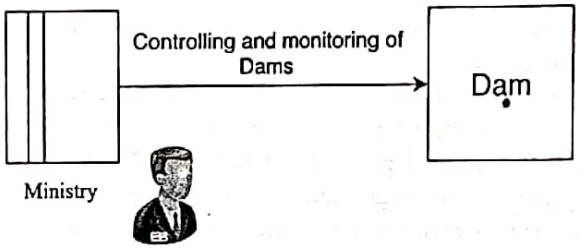


Figure 2: Proposed system

3.1. Data acquisition stage

The different sensors collect various dam parameters and transfer it to the controller unit. The data can be analog or digital depending on the sensor and the data we want. Parameters like water level, vibration, water purity etc.. are measured for efficient disaster management.

3.2. Data processing and cloud connectivity

The data obtained from the sensors are pre processed as per the written code.Through the Wifi connectivity of the NodeMCU the pre processed data is uploaded into a cloud platform.We can use any cloud platform of our choice

3.3. Data analyzing

The data from the cloud platform is fetched by a web platform where we can analyze the data. Different threshold values are set for different parameters so that if the data exceeds or goes down that particular threshold value certain precautions can be made.

3.4. Alert system

One of the important safety measure is to warn the civillions if there is an emergency situation. By using the GSM unit serial communications can be made. Warning systems can be made manual or automatic according to the intensity of the upcoming disaster. In serious conditions a warning message will be sent to the people living in the danger zone automatically without any permission from the authorities as the safety of the citizens is our first priority.

4. SYSTEM ARCHITECTURE

4.1 Power supply

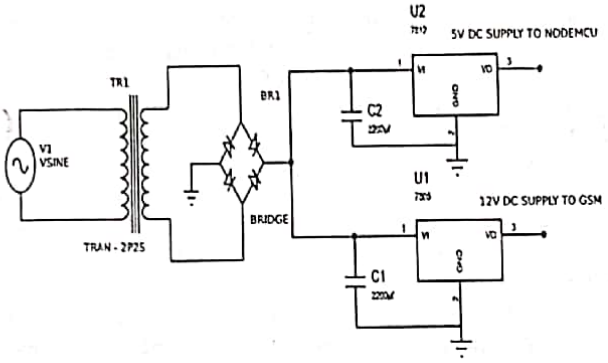


Figure 3: Power supply diagram

The power supply to the system needs to have two outputs. 5v DC for the smooth working of our microcontroller(NodeMCU) and another 12v supply to ensure the working of the GSM module used for serial communication.

4.2 Interfacing of sensors

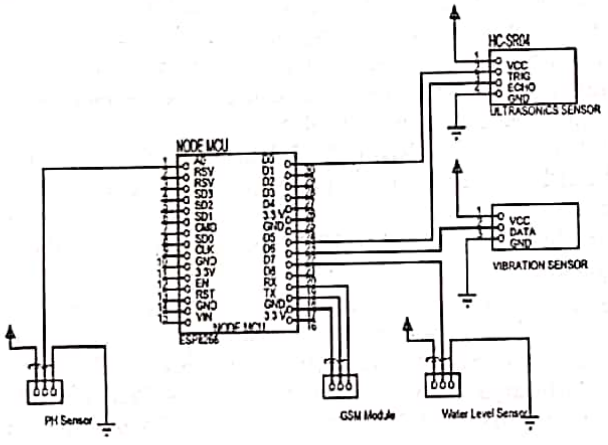


Figure 4: Sensor interfacing diagram

The NodeMU has both analog and digital input pins. The various sensors used are having both analog and digital signals as their output. In our system, the ph meter has an analog output and is connected to the A0 port of the NodeMCU and the other sensors having digital outputs are connected to the digital pins of the controller. The other sensors used are vibration sensor and Ultrasonic sensors. The GSM module is used for serial communication and is connected to the serial pins of the controller.

Use case diagram

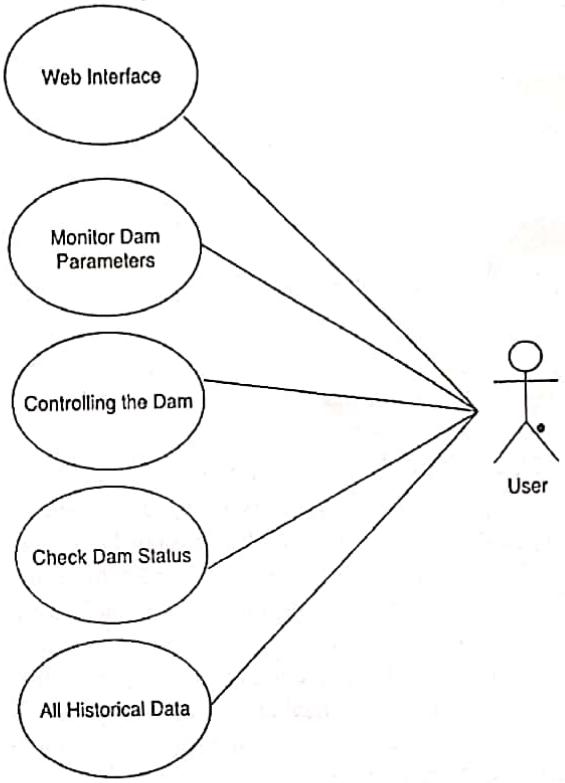


Figure 5: Use case diagram

5. RESULT

The results of this IoT powered dam management system is expected to be 70% more efficient by the excellent working of the prototype model. As convolutional methods involve more human interference this model makes use of the power of modern technologies for an accurate, real time analysis of dam and different security parameters of it. The prototype was able to perform real time operations efficiently by using cellular networks and it can be made more efficient by using more stable and reliable internet connection. Different dams have different capacity and other features, so the parameter limits vary according to the dam. The dam specific threshold values should be fed into the NodeMCU controller on the implementation stage. Our innovation is different from the

convolutional methods by it's efficient and unique usage of technology. In 2019, the effect of flood in kerala was doubled due to the non scientific and unplanned opening of neumerous dams. This is a clear example of how inadequate the current systems are. By using our findings managing dams becomes very simple and smart. It can also measure the quality of water present on the dam to know what purposes it is good for. Totally the project is lifesaving, eco-friendly and beneficial.

An example of the interface is given below with data from four different sensors:

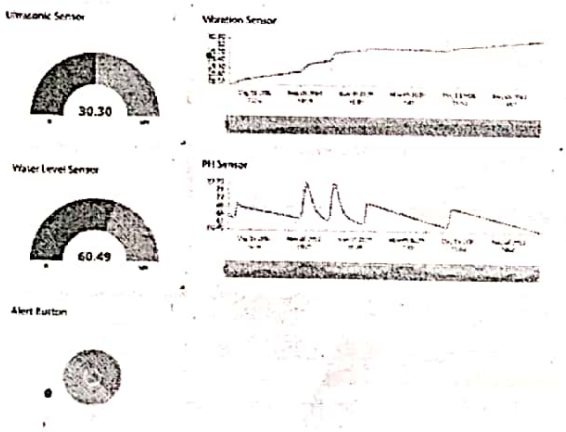


Figure 6: Example of user interface

The data obtained from the sensors are shown as a graph in the interface. The X axis of the graph corresponds to time and the Y axis corresponds to the value obtained from the sensors. In case of vibration sensor, the value on the Y axis will be the intensity of the vibration and in case of water level sensor that will be the amount of water present in the reservoir. Each graph will be having a maximum point. If the data from the sensor exceeds that threshold value, precautions needs to be taken.

6. CONCLUSION

The integrated dam management system is a complete solution for all the issues related to the dam monitoring and provides an efficient framework which allows the authorities to control and monitor the dams remotely. Application of IoT on dams would provide more efficient recording of sensor data, which would significantly reduce the probability of risk occurrence and provides effective dam monitoring and flood management. All data processing would be done on a cloud, which would considerably make the functioning of the system for data collection faster and more reliable. The system is highly flexible, smart, intelligent and fully acquires the other advantages of IoT technology.

REFERENCES

1. M.Madhumathi, R.Kingsy Grace, "Flood Alert Management System Using IoT and Microcontroller", International Journal of Innovative Research in Computer and Communication EngineeringVol. 5, Issue 4, April 2017.
2. Murkar Mandar Santosh, Naik Anjali Sajuram, Patankar Bhakti Santosh, Satam Shubhangi Bhikaji, Mrs. P. P. Kulkarni, "Water Level Monitoring and Dam Gate Control over IOT", International Journal on Future Revolution in Computer Science & Communication Engineering Volume: 4 Issue: 4, April 2018.
3. Aris Haris Rismayana1, Castaka Agus Sugianto, and Ida Bagus Budiyanto1, "Prototyping of Flooding Early Warning System using Internet of Things Technology and Social Media", MATEC Web of Conferences 197, 16003 (2018) AASEC 2018.
4. S.Bhargavi, Sowmya Shree N, Nitin Kumar, Sahana R, Thanuja T.S., "Real-time Implementation of IOT based Smart Dam System and Safety of Inhabitants through Live Footage", International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8, Issue-1C, May 2019.
5. Zeyana Mohammed Abdullah Al hadhrami1 and Dr.Abdul Khalique Shaikh2, "A System For Remote Monitoring And Controlling Of Dams", International Journal of Programming Languages and Applications Vol.7, No.2/3/4, October 2017.
6. Yanlai Zhou & Shenglian Guo, "Risk analysis for flood control operation of seasonal flood-limited water level incorporating inflow forecasting error". Hydrological Sciences Journal, 59:5, 1006-1019.
7. Shankareppagol LM, Akshay Bajirao C, Yuvraj Praksh J, Radhika Ramesh P, Samruddhi Suryawanshi S, and Suhas Shankarrao H, "Review on IoT Based Dam Parameters Monitoring System", Journal of Information Technology & Software Engineering, Volume 8 • Issue 5.
8. S.M.Khaled Reza, Shah Ahsanuzzaman, S.M. Mohsin Reza, "Microcontroller Based Automated Water Level Sensing and Controlling: Design and Implementation Issue", WCECS 2010, October 20-22, 2010, pp 220-224.
9. Rastko Martać, Nikola Milivojević, Vladimir Milivojević, Vukašin Ćirović, Dušan Barać, "Using Internet Of Things In Monitoring And Management Of Dams In Serbia", Facta Universitatis Series: Electronics and Energetics Vol. 29, No 3, September 2016, pp. 419 – 435.
10. Saraswathi V, Rohit A, Sakthivel S, Sandheep T J, "Water Leakage System Using IoT", International Journal of Innovative Research in Engineering & Management (IJIREM) ISSN: 2350-0557, Volume-5, Issue-2, March-2018.
11. T. Perumal, N. Sulaiman, C. Y. Leong, "Internet of Things (IoT) Enabled Water Monitoring System", 4th Global Conference on Consumer Electronics, 86–87 (2015).
12. Aishwarya Bangale, Ruchee Dandekar, Prerna Madke, U. H. Wanaskar, "IoT Based Real Time Water Level and Contamination Monitoring System with Android Interface", International Engineering Research Journal (IERJ) Volume 2 Issue 6 Page 2041-2043, 2016.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
ICCIDT - 2021 Conference Proceedings

Wearable Device to Track Covid 19 Symptoms

Susanna Sajan[1]
Student, Dept. of Computer Science & Engineering
Mangalam College of Engineering
Kottayam, India

Saran M S[2]
Student, Dept. of Computer Science & Engineering
Mangalam College of Engineering
Kottayam, India

Midhun Prasad[3]
Student, Dept. of Computer Science & Engineering
Mangalam College of Engineering
Kottayam, India

Minza Thazni[4]
Student, Dept. of Computer Science & Engineering
Mangalam College of Engineering
Kottayam, India

Gayathri R Krishna[5]
Assistant Professor, Dept. of Computer Science & Engineering
Mangalam College of Engineering
Kottayam, India

Abstract:- **Covid 19 forms a chain when contact with an infected person in the early months. It's very difficult for us to detect whether the person is having Covid or not. In this article, we are proposing a wearable device that can track Covid 19 symptoms. The proposed framework consists of 4 sensors for heart rate, body temperature, cough rate, and for measuring minimum distance. In the early months of the Covid-19 pandemic with no designated cure or vaccine, the only way to break the infection chain is self-isolation and maintaining the physical distancing. Here a combined application of the Internet of things with the Medical sector to make sure safety of every individual in this pandemic period. Internet-based solutions, brought by the Internet of Things (IoT) and cloud computation and storage technologies, have been driving revolutionary approaches in the sensitive domain of healthcare such as Real-time diagnosis of medical issues, Telemedicine, Remote monitoring of patients, Computer-assisted smart transportation in case of emergencies, are anticipated as Systems-of-Systems (SoS) that can execute several applications of different criticality, thus necessitating mission-critical and non-critical peripheral components. The Wearable IOT node works in association with the user's smartphone to collect proximity data using Bluetooth and to communicate with the server through the cellular data network.**

Key terms:- Sensors, Microcontroller, Gsm Module, IoT, Arduino Nano Board.

I. INTRODUCTION

This project is an IOT based project where the Internet of Things (IoT) development brings new opportunities in many applications, including smart cities and smart healthcare. The paper proposes COVID 19 detection and monitoring system that would collect real-time symptom data from wearable sensor technologies. Since COVID is increasing day by day, the death rate also increasing. COVID 19 also causes respiratory problems, high fever, cough, throat pain, etc. Recent studies have demonstrated the evolution of disease to hide its symptoms. As it is highly transmittable this disease might spread at an exponential rate costing the lives of thousands of people[1]. This chain of transmission has to be detected with utmost priority through early detection and isolation of infected people. One way to control the spread of viruses, until the vaccine is found effective. By implementing better systems for surveillance, healthcare, and transportation, contagious diseases will have less chance of spreading[3]. An IoT framework is presented to monitor participants' health conditions and notify them to maintain physical distancing. Applying ML algorithms on body parameters makes it possible to monitor participants' health conditions and to notify individuals in real-time. In addition, locally processing the data makes it possible to use the IoT node in environments without internet connectivity or fog-based networks. The system can assist participants in monitoring their daily activities and minimize the risk of exposure to the Coronavirus.

II. RELATED WORKS

Internet of Things (IoT) is an innovative technology used to provide information and monitoring systems during the COVID-19 epidemic. This technological platform can be used to tackle challenges during lockdown-like situations. IoT would help to provide an automated and transparent treatment process to tackle the COVID-19 pandemic situation. Internet of Things (IoT) enabled healthcare system is useful for proper monitoring of COVID-19 patients, by employing an interconnected network. This technology helps to increase patient satisfaction and reduces the readmission rate in the hospital. In a smart healthcare setting, the IoT can help to provide a remote diagnosis before hospitals for more efficient treatment [4].

For diabetic patients, it is vital to monitor their blood glucose continuously [5]; blood glucose data can be sent from wearable sensors to doctors or smartphones for continuous monitoring of patient's state of health. Castillejo et al. [6] develop an IoT e-health system based on Wireless Sensor Networks (WSN) for firefighters. Smartphones do play a large role in the IoT, however, because many IoT devices can be controlled through an app on a smartphone.

You can use your smartphone to communicate with your smart thermostat, for example, to deliver the perfect temperature for you by the time you get home from work. Another study helps us to track and identify the infected person using mobile phone tracking mechanism. IoT devices contain sensors and mini-computer processors that act on the data collected by the sensors via machine learning. Essentially, IoT devices are mini-computers, connected to the internet, and are vulnerable to malware and hacking Machine learning is when computers learn similarly to humans — by collecting data from their surroundings — and it is what makes IoT devices smart. Collected data can help the machine to learn your preferences and adjust itself accordingly. Machine learning is a type of artificial intelligence that helps computers learn without having to be programmed by someone. Access to High-quality Data:

Everyone, especially marketers and entrepreneurs, loves data and with the invention of IoT devices, companies now have greater access to data related to their customers and products than ever before. Technically, the more information you have, the easier it is for you to take the right decision. Better Tracking and Management Whatever the industry is, IoT makes tracking and management a breeze for organizations. From keeping track of inventory item by item to monitoring road traffic and weather conditions to notifying the concerned authorities about any suspicious behavior, IoT revolutionizes the way how we currently track and manage our business assets. IoT is not just about smart homes anymore, but it is now also about smart offices, smart warehouses, and smart anything else. Efficient Resource Utilization: Be it home, office, hotel, or car, IoT facilitates efficient utilization of assets for improved productivity. Leveraging the power of machine-to-machine interaction, an IoT system collects real-time data with the help of sensors and actuators so you can further use it to improve process efficiency and minimize human intervention, as a basic example, if any of your Home Appliances notifies you about the task completion, you need not worry about the inefficient consumption of the electricity.

Automation and Control: Automation is the need of the hour and IoT is renowned for the same. Since most of the IoT devices are connected through a wireless infrastructure, they can operate on their own with little or no manual intervention. For instance, home appliances such as air conditioners, washing machines, ovens, and refrigerators can be automatically get operated and you can even monitor and control them remotely. Comfort and Convenience: We live in a fast-paced world where busy people don't even care about small things like switching on/off lights and reading energy meters, and this is where the Internet of Things comes in.

IoT-Assisted ECG Monitoring Framework With Secure Data Transmission for Health Care Applications which is Capable of sensing, processing, and communicating, allowing sensors, embedding devices and other ' things ' to be created and the Health buffs who actively track their physical progress can have a reliable tracker for heart activity. Human Activity Recognition Based on Improved Bayesian Convolution Network to Analyze Health Care Data Using Wearable IoT Device. The data collection using decision-making tools uses wearable sensors for monitoring using cloud-assisted internet of things (IoT).

III. PROPOSED METHODOLOGY

In this article, the proposed COVID-SAFE framework offers: 1) a low-cost and lightweight IoT node[Fig .1] to monitor continually a person's body temperature, heart rate, and periodically monitor cough rate; 2) a smartphone app to display the parameters and individual risk factors; 3) a physical distance tracking mechanism to alert the user in case of violation of safe physical distance, and 4) a fog server that collects data from the IoT nodes and through internet it sends the necessary information towards the smartphone. The system mainly consists of namely 3 Modules. These modules combine to form our system.

A. MODULES

i. *User Module*

User Module Temperature sensor called Lm35 is an integrated circuit sensor the can be used to measure temperature with an electrical output proportional to the temperature more accurately than using a thermistor Heartbeat sensor. To use the sensor simply power it Vcc and ground pins. The sensor can simply power it using Vcc and ground pins. The sensor can operate at both 5 and 3.3v systems once powered connect the signal pin to the ADC pin of the microcontroller to monitor the change in output voltage.

ii. GSM Module

Global system for mobile communication. GSM module can send all the data towards the cloud server we can access the internet to the microcontroller using the GSM module.

iii. Server Module

Through the internet, the server module can send all the data to an android app called MITapp inventor.

B. SYSTEM ARCHITECTURE

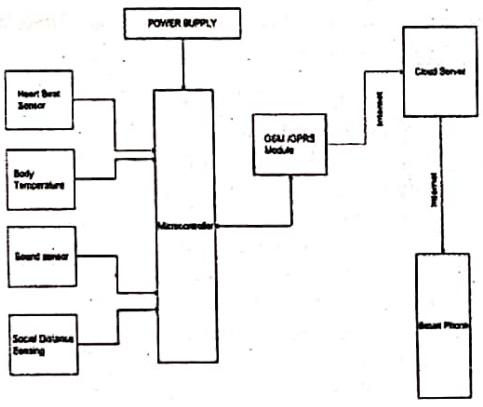


Fig 1. System Architecture

The framework for our proposed system includes a wearable IoT device, smartphone app, and fog (or cloud) server. Here we are using four sensors that are connected to a microcontroller called ATMEGA 328. The sensors used are the heart rate sensor, body temperature sensor, sound sensor, and the sensor for minimum distance maintaining. These parameters are all being controlled by a microcontroller that can coordinate all these values like a microprocessor. Using GSM Module/GPRS Module we can send all these data towards the cloud server or fog server. The data are visible on our smartphones. We can power the microcontroller using an adaptor or USB. The system architecture illustrates the high-level architecture of the COVID-SAFE framework.

i. Wearable IOT Device

The deployment of sensor devices has tremendously increased. Similarly, IoT applications have witnessed many innovations in addressing the COVID-19 crisis. State-of-the-art focuses on IoT factors and symptom features deploying wearable sensors for predicting the COVID-19 cases. The working model incorporates wearable devices, clinical therapy, monitoring the symptom, testing suspected cases. This IoT node works in association with the user's smartphone to collect proximity data using Bluetooth and to communicate with the server through the cellular data network. .It consists of a heart rate sensors body temperature sensor, a sound sensor, and a GSM module for data communication. We can access the internet to the microcontroller through GSM Module. The system then is synchronized with the software to monitor the user's behavior during daily activities. To measure the power consumption of the system, the wearable IoT device is connected to an adaptor or USB and elements of IoT.

ii. *Smartphone App*

The smartphone app shows the status of the patient. Firstly we have to enter personal details. By accumulating this information, the system can provide an individual risk factor for the user. Each parameter is shown in different fields. Here we are concerned about four parameters such as heart rate, body temperature, cough rate, and measuring social distance. These parameters are shown as the first field, second field, third field, and fourth field. The COVID-SAFE smartphone app, which is built to interact easily with users. This application collects all the data of related to patients. The app asks for symptoms following the body parameters, and provides the risk evaluation, and sends some useful tips.

iii. Arduino Nano Board

The Arduino Nano is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

iv. USB Plug & External Power Supply Plug

Every Arduino board needs a way to be connected to a power source. The Arduino Uno can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. The power source is selected automatically. The USB connection is also how you will load code onto your Arduino board.

v. Voltage Regulator

The voltage regulator is not something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says – it controls the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts.

vi. Power Pins

Voltage In Pin – The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin. 5V Pin – This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 – 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. It's not recommended. 3.3V Pin – A 3.3 volt supply generated by the onboard regulator. The maximum current draw is 50 mA. Ground Pins – There are several GND pins on the Arduino, any of which can be used to ground your circuit. IOREF Pin – This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

vii. Input & Output Pins

Each of the 14 digital pins on the Uno can be used as an input or output. They operate at 5 volts. These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-5k Ohms. In addition, some pins have specialized functions: Serial Out (TX) & Serial In (RX) – Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip. External Interrupts – Pins 2 and 3 can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. PWM – You may have noticed the tilde (~) next to some of the digital pins (3, 5, 6, 9, 10, and 11).

These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM). Think of these pins as being able to simulate analog output (like fading an LED in and out). SPI – Pins 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). SPI stands for

Serial Peripheral Interface. These pins support SPI communication using the SPI library. Analog Input Pins – Labeled A0 through A5, each of which provides 10 bits of resolution (i.e. 1024 different values). These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read. By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF Pin (Stands for Analog Reference Most of the time you can leave this pin alone). Additionally, some pins have specialized functionality: TWI – Pins A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library. Reset Pin – Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

viii. LED Indicators

Power LED Indicator – Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON'. This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit! On-Board

LED – There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. This useful to quickly check if the board has no problem as some boards has a pre-loaded simple blinking LED program in them.

TX & RX LEDs – These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).

ix. ATmega 328 Microcontroller

The black thing with all the metal legs is an IC or Integrated Circuit. Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type but is usually from the ATmega line of IC's from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.

x. Reset Button & ICSP Header

ICSP stands for In-Circuit Serial Programming. There are two ICSP headers on the board one for ATmega16U2 and the other one is for ATmega328. These are used to update or load the firmware into the microcontroller. Pushing the reset button temporarily connects the reset pin to the ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times.

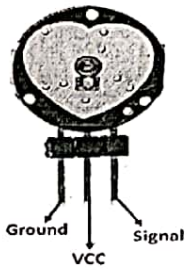


Fig 2. Hardware Overview

IV. FUTURE SCOPE

The future of health care is shaping up in front of our very eyes with advances in digital health technologies, like IoT, AI, Robotics, and nanotechnology. As this IoT-based device is capable of measuring human body parameters it can also be used for the continuous evaluation of patients who need regular medical checkups and for senior citizens. Doctors and nurses can use this handheld device to record patients' real-time data and constantly update their medical history. This makes more accurate and more efficient diagnoses and treatments.

V. .CONCLUSION

A wearable system/device capable to track key COVID-19 symptoms is presented. The COVID-19 is associated with typical symptoms. Their list is not short, but the most typical are fever, cough, shortness of breath or other breathing problems, chills, muscle pain, sore throat, loss of taste or smell. Serious symptoms, among others, include elevated heart rate (above 100 bpm) and lower oxygen saturation <92%. The ideal COVID-19 wearable device would be capable of measuring as many mentioned parameters as possible in everyday conditions and being easy to use by the seniors, young, without special training and knowledge. Off-the-shelf hardware and software components as simple sensors, general-purpose microcontroller, and gadgets like mobile devices and peripheries are used to detect and monitor body temperature, heart rate, continues cough, which are important to alert patients and remote medical staff about unusual symptoms correlated to COVID-19 or similar diseases. This product also helps to keep social distancing between peoples. The principle is not just simple and low cost, based on the components we use every day, but very immune to noise and artifacts.

VI. .ACKNOWLEDGEMENT

The authors wish to express gratitude towards the principal Dr. Manoj George, Dr. Sunitha E.V, H.O.D, Computer Science Department, and Ms. Gayathri Krishna, Assistant Professor, Computer Science Department, for the appropriate direction, significant help, and supportive remarks during the editing.

VII. .REFERENCES

[1] C.Huang et al., "Clinical Features of Patients Infected with 2019 Novel Coronavirus in Wuhan China", The Lancet Medical J., vol. 395, no. 10223, pp. 497-506, Feb. 2020.

[2] V. Stadnytskyi et al., "The Airborne Lifetime of Small Speech Droplets and Their Potential Importance in SARS-CoV-2 Transmission", Proc. National Academy of Sciences, vol. 117, no. 22, pp. 11,875-77, June 2020.

[3] L Borysiewicz, "Prevention Is Better than Cure", Clinical Medicine J. Royal College of Physicians, vol. 9, no. 6, pp. 572-83, Dec. 2009.

[4] "Guidelines for the Implementation and Use of Digital Tools to Augment Traditional Contact Tracing", Contact Tracing Resources from CDC,

[5] V. Chamola et al., "A Comprehensive Review of the COVID-19 Pandemic and the Role of IoT Drones AI Blockchain and 5G in Managing its Impact", IEEE Access, vol. 8, pp. 90,225-65, 2020.

[6] A. Al-Fuqaha et al., "Internet of Things: A Survey on Enabling Technologies Protocols and Applications", IEEE Commun. Surveys & Tutorials, vol. 17, no. 4, pp. 2347-76, 2015.

ISSN 2320 - 2602
Volume 9 No.7, July 2020
International Journal of Advances in Computer Science and Technology
Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst06972020.pdf
https://doi.org/10.30534/ijacst/2020/06972020

Gaze Based Password Entry using Android: Pin Based Authentication Methods to Reduce Shoulder Surfing Attacks

Devipriya S Kumar[1], Fincy Joseph[2], Mary Nimisha[3], Sreelakshmi S Nair[4], Ms.Gayathri R Krishna[5]
[1]Mangalam College of Engineering, India,devipriyasreeragam@gmail.com
[2] Mangalam College of Engineering, India, fincyjoseph1996@gmail.com
[3]Mangalam College of Engineering, India, marynimisha1996@gmail.com
[4]Mangalam College of Engineering, India, sreelakshmi.malikayil@gmail.com
[5] Mangalam College of Engineering, India, gayathri.krishna@mangalam.in

ABSTRACT
The paper addresses the problem of shoulder-surfing attacks on authentication schemes by proposing Illusion PIN (IPIN), a PIN-based authentication method that operates on touch screen devices. IPIN blends two keypads with different digit ordering with the help of hybrid images in such a way that the user who is close to the device is seeing one's keypad to enter their PIN, while the attacker who is looking at the device from a long distance is seeing only the other's keypad. It uses shuffling algorithms to shuffle the keypad since the attacker may memorize the spatial arrangement of the pressed digits. To improve the security of Illusion PIN, an algorithm is used which is based on human visual perception. By the end, the project quantified the level of resistance against shoulder- surfing by introducing the notion of safety distance, which is estimated with a visibility algorithm.

Key words: Authentication PIN, Hybrid Images, Human Visual Perception, Shoulder-surfing, Video Attack.

1.INTRODUCTION

1.1 Overview of Illusion

For instance, a baby who perceives tree branches in dark as if they are goblins could also be said to behave an **illusion.** The design of **Illusion PIN** is predicated on the straightforward observation that the user is often viewing the screen of the user device from a shorter distance than a shoulder-surfer. The **core idea of Illusion PIN** is to create the keypad on the touch screen to be interpreted with a unique digit ordering [10]. The user's keypad is shuffled in every authentication attempt.

1.2 Overview of Shoulder Surfing

In computer security, **shoulder surfing** is a type of social engineering technique used to get information like personal identification number (PINs), passwords and other confidential data by looking over the victim's shoulder, either from keystrokes on a tool or sensitive information being spoken and heard, also known as eavesdropping Figure 1.

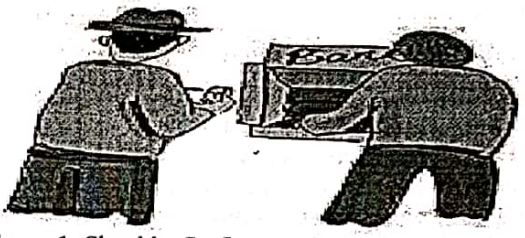


Figure 1: Shoulder Surfing Attack

The main measures of shoulder surfing are

- Gaze-based password entry
- Secret tap method
- Comparison of risks between alphanumeric & graphical
- PIN entry

1.2 GAZE based Password Entry

The basic procedure is that reminiscent to normal password entry, except that in situation of typing a key or touching the screen, the user looks at each desired character or trigger region in sequence (same as eye typing) [9]. The approach can, therefore, be used both with character-based passwords by using an on-screen keyboard and with a graphical password scheme.

1.3 Secret Tap Method

In computer security, shoulder surfing is a type of social engineering technique used to get information like personal identification numbers (PINs), passwords and other confidential data by looking over the shoulder of the victim, either from keystrokes on a device or sensitive information being spoken and heard, also known as eaves dropping. This attack is performed either at close range(by directly looking over the victim's shoulder) or from a longer range. To apply this technique attackers do not require any technical skills; keen observation of victims' surroundings and the typing pattern is required [7]. Therefore, it is important to make the authentication process more complex in order to prevent authentication information from being

stolen even if cameras and/or other individuals sees the information input process numerous times. One of the simplest forms of a secret tap method is biometrics such as fingerprint scanning or facial recognition, which cannot be replicated by an attacker [4].

1.4 Comparison of Risks

The key advantage of the graphical password compared to the alphanumeric password is that the improved memorability. However, the potential detriment of this advantage is that the increased risk of shoulder-surfing. The result indicates the very fact that both alphanumeric and graphical password-based authentication mechanisms may have significant vulnerability to shoulder-surfing unless certain precautions are taken [6]. Despite the common belief that non-dictionary passwords are the foremost secure kind of password-based authentication; results demonstrate that it's, in fact, the foremost vulnerable configuration toshoulder-surfing.

1.5 PIN Entry

A **personal identification number (PIN)**, or sometimes redundantly **PIN**, may be a numeric or alpha-numeric password employed in the method of authenticating a user accessing a system. The personal identification number has been the key to flourishing the exchange of PIN data between different data-processing centers in computer networks for financial institutions, governments, and enterprise [5].

2.BLOCK DIAGRAM

The Figure 2 indicates the working of illusion pin and its flow of functions.

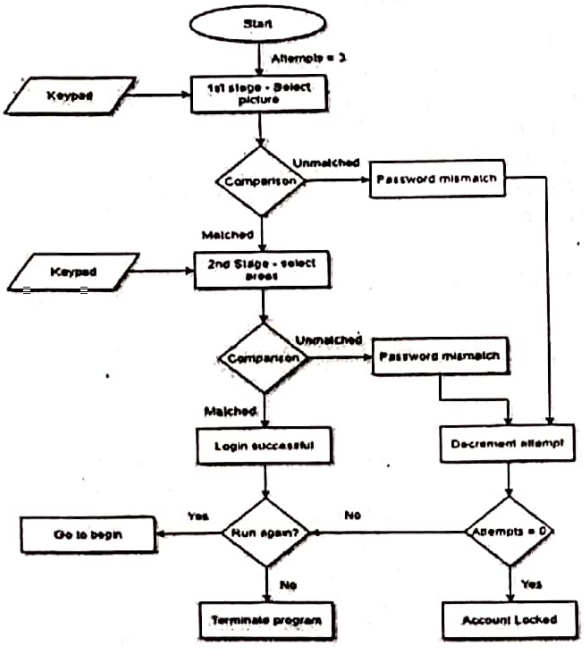


Figure 2: Working of illusion pin

3. LITERATURE SURVEY

Table 1: Literature Survey

SL NO	TITLE	MERITS	DEMERITS
1	Biometric-Rich Gesture A Novel Approach to Authentication on Multi-touch Devices	Recognize unique biometric gesture characteristics of an individual	speed of typing on
2	Finger-Drawn Authentication on touch devices	a user draw a PIN on touch interface with h finger	increasing authentication delay and complexity
3	DRAW-A-PIN: Authentication use finger-drawn PIN touch devices	It offers better security utilizing drawing traits behavioral biometric	attacker
4	Association bas graphical password design resistant shoulder surfing attack	user-friendly authentication, improve complexity into the authentication is reduce	Quantitative analysis is provided
5	Photographic Authentication through Untrusted Terminals		mathematical not secure as multi-characters swords

In Table1. It shows the comparison of the 5 similar related method which taken for the project and its basic characteristics are listed.

4. PROBLEM STATEMENT

Existing systems only provide some authentication techniques using pattern recognition schemes and it does not provide complete resistance to shoulder surfing. It only makes a way to recognize patterns or personal photographs of users and ask them to identify their own personal photographs from a set of images.This may cause an attacker to memorize the patterns or photographs and the solutions need to provide more resistance to shoulder surfing. There should be a solution to shuffle the keypads so that the attacker may not memorize it [2].

The motivation behind the project is the need for resistance to various shoulder surfing attacks faced nowadays. Since having different old technologies for shoulder surfing attacks, illusion pin comes with an authentication scheme to blend two keypads of different digit ordering to a single hybrid image to provide more security with the feature of shuffling keypads. The main aim of this project to avoid hacker's attack. here it's a practically impossible at the user can observer the device within in the bigger distance [3].so the user cannot understand what are often done on the system. If an attacker can see the pin authentication of the user that the attacker imitates the pin authentication by an assumption. To satisfy the wants of users to extend shoulder surfing resistance without the usability overhead. Address the matter of shoulder surfing attacks on authentication

schemes by proposing IPIN. Such some way that the user who is near the device is seeing on the keypad to enter the PIN, while the attacker who is starting at the device from an even bigger distance is seeing only the oppositekeypad.

5. PROPOSED SYSTEM

Traditional password authentication into a computer system with a keyboard is vulnerable to shoulder surfing attacks. Shoulder surfing refers to the usage of observation techniques i.e. looking over someone shoulder, to obtain their password [1]. In the proposed method, created a virtual keypad with a deceptive visual impression PIN. The virtual keypad is composed of two keypads with alternative digit orderings, combined in a single hybrid image. The keypad shows different values for user and attacker based on visibility algorithm that considers distance as a major factor for keypad changing Figure3.

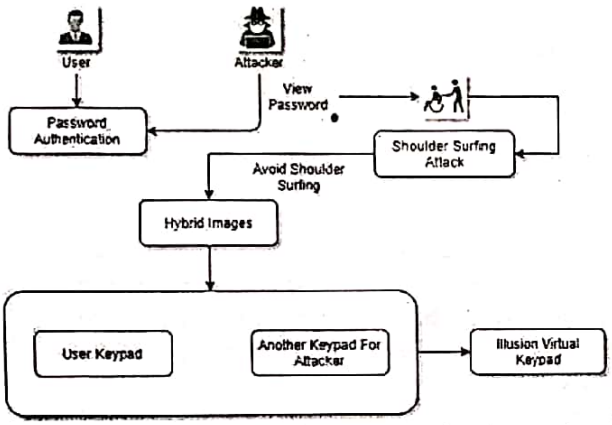


Figure 3: . Block diagram of user password authentication

Gaze tracking works by using computer vision techniques to track the orientation of the user's pupil to calculate the position of the user's gaze on the screen. Gaze-based password entry makes gleaning password information difficult for the unaided observer while retaining the simplicity and ease of use for the user.

6. TEST CASES

Table 2: Test Cases

Test Id	Test Description	Input	Expected Result
1	Authentication	Digits	Login Successful
2	Finger position	Digits	Security
3	Test with surveillance camera	Digits	Impossible to capture the number
4	Estimate the minimum distance from which a hacker can access the pin	Digits	Impossible to capture the number

In Table2 indicates the inputs we giving and its basic performance tasks. Here system performs authentication, finger position recognition, test with surveillance camera and estimate minimum distance from which a hacker can access the pin. Several inputs are given and finally how the output is successfully run by the system is shown.

7. EXPERIMENT RESULTS

In Figure4, it indicates the whole analysis of the system based on security is shown.

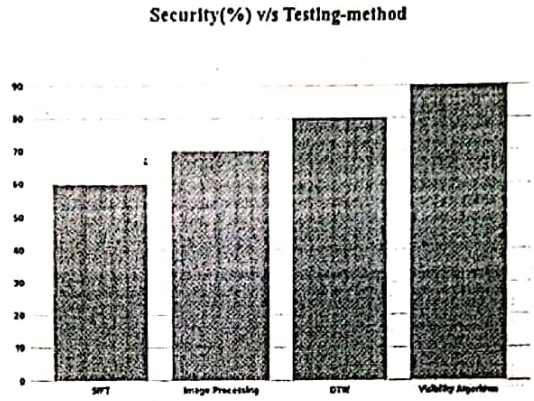


Figure 4: Experiment results

8. CONCLUSION AND FUTURE SCOPE

In future, Illusion PIN creates for android application. This can help to enhance mobile security. Illusion poses have variety of interesting questions, which warrant further investigation. Recall that scheme doesn't mandate a given image processing filter the selection of an oil painting filter has been driven mostly by heuristic considerations. Further experimentation is additionally needed to raised evidence the re-silence of the scheme to some kinds of attacks the low fidelity test conducted to see optimal parameter selection, while highly encouraging, has to be expanded to supply stronger statistical evidence that attackers don't seem to be easily able to revert a distorted image back to its original meaning.

While investigating how best to tune filter during the course of prototype design and implementation discovered that finding an optimal parameter point for the lossy filter depends on the image to be transformed. It can be concluded that the visibility index threshold value isn't universal. It also wishes to remind that the values of the DAF filter parameters depend up on the task at hand. As a result, it should to repeat the estimation process for a considerably different task [8]. Then it is often concluded that the visibility algorithm may be accustomed assess the visibility of general images, but its parameters should be appropriately tuned for the actual task athand.The main goal of work was to provide a line-based authentication scheme which can be used to resist shoulder surfing attacks.The proposed system uses Illusion pin, apin-based authentication method that uses the technique of blending hybrid images with two different digit orderings into a single image. It is used mainly in touch screen devices. It allows a person to resist from shoulder surfing attacks by providing two blended keypads for one

who is standing nearby it and other who is standing in a particular distance which is usually the attacker.

The system provides complete security to shoulder surfing attacks by shuffling the keypads using an algorithm so that the attacker cannot easily memorize the pin. conclude that the above method can be widely used to resist shoulder surfing attacks. The shuffling algorithm can widely be used to shuffle images but its parameters have to be tuned for the particular task inhand.

ACKNOWLEDGEMENT

We thank Department of Computer Science faculties and non- teaching staffs of Mangalam College of Engineering for permitting us to carry out this paper. Sincerely express our gratitude to all respected personalities who had guided and helped us in the completion of this paper.

REFERENCES

1 J Bonneau, C Herley, PC Van Oorschot, F Staino, the quest to replace passwords: A frameworks for comparative evaluation of web authentication schemes, in Security and Privacy (SP), 2012 IEEE Symposium on IEEE, 2012, pp. 553-567

2 M Harbach, A De Luca, S Eglman,theanatomyofsmartphoneunlocking,inProcee dingsofthe 34th Annual ACM Conference on Human Factors in Computing Systems, CHI,2016.

3 R Anderson, why cryptosystems fail, in Proceedings of the 1st ACM Conference on Computer and Communication Security, ACM 1993, pp.215-227

4 A J Aviv, K Gibson, E Mossop, M Blaze and J M Smith, Smudge attacks on smartphone touch screens, WOOT, vol10, pp.1-7, 2006

5 A Olivia, A Torrabla, P G Schyns, Hybrid images, ACM Transaction on graphics (TOG), vol 25, no.3, pp 527-532, 2006

6 D Kim, P Dunphy, P Briggs, J Hook, J W Nicholson, P Olivier, Multi-touch authentication on

7 N H Zakaria, D Griffins, S Brostoff, J Yen, Shoulder surfing defense for recall based graphical passwords, in Proceedingsof the seventh Symposium on usable privacy and security, ACM, 2011, p6

8 I Jenrnyn, A J Mayer, F Monrose, M K Reiter, A D Rubin, The design and analysis of graphical passwords, In use Nix Securtiy, 1999

9 E Hayashi, R Dhamija, N Christin, A perring, use of illusion: secure authentication usable everywhere, Proceedings of the 4th symposium on the usable privacy and security, ACM, 2008, pp35-45

10 J Bonneau, S Preibusch, the security of the customer- chosen banking plus, I Financial Cryptography and data security, Springer Berlin Heidelberg 2012, vol7397, pp25-40

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst01972020.pdf

https://doi.org/10.30534/ijacst/2020/01972020

HELPMATE-A Women Safety Device Using IoT and Machine Learning

Sreelakshmi G Nair[1], Nandu Krishnan K M[2], Vishnuraj R[3],Gayathri R Krishna[4]

[1]Mangalam college of Engineering, Kottayam, India, sreelakshmidasnair1998@gmail.com

[2]Mangalam college of Engineering, Kottayam, India, nandukm1998@gmail.com

[3]Mangalam college of Engineering, Kottayam, India,vishnureghu1998@gmail.com

[4]Mangalam college of Engineering, Kottayam, India,gayathri.krishna@mangalam.in

ABSTRACT

Nowadays women face various levels of threats from the society. Thus, women safety can be considered as an important issue that needs efficient solutions. Even though there exist some innovations towards this they are not much effective as they need human interaction to operate. From the previous experiences, we can see that a victim may not get any time or chance to operate any button or to switch on any application. Here we try to implement a device that can overcome these issues to a certain extend. This is a wearable device which has the ability to distinguish between a normal situation and dangerous situation by sensing the body temperature and heartbeats of women. When the device senses a dangerous situation, it will automatically call and send a message to the contacts which is already saved in the database along with the location details. It can also work in situations where there is no internet facility.

Key words: Arduino Board, Cloud Computing, GSM modem, GPS, Pulse Sensor, Temperature Sensor, ZigBee network.

1. INTRODUCTION

We are familiar with a numerous cases against women in these days. To avoid such crimes now exist many devices for women safety which helps to detect the location of the women and to alert authorities. Since these devices need some kind of human interaction to operate them, majority of time the user didn't get a chance to operate it. And also most of these devices need network facilities. So it cannot operate in remote areas. Hence in such situations the device becomes useless. Thus through this paper these devices are altered to operate without human interaction. For this a pulse rate sensor and a temperature sensor are added. Since there will be difference in body temperature and pulse rate when a person become scared or while running, it is easy to detect emergency situations using these 2 readings. To detect danger automatically machine learning algorithm is used and Cloud is used for collection and computation. Data of non danger situation is initially saved in the cloud as a reference. Logistic progression is used Cloud for comparing the actual data with collected data to predict whether the situation is danger or not. If danger is detected it automatically sends alert with location. ZigBee network is used as a remedy for network unavailability. It helps the device to send data to multiple hop distance.

2. LITERATURE SURVEY

2.1 Suraksha"-A Women Safety

In this paper the women safety device is named as Suraksha. It gives a warning with an instant location of the distressed victim to the police station. Through this the incident can be prevented and the culprit can be arrested. This device can reduce the increasing crime against women. It is a simple and easy to carry device. It has a major role in CCTNS which contain all digitized police records over India. A small press of a switch sends location as well as a warning message transmitted module to police station and other registered mobile number via GSM module. [2]

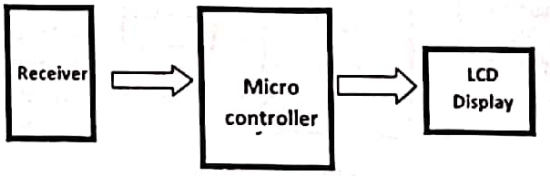


Figure 1: Conceptual design of receiver

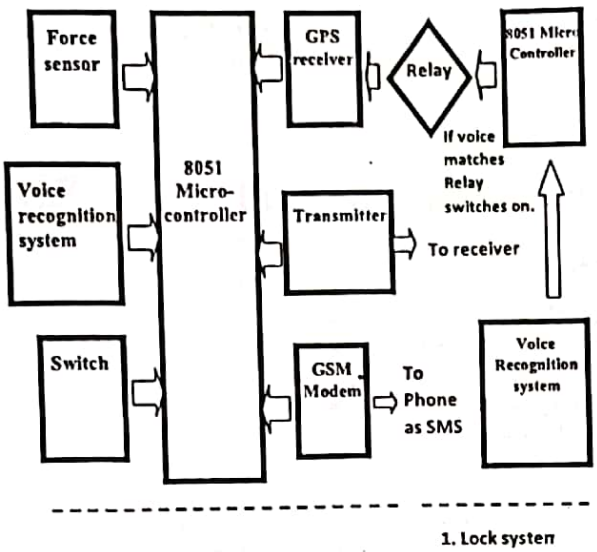


Figure 2: Conceptual design of transmitter

2.2 One Touch Alarm System for Women's Safety Using GSM

This paper introduces a one touch alarm system that ensuring women's safety using GSM module. It helps to identify protect women from dangerous situations. When the victim sense abnormal situation, just press on the button of the device. This device includes a PIC microcontroller, GSM module, GPS modules. The system looks very similar to a normal watch which tracks the location of the women using GPS and sends emergency messages using GSM, to contacts and the police station. The main advantage of this device over the other existing systems is that the user does not require a Smartphone. The device ensures more accuracy and more reliability. The watch will leave no stone unturned to help the dupe in any kind of emergency situations.

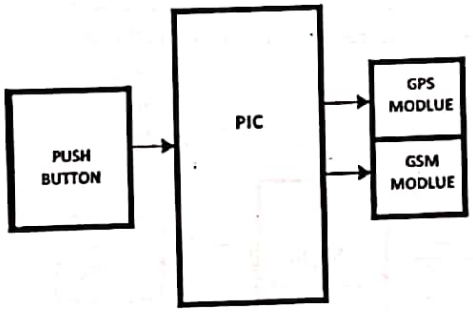


Figure 3: Block diagram

This device has 16k bytes flash memory and 1024bytes RAM. Software, numbers and message to inform friends, family and police are stored in the spot of PIC. A GSM module and a GPS module are linked to the controller. To communicate with GSM and GPS module, the Enhanced Universal Synchronous Asynchronous Receiver Transmitter (EUSART) module in the PIC is used. [3]

2.3 IoT based Smart System for Human

This paper describes a smart device, which contains multiple components, having a wearable Smart Device which continuously communicates with a smart phone through the Internet. The application is programmed and includes all the health related data of the user. This device generates a signal that is transmitted to the smart phone. The software or application has access to GPS and Messaging services which is pre programmed that whenever an emergency signal is received, it sends a help request to nearby police station, relatives and also to the people nearby having the application. With this action it helps the police to reach the victim more accurately. Sometime the people who has health related issues did not get proper medication on time and might leads towards the death that person if did not get help from any one. This led to the implementation of such a system. The proposed system makes it possible through a wearable band. It is integrated with some sort of sensors which will not only help in preventing the attack but also in medical issues. This device will generate an alert message with location and will send to nearest police station, nearest active peoples, relatives or nearest ambulance as per the situation. Based on the situation the alert will be send through the internet or SMS gateway. [4]

2.4 Smart Security Solution For Women Based On Internet Of Things (IOT)

This paper focuses on a security system that is designed to provide security to women. This system is an advanced system can be built that can detect the location and health condition of person. It includes electronic gadgets like GPS receiver, body temperature sensor, GSM, Pulse rate sensor. The heartbeat of a person in such situations will be normally higher which helps make decisions along with other sensors like motion sensors to detect the abnormal motion of the women. As compared with existing women security devices such as bulky belts, separate garments etc. it's completely comfortable and easy to use and this is the idea behind this. It has

4	Smart Security Solution For Women Based On Internet Of Things	Automatically functioning System	Need internet accessed smart phone
5	Design And Development Of Women Self Defence Smart watch Prototype	Provides a shock mechanism to produce non-lethal electric shock.	Control button should be pressed to operate

In this survey we just compared HELPMATE with other techniques used for women safety. In order to reduce its drawbacks, here adapt the merits of similar works by analysing the Literature review. The reason we come up with these idea is that, in situations like sudden unconsciousness and weakness due to fear or while sleeping, user may unable to resist an attack against her. This system also includes facility to transfer data to a large distance. Thus the effectiveness of the device becomes more.

3. MOTIVATION

The crimes against women increase day by day. The society is familiar with such news in each day. So, it is important to develop the technology towards this for assuring women safety. There exist some women safety devices but they are not much effective. These devices are not able to prevent the attacks in all the situations like sudden unconsciousness, while sleeping or weakness due to fear since they are non automated devices. On such situation we may not able to call others for help. But in every such situation our body temperature and pulse rate will show a noticeable difference. This is behind the idea. Remote areas may lack network facilities and to protect users in that area we need to provide extra facility. For that here use ZigBee network

4. SCOPE

By the implementation of such a system will help to avoid the crimes or attacks towards women by sharing the location of crime to the emergency contacts with an alert message and call. This system can also inform the nearby police station and thus the crime can be avoided as early as possible. Thus, by implementing such a system with high accuracy and work without any delay will definitely ensure safety for the women without any fail.

5. PROBLEM STATEMENT

The main problems in most of the women safety devices are not automatic. It needs a single touch or a voice command to unlock the system. It may not be possible at all situations. The individual may not get the time to operate the system due to many reasons. The objective of the device fails and the crime can't be identified. The device may also fail to function in remote areas since all the safety device needs internet access to transfer data. In remote areas where there is no signal the device become in dead state and the attack cannot be prevented. The solution to overcome these issues is to implement a device which is able to work automatically without any human interactions. And also the device should be able to function in remote areas without internet access. This implementation will lead to the creation of an effective women safety device.

6. PROPOSED MODEL

A system that can operate without any human interaction and automatically send alert message to emergency contact while women is in danger and even there is no internet connection. It also contains a push button for the cases in which the user is able to operate the system. The system contains a temperature sensor and a pulse rate sensor to collect the readings and send it to Arduino, which fixed in the system. Arduino send this data to Cloud through a gateway. Cloud compares the collected data with initially stored data. Readings in both danger and non danger situation are collected initially using mobile app and stored in cloud. Logistic progression algorithm is used as machine learning algorithm to compare collected readings with initial data. Prediction of danger is done by checking the match and mismatch of readings. The prediction is send from cloud to Arduino through a gateway. If prediction is danger then the GSM modem present in the system sends calls and messages along with the location of user detected using GPS that also fixed in the device. [1].

an added advantage so as to reduce the cost of the device and in reduced size. The GPS and the GSM are used of a smart phone. The watch can be installed with Bluetooth 4.0 BLE which comes in handy for several days on a single shot of charge. This also enables in reduced power use. [5]

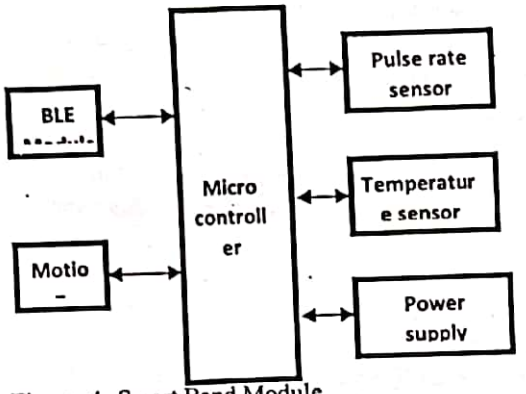


Figure 4: Smart Band Module

2.5 Women Self Defence Smart watch Prototype

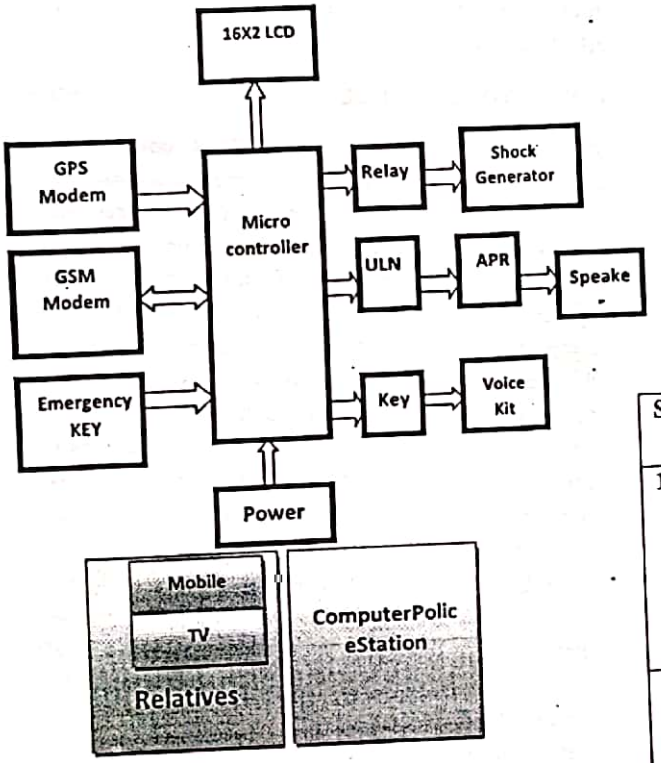


Figure 5: Self Defence module

This proposed system deals with situations where a woman can get help with the press of a button on the gadget. Self Defence module for women safety is like a Smart Watch for Women safety. This device contains technologies that are embedded into a compact device for women safety and protection. When the user is in danger, it has a control button that will be used by women to inform nearby police. When the system is activated, the watch directly gets connected to the satellite through GPS. It contains a shock mechanism to produce an electric shock in emergency situations to resist the attack. In order to minimize risk there are many approaches that proposed electronic tele-monitoring systems aimed at tracking victims and aggressors. These approaches are based on data transmission and locating technologies such as GPS and GPRS. Then the location is transferred through a GSM modem. [6]

When the supply is given the device will turn on.GPS and GSM connected to ATMEGA also start working and it displays the current position of device. Then with the help of GPS the location (latitude and longitude) of the victim is detected and is displayed on the LCD. When the victim feels danger, he/she presses the first emergency key, the kit displays emergency situation and voice kit is enabled. Now the victim gives voice command and it is recognized by the kit. If the voice command matches with the one stored in database then the appropriate action takes place. For example if POLICE gets the voice command given by the victim, then a text message is sent to a number of police station and also an alarm is generated. Another emergency key is also provided in the kit and if it is pressed by the victim it generates an electric shock of around 12 V DC which can give severe shock to the person who is trying to mistreat.

Table 1: Literature review

Sl.no	TITLE	PROS	CONS
1	Design and Development of "Suraksha"- A Women Safety	Intimidate instant location and a distress message to the cops and registered number	Voice command is needed start functioning
2	One touch alarm system for women's safety using GSM	Technologically sound equipments and ideas are used	Needs a human touch to start functioning
3	IoT based Smart System for Human Safety	Also help in medical Issues	Needs internet access

7. ARCHITECTURE

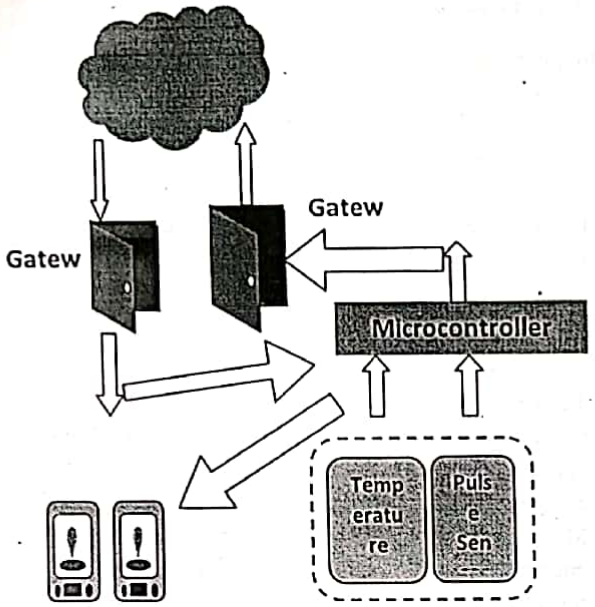


Figure 6: Architecture of the system

The architecture of this system begins from the sensors, a temperature sensor and a pulse sensor to collect readings from the body. A microcontroller unit (Arduino) is fixed in the device to collect the readings. These data sends to the gateway and then send to Cloud. To analyse the data machine learning is used in the cloud. After computing all the data on Cloud the situation is predicted as danger or not. The result is send to the microcontroller through a gateway. If the result tells danger then the GSM modem in the device sends messages and calls to the emergency contact. The location of the user is tracked using a GPS module connected to the device and send along with the message. For a user in remote areas the Internet connection may unavailable. Thus a ZigBee network module is added to escalate the information to a large distance by using its multiple hop communication facility. [1]

8. LOGISTIC REGRESSION ALGORITHM USING PYTHON

To analyse the data accurately and predict the danger Cloud use logistic regression as machine learning algorithm. By using the sensor value generated by the person who wearing the band and according to that danger and non danger situation is determined. Thus based on the initial data danger can be predicted accurately using this logistic regression algorithm. It is a classification algorithm used to predict binary output by using dummy variables. The danger is indicated by the binary value Yes and non danger situation is indicated by No. The function of independent variables temperature and pulse rate is modelled as probability of danger (P). It is a nonlinear function that ranges from -∞to+∞ where probability lies between 0 and 1.log odds is applied to the dependent variable that expressed aa linear function. [1]

A. ADVANTAGES

- Can be used by women while travelling alone on roads, in public transport or even at workplaces.
- Helps us to analyse the severity of crimes against women and reduce sexual harassments.
- Completely automatic system
- Able to work without internet access.
- Human interaction is not needed.
- Location is shared accurately without any delay.

B. DISADVANTAGES

- Pulse and temperature variations occurred due to some physical conditions may also be detected as an emergency situation.
- It requires a large storage space.

9. SYSTEM REQUIREMENTS

Here we need both software and hardware requirements in order for the implementation.

C. SOFTWARE REQUIREMENTS

- Data collected by temperature and pulse rate sensor.
- Machine learning algorithm
- Logistic regression using python.
- Cloud for storage

D. HARDWARE REQUIREMENTS

- Arduino ATmega328 Board.
- Temperature sensor LM35 series
- Pulse rate sensor
- GPS module
- GSM 30
- ZigBee S2C mmoduS2C

10. TEST CASE

Table 2: Test case

TCD	TEMP. VALUE	PULSE VALUE	EXPD. RESULT	ACTUAL RESULT	STATUS
1	37	83	Not emergency	Not emergency	Successful
2	36	138	Not emergency	Not emergency	Successful
3	40	140	Emergency Situation detected	Emergency Situation detected	Successful
4	38	85	Not emergency	Not emergency	Successful
5	41	83	Not emergency	Not emergency	Successful

11. OUTPUT

The system is able to predict danger based on the body conditions. Collected data is compared with initially stored data using logistic regression algorithm. When danger is detected emergency call and message will be send to the emergency contacts along with the location of user with high accuracy.

12. CONCLUSION

This system is implemented to ensure safety for women travelling alone in public transport, workplace, home or on road. This may help to reduce crimes and harassment to an extent. Since this device can also be operate in areas where internet is unavailable the effectiveness of the device increases. ZigBee mesh network provides multiple hop distance to transfer information to a large distance.

In order to reduce the drawbacks of the system advantages of related works are adapted after analysing the literature review. From the Literature review it can be analysed that the main demerit of these systems are it cannot be operated automatically without any human interaction. Thus user can't operate the system if the attack occurs when she becomes unconscious or weak due to fear or when the user is sleeping. And also these systems cannot use in remote areas. By overcoming such drawbacks this system is implemented in such a way to provide accurate predictions and efficient security without any fail.

13. FUTURE SCOPE

In future this system can add on a feature that the location can be shared as a pop-up notification instead of a message. Also the system can send the alert message also to the nearby police station by tracking with GPS. These future changes can increase the effectiveness of the device and thus it can ensure women safety.

ACKNOWLEDGEMENT

First of all, we thank the almighty God for giving us the strength to venture for such an enigmatic logical creation in a jovial way. We gratefully take this opportunity to express our profound thanks to our eminent director Er.Biju Varghese, chairman of Mangalam group of Institutions for giving encouragement throughout the course and motivate the students to promote their knowledge. We express our sincere thanks to Dr. Manoj George, the Principal for providing us the facilities to complete our project successfully. They are very grateful for providing the best facilities and environment to do our project. It is with deep sense of gratitude that we express our heartfelt thanks and indebtedness to Dr. Vinodh P Vijayan, Head of Department, Computer Science and Engineering Department, for his encouragement and inspiration. We would like to thank our project guide Ms. Gayathri R Krishna, Asst. Professor in Computer Science and Engineering Department for her valuable help, sincere guidance, timely suggestions and constant encouragement. We express our deep sense of gratitude to our project coordinator Ms. Sujitha M, Asst. Professor in computer Science and Engineering Department. Many others have helped us in preparing and processing the project in many ways. It is with pleasure that we acknowledge the help received from all the teachers and staff members of Computer Science and Engineering Department. Finally, we express our sincere thanks to all our friends, parents for their kind presence, support and interest to us.

REFERENCES

1. Muskan , TeenaKhandelwal, Manisha Khandelwal, and PurnenduShekharPandey"Women Safety Device Designed using IoT and Machine Learning"- 2018 IEEE.https://ieeexplore.ieee.org/document/8560188.

2. N. bhardwaj and N. Aggarwal, "Design and Development of "Suraksha"-A Women Safety," International Journal of Information& Computation Technology, vol. 4, no. 0974-2239, pp. 787-792, 2014.

3.Premkumar.P,CibiChakkaravarthi.R,Keerthana.M and Ravivarma.R'Sharmila.T, "One Touch Alarm System For Women's Safety Using GSM," International Journal of Science, Technology & Management, vol. 04, no. 2394-1537, March 2015. https://doi.org/10.15623/ijret.2015.0417013

4. A. Wadhawane, A. Attar, P. Ghodke and P. Petkar, "IoT based Smart System. for Human Safety," International Journal of Computer Applications, Vol. 179, No.7 , March, 2017.G https://doi.org/10.5120/ijca2017916012

5. G C Harikiran,Karthik Menasinkai and SuhasShirol, "Smart Security Solution For Women Based On Internet Of Things (IOT)", International Conference on Electrical, Electronics, and Optimization Techniques ICEEOT – 2016 IEEE. https://doi.org/10.1109/ICEEOT.2016.7755365

6. Shreyas R.S, Varun.B.C, Shiva Kumar.H.K, Punith Kumar B.E, Kalpavi.C.Y," Design And Development Of Women Self Defence Smart watch Prototype", International Journal of Advanced Research in Electronics and Communication Engineering IJARECE Volume 5, Issue 4, April 2016.

ISSN 2319-2720

Volume 9, No.2, April - June 2020

International Journal of Computing, Communications and Networking

Available Online at http://www.warse.org/ijccn/static/pdf/file/ijccn07922020.pdf

https://doi.org/10.30534/ijccn/2020/07922019

WiFi-based ad-hoc Network for Disaster Management

Joel Abraham[1], Denny Sallu[2], Akhil Bhaskar[3], Renjith CS[4] Ms.Tinu Thomas[5]

[1]Mangalam College of Engineering, Kottayam, India, joelabraham098@gmail.com

[2]Mangalam College of Engineering, Kottayam, India, dennysallu@gmail.com

[3]Mangalam College of Engineering, Kottayam, India, akhilbhaskar7@gmail.com

[4]Mangalam College of Engineering, Kottayam, India, csrenjith19@yahoo.com

[5]Mangalam College of Engineering, Kottayam, India, tinu.thomas@mangalam.in

ABSTRACT

Countries around the world face hundreds of natural calamities every year. In our country, the most recent being the floods that affected the state of Kerala and Uttarakhand. Most of the people living near water sources were stranded at homes. Despite the deployment of rescue teams to find them, the operations took longer than expected, resulting in loss of life. In any case, the effectiveness of a search and rescue is evaluated by the quick response.

As disasters disrupt communication mediums, valuable information regarding the location of the affected persons cannot be passed on to rescuers effectively. This results in delayed response and time is crucial when it comes to saving lives.

By creating a system that can be used by rescuers and affected persons alike, the delays caused by poor communication can be overcome. An ad-hoc network can be set up onto which this system can be implemented. These network credentials are made aware to people beforehand. At the time of the disaster, this WiFi network can be accessed by people to give information about their location and other parameters like current status, headcount, etc to an android application. Wi-Fi hotspots can be set up on individual phones so that nearby devices can also connect to the network. The database is designed to store information about people. This information can be used by the search and rescue team to reach affected people along with necessary supplies.

Key words : Ad-hoc, disaster area networks, disaster response, Wi-Fi hotspot, router.

1. INTRODUCTION

Our country faces hundreds of natural calamities every year [1]. Studies show several patterns on how disasters keep recurring in some areas. As a result of poor planning of strategies, rescue operations become ineffective where there is no protocol of mitigation. Being prepared for a disaster can help in a lot of ways to avoid the drastic effect of a disaster.

The most recent of times our land was affected by the worst floods during 2018 and 2019. Flash floods like these happen in a few hours and rescuers are not prepared to tackle them. In such flood-prone areas, people cannot organize themselves quickly enough and pass information after the wake of the disaster.

Most of the people living near water sources were stranded at homes. Places near riverbanks can be classified as high-risk areas. they need to be well prepared to handle such disasters.

Search and rescue teams were deployed to find them. But without knowing the exact location or number of people the task to rescue them becomes very difficult. First responders are usually people who know the area well. They are not well equipped to handle the situation

But it wasn't feasible to search all the houses as some people had already left to the relief camps

2. LITERATURE REVIEW

There are several systems that try to tackle the same problem, ie, creating a communication system after a disaster. Natural calamities leave all telecommunications services disabled as telephone wires and cell towers may be destroyed. As time is critical, the best approach is to create an ad-hoc network that can be accessed by people quickly and easily. This network might be able to get crucial initial information that can then be used to save lives.

The choice of the network is not wired as there are already limitations to what can be done. Most of the area might be flooded or unreachable depending on the calamity. It can also be dangerous to navigate in these areas a few hours after floods due to downed power lines etc.

Hence wireless networks are required. They do have a lot of limitations but it is more feasible than other methods.

There is plenty of research being done in creating ad-hoc networks. A wifi based mesh network [2]. The communication is based on IEEE 802.11b,g,n Wi-Fi standards. Here the wifi network provides the backbone for communication between the smart devices that are

connected to the network. The wifi nodes can be placed 100 meters apart and provide a range in that area.

Wifi hotspot method of transfer is when a device repeatedly broadcast network join beacons [3] so that any devices in the vicinity can connect to them. this is done periodically so that new devices can readily join the network along with existing devices

Another application to send data from sensors using Zigbee modules is discussed here [4]. They can monitor parameters recorded by the sensors remotely. This has useful applications in a disaster management system. It is used to measure environmental parameters like air quality, water levels, wind levels, etc. several other use-cases are also discussed in that paper. The relevance to this paper is that we can use these modules to make a more informative analysis of ambient conditions also.

Techniques discussed in [5] are more about hastily formed networks or HFN with particular importance of CISCO being able to use WiMAX to support agencies to provide a network that can be used to make emergency communication possible.
Another method was to use SATCOM or satellite internet that operated directly from satellites. The main drawback of this system is that poor weather conditions can impair the connection.
They also discuss the possibility of a WiFi-based mesh network [5] to which devices can seamlessly connect to and perform data transfer.

3. PROPOSED SYSTEM

A network can be created in a variety of ways. The effectiveness lies in how it is implemented in a given situation. A network-based in wifi can be set up fairly easily with almost everyone carrying a wifi capable device with them at all times. The process can be made more intuitive and simple using an interface that allows people to communicate to the rescuers in the event of a disaster, rescuers can set up an ad-hoc network. The main aim is that people can log onto this network via their mobile phones in order to communicate with the rescuers via an android application.
A long-range wifi transmitter keeps the system accessible to people in the affected area. The android application can be used to update details like location, number of people, required supplies, etc. A common database is maintained at the administration end. Such a system can reduce the time needed to identify the location of the people and the rescuers can be prepared.

3.1 Interface

An android application is used by the affected people as an interface to be able to communicate to the rescuers. This app needs to be pre installed by users in the area.[3]

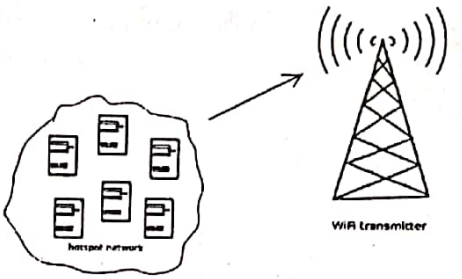


Figure 1: Disaster victims transmit information to rescuers via wifi

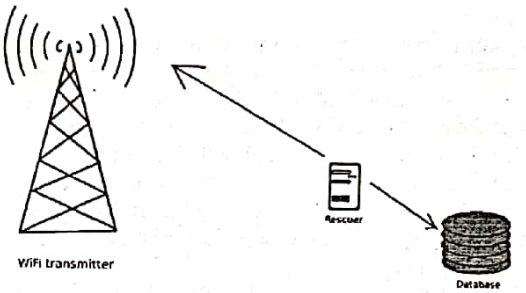


Figure 2: Disaster victims transmit information to rescuers via wifi

The files can be sent to other users using any peer to peer sharing so that new users can also join the network.
User registration is made when the network is active and basic information is required like name, contact number, location, etc.
These details are stored in a database at the rescuer's end. Whenever a user is using the network, the rescuers are notified and the information is accessed.
The application can be used to send information in the form of text that can indicate the names of people who are currently there with the user, their requirements, their location and how to reach there.
Real-time location can allow the rescuers to track movements. The application is developed in Android Studio and is lightweight.
An SOS message can be sent to the rescuer who is nearby who can then update the status in the database.
Other rescuers can view these updates so no redundant operations are carried out. Once that victim is rescued, the status of the database can be changed and the entry cleared.

3.2 WIFI Network

This network can be created by the rescuers in the form of a long-range wifi transmitter or by users who can create a local hotspot to which other users can connect to.
This creates a mesh network that can cover an area. For severely affected areas and remote areas the effective range may be reduced.
Both rescuers and users are on the same network and they can bidirectionally send and receive data.

3.3 Server

This is built and maintained at the end of the rescuers who can access it for information sent by other rescuers in that area. This server is made using Python.

3.4 Client

The client is running the latest version of the android application. This application is configured to connect with the network hosted by the server. This application does all the functions that are discussed in this paper.

4. SYSTEM ARCHITECTURE

The system is basically a peer to peer communication system that can be used in the time of a disaster to convey messages to nearby rescuers.
The basic function can be described in the following steps.

1. Install the application

   Users need to install the application to their smart devices. The application is lightweight and is supported on all android devices. The application itself is intuitive and easy to use. New users can register to the network using their names and other basic information. This information is used to make an entry in the database.
   The application has a dedicated SOS button that can be used to send distress signals. Other data include text fields that can be used to specify the number of people in the vicinity, possible safe routes etc.

2. Connect to the ad-hoc network

   Once the app has been installed, the users need to connect to the ad-hoc network using their registered name. This is done so that the rescuer can update the database on how many people are served or not to avoid redundant rescue operations. The main reason for such a system where the rescuers maintain a database is to organize search and rescue operations. In case a user is new and has not been registered, there is an option to send an SOS message which only contains the name and GPS data. This information is sent as soon as a connection is made to the wifi network

3. Register/send information

   After the connection has been made, the next step is to send and receive information. This is the main feature of the application. It enables users to pass on crucial information to the rescuers. The data fields are put in a way that only the minimum necessary information is gathered. They are used by the first responders to quickly identify and reach the users who sent the message.
   The idea is that users send information about the location and the number of people present, routes that can be navigable, etc. This piece of information can be used by the rescuers to organize a search and rescue for the given information.

4. Notify the rescuer

   Once the data has been sent to the wifi network, it reaches any rescuer in the range of the WiFi network. The application constantly broadcasts the SOS signal so that it can be intercepted by nearby users or rescuers. A user may send data to multiple rescuers redundantly but only one single entry is made for the user in the database. This helps to make organized rescue operations. The number of people present is a piece of important information because the rescuers can be ready with resources to help that many people. Basic requirements will be available with the rescue personnel, any special requirements can be specified. It can be special medication, medical aid, mobility tools, etc. If people are trapped under structures, there might be a need for special tools like crowbars, levers, etc. With this information, they can be prepared.

5. Update the server with victim details

   When rescuers get a message regarding the people in an area, they update a local database. This contains the information passed by the users. There are multiple entries and a new entry is searched for redundancy. If it already exists, the new entry is discarded. If

6. Change status of entry after rescue

   After the rescue operation is completed that particular entry is removed from the database

5 RESULT

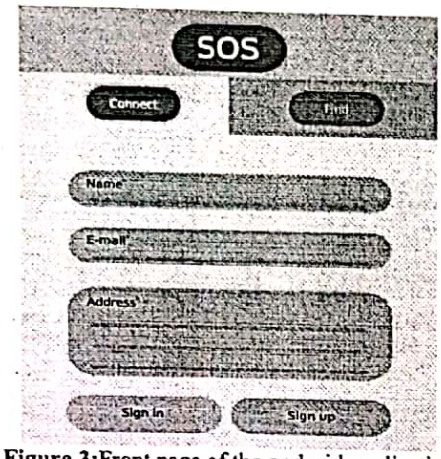


Figure 3: Front page of the android application

This page allows the user to sign up to the system. They should be able to do so after finding the network and connect. The data collected is used to initialise an account. Otherwise the user can choose to sign in.

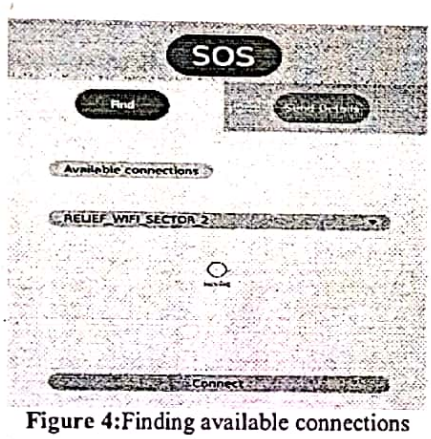


Figure 4: Finding available connections

This page allows users to connect to a network from a list of networks available. This network is provided by the rescuers in the area affected by the disaster. Users can login to their

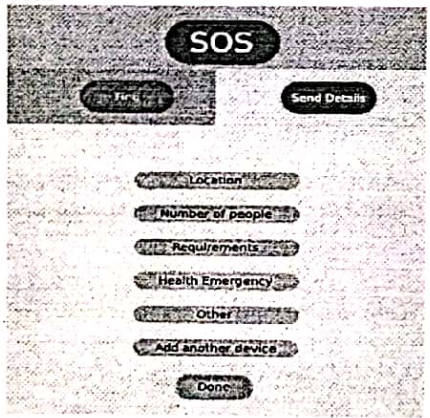


Figure 5: Options to send data to the server

The final tab is used to send specific data. The SOS button on top acts like a beacon that broadcasts messages to nearby devices and the server.

6 CONCLUSION

This system is a support for people who are affected by the calamity in the first few days. As there are many variables involved in deploying a system like this on the field, reliability and performance are subjective to specific scenarios. The application as a whole is a proposal to approach disaster management.

REFERENCES

1. P.Lavanya, B.Somi, S.Dev Nandan, J.Mani Mohana Krishna, N.Veeraiah **Post Disaster Relief Operations using Ad-hoc Network,** International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 5, Issue 3, March 2018 IJERCSE 51
2. G.T.C a, Jayarathna P.V.N.M b, Sandamini S.S.P c, D.S De Silva d **Wireless Ad-hoc Network for Disaster Relief Communication** Conference: 2015 8th International Conference on Ubi-Media Computing (UMEDIA)
3. Amitangshu Pal and Krishna Kant Computer and Information Sciences, Temple University, Philadelphia, PA 19122A **Smartphone-Based Disaster Recovery Network using WiFi Tethering** E-Darwin2: 2018 15th IEEE Annual Consumer Communications & Networking Conference (CCNC)
4. D. Rahul Naik, Lyla B. Das, Bindiya T. S, **Wireless Sensor networks with Zigbee and WiFi for Environment Monitoring, Traffic Management, and Vehicle Monitoring in Smart Cities** 2018 IEEE 3rd International Conference on Computing, Communication and Security (ICCCS)
5. Catherine Blackadar, Brian D. Steckler Jeannie A. Stamberger **The Evolution of Hastily Formed Networks for Disaster Response Technologies, Case Studies, and Future Trends** 2011 IEEE Global Humanitarian Technology Conference

ISSN 2319 – 7595

Volume 9, No.3, May - June 2020

International Journal of Information Systems and Computer Sciences

Available Online at http://warse.org/IJISCS/static/pdf/file/ijiscs04932020.pdf

https://doi.org/10.30534/ijiscs/2020/04932020

Smart Techie: An Online Examination System with Improved Use of Descriptive Answering

Nishamol Shaji [1], Santhy Rachel Thomas [2], Shalu Treesa [3], Sneha Philip[4], Tinu Thomas[5]

[1]Student, Mangalam College of Engineering, India, nishaelavunkal@gmail.com

[2]Student, Mangalam College of Engineering, India, santhyrachelthomas@gmail.com

[3]Student, Mangalam College of Engineering, India, shalustm66@gmail.com

[4]Student, Mangalam College of Engineering, India, philipsneha61@gmail.com

[5]Faculty, Mangalam College of Engineering, India, tinu.thomas@mangalam.in

ABSTRACT

The modern computerized system is developed with the aim to overcome the drawback of existing system. This paper proposes a web application for Job Searching and Job Posting. The main advantage is that any person anywhere from the world can register into the site for search and find the job. The recruitment is provided on the basis of a test. The test includes questions from various categories. Based on the result of the test, recruitment will be provided for the candidates. In the case of job recruitment, the module helps in registration of the prospective candidates with the system. The candidate has to register with the site to get a login, once login is available they can attend the test. The system contains a list of companies. The test is based on Latent Semantic Analysis. In general LSA can be considered as an excellent information retrieval technique. But for this specific task Descriptive Answer Assessment (DAA) is also used. That means answers can be either objective or descriptive. In case of descriptive answers the candidate can answer either by writing or by explaining the answer in his/her own voice. LSA is mainly used for short answers and DAA for large explanations. The companies can add jobs according to the category. They can view their profile and if needed, can update the details.

Key words: Python, Latent Semantic Analysis, Descriptive Answer Assessment.

1. INTRODUCTION

The Internet has caused the largest change to the recruitment landscape in the past decade acting as a conduit between employers and job seekers. Technology has enabled corporate website suppliers and job seekers to become more sophisticated interactive and to connect globally 24 hours a day,7 days a week.

A. What is e-recruitment?

E-recruitment, also known as online recruitment, is the practice of using technology and in particular Web-based resources for tasks involved with finding, attracting, assessing, interviewing and hiring new personnel.

The purpose of e-recruitment is to make the processes involved more efficient and effective, as well as less expensive. Online recruitment can reach a larger pool of potential employees and facilitate the selection process. The online promotion of an organization as a desirable place to work, through the corporate website or other venues, is one element of e-recruitment. E-recruitment software and systems are available as standalone applications, product suites and services.

A recruitment management system is an integrated product suite or portal that streamlines and automates the processes involved. The use of websites such as LinkedIn, Facebook and Twitter for some aspects of recruitment are sometimes referred to as social recruiting.

B. What is LSA?

Latent Semantic Analysis (LSA) is a technique in natural language processing in particular distributional semantics of analyzing relationships between the set of documents and the terms they contain by producing the set of concepts related to the documents and terms.

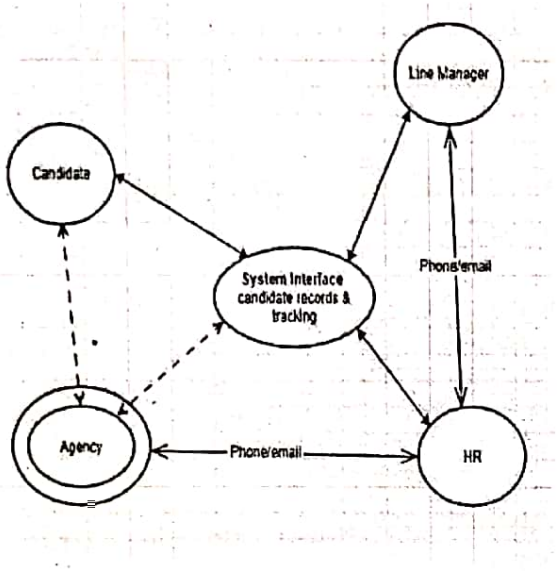


Figure1: Landscape of e-recruitment

In LSA, it assumes words that are close in meaning will contain in similar piece of text or the distributional hypothesis. A matrix is formed from a large piece of text and it containing the word counts per document.

A mathematical technique called Singular Value Decomposition (SVD) is used to reduce the number of rows while preserving the similarity structure among columns.

2. MOTIVATION

There are lots of examination portals that are operated over several servers which are used to conduct online examination for various purposes. Current online examinations mostly adopted conventional methods such as true-false, multiple choices, multiple selection and text input questions

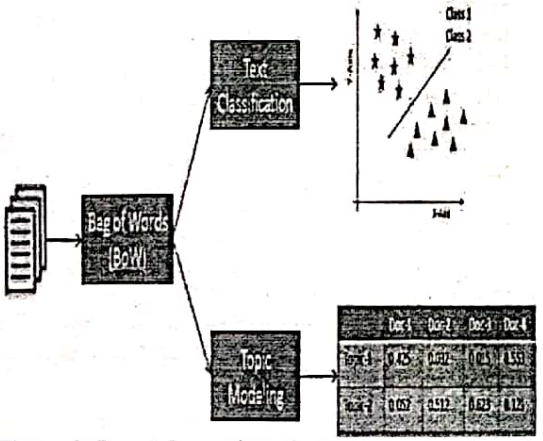


Figure 2: Latent Semantics using Python

Until now, the online examination system would only deal with textual[1,2,3] answers, there was no provision for the voice based examinations. One of the most important characteristics of the proposed Web-based online examination system is its ability to assess the knowledge of the student in a particular field and to adapt to his need of getting placed in the desired job sector.

This job portal works on by, conducting online exams with the improved use of descriptive answering through the voice-based input.

3. LITERATURE SURVEY

A lot of studies have been done by in an attempt to provide intelligent services in the e-examination for various purposes.

In Data-driven Job Search Engine Using Skills and Company Attribute filters a framework that provides an end-to-end "Data-driven Jobs Search Engine" is presented. The objective of the paper developing e-Examination Voice interface for Visually Impaired students in Open and Distance Learning Context, is to provide a framework that will guide the development of a voice-based e-examination expert system for the visually impaired students in ODL. The paper, Job Portal - A Web Application for Geographically Distributed Multiple Clients, proposed the design of an online recruitment system that allows employers to post their job advertisements, which job seeker can refer for their use.

Interactive Items -Based Online Examination System paper focuses on finding: interactive item testing system, Web-based drawing tool, Automatic Marker. The paper, A concept of the web-based e-testing system aims at the development of a general web-based e-testing knowledge system (WbeTS) solution with ideal use of communication methods offered by the Internet.

4. SCOPE OF THE PROJECT

Finding the best candidates to match a set of job requirements can be viewed as both an art and a science. Smart Techie: An Online Examination System with improved use of Descriptive answering is a total online[4,5] web application, targeted to simplify the complexity of choosing a right job.

It provides the opportunity for a job seeker to search for relevant jobs based on [6,7]the person's skill set, the desired industry space, the preferred technology stack and many other skill and company attributes. Any person anywhere in the world can register into the site for a better placement assistance.

5. PROBLEM STATEMENT

The existing system is a common web portal which can't predict a particular field of job for the students. Often students cannot find the right jobs after graduation. .Job seeker expectations in terms of job specifications are often different from that of company. Many new graduates, become unemployed because they do not have the job skills needed for the companies.

6. PROPOSED SYSTEM

Proposed model named Smart Techie: An Online Examination System with Improved Use of Descriptive Answering used for Job Searching and Job Posting. This web application will reduce the pressure of choosing a better career. It is based on Latent Semantic Analysis (LSA). LSA is a technique in natural language processing. The main advantage of the system is voice recognition.

The first step is to find out the role we needed. There are plenty of things that make[8,9] each one of us unique. Different people have different skills among them. So in order to find out our own apt role, we need to find our skill. Smart Techie helps to find out our skills too.

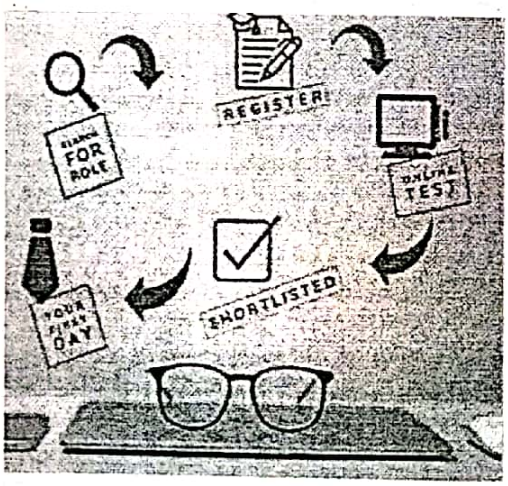


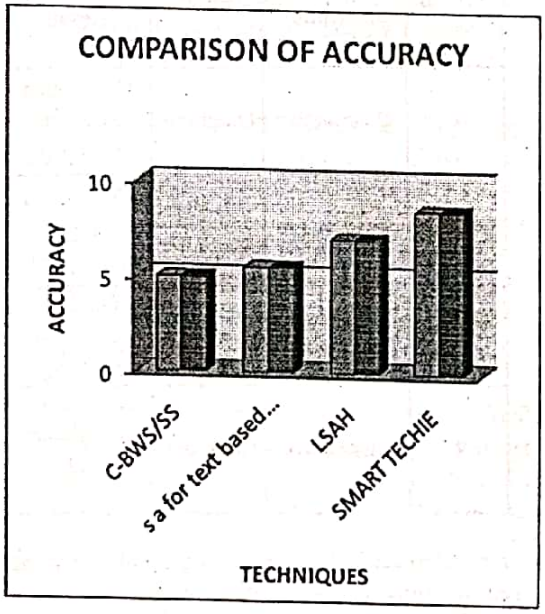
Figure 3: Block Diagram of Smart Techie

The next step is registration. In order to attend the test, we need to register for it. The admin module deals with the overall management of the site. The admin can add new jobs and company. They can also view various another features like viewing jobs that are available for the company etc. The admin have the provision to approve a newly registered company or to remove an existing company. When the admin approves the company a mail will be automatically send to the corresponding mail id.

After registration the registered [14]members can take the online test. This online test helps to find out their apt skill to choose their role. The system uses Improved Use of Descriptive Answering method using LSA. Latent Semantic Analysis can be considered as an information retrieval technique, for the task of Descriptive Answer Assessment (DAA). It consists a Vocal Answering module, which can automatically check the answer is correct or not, if the question is in descriptive mode.

Finally, based on the online test result, the students get shortlisted and are able to attend the interview process. In short our system helps the students to find out their skills and get their apt role for their career.

7. RESULT ANALYSIS



Smart Techie: An Online Examination System with Improved Use of Descriptive Answering used for Job

Searching and Job Posting. This web application will reduce the pressure of choosing a better career. It is based on Latent Semantic Analysis (LSA). LSA is a technique in natural language processing. The main advantage of the system is voice recognition.

We compared our model with other methods mentioned above such as C-BWS/SS, Text-based research, LSAH. Here the model we built is more accurate and efficient as the input we given will clearly predicted without any problem. Rest of the method mentioned contains old concept but have a complex process of execution. Some have used way mathematical expressions to express the result to desired one. The important one to be noted is the accuracy that each and every method is developed.

Since SMART TECHIE the model we developed has the high accuracy because of that much amount of trained and the techniques[11,12,13] used to bring us the desired result. Since using of latest technologies brings more sophisticated in developing a model and also will be very useful for the people.

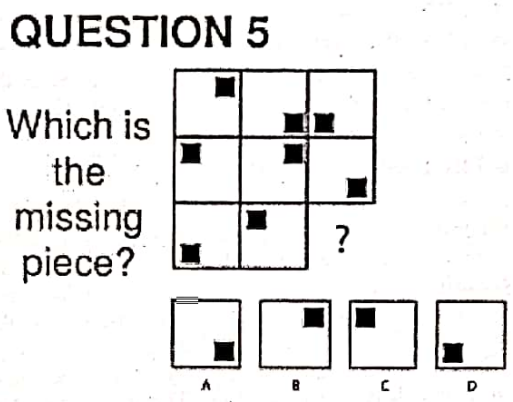
8. TESTCASES

Table 1: Test case of SMART TECHIE

Test Id	Test Description.	Input	Expected Result
1	Quantitative	Questions	Completion and go to Next page
2	Verbal	Verbal questions	Completion and go to Next page
3	Logical Reasoning	Questions	Completion and go to Next page
4	Descriptive	Questions	Completion page

From references, it can be understandable that the system contains different levels of aptitude with a fixed amount of time. When one section is completed by the candidate it will automatically display next section to attend the questions. Each section have time limit to attend the questions, once if the candidate is fail to complete the questions within time, then also it will directly go to next section. Candidate can answer the questions by selecting description or MCQ or answer by audio. After the completion of entire test, the completion page will be on the monitor by displaying 'SUCESSFULLY COMPLETED'.

9. OUTPUT OF SMART TECHIE



10. CONCLUSION AND FUTURESCOPE

SMART TECHIE is a web application for a Job Searching and Job Posting. The main advantage of the system is that any person anywhere from the world can register into the site for job recruitment. The recruitment is provided on the basis of a test. The test includes questions from various categories which can be answered by bubbling or by description or by an audio as answers. Based on the result of the test, recruitment will be provided for the candidates. The candidate has to register with the site to get a login, once login is available; they can register their CV with the site and can attend the test. The system contains a list of companies.

SMART TECHIE is a total online product targeted to simplify the complexity of choosing a right job in a suitable company. The main objective is to provide placement assistance for both employees and employers.

Future scope is that to make easy to get job after attending an aptitude test. The company level will based on the results of candidates. This system will make the job recruitment process very easy, so as to reduce the unemployment situation in the future.

ACKNOWLEDGEMENT

We take this opportunity to express our sincere gratitude to all respected personalities who had guided and helped us in the completion of this paper. First, we express our thanks to Almighty God for guiding us in this venture and make it a huge success. We also thank the management of Mangalam College of Engineering, and the Principal for permitting us to carry out this paper. Our sincere thanks to the Head of the Department of Computer Science and Engineering for permitting us to make use of the facilities available in the department. Finally, we extend our gratefulness to all teaching and non-teaching staffs who were involved in the successful completion of this paper work and to all our friends who have patiently extended all sorts of help for accomplishing this paper.

REFERENCES

[1] Deerwester S., Dumais S. T., Furnas G.W., Landauer T.K. and Harshman R. (1990), Indexing by latent semantic analysis, Journal of the American Society for Information Sciences,41, pp. 391-407.

[2] Gliozzo Alfio M., New York, NY (US) (2015), "Latent Semantic Analysis For Application In A Question Answer System", Patent no: US 9,020,810 B2.

[3] E-exams in engineering education — online testing of engineering competencies: Experiences and lessons learned 978-1-5386-2957-4/18/ 2018 IEEE 17-20 April, 2018, Santa Cruz de Tenerife, Canary Islands, Spain.

[4] Voice: technologies and algorithms for biometrics applications
https://ieeexplore.ieee.org/servlet/opac?mdnumber=EW1182

[5] Smart online assessment system for descriptive responses using machine learning techniques, 2017 International Conference on Communication and Signal Processing (ICCSP).

[6] W. T. Yih and C. Meek, "Improving similarity measures for short segments of text," in Proceedings of the National Conference on Artificial Intelligence. vol. 22. no. 2. Menlo Park, CA; Cambridge, MA; London; AAAI Press; MIT Press; 1999, 2007.

[7] Saat, N.M.; Singh, D. "Assessing suitability of candidates for selection using candidates' profiling report", Electrical Engineering and Informatics (ICEEI), 2011 International Conference on, On page(s): 1 – 6

[8]F.Batmaz and C.J.Hinde A Diagram Drawing Tool for Semi–Automatic Assessment of Conceptual Database Diagrams In Proceedings of the 10th CAA International Computer Assisted Assessment Conference, pp. 71-84,2006.

[9]Athanasios Tsintsifas. A Framework for the Computer Based Assessment of Diagram Based Coursework. The University of Nottingham for the degree of Doctor of Philosophy, March 2002.

[10] Vinodh P Vijayan, Deepti John, Merina Thomas, Neetha V Maliackal, Sara Sangeetha Varghese "Multi Agent Path Planning Approach to Dynamic Free Flight Environment", International Journal of Recent Trends in Engineering (IJRTE), ISSN 1797-9617 Volume 1, Number 1, May 2009, Page(s): 41-46.

[11] Juby Joseph, Vinodh P Vijayan" Misdirection Attack in WSN Due to Selfish Nodes; Detection and Suppression using Longer Path Protocol" International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 7, July 2014, pp. 825-829, ISSN: 2277 128X

[12] V P Vijayan, Biju Paul "Multi Objective Traffic Prediction Using Type-2 Fuzzy Logic and Ambient Intelligence" International Conference on Advances in Computer Engineering 2010, Published in IEEE Computer Society Proceedings, ISBN: 978-0-7695-4058-0, Print ISBN: 978-1-4244-7154-6

[13] Vijayan V P, Gopinathan E "Improving Network Coverage and Life-Time in a Cooperative Wireless mobile Sensor Network " Fourth International Conference on Advances in computing and communications (ICACC) Aug, 2014. Published in IEEE Computer Society Proceedings. Print ISBN: 978-1-4799-4364-7, INSPEC AccessionNumber:14630874,DOI:10.1109/ICACC.2014.1 6 PP 42-45.

[14] Vinodh P Vijayan, Biju Paul " Traffic scheduling for Green city through energy efficient Wireless sensor Networks " International Journal of Advanced Trends in Computer Science and Engineering, Volume 8, No.4, July – August 2019, ISSN 2278-3091,
https://doi.org/10.30534/ijatcse/2019/81842019.

Volume 9 No.7, July 2020 ISSN 2320 - 2602
International Journal of Advances in Computer Science and Technology
Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst04972020.pdf
https://doi.org/10.30534/ijacst/2020/04972020

Smart Ambulance with Patient Health Monitoring

Aryamol K S[1], Febin Joe Kurian[2], Albin Shaji[3], Adarsh Venkatesh[4], Merlin Mary James[5]
[1]Mangalam College of Engineering, Kottayam, India, aryasurendrank@gmail.com
[2]Mangalam College of Engineering, Kottayam, India, febinkandamparambil@gmail.com
[3]Mangalam College of Engineering, Kottayam, India, albinshaji5555@gmail.com
[4]Mangalam College of Engineering, Kottayam, India, adrasdv8281@gmail.com
[5]Mangalam College of Engineering, Kottayam, India, merlin.james@mangalam.in

ABSTRACT

India being one of the most populated countries in the world, the emergency medical response in the country is lagging behind other countries. Delayed provision of medical attention and road traffic congestions are the major issues in emergency services. It is also due to the lack of knowledge and implementation of technology at ground zero. Here we are introducing smart ambulance with patient health monitoring. It would make us a competitive position in emergency services around the world. This is achieved by using system in the ambulance that transmits information to the hospital regarding the status of patient. After receiving information, the hospital can prepare their staff for proper treatment of coming patient which helps to improve the medical care. The system is also designed to take necessary actions for the smooth passage of the ambulance through junctions. IoT being a revolutionary development over the last few years it can be widely used in large number of end system.

Key words: Ambulance, Biomedical sensors, Health monitoring, IoT, Traffic control

1. INTRODUCTION

Nowadays, many cities are working on transforming themselves into smart cities by means of all possible advancements in the sector of smart technology. Improving efficiency in healthcare sector is one of the most difficult and challenging jobs. It includes various aspects such as giving ambulatory health care for the patient so that the chances of surviving increases in critical condition [1]. It is also necessary to avoid traffic congestions so that the ambulance can reach within minimum, amount of time.

If a person suddenly falls ill and he is carried to the hospital, the doctor will get to know about his condition or the cause only after diagnosing him which is a time consuming process. So it is necessary to have a monitoring technology in the ambulances so that we can avoid the wastage of time for giving him the proper medical care. This can be achieved by implementing IoT in healthcare[2].The Internet of things (IoT) is a system of interrelated computing devices which has the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction [2]. The critically ill patients and accident victims requires more medical attention. Here it is achieved by using a system in the ambulance to transmit their status to the hospital. So that the doctor understands the conditions and he can take right decisions regarding the administration of drugs to the patient. Also can make up with good time management by having an effective traffic control over traffic jams.

2. LITERATURE REVIEW

2.1 Smart Ambulance System

The paper describes about building a platform with the help of IoT and smartphone technologies. Here the application uses Global Positing System (GPS) hardware to collect the location information.The Google Map Application Programming Interface (API) is used to plot the details of the ambulances. It is plotted on the Google Map Client of the Smartphone App. The other module here follows the same functionality that enables user to find the hospitals. With the help of this smart ambulance, information regarding the patient's health can be transferred to the hospital for improved medical care. The interaction between the smartphone and the centralized database is achieved using Representational State Transfer Application Programming Interface (REST APIs) [1].

2.2 Monitoring Patient's Health with Smart Ambulance system using Internet of Things (IOTs)

This paper describes about an intelligent smart health system. An IOT-based live monitoring system is developed with the help of sensors and microcontrollers.The sensors are used to collect the patient vital details. These details are then send to the collaborated hospital's website. If the condition is critical, an alert notification will be sent to the hospital monitoring website.There is also an implementation of live trafficking systemusing Google map. The ambulance driver will use google map with the help of the website to reach the hospital on time which also helps to avoid accidents and obstacles. Here an integrated hardware is made using Arduino and sensors [2].

2.3 A Smart Ambulance System

This paper describes a system which provides clearance to ambulance vehicle by turning all the red lights on the path of the emergency vehicle to green. This gives a complete green bay which is the synchronization of the green phase of traffic signals to the desired vehicle.In addition to the green bay path, the described system will also provide patient monitoring from the hospital. In every few minutes the current condition of the patient is send to the hospital to get the suggestions. The system is implemented using GPS, GSM and smart mobile along with ZigBee Technology. After choosing the path to hospital the traffic signal within this direction will be green light. This route will be considered as green bay. For the implementation the ARM Cortex-M3 is interfaced with traffic signal and ambulance section [3].

2.4 Smart Ambulance Guidance System

This paper describes a method for alerting or controlling the traffic signal before the ambulance reaches the traffic signal with the concept of Internet of Things (IoT). System uses a central server to control the traffic controllers. The traffic signal controller is implemented using Arduino UNO. The ambulance driver uses a web application. It makes request to the traffic controller to make the signal green on the same path. The hardware components used are ArduinoUno and ESP8266 Wi-FiModule. The system is of low cost [4].

2.5 Smart Ambulance System using IoT

This paper comes with a concept 'Green Corridor' by which patient will get needed treatment on time. The ambulance is equipped with a system having different sensors like heart rate sensor, blood pressure, ECG which is used to monitor the patient vital parameters. This parameters are then send to hospital's database. At the same time traffic signals will be operated using GPRS message through cloud. After getting status of vital parameters, hospital authorities prepares themselves for the proper treatment of coming patient. As when the smart ambulance is within range of 100m from the traffic island, signal will be turned to green in the direction. Communication between smart ambulances is done by GPRS through cloud. The system ensures quick response in emergency situations [5].

3. SYSTEM ARCHITECTURE

The objective of our project is to build an efficient system in ambulance for patient health monitoring and for traffic signal control. Such a system in ambulance can come up with good emergency medical responses[1]. Our system consists of an IoT based patient health monitoring and a traffic control part using simple wireless transmission [4]. Figure 1 shows the block diagram of our system.

In health monitoring,biomedical sensors are used for capturing the patient vital details such as temperature, heart beat rate, pressure. This collected details are processed by the microcontroller and are then send to the server with the help of a Wi-Fi module so that it can be accessed by the hospital. They can access this server through a website that is opened and monitored for 24x7 by the staff. When ambulance carries apatient the data enters to website and the hospital staff will make a contact with the medical assistant in the ambulance and gives necessary instructions about giving the correct medical care. This communication will be through the mobile phones since there may occur some lagging and connectivity issues with internet in some areas. The hospital staff will also continuously monitor the sensor measurements shown to analyze his condition. Thus it makes the doctor aware of the patient condition before he reaches the hospital.

The second part of the system is the traffic control, as already mentioned here we are adopting a wireless transmission technique[6] [7]. There is a joystick placed in the ambulance for the purpose of direction selection. When the ambulance approaches the junctions the driver selects the direction using the joystick. This signal is then processed and send to the traffic island with the help of microcontroller and the transmitter respectively. There is a receiver in the traffic island which receives this signals and analyze them with the help of microcontroller. After analyzing the microcontroller makes the traffic light in the selected direction to green [3]. Thus ensures the smooth passage of ambulance through the junctions. This improves in the time management

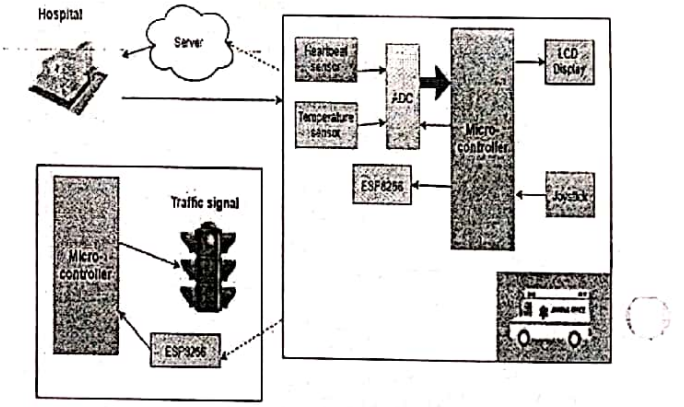


Figure 1: Block diagram

The system consists of three modules:

- Ambulance
- Hospital
- Traffic Island

3.1 Ambulance

The module includes Bio-medical sensors for capturing the patient vital details, the microcontroller used as the central controlling unit, the joystick for the direction selection, and component for Wi-Fi connectivity and data transfer.

Here we are using two types of biomedical sensors the temperature sensor and the pulse rate heart beat sensor

A) Temperature sensor

The LM35 is the temperature sensor used in the system. It measures the body temperature with an electrical output that is proportional to the Celsius temperature [3]. This sensor generates a high output voltage thus avoiding amplification. The scale factor is0.01V/°C. Figure 2 shows LM35

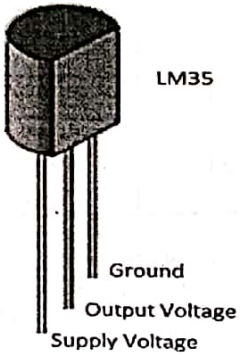


Figure 2: LM35

B) Pulse rate heart beat sensor

It senses the pulse and gives the heart beat rate, systolic and diastolic pressure. The front of sensor with heart logo makes the contact with the skin.Also you can see a small round hole, it is where the LED shines. There is also a little square just under the LED. The square is an ambient light sensor used to adjust the screen brightness in different light conditions, see in Figure 3. The LED shines light into the fingertip or other capillary tissue, and sensor reads the light that bounces back.

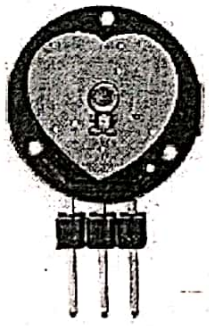


Figure 3: Pulse rate heart beat sensor

C) ATmega32 microcontroller

It is a low power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. It is central controlling unit of the system. It has got 32 x 8 general working purpose registers and contains 2K bytes of internal SRAM and 1024 bytes of EEPROM. Figure 4 shows the pin diagram.

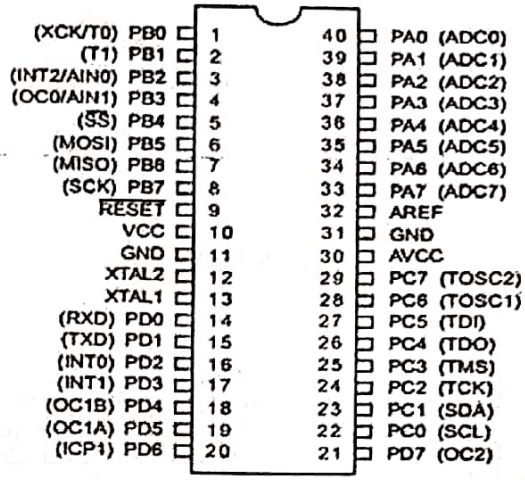


Figure 4: Pin diagram of ATmega32

D) Joystick

It is used for direction selection. While approaching the junctions the ambulance driver selects the direction to which he needs to move. See Figure 5.

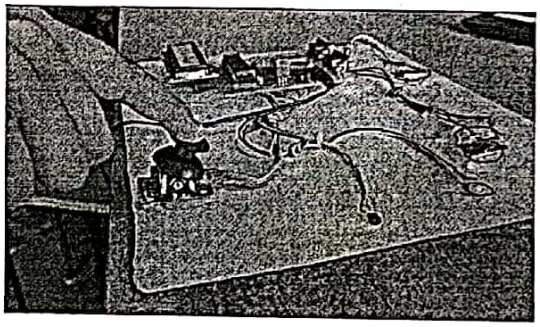


Figure 5: Selecting direction using joystick

E) ESP8266

The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP capability. The board also has an integrated MCU (Micro Controller Unit) [4]. Here there is two ESP8266 in the ambulance module one is for the Wi-Fi connectivity to send the patient details to the server and the other act as a signal transmitter from the ambulance to the traffic island for the selection of direction. Figure6 shows ESP8266.

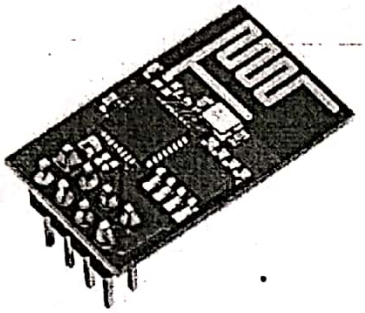


Figure 6: ESP8266

3.2 Hospital

A website for accessing the server is opened for whole 24x7 days. The hospital staff will be monitoring the patient condition through this. Further they make a contact with the medical assistant in the ambulance and gives necessary instruction about giving proper medical care. The hospital staff utilizes this facility to make necessary arrangements for treating the coming patient.

3.3 Traffic island

It consist of the traffic lights controlled by a microcontroller and an ESP8266 placed in the traffic island which act as a receiver. The direction selection signals initiated from the ambulance are received by ESP8266. These signals are then analyzed by the microcontroller and the signal in the selected direction is turned to green, see Figure 7 This allows the smooth passage of ambulance through the junctions.

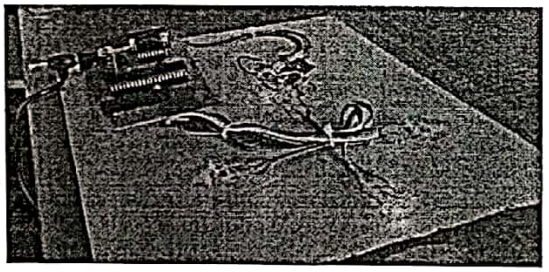


Figure 7: green light in the selected direction

4. EXPERIMENTAL ANALYSIS

The sensor values collected by the biomedical sensors Figure 8and are shown in the LCD display see Figure 9. This data is passed to the server and analyzed by the hospital staff. Table 1 shows some test cases with various people.

Table 1: Test cases

SL NO	Temperature	Heart Rate	Systole Pressure	Distole Pressure
1	31	65	80	40
2	31	75	85	45
3	33	45	90	50
4	31	50	95	55
5	31	55	100	60

The data in the table are collected by the sensors. These are then send to the server using ESP8266. The data enters to the website which is kept opened in the hospital.

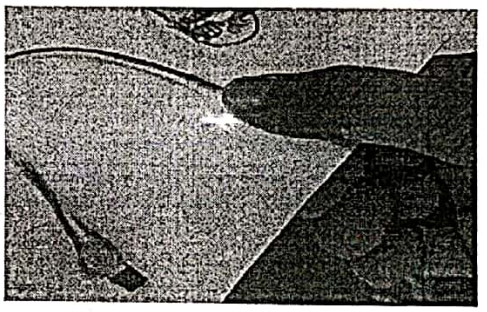


Figure 8: Taking the sensor reading

In the Figure 5 the direction selected is 'forward' and the from Figure 7 we can see that the green light glows in the selected forward direction

Figure 9: Reading shown in LCD

5. CONCLUSION

In this project we introduce an efficient smart ambulance with patient health monitoring. With the help of this project a critically ill patient or an accident victim carried by an ambulance gets immediate medical attention from the hospital. The doctors are well aware of the patient present condition from the ambulance. So, the hospital staffs can make necessary arrangements for treating him. We implements the patient heath monitoring using IoT and the traffic control using wireless transmission technique. When the ambulance approaches the junctions the direction from the junction is selected with the help of the joystick. And the signal to the selected path becomes green so the ambulance doesn't get stuck in the junctions.

REFERENCES

1. Ms. Poonam Gupta, Mr. Satyasheel Pol, Mr. Dharmanath Rahatekar, Ms. Avanti Patil **"Smart Ambulance System"** *International Journal of Computer Applications (0975 – 8887) National Conference on Advances in Computing, Communication and Networking (ACCNet – 2016)*
2. Ms. Himadri Nath Saha, Ms. Neha Firdaush Raun, Ms. MaitrayeeSaha **"Monitoring Patient's Health with Smart Ambulance system using Internet of Things (IOTs)"** 978-1-5386-2215-5/17/$31.00 ©2017 IEEE
3. Mr. Sandeep Reddy, Mr. Vandhana Khare **"A Smart Ambulance System"** *International Journal of Innovative Technologies* Volume.05, Issue No.02, February-2017, Pages: 0224-0227
4. Mr.Bhushan Anant Ramani, Prof. Amutha Jeyakumar **"Smart Ambulance Guidance System"** *ISSN: 2277-9043 International Journal of Advanced Research in Computer Science and Electronics Engineering* Volume 7, Issue 7, July 2018
5. Mr. Omkar Udawant, Mr. Nikhil Thombare, Mr. Devanand Chauhan, Mr. Akash Hadke, Mr. Dattatray Waghole **"Smart Ambulance System using IoT"** *2017 International Conference on Big Data, IoT and Data Science (BID) Vishwakarma Institute of Technology, Pune,* Dec 20-22, 2017
6. Ruihua Zhang, and Dongfeng Yuan, **"A Health Monitoring System for Wireless Sensor Networks,"** *in Proc. of 2ed IEEE Conference on Industrial Electronics and Applications (ICIEA),* pp. 1648-1652, Harbin, China, May2007
7. Leu, Fang-Yie, et al. **"Controlling traffic lights for ambulances "** *Broadband Wireless Computing Communication and Applications (BWCCA), 2012 Seventh International Conference on. IEEE, 2012.*

ISSN 2320 - 2602

Volume 9 No.7, July 2020

International Journal of Advances in Computer Science and Technology

Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst07972020.pdf

https://doi.org/10.30534/ijacst/2020/07972020

FAKE NEWS DETECTION USING ARTIFICIAL INTELLIGENCE

Arjun Raj[1], Ajay Thampi[2], Aakash Kashyap[3] , Merlin Mary James[4]

[1]Mangalam College of Engineering, Kottayam, India,arjunraj.pala@gmail.com

[2]Mangalam College of Engineering, Kottayam, India, ajaythampi424@gmail.com

[3]Mangalam College of Engineering, Kottayam, India, aakashkashyap2006@gmail.com

[4]Mangalam College of Engineering, Kottayam, India, merlin.james@mangalam.in

ABSTRACT

The main objective of this project is to detect fake news by collecting news from different articles. However, manually determining the veracity of news is a challenging task, usually requiring annotators with domain expertise who perform a careful analysis of claims and additional evidence, context, and reports from authoritative sources. The main aspects of fake news detection are characterization and detection. With using the help of machine learning algorithms such as Sentiment analysis, a classifier can be created.

Key words : Classifier, Fake news detection, machine learning, Sentiment Analysis.

1.INTRODUCTION

In this conference paper, we are going to discuss the automatic detection of fake news using machine learning algorithms. Fake news can be defined as a news that is false, mainly spread on the internet to deceive readers. Sometimes the reader might look for authentic news on its own, but it can consume a considerable amount of time. So, for the same purpose, we developed an automatic fake news detection algorithm using machine learning with the help of Sentiment analysis. This algorithm provides the reader with true and authentic news only, i.e. it tells the reader whether the statement is true or not. This is done by comparing the given news with similar keywords and statements stored in the database already. Hence, we get the output with the percentage of truthfulness.

2.LITERATURE REVIEW

(i). Supervised Learning For Fake News Detection

Most of the fresh work has focused on understanding and detecting fake news which is spread on social media. For achieving this goal, several types of features are extracted from the news, it includes several sources and posts from social media. With respect to the main features proposed in the literature for fake news detection, a new set of features is introduced which measures the prediction performance of current form and features for automatic detection of fake news.Our output discloses the fact that how important and useful it is to explore new features for the detection of fake news. Finally, we discuss how fake news detection approaches can be used in the practice, highlighting challenges and opportunities.[1]

(ii). Automatic deception detection: Methods for finding fake news:

In this paper, we have provided with different types of methods which can tell you about the truthfulness of a news, derived from two major categories – linguistic cue approaches (with machine learning), and network analysis approaches. This new hybrid fashion of combining both linguistic cue and machine learning with network based behavioral data has proven very promising. Since, creating a fake news detection system is a tough task, we have successfully introduced operational guidelines for designing a fake news detection system.[2]

(iii). Detecting fake news for reducing misinformation risks using analytics approaches.

In this paper a novel text analytics-driven approach that can be used for detecting fake news is explained. We initially depict the system for the proposed approach and the basic diagnostic model including the usage subtleties and approval dependent on a corpus of news information.

We gather genuine and counterfeit news, which is changed from an archive based corpus into a point and occasion based portrayal. Fake news detection is performed using a two-layered approach, which consists of detecting fake topics and fake events. The efficacy of the proposed approach is demonstrated through the implementation and validation of a novel FakE News Detection (FEND) system. [5]

(iv). Information Credibility on Twitter.

In this paper, we focus on automatic methods for assessing the credibility of a given set of tweets. We classify the microblog posts on the basis of "trending" topics and mark them as credible or not credible, based on their

characteristics. The tweeting and retweeting behaviour is studied to extract more features.[3] [4]

3.BASIC CONCEPTS

Fake news detection makes use of various features that are associated with a sentence, source reliability, source history, etc. All these features are considered while deciding the accuracy of news.Basically, we can categorize fake news detection features into different types. Such as:

1. Features of the content given with the news.
2. Features drawn out from the source of the news.

The main features of the fake news detection system are:

(i). Textual Features

Textual features are details that are carved out from the news, including the body of the news, headline, and any message used by the source in text form. Some image processing techniques are also performed if the news is attached to any kind of image or video.

(ii). Language Features

In this feature, we check for any kind of violation of the syntax of the English language. Features like bag-of-words, parts-of-speech(POS), etc. are explored here for any kind of error. Here the writer's style is taken into consideration as it is an indicator of fine text. So, features based on text reliability are also implemented.

(iii). Lexical Features

Lexical features give us the amount and clarity of unique words and the frequency in which they are used in the news text. Features like first-person pronouns, demonstrative pronouns, verbs, hashtags, number of words, all punctuations, countings, etc. are evaluated and categorized as lexical features

(iv). Semantic Features

Here the semantic features of the text content are evaluated on the basis of the toxicity score obtained by google's API. Machine learning techniques are used by the API to determine up to what extent a text can be labeled as "toxic" or simply harmful.

A. Fake News

There are various ways to describe what's fake news. Fake news is a news which consists of disinformation or deluded information either used deliberately or due to the lack of information sources. Either way, it is a barrier to the development of our society. Fake news can mislead people to a different path in a way so that they cause damage to society.

B. Fake News Detection

To avoid the damage caused by fake news, we developed an automatic fake news detection application. By using this application we can easily differentiate between fake news and authentic news. This task is done with the help of machine learning algorithms. Also, we use Sentiment analysis to obtain good accuracy.

Sentiment analysis is the process of detecting the accuracy of a piece of sentence i.e. whether it is true or false. This is done by understanding the statement i.e. if the statement is negative or positive. We understand the statement using the words, punctuations, etc used in it. The given statement is eventually compared with some relative statements stored in the database already. For receding complexity, the output is generalized into either True or False. Also, it provides us with the accuracy of the truthfulness of the given news.

(i). Supervised Learning

It is one of the fundamental tasks to be performed in this entire process. This is a machine learning technique that uses both input and output in order to obtain the necessary methods to reach that certain output. For this, a large amount of data, which comprises both true and false data, has been taken as a data set. 70% of this data is used as training data, to train the data to yield the corresponding results. The remaining 30% is used to validate the system. This learning also helps in future validations and modifications. The accuracy increases with the amount of data used to train the system.

(ii). Sentiment Analysis

Sentiment Analysis is the use of various advanced

technology to extricate, quantity, and systematically point out the influential states and intuitive information. Natural language processing (NLP), computational linguistics, Biometrics, and text analysis are various technologies that are used in Sentiment analysis. Simply Sentiment analysis can be explained as a method of determining the attitude or feeling of the author by analyzing various words and phrases that he/she had used in the sentence and thereby determining the credibility of the sentence.

4.ARCHITECTURAL MODEL

Spreading of phony news is a worldwide situation that is unavoidable at the social level among people, and furthermore through web based life. The mission of distinguishing counterfeit news has tried an enormous assortment of names, from deception to gossipy tidbits and afterward to spam.

There has been a monstrous assortment of work encompassing content examination of phony news and

comparative subjects, for example, gossipy tidbits or spam. We have dissected various articles and reports. Using these data, we have built a model that gets trained using this data and tries to predict whether the news is fake or not based on new out-of-sample data.

The dataset of Figure 1 contains the sample data that is used in supervised learning. One of the most important features of using machine learning is that the system learns each time it is being used. Thus the accuracy increases by the increase of usage of the system.

The database is used to store the collected data. By data we mean the authentic news obtained from different sources like news channels, newspapers, various online platforms, etc. This database can be further extended by adding up more authentic news. This data is compared with the input data to check the authenticity of the news.

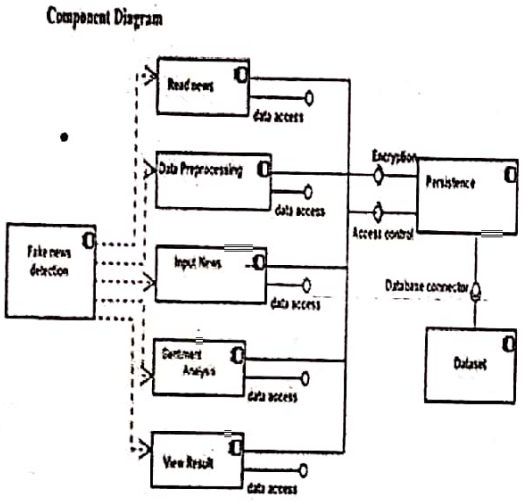


Figure 1: Component Diagram

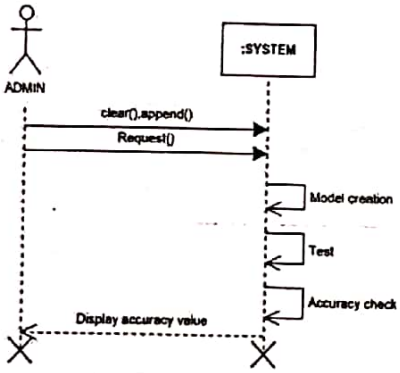


Figure 2: Admin use case diagram

For the analysis of data [Figure 1], we use Sentiment Analysis. It is the procedure of computationally recognizing and classifying assessments communicated in a bit of content, particularly so as to decide if the author's mentality towards a specific point, item,etc. is positive, negative or nonpartisan. Most of the time, the honesty of specific surveys or content can be anticipated by inspecting the comments and comparable articles. On the off chance that most comparative articles are not in accordance with the news, all things considered, the news may be one-sided or counterfeit. Similarly, the comments on the article can be used to evaluate whether the facts in the article are reliable. We use a web application or a website to display our output. It is easily accessible and user friendly. The complexity level is negligible since the output is either false or true. We can further modify our application to the mobile level or we can even use a plugin.

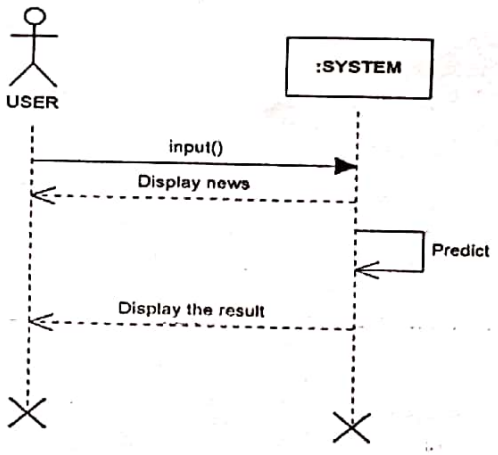


Figure 3: User use case diagram

The working of the website based user-admin interaction is shown in Figure 2 and Figure 3. The user- website interaction is the simplest in the form. The goal is to create a simpler UI so that each user can easily navigate through the website as well as perform the task. The user can give the input data, which in this case is the 'news' that needs to be identified as fake or not. Once the user proceeds, the process is executed, and the final result is shown on the website screen; the credibility of the 'news'.

The user is unaware of the actions performed by the system in the background to reach the desired output. The admin, as described in Figure 2, has more privilege than the common user. Admin has direct access to the dataset used by the machine learning program. With the situation arises, the admin can add/remove the data in the dataset to yield more accurate results. The admin can check the accuracy of data using Sentiment analysis. This gives a more upper hand in increasing the accuracy of the result produced.

Thus, the admin can manually check the automatic working of the machine learning algorithm. Moreover, the implementation of fake news detection can be done in different ways such as android application, website plugin, as per the compatibility of the user.

5.CONCLUSION

The pandemic and natural disasters have been rising rapidly, as the situation tenses the spreading of fake news also increases tragically. This spread of fake news ultimately affects the whole society. Thus, finding deceptive and fake news is essential to our daily lives.

In this project our objective is to build a classifier that can predict whether a piece of news is fake or not based only on its content, thereby approaching the problem from a purely deep learning technique. We have analyzed different articles. Using this data, we have built a model that gets trained using this data and tries to predict whether the news is fake or not based on new out-of-sample data. For better accessibility, the entire procedure is built as a website, enabling an easy UI for better execution and simplicity of the operation.

ACKNOWLEDGEMENT

The authors wish to thank Principal Dr.Manoj George, Mangalam College of Engineering, Dr. Vinodh P Vijayan H.O.D, Computer Science Department, Mrs. Merlin Mary James for the proper guidance, valuable support, and helpful comments during the proof reading.

REFERENCES

1. Julio C. S. Reis, Andre Correia, Fabricio Murai, Adriano Veloso, and Fabricio Benevenuto. **Supervised Learning for Fake News Detection,** *IEEE Intelligent System, March/April,2019, pp:1541-1672.*
2. Nadia K. Conroy, Victoria L. Rubin , Yimin Chen. **Automatic deception detection: Methods for finding fake news,** *Proceedings of the Association for Information Science and Technology,Volume 52, Issue 1,2015,Pages 1-4.*
3. David M. J. Lazer, Matthew A. Baum,Yochai Benkler, Adam J. Berinsky, Kelly M. Greenhill, Filippo Menczer, Miriam J. Metzger, Brendan Nyhan, Gordon Pennycook, David Rothschild, Michael Schudson, Steven A. Sloman, Cass R. Sunstein, Emily A. Thorson, Duncan J. Watts, Jonathan L. Zittrain . **The science of fake news in Science** , *09 Mar 2018: Vol. 359, Issue 6380,pp.1094-96.*
4. Carlos Castillo,Marcelo Mendoza, Barbara Poblete .**Information credibility on twitter in WWW '11,** *Proceedings of the 20th international conference on World wide web,March 2011,Pages 675–684.*
5. Chaowei Zhang,Ashish Gupta,Christian Kauten. **Detecting Fake News for Reducing Misinformation Risks Using Analytics Approaches,** *European Journal of Operational Research ,Vol:279(3) , June 2019.*

International Journal of Cast Metals Research
Volume 34, 2021 - Issue 2

Research Article

Characterisation of tensile fracture in squeeze casted Al–Si piston alloy

K. Pratheesh ✉ M. Ravi & Manoj George

Pages 50-60 | Received 10 Dec 2019, Accepted 08 Feb 2021, Published online: 25 Feb 2021

ABSTRACT

Nowadays, Squeeze casting is considered as a convenient process for developing quality piston components. In this paper, casting methods such as squeeze casting and die

JOHNSON MATTHEY TECHNOLOGY REVIEW

A journal published by Johnson Matthey Plc

Journal Archive

Johnson Matthey Technol. Rev., 2022, 66, (2), 186
doi:10.1595/205651321x16238564889537

Towards the Enhanced Mechanical and Tribological Properties and Microstructural Characteristics of Boron Carbide Particles Reinforced Aluminium Composites: A Short Overview

Improved properties compared to silicon carbide or alumina reinforced composites

V. V. Monikandan*§

MatRICS Technological Solutions, 3/4A, Aanavalli, Vellimalai, Kalpadi Post, Kanyakumari District, Tamil Nadu – 629 204, India

§Present address: School of Minerals, Metallurgy and Materials Engineering, Indian Institute of Technology Bhubaneswar, Jatni Road Argul, Bhubaneswar, Odisha – 752 050, India

K. Pratheesh

Department of Mechanical Engineering, Mangalam College of Engineering, Mangalam Hills, Ettumanoor, Kottayam, Kerala – 686 631, India

P. K. Rajendrakumar, M. A. Joseph

Department of Mechanical Engineering, National Institute of Technology Calicut, Kozhikode, Kerala – 673 601, India

*Email: saai.manikandan@gmail.com

PEER REVIEWED
Received 22nd March 2021; Revised 21st May 2021; Accepted 15th June 2021; Online 16th June 2021

Article Synopsis

This paper overviews the fabrication, microstructural characteristics, mechanical properties and tribological behaviour of B_4C reinforced aluminium metal matrix composites (AMMCs). The stir casting procedure and parameters used to fabricate the Al-B_4C composites are discussed. The influence of physical parameters such as applied load, sliding speed and sliding distance on tribological behaviour is analysed. The role of the mechanically mixed layer (MML) and wear mechanisms on the wear behaviour and friction coefficient are emphasised. The overview of tribological behaviour revealed that

ScienceDirect

Powder Technology
Volume 385, June 2021, Pages 227-233

Machinable green bodies by dry pressing of alumina powder using natural rubber latex as a cross-linkable binder

[illegible] [a,b], Sujith Vijayan [a], Praveen Wilson [a], P. Arun Kumar [b], K. Prabhakaran [a]

Show more

Outline | Share Cite

https://doi.org/10.1016/j.powtec.2021.02.054

Highlights

- Natural rubber is used as a binder in powder pressing for the first time.
- Alumina-rubber latex co-dispersions coagulate at lower rubber concentrations.
- Rubber cross-linking produced remarkable increase in the green strength.
- Green bodies are amenable to machining using conventional machines and tools.

Abstract

We report the use of natural rubber as a binder for powder pressing for the first time. The feedstock for powder pressing is obtained by the co-coagulation of alumina powder-natural rubber latex co-dispersions in 10 mM formic acid solution. The pressing pressure and binder concentration are optimized by measuring the green density and diametrical compressive strength. The remarkable increase in diametrical compressive strength observed on heating the pressed bodies at 220 °C is due to the cross-linking of natural rubber. A maximum diametrical compressive strength of 9.4 MPa observed at 8 wt% natural rubber concentration is one of the highest values reported in the literature. The pressed compacts after cross-linking heat-treatment are amenable to milling, drilling and lathing using conventional machines and tools. The pressed bodies on binder removal and sintering at 1550 °C produce alumina ceramics of ~97% of theoretical density with an average grain size of 1.8 μm.

Graphical abstract

Journal of Materials Science & Technology
Volume 94, 20 December 2021, Pages 113-122

Research Article

Thermally insulating robust carbon composite foams with high EMI shielding from natural cotton

A. Chithra [a], Praveen Wilson [a], Sujith Vijayan [a], R. Rajeev [b], K. Prabhakaran [a]

Show more

Outline | Share | Cite

https://doi.org/10.1016/j.jmst.2021.02.064

Highlights

- Conversion of biomass, medical-grade cotton and sucrose, into carbon foams by filter-pressing.
- Foams exhibit density in the range of 0.06 to 0.31 g cm^{-3}.
- Foams possess reasonable compressive strength in the range 5 kPa to 1.4 MPa.
- Foams possess partial compressibility.
- Low thermal conductivity (0.069 to 0.185 W $m^{-1}K^{-1}$) and good flame resistance.
- carbon composite foams are amenable to machining using conventional machines and tools.
- CCFs materials showed good electrical and EMI shielding properties.
- The rigid CCFs showed shielding effectiveness in the ranges of 21.5 to 38.9 dB with adsorption dominant shielding properties.

Abstract

Thermally insulating and fire-resistant carbon composite foams are prepared by consolidating natural cotton fibre dispersed in aqueous sucrose solution by filter-pressing followed by drying and carbonization. The compressive strength (5 kPa to 1.4 MPa) and thermal conductivity (0.069 to 0.185 W $m^{-1} K^{-1}$) depend on the foam density (0.06 to 0.31 g cm^{-3}) which is modulated by varying the sucrose solutions concentration (100 to 700 g L^{-1}). Partially flexible to the rigid transition of the carbon composite foams occurs at sucrose concentration above 200 g L^{-1}. The tubular carbon fibre formed from cotton is welded at their contact points by the amorphous carbon produced from sucrose leading to partial flexibility at low sucrose concentration and advancement of fibre- to- fibre bonding area at higher sucrose concentration results in rigid foam. The porosity in the inter-fibre space and lumen of the carbonized cotton fibre contributes to the low thermal conductivity. The carbon composite foams prepared at a sucrose solution concentration of 500 g L^{-1} and above are amenable to machining using conventional machines and tools. The rigid carbon foams show EMI shielding effectiveness and specific shielding effectiveness in the ranges of 21.5 to 38.9 dB and 108–138 dB $cm^3 g^{-1}$, respectively.

ScienceDirect

Industrial Crops and Products

Volume 145, March 2020, 112076

Carbon foams with low thermal conductivity and high EMI shielding effectiveness from sawdust

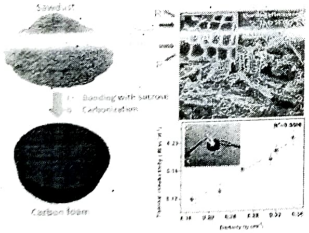
A. Chithra [a], Praveen Wilson [a], Sujith Vijayan [a], R. Rajeev [b], K. Prabhakaran [a]

Show more

Abstract

Thermally insulating amorphous carbon foams are prepared by cementing sawdust particles with sucrose by filter-pressing and carbonization. The density of the carbon, modulated by using sucrose solution of concentrations in the range of 100–700 g L^{-1}, is in the range of 0.15–0.35 g cm^{-3}. The compressive strength in the transverse direction (0.24–3.2 MPa) is higher than that [illegible] direction (0.22–1.76 MPa) due to the preferential orientation of elongated sawdust particles transverse to the filter-pressing direction. The Young's moduli in the filter-pressing and transverse direction are in the ranges of 5.5–81.7 MPa and 6–80.5 MPa, respectively. The carbon foams exhibit excellent fire resistance and low thermal conductivity in the range of 0.12 to 0.20 W m^{-1} K^{-1}. The sawdust-based carbon foams show absorption dominated EMI shielding with a total shielding effectiveness of 25–53 dB.

Graphical abstract



Download : Download high-res image (217KB)

Download : Download full-size image

Introduction

Carbon foams are new generation macroporous carbon materials showing adequate mechanical strength, tuneable thermal and electrical conductivities, sound and electromagnetic wave absorption and fire resistance (Fang et al., 2007; Inagaki et al., 2015; Lei et al., 2010; Letellier et al., 2017; Liu et al., 2007; L. Zhang et al., 2016). They find applications in lightweight fire-resistant structures, high temperature thermal insulation, heat exchangers, heat sink, electromagnetic interference (EMI) shielding, acoustic absorption and battery electrodes (Amini et al., 2011; Farhan et al., 2016; Gallego and Klett, 2003; Jeong et al., 2015; Q. Li et al., 2016; Wilson et al., 2018; Y. Zhang et al., 2016). Conventionally, carbon foams are prepared by foaming [illegible] or organic polymer resins, followed by setting and carbonization/graphitization in an inert atmosphere

Chemical Engineering Journal
Volume 381, 1 February 2020, 122628

Waste to wealth: Lightweight, mechanically strong and conductive carbon aerogels from waste tissue paper for electromagnetic shielding and CO_2 adsorption

Linsha Vazhayal, Praveen Wilson, Kuttan Prabhakaran

https://doi.org/10.1016/j.cej.2019.122628

Highlights

- Waste tissue paper was successfully utilized for the preparation of WTP-PVA CAs.
- The WTP-PVA CAs displayed low density and superior mechanical properties with specific Young's modulus 1246.8 MPa $cm^3 g^{-1}$.
- The WTP-PVA CAs showed good electrical and thermal properties.
- The average EMI shielding effectiveness of WTP-PVA is ~40.8 dB with an absorption-dominant shielding feature.
- WTP-PVA CAs showed considerable capacity to CO_2 adsorption with excellent selectivity and recyclability.

Abstract

Carbon aerogels (CAs) have always shown great potential for multifunctional applications. However, simultaneous improvement of mechanical, electrical and thermal properties of CAs with low density is still a big challenge due to their structural defects, disordered microstructure, and colossal oxygen containing functional groups. Herein, a subtle approach is developed to prepare CAs from waste tissue paper (WTP) and poly(vinyl alcohol) (PVA) as the basic ingredients. The WTP-PVA CAs possessed highly interconnected three dimensional porous structure with low density (0.057 g cm^{-3}), high porosity (~97%) and specific surface area (1384 $m^2 g^{-1}$). Albeit with low density, the resultant CA displayed superior mechanical properties (specific Young's modulus up to 1246.8 MPa $cm^3 g^{-1}$) and thermal stability. Besides, they also featured high electrical conductivity (1.35 S cm^{-1}) and low thermal conductivity (0.087 W $m^{-1} K^{-1}$). These properties provided an opportunity for some advanced applications such as electromagnetic interference (EMI) shielding and CO_2 gas capture. The highest shielding effectiveness (SE), specific SE and thickness-averaged specific SE of WTP-PVA in the X-band are 40 dB, 700 dB $cm^3 g^{-1}$ and 1818 dB $cm^2 g^{-1}$ respectively, with an absorption-dominant shielding mechanism. More importantly, the WTP-PVA CA with abundant ultramicropores showed great potential for CO_2 adsorption (5.14 mmol g^{-1} at 0 °C) with good selectivity and regeneration capability even without the aid of any chemical activation, functionalization or heteroatom doping.

Journal of Asian Ceramic Societies >
Volume 8, 2020 - Issue 1

Preparation of ceramic foam spheres by injection molding of emulsions

Sujith Vijayan, Praveen Wilson, K. Prabhakaran, Abdusamad A Salih & Kuruvilla Joseph

Pages 21 - 28 | Received 08 Jul 2019, Accepted 11 Nov 2019, Published online: 02 Dec 2019

Download citation https://doi.org/10.1080/21870764.2019.1695558 Check for updates

ABSTRACT

An emulsion-based injection molding process has been reported for the preparation of ceramic foam spheres from kaolin and alumina. The foam spheres produced from kaolin alone cracked during sintering due to extensive shrinkage and an excessive glass phase. Incorporation of a minimum of 10 wt% alumina in kaolin prevented the cracking of foam spheres during sintering by promoting secondary mullite growth, which decreases both the glass phase concentration and sintering shrinkage. Foam spheres with an interconnected cellular structure having open porosities, average cell sizes and diametrical compressive strengths in the ranges of 76.5 to 82.7 vol.%, 6.8 to 9.2 μm and 1.65 to 0.93 MPa, respectively, were produced from emulsions prepared

International Journal of Applied Ceramic Technology / Volume 17, Issue 2 / p. 519-528
ORIGINAL ARTICLE

Nanowire-decorated SiC foam from tissue paper and silicon powder by filter-pressing

Praveen Wilson, Sujith Vijayan, Kuttan Prabhakaran ✉

First published: 20 October 2019
https://doi.org/10.1111/ijac.13412
Citations: 2

Abstract

A facile and scalable method for the preparation of low-density SiC foam from tissue paper and silicon powder is reported. The co-dispersion of pulp-containing tissue paper micro-ribbons and silicon powder is coagulated by adjusting the pH to 3.5. The silicon particles adhere to the tissue paper micro-ribbons during the coagulation. The coagulated co-dispersion on filter-pressing consolidates the silicon particle-decorated tissue paper micro-ribbons and orients them perpendicular to the filter-pressing direction. The filter-pressed body on drying followed by heat treatment at 1600°C in inert atmosphere produces SiC foam. The tissue paper micro-ribbons retain their morphology during carbonization as well as high-temperature reaction with the silicon. The enormous growth of carbon-rich SiC nanowires is observed on the SiC micro-ribbons. The random orientation of SiC micro-ribbons in the X-Y plane with the hairy nanowires on the surface and their stacking in the Z-direction produces a porosity of ~94 vol.% with pore sizes in the range of 0.08 to 20 μm. The SiC foam shows a compressive strength and Young's modulus of 0.22 and 5.5 MPa, respectively. The thermal conductivity decreases from 0.11 to 0.07 W m^{-1} K^{-1} when temperature increases from 25°C to 350°C.

ScienceDirect

Materials Today: Proceedings
Volume 45, Part 6, 2021, Pages 3916-3921

Comparison of mechanical and wearing properties between LM6, LM6/B_4C and LM6/B_4C/Gr aluminium metal matrix composites

M.H. Faisal [a], V. Sreekumar [b], Nidhish Mathew Nidhiry [c]

Show more

Outline | Share | Cite

https://doi.org/10.1016/j.matpr.2021.01.340

Abstract

Due to greater specific modulus, better wear resistance, excellent specific strength, and declined coefficient of thermal expansion value, particulate reinforced aluminum matrix composites have acquired appreciable consideration. Casting route and PM are the commonly used fabrication methods from which we select stir casting technique due to its simplicity and low expense. In this study mechanical properties like tensile strength, yield strength, hardness, wear, coefficient of friction (COF) and frictional properties of light metal (LM6), LM6/ Boron Carbide (B_4C) and LM6/B_4C/Graphite (Gr) 2% were analyzed with the aid of Universal Testing Machine (UTM), Rockwell Hardness Tester and Pin on Disk Tester. B_4C was chosen due to its excellent reinforcement properties compared to silicon carbide (SiC) and alumina. Gr (2%) was added in one sample to obtain better tribological as well as better sliding lubricating characteristics. The test outcomes reveal that by increasing the percent of B_4C particles in the LM6 matrix, the mechanical as well as tribological properties are improved and the new material developed can replace conventional LM6 aluminium alloy in its applications.

Next

Keywords

LM6; Boron carbide; Graphite; Aluminium metal matrix composite; Wear; Coefficient of friction

Cited by (1)

Fabrication and analysis of LM13/B<inf>4</inf>C/Gr hybrid metal matrix composites
2021, Materials Today: Proceedings

Show abstract

ScienceDirect

Materials Today: Proceedings
Volume 47, Part 15, 2021, Pages 5276-5280

Fabrication and analysis of LM13/B_4C/Gr hybrid metal matrix composites

M.H. Faisal [a] ✉, V. Sreekumar [b], Nisha Shamsudin [c]

Show more

Outline | Share | Cite

https://doi.org/10.1016/j.matpr.2021.05.651

Highlights

- This article describes production process of LM13/B_4C/Gr composites.
- Test results indicate that the mechanical properties of new hybrid composites are found improved.

Abstract

Due to mechanical characteristics like light weight nature, enhanced wear resistance, greater strength to wear ratio, stiffness, and better electrical and thermal properties, Aluminium (Al) matrix composites are deployed in military, automotive and aerospace areas. Frequently utilized ceramic elements for reinforcing with Al are alumina and silicon carbide (SiC). Boron carbide (B_4C) is an excellent reinforcement substance having a higher hardness than other substances. Because of its substantial hardness, B_4C can be used as a substitute to alumina and SiC. In addition to its superior hardness, modest density, better chemical stability, and wear resistance are diverse appealing characteristics of B_4C. So, for boosting the properties of the LM13/Gr composite samples, B_4C is added up to 9% by considering its clustering property. This article describes the production process of LM13/B_4C/Gr composites and evaluation of their mechanical characteristics. Stir casting method is adopted to produce the Al composite samples and the mechanical properties of new hybrid composites are found improved. Selection and/or Peer-review under responsibility of International Conference on Sustainable materials, Manufacturing and Renewable Technologies (i-SMaRT 2021)

Previous Next

Keywords

LM13; Boron carbide; Graphite; Aluminium metal matrix composite

International Journal of Cast Metals Research
Volume 34, 2021 - Issue 2

Research Article

Characterisation of tensile fracture in squeeze casted Al–Si piston alloy

K. Pratheesh ✉ M. Ravi & Manoj George

Pages 50-60 | Received 10 Dec 2019, Accepted 08 Feb 2021, Published online: 25 Feb 2021

ABSTRACT

Nowadays, Squeeze casting is considered as a convenient process for developing quality piston components. In this paper, casting methods such as squeeze casting and die

JOHNSON MATTHEY TECHNOLOGY REVIEW

A journal published by Johnson Matthey Plc

Journal Archive

Johnson Matthey Technol. Rev., 2022, 66, (2), 186
doi:10.1595/205651321x16238564889537

Towards the Enhanced Mechanical and Tribological Properties and Microstructural Characteristics of Boron Carbide Particles Reinforced Aluminium Composites: A Short Overview

Improved properties compared to silicon carbide or alumina reinforced composites

V. V. Monikandan*§

MatRICS Technological Solutions, 3/4A, Aanavalli, Vellimalai, Kalpadi Post, Kanyakumari District, Tamil Nadu – 629 204, India

§Present address: School of Minerals, Metallurgy and Materials Engineering, Indian Institute of Technology Bhubaneswar, Jatni Road Argul, Bhubaneswar, Odisha – 752 050, India

K. Pratheesh

Department of Mechanical Engineering, Mangalam College of Engineering, Mangalam Hills, Ettumanoor, Kottayam, Kerala – 686 631, India

P. K. Rajendrakumar, M. A. Joseph

Department of Mechanical Engineering, National Institute of Technology Calicut, Kozhikode, Kerala – 673 601, India

*Email: saai.manikandan@gmail.com

PEER REVIEWED
Received 22nd March 2021; Revised 21st May 2021; Accepted 15th June 2021; Online 16th June 2021

Article Synopsis

This paper overviews the fabrication, microstructural characteristics, mechanical properties and tribological behaviour of B_4C reinforced aluminium metal matrix composites (AMMCs). The stir casting procedure and parameters used to fabricate the Al-B_4C composites are discussed. The influence of physical parameters such as applied load, sliding speed and sliding distance on tribological behaviour is analysed. The role of the mechanically mixed layer (MML) and wear mechanisms on the wear behaviour and friction coefficient are emphasised. The overview of tribological behaviour revealed that

Powder Technology
Volume 385, June 2021, Pages 227-233

Machinable green bodies by dry pressing of alumina powder using natural rubber latex as a cross-linkable binder

... [a,b], Sujith Vijayan [a], Praveen Wilson [a], P. Arun Kumar [b], K. Prabhakaran [a]

Show more

https://doi.org/10.1016/j.powtec.2021.02.054

Highlights

- Natural rubber is used as a binder in powder pressing for the first time.
- Alumina-rubber latex co-dispersions coagulate at lower rubber concentrations.
- Rubber cross-linking produced remarkable increase in the green strength.
- Green bodies are amenable to machining using conventional machines and tools.

Abstract

We report the use of natural rubber as a binder for powder pressing for the first time. The feedstock for powder pressing is obtained by the co-coagulation of alumina powder-natural rubber latex co-dispersions in 10 mM formic acid solution. The pressing pressure and binder concentration are optimized by measuring the green density and diametrical compressive strength. The remarkable increase in diametrical compressive strength observed on heating the pressed bodies at 220 °C is due to the cross-linking of natural rubber. A maximum diametrical compressive strength of 9.4 MPa observed at 8 wt% natural rubber concentration is one of the highest values reported in the literature. The pressed compacts after cross-linking heat-treatment are amenable to milling, drilling and lathing using conventional machines and tools. The pressed bodies on binder removal and sintering at 1550 °C produce alumina ceramics of ~97% of theoretical density with an average grain size of 1.8 μm.

Graphical abstract

Journal of Materials Science & Technology
Volume 94, 20 December 2021, Pages 113-122

Research Article

Thermally insulating robust carbon composite foams with high EMI shielding from natural cotton

A. Chithra [a], Praveen Wilson [a], Sujith Vijayan [a], R. Rajeev [b], K. Prabhakaran [a]

Show more

Outline | Share | Cite

https://doi.org/10.1016/j.jmst.2021.02.064

Highlights

- Conversion of biomass, medical-grade cotton and sucrose, into carbon foams by filter-pressing.
- Foams exhibit density in the range of 0.06 to 0.31 g cm^{-3}.
- Foams possess reasonable compressive strength in the range 5 kPa to 1.4 MPa.
- Foams possess partial compressibility.
- Low thermal conductivity (0.069 to 0.185 W $m^{-1}K^{-1}$) and good flame resistance.
- carbon composite foams are amenable to machining using conventional machines and tools.
- CCFs materials showed good electrical and EMI shielding properties.
- The rigid CCFs showed shielding effectiveness in the ranges of 21.5 to 38.9 dB with adsorption dominant shielding properties.

Abstract

Thermally insulating and fire-resistant carbon composite foams are prepared by consolidating natural cotton fibre dispersed in aqueous sucrose solution by filter-pressing followed by drying and carbonization. The compressive strength (5 kPa to 1.4 MPa) and thermal conductivity (0.069 to 0.185 W $m^{-1} K^{-1}$) depend on the foam density (0.06 to 0.31 g cm^{-3}) which is modulated by varying the sucrose solutions concentration (100 to 700 g L^{-1}). Partially flexible to the rigid transition of the carbon composite foams occurs at sucrose concentration above 200 g L^{-1}. The tubular carbon fibre formed from cotton is welded at their contact points by the amorphous carbon produced from sucrose leading to partial flexibility at low sucrose concentration and advancement of fibre- to- fibre bonding area at higher sucrose concentration results in rigid foam. The porosity in the inter-fibre space and lumen of the carbonized cotton fibre contributes to the low thermal conductivity. The carbon composite foams prepared at a sucrose solution concentration of 500 g L^{-1} and above are amenable to machining using conventional machines and tools. The rigid carbon foams show EMI shielding effectiveness and specific shielding effectiveness in the ranges of 21.5 to 38.9 dB and 108–138 dB $cm^3 g^{-1}$, respectively.

ScienceDirect

Industrial Crops and Products

Volume 145, March 2020, 112076

Carbon foams with low thermal conductivity and high EMI shielding effectiveness from sawdust

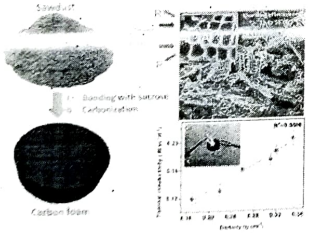
A. Chithra [a], Praveen Wilson [a], Sujith Vijayan [a], R. Rajeev [b], K. Prabhakaran [a]

Show more

Abstract

Thermally insulating amorphous carbon foams are prepared by cementing sawdust particles with sucrose by filter-pressing and carbonization. The density of the carbon, modulated by using sucrose solution of concentrations in the range of 100–700 g L^{-1}, is in the range of 0.15–0.35 g cm^{-3}. The compressive strength in the transverse direction (0.24–3.2 MPa) is higher than that [illegible] direction (0.22–1.76 MPa) due to the preferential orientation of elongated sawdust particles transverse to the filter-pressing direction. The Young's moduli in the filter-pressing and transverse direction are in the ranges of 5.5–81.7 MPa and 6–80.5 MPa, respectively. The carbon foams exhibit excellent fire resistance and low thermal conductivity in the range of 0.12 to 0.20 W m^{-1} K^{-1}. The sawdust-based carbon foams show absorption dominated EMI shielding with a total shielding effectiveness of 25–53 dB.

Graphical abstract



Download : Download high-res image (217KB)

Download : Download full-size image

Introduction

Carbon foams are new generation macroporous carbon materials showing adequate mechanical strength, tuneable thermal and electrical conductivities, sound and electromagnetic wave absorption and fire resistance (Fang et al., 2007; Inagaki et al., 2015; Lei et al., 2010; Letellier et al., 2017; Liu et al., 2007; L. Zhang et al., 2016). They find applications in lightweight fire-resistant structures, high temperature thermal insulation, heat exchangers, heat sink, electromagnetic interference (EMI) shielding, acoustic absorption and battery electrodes (Amini et al., 2011; Farhan et al., 2016; Gallego and Klett, 2003; Jeong et al., 2015; Q. Li et al., 2016; Wilson et al., 2018; Y. Zhang et al., 2016). Conventionally, carbon foams are prepared by foaming [illegible] or organic polymer resins, followed by setting and carbonization/graphitization in an inert atmosphere

Chemical Engineering Journal
Volume 381, 1 February 2020, 122628

Waste to wealth: Lightweight, mechanically strong and conductive carbon aerogels from waste tissue paper for electromagnetic shielding and CO_2 adsorption

Linsha Vazhayal, Praveen Wilson, Kuttan Prabhakaran

https://doi.org/10.1016/j.cej.2019.122628

Highlights

- Waste tissue paper was successfully utilized for the preparation of WTP-PVA CAs.
- The WTP-PVA CAs displayed low density and superior mechanical properties with specific Young's modulus 1246.8 MPa $cm^3 g^{-1}$.
- The WTP-PVA CAs showed good electrical and thermal properties.
- The average EMI shielding effectiveness of WTP-PVA is ~40.8 dB with an absorption-dominant shielding feature.
- WTP-PVA CAs showed considerable capacity to CO_2 adsorption with excellent selectivity and recyclability.

Abstract

Carbon aerogels (CAs) have always shown great potential for multifunctional applications. However, simultaneous improvement of mechanical, electrical and thermal properties of CAs with low density is still a big challenge due to their structural defects, disordered microstructure, and colossal oxygen containing functional groups. Herein, a subtle approach is developed to prepare CAs from waste tissue paper (WTP) and poly(vinyl alcohol) (PVA) as the basic ingredients. The WTP-PVA CAs possessed highly interconnected three dimensional porous structure with low density (0.057 g cm^{-3}), high porosity (~97%) and specific surface area (1384 $m^2 g^{-1}$). Albeit with low density, the resultant CA displayed superior mechanical properties (specific Young's modulus up to 1246.8 MPa $cm^3 g^{-1}$) and thermal stability. Besides, they also featured high electrical conductivity (1.35 S cm^{-1}) and low thermal conductivity (0.087 W $m^{-1} K^{-1}$). These properties provided an opportunity for some advanced applications such as electromagnetic interference (EMI) shielding and CO_2 gas capture. The highest shielding effectiveness (SE), specific SE and thickness-averaged specific SE of WTP-PVA in the X-band are 40 dB, 700 dB $cm^3 g^{-1}$ and 1818 dB $cm^2 g^{-1}$ respectively, with an absorption-dominant shielding mechanism. More importantly, the WTP-PVA CA with abundant ultramicropores showed great potential for CO_2 adsorption (5.14 mmol g^{-1} at 0 °C) with good selectivity and regeneration capability even without the aid of any chemical activation, functionalization or heteroatom doping.

Journal of Asian Ceramic Societies >
Volume 8, 2020 - Issue 1

Preparation of ceramic foam spheres by injection molding of emulsions

Sujith Vijayan, Praveen Wilson, K. Prabhakaran, Abdusamad A Salih & Kuruvilla Joseph

Pages 21 - 28 | Received 08 Jul 2019, Accepted 11 Nov 2019, Published online: 02 Dec 2019

Download citation https://doi.org/10.1080/21870764.2019.1695558 Check for updates

ABSTRACT

An emulsion-based injection molding process has been reported for the preparation of ceramic foam spheres from kaolin and alumina. The foam spheres produced from kaolin alone cracked during sintering due to extensive shrinkage and an excessive glass phase. Incorporation of a minimum of 10 wt% alumina in kaolin prevented the cracking of foam spheres during sintering by promoting secondary mullite growth, which decreases both the glass phase concentration and sintering shrinkage. Foam spheres with an interconnected cellular structure having open porosities, average cell sizes and diametrical compressive strengths in the ranges of 76.5 to 82.7 vol.%, 6.8 to 9.2 μm and 1.65 to 0.93 MPa, respectively, were produced from emulsions prepared

International Journal of Applied Ceramic Technology / Volume 17, Issue 2 / p. 519-528
ORIGINAL ARTICLE

Nanowire-decorated SiC foam from tissue paper and silicon powder by filter-pressing

Praveen Wilson, Sujith Vijayan, Kuttan Prabhakaran ✉

First published: 20 October 2019
https://doi.org/10.1111/ijac.13412
Citations: 2

Abstract

A facile and scalable method for the preparation of low-density SiC foam from tissue paper and silicon powder is reported. The co-dispersion of pulp-containing tissue paper micro-ribbons and silicon powder is coagulated by adjusting the pH to 3.5. The silicon particles adhere to the tissue paper micro-ribbons during the coagulation. The coagulated co-dispersion on filter-pressing consolidates the silicon particle-decorated tissue paper micro-ribbons and orients them perpendicular to the filter-pressing direction. The filter-pressed body on drying followed by heat treatment at 1600°C in inert atmosphere produces SiC foam. The tissue paper micro-ribbons retain their morphology during carbonization as well as high-temperature reaction with the silicon. The enormous growth of carbon-rich SiC nanowires is observed on the SiC micro-ribbons. The random orientation of SiC micro-ribbons in the X-Y plane with the hairy nanowires on the surface and their stacking in the Z-direction produces a porosity of ~94 vol.% with pore sizes in the range of 0.08 to 20 μm. The SiC foam shows a compressive strength and Young's modulus of 0.22 and 5.5 MPa, respectively. The thermal conductivity decreases from 0.11 to 0.07 W m^{-1} K^{-1} when temperature increases from 25°C to 350°C.

ScienceDirect

Materials Today: Proceedings
Volume 45, Part 6, 2021, Pages 3916-3921

Comparison of mechanical and wearing properties between LM6, LM6/B_4C and LM6/B_4C/Gr aluminium metal matrix composites

M.H. Faisal [a], V. Sreekumar [b], Nidhish Mathew Nidhiry [c]

Show more

Outline | Share | Cite

https://doi.org/10.1016/j.matpr.2021.01.340

Abstract

Due to greater specific modulus, better wear resistance, excellent specific strength, and declined coefficient of thermal expansion value, particulate reinforced aluminum matrix composites have acquired appreciable consideration. Casting route and PM are the commonly used fabrication methods from which we select stir casting technique due to its simplicity and low expense. In this study mechanical properties like tensile strength, yield strength, hardness, wear, coefficient of friction (COF) and frictional properties of light metal (LM6), LM6/ Boron Carbide (B_4C) and LM6/B_4C/Graphite (Gr) 2% were analyzed with the aid of Universal Testing Machine (UTM), Rockwell Hardness Tester and Pin on Disk Tester. B_4C was chosen due to its excellent reinforcement properties compared to silicon carbide (SiC) and alumina. Gr (2%) was added in one sample to obtain better tribological as well as better sliding lubricating characteristics. The test outcomes reveal that by increasing the percent of B_4C particles in the LM6 matrix, the mechanical as well as tribological properties are improved and the new material developed can replace conventional LM6 aluminium alloy in its applications.

Next

Keywords

LM6; Boron carbide; Graphite; Aluminium metal matrix composite; Wear; Coefficient of friction

Cited by (1)

Fabrication and analysis of LM13/B<inf>4</inf>C/Gr hybrid metal matrix composites
2021, Materials Today: Proceedings

Show abstract

ScienceDirect

Materials Today: Proceedings
Volume 47, Part 15, 2021, Pages 5276-5280

Fabrication and analysis of LM13/B_4C/Gr hybrid metal matrix composites

M.H. Faisal [a] ✉, V. Sreekumar [b], Nisha Shamsudin [c]

Show more

Outline | Share | Cite

https://doi.org/10.1016/j.matpr.2021.05.651

Highlights

- This article describes production process of LM13/B_4C/Gr composites.
- Test results indicate that the mechanical properties of new hybrid composites are found improved.

Abstract

Due to mechanical characteristics like light weight nature, enhanced wear resistance, greater strength to wear ratio, stiffness, and better electrical and thermal properties, Aluminium (Al) matrix composites are deployed in military, automotive and aerospace areas. Frequently utilized ceramic elements for reinforcing with Al are alumina and silicon carbide (SiC). Boron carbide (B_4C) is an excellent reinforcement substance having a higher hardness than other substances. Because of its substantial hardness, B_4C can be used as a substitute to alumina and SiC. In addition to its superior hardness, modest density, better chemical stability, and wear resistance are diverse appealing characteristics of B_4C. So, for boosting the properties of the LM13/Gr composite samples, B_4C is added up to 9% by considering its clustering property. This article describes the production process of LM13/B_4C/Gr composites and evaluation of their mechanical characteristics. Stir casting method is adopted to produce the Al composite samples and the mechanical properties of new hybrid composites are found improved. Selection and/or Peer-review under responsibility of International Conference on Sustainable materials, Manufacturing and Renewable Technologies (i-SMaRT 2021)

Previous Next

Keywords

LM13; Boron carbide; Graphite; Aluminium metal matrix composite

Effect of Timber Members on Structures under Seismic Loading

Noel Johnson[1]
[1]PG Student,
Department of Civil Engineering,
Mangalam College of Engineering
Kottayam, Kerala

Aswathy Soman[2]
[2]Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering
Kottayam, Kerala

***Abstract*— The sustainability of Reinforced Cement Concrete material and its structures will play predominant role in creating environmental impacts. The alternative material for construction of multi-story structures is the need of hour. The substitute material should be compatible for construction as well as should sustained the seismic forces during earthquake. The substitute material taken is Timber, being an orthogonal in nature, behaves differently from RCC with respect to elastic and physical properties. Here, G+9 RCC structure and G+4 timber strucure are considered to find the seismic compatibility of structure. G+4 timber model, RCC- timber model, steel- timber model are considering for the dynamic loading analysis. The building modeled in ETABS software using different material properties. The high self-weight and brittleness of concrete is not favorable to seismic prone structures whereas steel structures are 60% lesser in weight through they can withstand earthquake more effectively than the concrete structures.**

***Keywords*— Steel frame; RCC frame; Timber frame; Seismic Analysis; ETABS2016**

I. INTRODUCTION

Concrete is a material that literally holds different places together. From row houses and apartment buildings to bridges, viaducts and sidewalks, this inescapable grey material's importance to modern urban life is undeniable. Despite of its undeniable importance in day-to-day construction purpose, many research scholars, environmentalists and construction engineers are seeking for a complete alternate material to RCC, due to increasing amount of severe harmful environmental impact of material. There are however a number of alternative green building materials that offer alternatives to concrete, and a lower environmental impact. And one of those alternative material is Wood or Timber. Timber still retains many advantages over more industrial building materials like concrete or steel.

In India most of the people approached towards the concrete structure instead of steel as they find concrete as convenient and cost effective in nature. But as India is becoming worlds second most populous country and the area is just limited then vertical hike is in the building construction is very necessary. So, for construction of this multistoried building steel can be a truly effective material in all engineering aspect. The use of steel as a core construction material is not yet become prevalent in India as it is in other developing where maximum construction both commercial and residential high rise structures are being built of steel. It is very stiff and they possesses high strength to weight ratio which shows great integrity against the seismic loading.

II.LITERATURE REVIEW

Anuj Domale, L.G.Kalurkar (2018) presented a paper on Seismic Analysis of RCC and Steel Frame Structure by Using ETABS. The study an attempt has been made to analyze the seismic behavior of RCC and steel frames using Etabs 2015.The high self-weight and brittleness of concrete is not favorable to seismic prone structures whereas steel structures are 60% lesser in weight through they can withstand earthquake more effectively than the concrete structures. Aim of the study to compare the seismic performance of G+6 and G+9 frames for both steel and RCC. For current study all frames are analyzed under equivalent static method

Shubham Bhutada, P.D. Pachpor, A.K. Sharma (2019) presented a paper on research on RCC and Timber Multi-Storey Structures using Response Spectrum Search. In this study two geometrically identical multi-story structures are compared to find the seismic compatibility of timber structure as compared to RCC structure. Both the buildings were modelled in ETABS software using different material properties, RCC and Timber, and were analysed using Response Spectrum Analysis. Different parameters were studied and compared for both the buildings like, shear force, bending moment, lateral story displacement and story shear. After analysis, it was concluded that timber structures can be built with lighter sections as that of RCC. And due to much more flexibility of Timber Structures, proper design of connections and their adequate strength is required to increase the stiffness of timber structures.

Zheng Li , , Minjuan He , Xijun Wang , Minghao Li (2018) presented a paper on Seismic performance assessment of steel frame infilled with prefabricated wood shear walls. Steel-timber hybrid structural systems offer a modern solution for building multi-story structures with more environmentally-friendly features. This paper presents a comprehensive seismic performance assessment for a kind of multi-story steel-timber hybrid structure. In such a hybrid structure, steel moment resisting frames are infilled with prefabricated light wood frame shear walls to serve as the lateral load resisting system (LLRS). In this paper, drift-based performance objectives under various seismic hazard levels were proposed based on experimental observations. Then, a numerical model of the

Comparison of Analysis of Normal Bridge and Horizontally Curved Bridge

Mebin Mathew[1]
[1]PG Student, Department of Civil Engineering,
MangalamCollegeofEngineering
Kottayam, Kerala

Salini Theres Kurian[2]
[2]Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering Kottayam, Kerala

Abstract:- **Bridges are the lifelines and supporters for the improvisation of the road network. Not only do the bridges help in traffic flow without any interference but also maintain the safety of roads. Due to this reason the bridges design has gained much importance.Due to the curvature in the bridge there will be large centrifugal reactions on the vehicles. Apart from the reaction a large torsional moment will be induced on the supporting girders. This paper is basically concerned about the analysis and design of normal and curved bridge by STAAD Pro which contains a span of 100m X 16m and has a 4-girder system. The objective is to check the result for particular input design, properties and parameters and the approach has been taken from AASHTO standard design. The nodal displacement, beam property, concrete design can be easily found out performing the analysis and design method.**

Keywords:- 4girder System, AASHTO, Curvature, STAAD Pro.

I. INTRODUCTION

In Past, advanced mathematical methods were used for the analysis of the large structures such as Bridges, buildings etc. Those methods are elaborated techniques. So, it takes too much time for designer to concentrate on the calculations. Nowadays, STAAD. Pro Software is being widely used for the analysis and design of buildings, towers etc. In this project, STAAD Pro. has been used for the analysis and design of a deck slab bridge in connection with STAAD . It becomes much more easier to assign the properties and other specifications in creating deck slab by the STAAD Pro. software. The various properties are to be considered in the analysis and design of the deck slab of a bridge which include section property, plate thickness, dead load, live load etc. Dead Load consists of its own weight and portion of weight of superstructure and fixed loads also.

From past few decades, the infrastructure has seen a great boom in the world. To access any inaccessible areas bridges were built. Hence building bridges became mandatory for infrastructure development. During the ancient time natural bridges were created by nature, as in, tree trunks extended to the inaccessible areas. Then humans started building their artificial bridges to travel to other side of the valley or non-transportable point. The bridges built by humans were usually made up of wood or bamboo thatch. As the population increased the need for bigger and sturdier bridge was more. This led for innovation in bridge building techniques thus many types of bridges were formed. There are many classifications of bridges. The bridge which is under study is girder bridges subjected to some radius of curvature that is also known as curved bridge. The curvature in the bridges is usually introduced to eliminate the support irregularities or presence of important structures which cannot be demolished. Due to the curvature in the bridge there will be large centrifugal reactions on the vehicles. Apart from the reaction a large torsional moment will be induced on the supporting girders. The columns location and orientation is also a major design category in bridges. When the columns are tilted from the normal angle the column is said to be skewed. Skewed column decreases the stability of structures. Skewed columns along with some degree of horizontal curvature to the bridges create a lot of instability. The design of such bridges is always governed by code books and designed very carefully. The study deals with bridges subjected to seismic loads and its behavior when the bridge is curved horizontally at deck section and skewed at column or pier section. The bridge will be subjected to many kinds of loads such as earthquake, wind and vibration loads created by the live load on the bridge.

II. LITERATUREGAP

Due to the curvature in the bridge there will be large centrifugal reactions on the vehicles. Apart from the reaction a large torsional moment will be induced on the supporting girders. Analysis is done to the Normal straight bridge and the outputs like bending moment, shear force and reactions are noted. The same analysis is done on Horizontally Curved bridge. The comparison is done between the analysis of Normal straight bridge and Curved bridge.

III. OBJECTIVE

- To determine deflection, bending moment, reaction and shear force of normal bridge.
- To determine deflection, bending moment, reaction of horizontally curved bridge.
- The comparison is to be done on the analysis between the Normal bridge and curved bridge
- This study can be used for knowing the effectiveness of the curvature of the curved bridge and to design the bridge with a clear calculation.
- By this study the additional elements needed for the stability of the bridge can be found.

Effect of Staircase on the Seismic Performance of Buildings

Kevin Kuruvila[1], Ann Mary Jose[2]
[1]PG student, [2] Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering, Kottayam

Abstract **- In this paper, the effect of different staircase location during earthquake have been studied in design of building, the staircase is generally not a primary part & considered secondary Structural member in the RC frame building. So, its negligence in Analysis & design causes vulnerable damage in the structure. Here the staircase model in different location is compared to check how it affects the seismic performance of the building.**

Key words: Stair case, Story Drift, Base Shear, Earthquake, Location

I. INTRODUCTION

Earthquake is an impulsive event and acts quite differently. The force generated by seismic action of earthquake is different than other types of loads, such as, gravity, Dead load, Live load and wind load. It strikes the weakest spotin the whole Structural frame building. Ignorance in structural design and poor quality & maintenance of construction result many weaknesses & faults in the structure member and Structural Building also, thus cause vulnerable damage to life and Structural property of building.

In RC frame structural buildings, the primary structural system to resist Lateral & Gravity load are beams and columns. Besides, primary frame structural system, some structural member also contributes to lateral load resistance. These elements fall in the category of secondary systems. Secondary system can be structural secondary like staircase, structural partition etc and non-structural secondary like storage tanks, machinery etc. A special case of structural secondary members which are normally designed for non-seismic force; are concrete staircase.

In the present study, the effects of staircase on the seismic performance of the RC frame structural buildings of different plans have been studied in this paper with different structural seismic parameter e.g. Story displacement, Story drift & storey Shear.

II. METHODOLOGY

In this paper, linear dynamic analysis (response spectrum analysis) is performed using ETABS software. This analysis considers dynamic forces which are applied to thestructuresaspercode-baseddesignspectrum.Ithelpstodeterminetheeffectofthehigh ermodesofvibrationanddistributionofforces.Inresponsespect rumanalysis,multiple mode shapes are taken in to consideration. Depending upon the modal mass and modal frequency, a response is read from the design spectrum for each mode.Later,theseresponsesarecombinedtodeterminethetotal responseofthestructurebymodalcombinationmethods.Thism ethodisperformedforthestructureswhosemodes,exceptthefun damentalone,influencetheresponseofastructure.Responsesp ectrumistheestimationofmaximumresponses.

A. Geometrical Properties

Table 1: Geometrical Parameters

Height of Building	24m
Column Size	400mmX500mm
Beam Size	300mmX400mm
Slab Thickness	150mm
Staircase Slab Thickness	200mm
Story Length in X & Y Direction	24m
Each Story Height	3m
No of bays in X&Y direction	5nos each

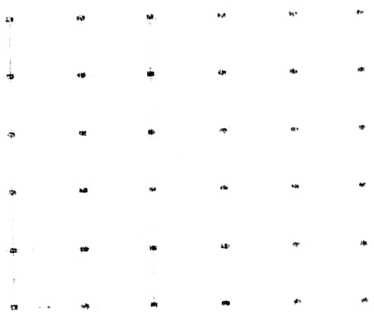


Fig.1 Plan of the building

B. Load Parameters

The seismic parameters considered in dynamic analysis of all the models are assumed as per IS 1893 (Part 1): 2002 The buildings are assumed to be in Zone IV&V with the peak ground acceleration value of 0.36g. The importance factor, I is taken as 1.5 (for important building). Also, the response reduction factor R taken as 5 for SMRF system of the buildings. The soil strata beneath the foundation is assumed as medium soil. The gravity and imposed loads are taken as per IS 875 (Part 1 and 2): 1987, self-weight of the structure is calculated and imposed load is assumed to be 3 kN/m2 for a typical residential building.

Replacement of Coarse Aggregate with Plastic Fibers in Concrete Cube

Vaishnavi A[1], Leskhmipriya Anil[2],
Sooraj Thomas Tharian[3], Praksh Mohan[4],
[1, 2, 3, 4]UG Students,
Department of Civil Engineering,
Mangalam College of Engineering, Ettumanoor,
Kottayam, Kerala

Aswathy Soman[5]
[5]Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering, Ettumanoor,
Kottayam, Kerala

***Abstract*—The production of plastic is increasing at a faster rate. It is very difficult to dispose this plastic waste as it creates environmental pollution. Plastic bottles usually take thousands of years to degrade and produce toxic fumes when incinerated. As a matter of fact out of every 5 discarded waste bottles only 1 bottle is sent to the recycle bin. As a result huge mounds of PET bottles have been created on the earth's surface. For solving this problem, construction industry can take a step to utilize this plastic waste as a substitute for aggregates. This project is to examine the possibility of replacing coarse aggregate with plastic fibers in concrete cubes. In this work coarse aggregate is replaced partially with plastic fibers at different percentages (0%, 10%, 15%, 20%,) and optimum percentage has to be found. Several tests are done to determine the properties of concrete cube (150mm X 150mm X 150mm) containing plastic fibers and its suitability as a construction material. Also properties of concrete mix with plastic fibers was studied and compared with control mix with normal aggregates. The plastic fibers were used of aspect ratio 45 whose dimension is 90mm X 2mm.**

Keywords*— *Polyethyelene Terephthalene , plastic fibers, aspect ratio.

I. INTRODUCTION

Plastic is a non-biodegradable material which takes hundreds of years to degrade. The global production of the plastic is about 150 million tons every year. Earlier the recycling plastic bottles came into existence but it did not work efficiently. Plastic can be reduced, reused and recycled. Reducing the use of plastic is a difficult task nowadays due to the nature of living of humans. So the other ways to reduce environmental problems caused by plastic are by recycling or reusing the waste plastic. The recycling of the plastic can be done only 2-3 times as the plastic tends to lose its strength afterwards. In fact 70% percent of the plastic is left out as waste every year. This plastic waste leads to various problems such as landfill problem, and if it is disposed in water bodies, it causes water pollution leading to the death of various aquatic lives. Hence there's a need to find solution for this problem of plastic disposal. Plastic waste can also be used to produce new plastic based products after processing. Many organizations along with government are working together to find solution for this and to build sustainable cities for the future. Replacing materials in concrete is one of the best solution for the disposal of plastic waste. It has economical advantage along with ecological advantages. Nowadays there is a huge scarcity of construction materials so waste materials are best alternative to be used in construction. It not only reduces the waste and pollution but also serves as an alternate material for aggregates in construction. Many tests have been performed to evaluate the properties of cement-composites containing plastic fibers as aggregates. This paper presents a review on the use of plastic fibers as coarse aggregate in concrete.

II. LITERATURE REVIEW

Ozbakkaloglu et al., 2017 performed various tests on mechanical properties of concrete containing waste plastic as a replacement of coarse aggregates under elevated and ambient conditions of temperature. The results showed that higher the replacement of (RPA's) in the specimen, lower is the corresponding workability of the mix. Liliana et al., 2013, found that as the size of the recycled plastic is increased, the Young's Modulus of the specimen decreased, and the compression strain increased. Jalali et al., 2011, studied the durability characteristics of polymeric waste particles in concrete. Albano et al.,2009, done more tests for w/c ratios (0.5 and 0.6), and it showed that the mixes with 10% replacement resulted to have the best mechanical properties, and the mixes with 20% replacement resulted to have the lower compressive strength. Semiha et al., 2009, carried out laboratory tests on the use of shredded waste PET bottles with GBFS and concluded that the mortar produced could be used as an earthquake resistant material. Its use proved productive for the environmental problems. Batayneh et al., 2007, evaluated the impact of waste plastic on the slump of specimen. Partial replacement of fine aggregates by waste plastic aggregates upto 20% replacement was checked. It showed that the slump was reduced to 25% compared to the control mix for a 20% replacement of fine aggregates with plastic content.

III. EXPERIMENTAL PROGRAM

3.1 *GENERAL*

Before casting the concrete specimens as per the mix design, the detailed laboratory tests were done to know the material properties. The ingredients of concrete (cement, fine aggregate, coarse aggregate) were evaluated as per IS specifications.

Stability Analysis of Different Soilfil on Embankment Subgrade using Plaxis-2d

Mukthar V Basheer[1], Rajat Ravi[2], Sreedevi S[3], Sreelakshmi S[4],
[1,2,3,4]UG Students
Department of Civil Engineering,
Mangalam college of Engineering,
Kottayam, India

Vilbin Varghese[5]
[5]Assistant Professor
Department of Civil Engineering,
Mangalam College of Engineering,
Kottayam,India

Abstract– **Slope stability analysis is one of the most important topic in geotechnical engineering. For the construction of railways, embankments, canal, road Embankments, earth dams etc. we go for different slopes with different geometric conditions. If the slope is naturally made, the kind of problem is to check the sustainability of slope. If it is manmade type, the problem of choosing soils to build and other conditions which required for stable. The clear idea of this topic is to know the best suitability of locally available fill materials. For this particular analysis done in latest version of plaxis 2D. Evaluation of the stability analysis for road embankment is not only a problem but also a challenge or Geotechnical Engineering. In manmade slope, the problem of choosing soil is an important role for stability condition. The main purpose on this study is to determine the stability of road fill Embankment according to the factor of safety and deformation. In this study, the stability of slope was modelled in scenarios (different fills, different inclination and various level of water table). Finite Element Method by Plaxis 2D was used in numerical analysis of slope. The result of this study showed the suitability of fill soil in embankment construction according to the comparative study of deformations, factors of safety. In collected fill soils, Clayey sand is most suitable for road fill embankment.**

Keywords :- Stability, deformations, factor of safety, fill soils

I. INTRODUCTION

Embankment plays a major role in the durability of roads. Embankment refers to comprising of various soil blends to comprising of various soil blends resulting in settlement due to load transferred from traffic. The different soil blends are used in this research. Stability soil blends are used in this research. Stability analysis of soil helps in studying the behavior of embankment underloading. Stability analysis is an important role not only in the construction of transportation facilities, failure of slope can be caused by movements within the human created cut or a combination of both. Reason for failure is usage of poor material as fill. The present work is focused on investigation the behavior of locally fill material when it used in road fill embankment by using Plaxis program in slope stability analysis

II. LITRATURE REVIEW

Stability calculation is performed to assess the safe design of human made or natural slope like embankment and respectively the equilibrium conditions. The term stability analysis can be explained as the resistance of inclined surface to failure by sliding or collapsing analysis aims for a safe design in terms of stability of subgrade embankment. The failure mechanism plans an important role in this study. Finite element analysis is the best numerical method for determining the stability problem. Widely adopted numerical technique for analyzing geotechnical stability analysis on the soil based on plaxis 2D. Stability of soil based on plaxis 2D stability of slope needs a large attention for engineers in the field of construction as it is an important problem

III. OBJECTIVES

- To study the effective stresses, active pore pressure, excess pore pressure and total displacement of different soils using PLAXIS -2D software for wheel loads by comparing three embankment models.
- To study stability analysis of embankment constructed with different soil fill
- Effect of slope stability in embankment
- Effects of stress deformation in each models.
- Effects of total displacement in each models.
- To study active and excess pore pressure acting on each models.

IV. MATERIALS USED

Materials used for this study are

- Sand
- Peat
- clay

IV. PLAXIS -2D

A widely adopted technique, software was firstly developed by technical university of Delft in 1987. Plaxis 2D usually analysis stability of soft soils. It can be effectively used in investigation of soil settlement. The input procedures enable the enhanced output facilities provide a detailed presentation

Environmental Noise Pollution Assessment and Mapping of Kottayam Town

[1]Afeef Muhammed, [2]Aravind J Chandran, [3]Betsy Sara Basil, [4]B S Gayathri, [5]Sankar Bose
[1,2,3,4]Students, Department of Civil Engineering, Mangalam College Of Engineering, Kerala, India
[5]Assistant Professor, Department of Civil Engineering, Mangalam College Of Engineering, Kerala,India

Abstract- **In developing nations noise is a major pollutant to the environment. Road traffic is a superior source of noise pollution and it has detrimental effects on human beings. Fast growing vehicle population in town in the recent years, has resulted in considerable increase in traffic on roads causing alarming noise pollution. In Kerala roads are in bad condition, and poorly maintained and has considerable number of vehicles of outdated technology, the road traffic noise assumes much more importance. Noise affects human body in a number of ways ranging from Psychological to Physiological, e.g. auditory damage, speech interference, sleep interference, general annoyance, reduces the working efficiency, increases blood pressure & fatigue etc. The main objective of this study is to aware the public about the noisy environment with which we live today, due to the increased urbanization and increased traffic intensity. Using ArcGIS 10.7.1 software, noise maps are generated to make the awareness more straight.**

Keywords— Noise mapping, Arc GIS, Sound level analyser

I. INTRODUCTION

The environmental condition of Kottayam town has been changing abruptly along with the rapid growth of urbanization. Reckless use of horns and continuous vehicular movement results the noise pollution problem in the town. The present study is an attempt to evaepaluate noise pollution load of Kottayam town due to urbanization activities and its detrimental effect on the human health and environment. The main use of noise maps is to identify and quantify the scale of noise problems and provide information for town planning and traffic management. Noise maps build in GIS can be used for analysis and management process

So many studies and researches have been done and being doing on this context; In 2008-2009, Dr. Santosh Rangnekar[1] did survey on Noise Pollution and its Management and found out that the average noise level for traffic intersections and silent zone shown some sampling stations with undesirable values. It was concluded that the major reason of noise pollution inside the city was due to air horns and vehicular movements.

In 2013, S.U.Bande[2] completed a review on Road Tarffic Noise Assesment in India and noted that noise environment of the study area may pose as a great threat to the health of dwellers of the study area in long term. Therefore, a strict enforcement of law and regulation is felt in this regard.

In 2015 Jigna Patel[3] did a research on State of the Art

Review on Road Traffic Noise Mapping using GIS. Data collected and results analyzed indicate that almost on all major roads, are always higher than the permissible noise levels/limits prescribed by CPCB.

In 2010 Avnish Chauhan[7] did Assessment of Noise Level in Different Zones of Haridwar City and concluded It was also observed that higher noise level in the city is due to rapid and unplanned urbanization resulting in great influx of people from all parts of the region, lack of sufficient parking spaces and exponential growth.

In 2011 Dev Pramendra[11] and Singh Vartika[12] researched on Enviromental Noise Pollution Monitoring and Impacts On Human Health in Dehradun City

A. SOURCES OF NOISE

Major source of noise in the town is traffic noise from the motors and exhaust systems of automobiles. Also noise from the roadway is generated by construction, commercial activity, political and religion activities, and ceremonials festivals. Noise levels and its impact depend on infrastructure, number of vehicles, road quality, weather and climate. Further sources are factories, batching plants, railway stations, motor garages, workshops and public address system etc.

II. MATERIALS AND METHODOLOGY

A Noise assessment is the actual measurement of the noise levels. The NIOSH Sound Level Meter (SLM) app combines the best features of professional sound levels meters and noise dosimeters into a simple, easy-to-use package. Developed by experienced acoustics engineers and hearing loss experts. Tested and validated (accuracy ± 2 dB) according to standards in a reverberant chamber at the NIOSH acoustics lab the only proper method to validate accuracy. The sound level meter application was calibrated before taking the measurements. Sound level measurements during peak time morning (8–10am) and evening (3-5pm) was carried out in Kottayam town areas on both a working day and non working day. The noise level in Kottayam city was observed during different time intervals at different selected study locations. The study locations were identified and grouped into fore different zones namely Commercial Zone, Silent Zone, Residential zone and Industrial Zone. Commercial zone incorporated with a lots of shopping malls, tourist attractive spots etc. It covers Baker Junction, Mall of Joy, Railway station, KSRTC Bus Station, Nagambadom (Bism Enterprises, Oxygen, Reliance, myG), Private Bus Station. The silent zone is incorporated with educational institutions, hospitals etc. It includes Medical College, M G University, CMS, Baselius, Caritas, Collectrate, Bharath Hospital Residential zone covers the areas of SFS Flats Kodimatha, Kurishupally areas, Skyline Kanjikuzhy, Souhrtha Nagar SH

Analysis of Pollution Trends in Subsurface Water At Poovanthuruth, Kottayam

Jetcy Elizabeth Philip[1], Kavya Prakash[2],
Kelvin Jims[3], Libin Joseph[4],
[1,2,3,4]UG Students, Department of Civil Engineering,
Mangalam College of Engineering, Ettumannoor,
Kottayam

Senthilkumar R[5],
[5]Associate Professor,
Department of Civil Engineering,
Mangalam College of Engineering, Ettumannoor,
Kottayam

Abstract— **Water is one of the essential requirements of all livelihoods. Humans need water in many daily activities like drinking, washing, bathing, cooking, etc. If the quality of water is not good, then it becomes unfit for drinking and other activities. A water quality audit is a study of an entity. It starts when water enters the premises and goes up to the point where wastewater is discharged, critically examining all aspects of use. A water audit is an effective management tool for minimizing losses, optimizing various services, and enabling considerable water conservation. Drinking water safety and security is of high importance as it affects public health and economic life. These audits are an essential way for checking how the water quality is performing and ensuring that the drinking water regulations have complied. This audit recommends how to reduce the wastage as well as consumption of water. This paper focuses on understanding the quality of water.**

Keywords:-Water quality, audit, hardness, alkalinity, pH.

I. INTRODUCTION

Water is the source of life, and its security and safety are of paramount importance. Clean and safe water is an absolute need for a healthy and productive life. The quality of the water supply is vital in determining the health of individuals and whole communities. The rates of these water bodies vary widely depending on the location and environmental factors. The safety of drinking water is today one of the most critical issues since various hazards can threaten public health. The World Health Organization has recorded 27 different waterborne diseases and other water-related hazards. The safety of drinking water is increasingly recognized as a challenge. Contaminated water can cause epidemics, interrupt economic life, and create massive panic.

Water quality audit is an effective management tool for minimizing losses, optimizing various uses, and thus enabling considerable conservation of water not in the irrigation sector alone but other sectors of water use such as domestic, power, and industrial as well. The quality of water is described according to its physical, chemical, and biological characteristics. It is, therefore, to check the water quality at regular intervals of time. Parameters that may be tested include pH, Temperature, Turbidity, TDS, Total Hardness, Chloride, Total alkalinity etc. Water quality auditing is an analytical technique that quantifies water usage and quality while simultaneously allowing for an investigation into the behavior aspects of water management. Water quality audit is an important management tool for effective conservation of water.

The site selected for this study is Poovanthuruth, Kottayam district. There are small-scale industries located at Poovanthuruth. The effluents discharged from the industries contaminate the well water. Therefore the water is not suitable for drinking purposes. So this study focuses on the quality of drinking water from the well of surrounding houses(near the industrial area) at Poovanthuruth. It is, therefore, to check the water quality at regular intervals of time. The quality of water from the wells has significant importance because it is generally used for several purposes such as drinking, domestic, and residential water supplies. The quality of this water mainly depends on numerous interconnected parameters with a local and temporal variation which are influenced by the water flow rate throughout the year [4]. Organic and inorganic pollutants have been routinely detected at unsafe levels in groundwater, rendering this important drinking water resource practically unusable [5]. A proactive approach is needed to prevent human health and ecological consequences from ingestion of contaminated groundwater.

II. LITERATURE REVIEW

The groundwater quality parameters in the surrounding wells of Jawaharnagar, in the upper Musi catchment area of Ranga Reddy district in Andhra Pradesh was studied. [1] The bore wells data was collected from the study area for two seasons, i.e., post-monsoon in December 2007 and pre-monsoon in June 2008. The groundwater was acidic and very hard. It is done by using Arc GIS software. The study reveals that the concentrations of major constituents are well within the permissible limits of IS-10500-1994, except in few cases where total hardness and fluoride concentrations are high. The fluoride concentration exceeded the permissible limit. From the analysis, it was observed that the groundwater is polluted in the entire study area. During the last few years, the utilization of surface and groundwater for drinking, manifolds, but consequently it is observed that the water is polluted and affecting the human health, soil nutrients, livestock, biomass and environment in certain areas.

The Water Quality Index(WQI) has been calculated for different surface water resources, especially lakes, in Nagpur city, Maharashtra (India), for the session January to December 2008; comprising of three seasons, summer, winter and rainy season. [2] Sampling points were selected based on their importance. The water quality index was

Wastewater Treatment Technologies: A Review

Jayalekshmi S J[1], Minnu Biju[2], Jithin Somarajan[3], P E Muhammad Ajas[4]
[1,2,3,4] UG Students
Department of Civil Engineering,
Mangalam College of Engineering, Ettumanoor
Kottayam, India

Dona Sunny[5]
[5]Assistant Professor
Department of Civil Engineering.
Mangalam College of Engineering, Ettumanoor
Kottayam, India

Abstract—**Wastewater is the water that emanates from domestic sources, restaurants, establishment, industries, agriculture fields, etc. Around 80% of all wastewater is discharged into the world's waterways, and it creates health, environmental and climate-related hazards. The dissolved and suspended organic solids in wastewater are "putrescible" or biodegradable. It is important to treat the wastewater before discharging it. It is essential to reduce the impact created by the wastewater through different treatment methods and reuse the treated water for various purposes. The present study emphasis on various modern wastewater treatment technologies and compare their efficiency with traditional treatment methods, and also find the end-use possibility of treated water.**

Keywords— Wastewater, modern treatment methods, traditional treatment methods, water reuse.

I. INTRODUCTION

Water covers 71% of the earth's surface and makes up 65% of our bodies. We use clean water for various purposes including cooking, washing, gardening etc. and finally end up as wastewater. When water becomes contaminated, it loses its economic and aesthetic value, as well as posing a threat to our health and the sustainability of marine life that depends on it [1]. It is estimated that out of the total water supplied around 70% to 80% becomes wastewater. The wastewater that is generated is released into the natural water stream. Disposal of wastewater into the surface water sources causes significant issues and harms people's health the only solution for this is to treat the wastewater to the standards [2]. The wastewater contains many pathogenic bacteria, microorganisms, suspended solids, nutrients, minerals, toxic metals etc. For several years the primary goal of wastewater treatment was to reduce the number of suspended solids, oxygen-demanding materials, harmful bacteria, and dissolved inorganic compounds. However, in recent years more stress has been placed on improving the municipal treatment processes for the disposal of solid waste. In traditional wastewater treatment physical, chemical and biological processes are employed to remove organic matter, nutrients and solids from wastewater [3]. Preliminary, primary, secondary and tertiary treatments are the different treatment stages. Preliminary treatment includes the removal of coarse solids and other large materials from wastewater. The physical processes of sedimentation and flotation are used in primary treatment to remove organic and inorganic solids. In secondary treatment, the effluent is treated to remove the residual organics and suspended solids. Tertiary treatment includes all operations and processes used to remove the pollutant not removed in previous stages. Even though these steps can improve the water quality of normal wastewater, they cannot be a remedial option for treating the wastewater generated by the increasing industrial activities. The wastewater that we are dealing with may contain more pollutants that are difficult to remove by the conventional method. The wastewater that is to be treated may contain more contaminants that cannot be treated by traditional methods. The method of treatment to be used is decided by the nature of wastewater and therefore it is important to know the wastewater characteristics like COD, TS, VS and salt content [4-5].

II. METHODOLOGY

Even though more than 75% of the earth is covered by water the availability of pure water is short. There are places in India where people are having difficulty in finding pure water for their daily needs. So, it is essential to use what we have carefully. The conventional method of treating wastewater helps in reducing the adverse environmental and health problem created by them, but the quality of treated water is not up to the standards of pure water [6]. Also, various human activities have created new contaminants in wastewater called emerging pollutants. Their presence is challenging for the conventional wastewater treatment methods [7]. In the present study, the efficiency of modern technologies in wastewater treatment has been studied along with their limitations.

III. CONVENTIONAL WASTEWATER TREATMENT METHOD

Traditional wastewater treatment uses physical, chemical, and biological methods to remove solids, organic matter and, nutrients from wastewater. The different stages include preliminary, primary, secondary and tertiary.

A. Preliminary Treatment

The objective of preliminary treatment is to separate floating materials like dead animals, free branches, papers, pieces of rags, and also heavy settleable inorganic solids. This stage also helps in removing oils, grease, etc., from the sewage. This treatment reduces the BOD of wastewater by 15-30%. Screening, detritus tank, comminutors, floatation unit and skimming tanks are the various units involved in preliminary treatment. Screening is used for the removal of floating matter. Detritus tank is also known as grit chamber, is used for removal of sand and grit. Comminutors are used for grinding and chopping large size suspended solids. Floatation units and skimming tanks are used to remove oils and greases [8].

Experimental Study on Treating Dairy and Kitchen Waste Water using Pappaya seed powder and Aloevera Gel

Vilbin Varghese[1]
[1]Assistant Professor
Department of Civil Engineering
Mangalam College of Engineering
Ettumanoor,Kerala

Christeena Thomas[2]
[2]Former UG Student
Department of Civil Engineering
Mangalam College of Engineering
Ettumanoor,Kerala

Anjana Raj[2]
[2]Former UG Student
Department of Civil Engineering
Mangalam College of Engineering
Ettumanoor,Kerala

Aswathyvishnupriya S[2]
[2]Former UF Student
Department of Civil Engineering
Mangalam College of Engineering
Ettumanoor,Kerala

Athul Vinod[2]
[2]Former UG Student
Department of Civil Engineering
Mangalam College of Engineering
Ettumanoor,Kerala

Abstract— **The use of natural resources in the process of water treatment, thus constitutes a potential promising ways to reduce on one hand, the high costs and environmental impacts due to the use of synthetic products used previously, and secondly allow as many people as possible access to drinking water. This will constitute therefore a major economic issue for developing countries. In conventional method of coagulation and flocculation alum, ferric chloride and ferrous sulphate were used as coagulant for effective removal of turbidity. But in one of the research it is found that continuous use of alum has caused several problems affecting human health. So this study is mainly focused on decreasing alum dose with use of natural materials. Natural coagulants are natural based coagulants that can be used in coagulation process of waste water treatment for reducing turbidity. The study aimed to, Carica papaya L. (papaya seed) powder , Aloe barbadensis (Aloe Vera) gel as a coagulant in dairy waste water and kitchen waste water samples collected. The experiments proved that turbidity and chlorides had reduced effectively.**

Keywords- Carica papaya L. (papaya), Aloebarbadensis (Aloe Vera), Arachishypogaea (Peanut), Turbidity, Dairywaste, Kitchen waste.

I. .INTRODUCTION

Water is a precious and essential natural resource, unevenly distributed on our planet. Freshwater represents only 2.5% of global supplies of water. About 70% of this freshwater quantity are either trapped under ice caps, or disseminated in the form of humidity or steam. Less than 1% of the world's freshwater, about 0.007% of planet's waters, are easily accessible to the various uses for development.

The use of natural resources in the process of water treatment, thus constitutes a potential promising ways to reduce on one hand, the high costs and environmental impacts due to the use of synthetic products used previously, and secondly allow as many people as possible access to drinking water. This will constitute therefore a major economic issue for developing countries. In conventional method of coagulation and flocculation, alum, ferric chloride, and ferrous sulphate were used as coagulant for effective removal of turbidity. But in one of the research it is found that continuous use of alum has caused several problems affecting human health. It is found that aluminium is one of the causes for Alzheimer's syndrome. So this study is mainly focused on decreasing alum dose with use of natural materials. Natural coagulants are natural based coagulants that can be used in coagulation process of waste water treatment for reducing turbidity. The study aimed to evaluate the efficiency of Artocarpus Heterophyllus (Jackfruit seed) powder, Carica papaya L. (papaya seed) powder , Aloe barbadensis (Aloe Vera) gel and Arachishypogaea (Peanut) powder as coagulants in dairy waste water and kitchen waste water samples collected.

II. MATERIALS REQUIRED

A. Carica papaya L. (papaya seed powder)

Papaya is a tall herbaceous plant in genus carica with edible fruits. These plants are grown in all parts of world.

B. aloe barbadensis (aloe vera gel)

It belongs to Asphodelaceae famiy. and is a shrubby or arborescent, perennial, xerophytic, succulent, pea green colour plant.

III. LITERATURE REVIEW

Hemraj S.R et al (2019) made the experiment on dairy industry which is one of the major source of food processing. These industries produce a huge amount of wastewater .Such wastewater is to be treated by using naturally and easily available coagulants and then tests are to be carried to check the water different characteristics of waste water before and after coagulation process. Natural coagulants used are Jack fruit seeds and Aloevera gel. The mixed proportion of jackfruit seed powder and Aloevera gel are used as adsorbents. The maximum percentage reduction of various parameters can be observed at a dosage of 0.8 gm of Jack Fruit seed. The maximum percentage reduction of various parameters can be observed at a dosage 4% of Aloevera Gel

Study On Outrigger Structural System

Jeena Joshua
[1]PG Scholar, Department of Civil Engineering
Mangalam College of Engineering,
Ettumanoor, Kottayam

Adithya Vishwambharan[2]
[2]Assistant Professor, Department of Civil Engineering
Mangalam College of Engineering,
Ettumanoor, Kottayam

Abstract—**The rapid developments of materials, construction technologies and structural systems have given rise to a significant increase of skyscrapers over the past decades. The reduction of the top drifts and base core overturning moments under lateral loads, such as earthquakes and wind loads, has drawn increasing attention in the structural design of super-tall buildings. The principle of using an outrigger system to enhance the structural lateral stiffness and overall stability is that the core-tube and the external columns are connected by rigid horizontal cantilevers. Optimum locations for Installations of outrigger systems can be founded. Overall displacements and lateral drift can be reduced. Outrigger systems enhance the stiffness of high-rise buildings by the introduction of stiff outriggers at different locations. The loads considered are as per IS codes. An ETABS model of 45-storey building is considered for this study.**

Keywords— ***Outrigger, ETABS, Displacement, Drift, Time period, Belt Truss System***

I. INTRODUCTION

1.1 General

The fascination of constructing tall buildings were started by the mankind from the early stage of Civilization. Human race had always fascinated for height and throughout our history, we have constantly sought to reach for the stars, from the ancient pyramids to today's modern skyscraper. Initially they were constructed for defence purposes, however now a days it is been largely used for commercial, residential and mixed purposes also.

Consequent development of urban population, constrained availability of space, cost of plots, urge to preserve agricultural lands, significance of pride, advanced technologies has contributed to construct tall buildings.

Once the height of the structure increases, its stiffness and strength decreases. Therefore an engineer will be having a tedious job of taking due concern about the various parameters such as strength, stability, displacements, storey drifts etc. The major loads acting will be vertical like gravity load (Dead Load and Live Load), lateral like Earthquake Load and Wind Load. The main function of the structural elements is to withstand all these forces.

Tall structures can basically be simplified into a cantilever which is restrained at the base and free at the top. Even though gravity loads are the prominent loads on the structure, lateral loads like earthquake and wind loads are dominant as they are unpredictable and has the tendency to tilt and overturn the whole structure.

1.2 Structural Behaviour of Outrigger System

The outrigger and belt truss system acts very important role to resist the lateral loads in the structure. In this structure the external columns are tied to the central core wall with stiffened outriggers and belt truss at one or different levels. The outrigger and belt truss system effectively control the excessive drift due to lateral load and minimize the risk of structural and non-structural damage. Outriggers are stiff elements connected to a structure core to outer columns. Whenever a lateral load is acting on an outrigger structure, column-restrained outrigger offers resistance to the core from rotation. It induces tensile force and compressive force in windward and leeward mega-columns resulting in an increased effective depth of the whole structure.

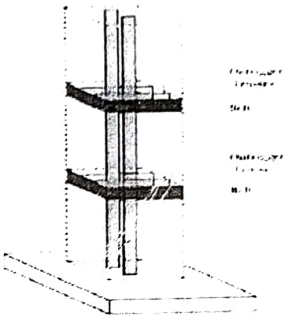


Fig- 1.1: Structure with Outriggers and Outrigger with Belt Truss

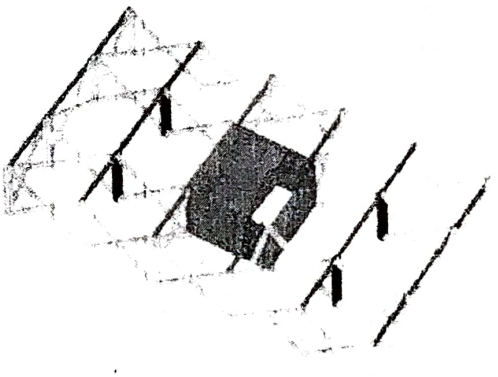


Fig- 1.2: 3D view of Outrigger and belt truss belt truss

II. LITERATURE REVIEWS

2.1 *General*

The literature review is the most important which has the similar studies give on focus from recent parts of outrigger system of reinforced concrete frames to determine the research work using high seismic zone wind analyzed. The concept of modeling and analysis used for purpose of improvement technique and economically.

Comparison of behavior of RCC and Steel Structure using ETABS Software

(Details for Structural Project and Analysis)

Lavitha V
Department of Structural & Construction Management
Mangalam College of Engineering
Kottayam, Kerala

Gokul. P. V
Assistant Professor,
Department of Structural & Construction Management.
Mangalam College of Engineering
Kottayam. Kerala

Abstract— **The residential housing sector (G+3, G+5, G+6 etc.) use of steel has increased, but RCC construction still predominates the Indian construction business. In the present study an attempt has been made to analyze the seismic behavior of RCC and steel frames using Etabs2016.The high self-weight and brittleness of concrete is not favorable to seismic prone structures whereas steel structures are 60% lesser in weight through they can withstand earthquake more effectively than the concrete structures. Aim of the study to compare the seismic performance of G+6 frame for both steel and RCC and to introduce the container into the steel frame and analyze its seismic response. For current study all frames are analyzed under equivalent static method. In this comparative study it is concluded that steel frames are most effective than the concrete as it has the highest strength to weight ratio.**

Keywords—Steel frame; RCC frame; Seismic Analysis; ETABS2016; IS 1893:2002

I. INTRODUCTION

There are tons of empty containers out there waiting to be reused or recycled. Due to recent development of technological innovation, reuse of shipping containers for home building usage might deserve further investigation between its other usages. Promising cases of transforming containers to youth center, classroom, emergency shelter, office, house and hotel are emerging around the world each year. This would be a kind of offset in a way, which could result in greener and healthier coastlines without creating another issue in landfill. However, the matter is how to transform those containers sustainably for homebuilding purposes in a way that makes our society greener and healthier. In India most of the people approached towards the concrete structure instead of steel as they find concrete as convenient and cost effective in nature. But as India is becoming worlds second most populous country and the area is just limited then vertical hike is in the building construction is very necessary. So, for construction of this multistoried building steel can be a truly effective material in all engineering aspect. The use of steel as a core construction material is not yet become prevalent in India as it is in other developing where maximum construction both commercial and residential high rise structures are being built of steel. It. This paper emphasized to prefer steel frame over the RCC as it perform far better than RCC under the seismic loading. Some people might not have any idea that shipping containers can be used as home building materials. Steel for house building purposes reduces the need for newest materials used in conventional construction. It is well established that containers are produced in the same standard dimensions with some inbuilt properties, which makes them a spectacular modular structural component. The recent use of prefabricated shipping containers may be a substitute of traditional timber-framed construction.. Steel are designed to carry and bear very high loads, as well as resist to aggressive environments. In this project we are doing the seismic analysis of the G+6 building. Many RCC structures proved to be inconvenient in many case like ductility, time period, base shear etc..The analysis and validation of these factors are done in the project to compare the RCC structure with steel structure like container house.40 feet long containers are introduced and seismic analysis is done, so that the container house can be proved to be safe in seismic zones. Cargo containers are manufactured from weathering steel. Weathering steel includes alloying elements that affect the materials corrosion procedure. Weathering steel creates an amorphous inner layer that protects the integrity of the steel against external harmful agents. Figure 1.1shows the placement of the layer as well as its composition. The continuity of the layer also adds to the protection of the steel.

II. LITERATURE GAP

RCC Frame structure is requiring more time period compared to steel structures like container house.Base shear for RCC structures is more compared to steel structures.More time period due to increased weight of RCC.Seismic weight of RCC frame structure is more than steel frame structure. Because of its greater dense cross-section of structural member.RCC structure has less strength and ductility.Steel structure have very low insulation. Steel buildings should be proven to be safe in seismic prone areas.

III. OBJECTIVE

To prove by validation that. Ductility is more for steel structures is more than RCC structures. Strength is more for steel structures is more than RCC structures. Base shear is more for steel structures is more than RCC structures. Value of highest time period is more for RCC structures than steel structures. Lateral forces are withstanded more by steel structures than RCC structures. To implement this validated steel frame structure is required. To provide seismic or dynamic loading using E Tabs to show that steel buildings are safe in seismic zone too.

Microsimulation Modelling in VISSIM for Long-Term Improvements in Kuruppanthara Junction

[1]Alvin Jose James, [2]Amal Prasad, [3]Brinda P Ashok, [4]Reshma Ramachandran, [5]Arun Issac Varghese
[1,2,3,4] UG Students, [5]Assistant Professor
Department of Civil Engineering, Mangalam College of Engineering,
Kerala, India

Abstract—: **Travel efficiency and traffic safety of non-signalized intersections are two main objectives considered in traffic management and control. Traffic analysis at non-signalized intersections has always been a difficult process to carry out with the ever-increasing volume of vehicles. Kuruppanthara junction is a four-legged intersection situated at Kottayam district in Kerala. The ineffective signaling and lack of space leads to long queues in the intersection and improper positioning of bus bays in the influence zone of the junction cause heavy traffic congestion during peak hours. The focus of the study is to investigate the current situation and to develop two models of intersections and comparing each other and choosing the most efficient intersection model. Seeking appropriate control mechanisms with the help of traffic simulation software is an effective way to solve the problem. By using VISSIM microsimulation software we created two models and ran simulations with signals fitted to each model and compared the queue length and suggested that model for long-term solution for the trip makers at Kuruppanthara junction.**

Keywords: ***VISSIM, Intersections, Traffic simulation, Queue length***

I. INTRODUCTION

With the increase in car ownership, which causes terrible traffic jams and low transport efficiency, urban traffic is becoming more oppressive. The sudden increase in population and urbanization of the country lead to a very unauthorized and inefficient road network with poor utilization of roads and faulty designs. Very often we see traffic congestion, accidents, unauthorized parking and inadequate road widths with very low capacity. We need more efficient road designs in order to minimize traffic congestions and accidents, and ensure better flow of traffic. Traffic simulation software plays an important role in designing road models. Its output serves two purposes; to present a visual image of the predicted traffic suitable for public presentation and to provide quantitative answers to differentiate between the levels of service offered by the road design options.

Microsimulation is a relatively new technique for representing road traffic flow, in which the actions of every individual vehicle are evaluated at sub second intervals. Their journeys through the road network are derived by analyzing their interactions with the road network, the traffic control systems, and with the other vehicles on the network. The random wait for a gap in traffic, the clustering of vehicles and the variance in the length of time required to make a journey are all automatically assessed and assimilated. A microsimulation model is fundamentally quite simple. Concerning speed and lane choice each individual vehicle follows the road alignment and constantly makes decisions. It must decide which way to turn at the end of the road, and also it must wait for a suitable gap in the traffic before moving out. Such a simulation can be implemented using a simple car model and elementary physics involving equations of motion

Traffic flow software has been available in almost its current form since the 1960s. Its function is quite simple: build a computerized model of a road system and load it with vehicles representing the demand on that system. The software then enables the user to adjust the road network description or travel demand within the model so that it represents what is observed on the road. The model is then used to predict what will happen in the future if the road network or travel demands change.

S-Paramics (2006) is one example of a number of similar microsimulation software packages. All are designed to perform a similar task. S-Paramics, Aimsun (2006) and Vissim (2006) are the most well-known. S-Paramics is based on research from Fritzsche (1994) with modifications derived from the experience of using it on many transport planning projects (Duncan and McArthur, 1997). Recent research from the USA into driver behavior is also contributing to internal behavior models (NGSim, 2006). S-Paramics is a discrete time step based simulation where the time step is commensurate with a driver's reaction time. At each time step Drivers make a set of decisions about what they will do in the future at each time step. It is the interaction between individuals that allows microsimulation to represent the flow of traffic on a road system.

This paper introduces the application of VISSIM software, in the design and testing of a model of traffic light controlled intersection. The main aim of this paper is to propose two intersection models leading to the elimination of congestion during peak hour. VISSIM is a microscopic multi-modal traffic flow simulation software developed by PTV Planung Transport Verkehr AG in Karlsruhe, Germany. VISSIM was first developed in 1992. The latest version of VISSIM is PTV VISSIM 21 released in 2021 and we have used this version in our project. VISSIM is a software that can be used to analyze private and public vehicles even under constraints such as lane configuration

Study on Acceptability of Hyperloop in Kerala

Roshy Philip[1], Sherin Skaria[2],
Tibin Gevarughese Kurian[3],
[1,2,3]UG Students, Department of Civil Engineering,
Mangalam College of Engineering, Ettumanoor, Kottayam

Reni Kuruvilla[4],
[4]Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering, Ettumanoor,
Kottayam

Abstract— **The conventional mode of transportation of people consists of four unique types and that are rail, road, water, and air. These modes of transport tend to be either relatively slow, expensive, or a combination of both. Hyperloop is a new mode of transport that seeks to change this pattern by being both fast andinexpensive for people and goods. Hyperloop is a proposed mode of passenger and freight transportation that propels a capsule-likevehicle through a near-vacuum tube at more than airline speed. Passengers may enter and exit Hyperloop at stations located eitherat the ends of the tube, or branches along the tube length. It quickly becomes apparent just how dramatically the Hyperloop could change transportation, road congestion and minimize the carbon footprint globally. The purpose of this study was to determine the user acceptability of hyperloop. However, user acceptability is important for the enforcement and widespread useof these technical innovations. An online study on the acceptability of hyperloop based on quantitative data of a sample presented. The results show a remarkably high level of overall intention to use the hyperloop public transport system in Kerala in the future.**

Keywords— Hyperloop; Propels; Vacuum Tube; Capsule

I. INTRODUCTION

The Hyperloop is a concept for high-speed transportation. consisting of capsules traveling at high speeds in a tube with near vacuum pressure. Imagine travelling from Thiruvananthapuram to Kasaragod in one hour without boarding a plane and with nowaiting time or emissions. These are the ambitious targets of hyperloop, a radical mobility innovation currently under development. The core technology of the hyperloop is based onvehicles designed to transport people in low-pressure tubes, accelerated by a magnetic levitation belt. Hyperloop technology presents opportunities for shortened travel time, a lower infrastructure footprint and an exceptionally low use of energy. Virgin Hyperloop One (VH1), a technology company with headquarters located in California, United States. has developeda full-scale test facility that uses the core elements of hyperlooptechnology. Key factors for the successful introduction of the hyperloop as a mass transportation solution include overcoming technical and economic challenges, as well as gainingacceptability among potential users. However, research on users perspectives toward hyperloop technology remains scarce. Theaim of this study is to generate a deeper understanding of user acceptability of hyperloop technology by identifying users' willingness to use this mode of transportation and the factors that support user acceptability or rejection of the new technology.

The key challenge of this study is that most potential users are not currently aware of hyperloop technology and its development. Therefore, it is of particular interest to examine how different levels of user knowledge about hyperloop affectits overall acceptability.

II. LITERATURE REVIEW

Potla Jithendra (2018) investigated that the hyperloop is thenew mode of transportation alongside road, rail, air and water.The study reveals the theoretical evaluation of the currentmaglev as well as the evacuated tube technology and concluded that the Hyperloop is feasible if properly designed. It has thepotential to be much more efficient in terms of energy usage ofpods traversing down the tube. Author came out with a resultthat the transportation of passengers can be possibly done in avery less time at cheaper rates. Further improvements in thistechnology can lead to more reduction in price with greater sustainability

Wang Zhiqiang and Huang Yage (2017) use questionnaire survey method, collected data from Suzhou metro passengers and evaluated data to common dynamic guidance information,based on the survey result, analysed the availability, clarity andcomprehensibility characteristics of dynamic guidance information in various medium. Their analysis find that metro passengers have certain expectation on the dynamic guidance information's effect, hoping accompanied by perfect dynamic information during the travel process to improve the service experience. The analysis shows that passenger's age, education level and taken subway's frequency will affect it's dynamic guidance way's acceptability, but not outstanding.

S Roopa and M.S. Rani (2017) have studied the questionnaires that are frequently used in quantitative marketing research andsocial research. They achieved the purpose of questionnaireresearcher need to put in place of reliability and validity, formatof the questionnaire, logical arrangement, knowledge, classification behaviour, perception of question, length and output of the questionnaire. They reveals in depth information about requisites like constructing a questionnaire, pilot testing them, standardizing them and reframing the poor questions and provide an estimate of the average time each questionnaire will taken to complete

Waste Glass Powder as Partial Replacement of Cement-Review

[1], Amurutha Raj [2]Mary Divya.C J, [3]Abel Biju, [4]Ajith Cherian Jacob, [5]Adithya Viswambaran
[1,2,3,4]Students, Department of Civil Engineering, Mangalam College of Engineering, Kerala, India
[5]Assistant Professor, Department of Civil Engineering, Mangalam College of Engineering, Kerala, India

ABSTRACT **- Safe disposal of the huge amount of waste glass has become a serious environmental concern in many countries. Plastic is generated in large quantities all over the world.it is believed that the breakdown of plastic takes time of more than thousand years. Improper plastic waste management leads to several environmental and health hazard. On the other hand, the production of concrete uses huge amount of natural resources and adds greenhouse gases to the environment. Therefore, researchers have been working on the reuse of waste glass as a supplementary cementitious material in the production of cement, mortar and concrete. Glass is principally composed of silica .Use of milled waste glass in concrete as partial replacement of cement could be an important step towards development of sustainable infrastructure systems.In this research compressive strength and flow tests on mortar and concrete were carried out by adding 0-25% ground glass in which water to binder ratio is kept the same for all replacement levels.With increase in glass addition mortar flow was slightly increased while a minor effect on concrete workability was noted. As with mortar, concrete cube samples were prepared and tested for strength. The compressive strength test result indicated that recycled glass mortar and concrete gave better strength compared to control samples. A 10% replacement of cement with waste glass was found convincing considering cost and the environment.**

Keywords: Waste glass, Recycling, Supplementary cementitious material, Compressive strength.

I .INTRODUCTION

Million tons of waste glass is being generated annually all over the world. Once the glass becomes a waste it is disposed as landfills, which is unsustainable as this does not decompose in the environment. Glass is principally composed of silica. Use of milled (ground)waste glass in concrete as partial replacement of cement could be an important step toward development of sustainable (environmentally friendly, energy-efficient and economical) infrastructure systems. The concept of recycling and sustainability has been introduced to maintain the level natural resources. Industrial wastes are being produced per annum by chemical and agricultural process in India. By the inclusion of industrial waste in concrete, the energy and the environment can be saved. The use of these by-products offers environmental advantages like divert the material from the waste stream, reduce the energy used in processing virgin materials, use of virgin materials, and decreases pollution During manufacturing of one ton of ordinary During manufacturing of one ton of ordinary Portland cement an equal amount of carbon-dioxide is released into the atmosphere which is harmful to the environment. So, there is a need to choose an alternative Also, the cost of cement is also steadily increasing day by day. So, there is a great need to use industrial waste products in an appropriate manner to reduce cost and environmental problems. Concrete is a construction material which is composed of cement, fine aggregate and coarse aggregate mixed with water, which hardens with time. As per present world statistics, every year millions of tons of cement are required in the construction sector. In concrete mainly Ordinary Portland Cement is used. In addition, huge quantity of energy is required for the production of cement.

II. SCOPE OF THE STUDY

Use of glass powder as a partial replacement of cement can improve the chemical, mechanical and physical properties of concrete use of glass is an environmental friendly alternative to dumping it as a waste. It also reduces the consumption of natural resources. By using waste glass, production of cement can be reduced and also cost of cement production can be reduced.

- To control the environmental pollution.
- To produce low-cost concrete.
- Economical and profitable substitute to landfills, incinerator.

III. LITERATURE REVIEW

Dr. G Vijayakumar: The researcher was interested in finding out the mechanical properties like compressive strength and split tensile strength of concrete by replacing cement with waste glass powder. Cement manufacturing industry is one of the carbon dioxides emitting sources besides deforestation and burning of fossil fuels. The global cement industry contributes about 7% of greenhouse gas emission to the earth's atmosphere. In order to address environmental effects associated with cement manufacturing, there is a need to develop alternative binders to make concrete. Consequently, extensive research is on going into the use of cement replacements, using many waste materials and industrial by products. Efforts have been made in the concrete industry to use waste glass as partial replacement of course or fine aggregates and cement. In this study, finely powdered waste glasses are used as a partial replacement of cement in concrete and compared it with conventional concrete. Glass powder was partially replaced as 10%, 20%, 30% and 40% and tested for its compressive, Tensile and flexural strength up to 60 days of age and were compared with those of conventional concrete; from the results obtained, it is found that glass powder can be used as cement replacement material upto particle size less than 75µm to prevent alkali silica reaction.

A Review on Impact of Heavy Vehicles on Highway Traffic

Arjun N.V.[1], Neenu Vijayan[2],
Swathy E.R [3], Timothy Ninan[4],
UG Students, Department of Civil Engineering, Mangalam College of Engineering, Ettumanoor, Kottayam

Vaishnav V.K.[5],
Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering, Ettumanoor, Kottayam

Abstract— **The operational ability and acceleration capability of heavy vehicle are different as that of other smaller size vehicles and passenger car. An increasing number of heavy vehicles in urban traffic may result in relatively different traffic flow characteristics. The purpose of this paper is to examine the study done by Chang-Gyun Roh *etal.* (2011) [1], who investigated the effects of Heavy Vehicles on traffic flow using real-time AVC data and to analyse the relationship between average speed, HV ratio, flow rate, and the number of lanes. The work examines the impact of heavy vehicle movement on measured highway traffic characteristics in detail. In order to analyse the impact of heavy vehicles (HV) on highway traffic flow and density, real-time Automatic Vehicle Classification (AVC) data was collected for different major highways (four-lane and six-lane and eight-lane respectively) in Seoul Metropolitan area, South Korea, for a period of 2 months. The observations showed that the average speed decreased with the flow rate increase of flow rate and HV ratio for the highways.**

Keywords-Heavy vehicles (HVs), Highway, Traffic flow parameters.

I. INTRODUCTION

With advancements and innovations in society, the need for heavy vehicles, used for purposes like transportation of goods and personnel, have risen. Heavy vehicles (HV) such as buses, trucks, recreational vehicles (RV) etc. affect the traffic flow more than other vehicles. Although heavy vehicles comprise a small proportion of traffic stream, they have an important effect in traffic flow and produce a disproportionate effect particularly during heavy traffic conditions [2].The presence of heavy vehicles in traffic strongly influences various traffic parameters, depending on its percentage. These vehicles are bigger in size, generally have a lower rate of acceleration, resulting in slow speed of these vehicles and hence affecting smaller vehicles. Drivers of small vehicles are forced to either comply by decreasing their speed and following the large vehicles, or resort to change lanes to drive around them. Highway Capacity Manuals (HCM) have integrated a way to solve the problem of mixed traffic by using passenger car equivalents (PCEs)[3]. These units can be used to convert a mixed highway traffic flow into an equivalent standard passenger car traffic flow. This method can trigger speed variations and change the features of traffic flow on highways [4].

II. LITERATURE REVIEW

For conducting this study, Chang-Gyun Roh *etal.* (2011) collected a large amount of traffic data over a 2-month duration from August to September 2011 on three major highways in Seoul, South Korea. The unique factor was the difference in number of lanes in the selected highways. four, six and eight lanes respectively [5]. Hence various environmental and traffic conditions were provided to study the traffic dynamics between HVs and other passenger cars [6], [7]. The main objectives were:

1. To analyse the impact of heavy vehicle ratio in reduction of overall traffic speed.
2. To study the effect of flow, speed, volume and number of lane-changing movements of the highway on the impact of heavy vehicles.
3. To examine the HV traffic flow pattern based on number of highway lanes

III. METHODOLOGY

The works begins with site selection for data collection. Piezo-electric sensors are used in the roads, for the movement of traffic and to identify the different categories of vehicles passing through. The AVC systems are installed on the roads and as the vehicles passing through the road, the system would detect the number of axles on the vehicle, vehicle speed and traffic volume. Before being used for further analysis, the data gathered is screened for errors. When an error is detected, all 5-minute data before and after that point in the data is deleted. Time is not included in the research data sets. Any data collected during heavy rain or bad weather was excluded due to high probability of inaccuracies.

A. Data Collection

According to Roh *et al* (2011), the impact of large vehicles on traffic was examined using collected data included high traffic volume and various ratios of heavy vehicles on the highways. The piezoelectric sensor with AVC system collecting the traffic information distinguished the various types of vehicles in the traffic flow. The axle weight of vehicles which pass through the sensor generate electric charges that measures the number of axles, thus recognising the vehicle category. These sensors are also able to measure the speed of the vehicles.

B. Determination of Study Area

Data was collected from various suitable sites. The sites should be straight sections with level terrain and without having any influence of access points, intersections or traffic control devices up to 500 meters in either direction. The finalised sites were (1) four-lane highway (Seoul-Chuncheon Expressway) (2) six-lane highway (the Pyeongtaek-Jecheon Expressway) (3) eight-lane highway (Gyeongbu Expressway).

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
ICARI - 2021 Conference Proceedings

Review of Analysis of Irregular Building

Jerin Mathew Jose[1], Kesiya Josy V[2],
Likhith Koruthe Varghese[3], Nayana P P[4]
[1,2,3,4]UG Students, Department of Civil Engineering
Mangalam College of Engineering,
Kottayam,India

Adithya Viswambaran[5]
[5]Assistant Professor, Department of Civil Engineering
Mangalam College of Engineering,
Kottayam,India

Abstract— **This paper deals with the review of structural behavior of irregular building for different plans like rectangular,C,L and I shape. Modeling of 15- stories RCCframed building to be a done on the ETABS software for analyze. maximum shear forces, bending moments, and maximum story displacement are computed and then compared for all the analyzed structure.**

Keywords: - Irregular building, ETABS software, shear force, story displacement,story drift.

I. INTRODUCTION

ETABS provides both static and dynamic analysis for a wide range of gravity, thermal and lateral loads. Dynamic analysis may include seismic response spectrum or accelerogram time history. This analysis mainly deals with the study of a rectangular, L, C and I shaped plan using ETABS.

The behaviour of any building depends on the arrangement of structures present in it.Irregularity in structures is alack of symmetry or eccentricity between geometry,mass,stiffness etc.Irregularities are introduced in real design for both aesthetic and utility.Irregularities in the distribution of mass, stiffness, and geometry along the height of the building grouped as vertical irregularities.The system having physical discontinuityis termed as irregular building.

A 32m x 24m 15- stories structure having 4m x 4m bays are modeled using ETABS. The height of each story is taken as 3m, making the total height of the structure 45m. Loads considered are accepted by the IS-875(Part1, Part2), IS-1893(2002) code,and combinations are acc. to IS-875(Part5). Analysis of the structure, maximum shear forces, bending moments, story drift, and maximum story displacement, are computed and then compared for all the analyzed system.

II. LITERATURE REVIEW

Abhay guleria studied the structural analysis of multi-storey irregular building with different plans. It emphasizes on the structural behavior of multi-storey buildings for different plan configurationslikerectangular, C, L, and I shape. Help to give an idea about the story overturning moment varies inversely with storey height. Dynamic analysis, mode shapes are generated, and it can be asymmetrical plans undergo more deformation thansymmetricalplans. Modeling is to be done by using this journal.

SIVA NAVEEN E (2018) also studied the dynamic analysis of irregular buildings under earthquake loads.The structural behavior of multi -story frames with single and combination of irregularities.Help incorporating abnormalities in structures without compromising their performance the regular and irregular models. The Idea about the response spectrum analysis was conducted to clarify these models by taking the results of maximum displacement, inter-story drift, and story shear to compared. Response spectrum method allows a clear understanding of the contribution of different modes of plans.It is also useful for approximate evaluation of seismic reliability of structures.

From the above papers the problem, was learnt, analyzed and solved. Thispaper, focused on the dynamic analysis of an irregular buildings using grid slabs for different plan configurations. The topic which we are doing has very few articlespublished

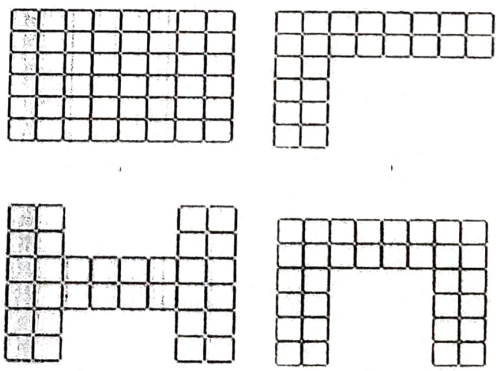
III. METHODOLOGY

A. Modelling of RCC frames

An RCC framed structure is an assembly of slabs, beams, columns, and foundations inter-connected to each other, as a unit. The load transfer mechanism in these structures is from slabs to rays, from beams to columns, and then,ultimately, from columns to the foundation, which in turnpasses the load to the soil. In this study, we have adopted four cases:

a) Rectangular Plan
b) L-shape Plan
c)I-shape Plan
d) C-shape Plan

Fig. 1: Plans of buildings



Finite Element Modelling and Dynamic Analysis of Skew Bridge using Staad.Pro

Rahna Sajeeb
P G Scholar
Department of Civil Engineering
Mangalam College of Engineering Ettumanoor,
Kottayam

Adithya Viswambharan
Assistant Professor
Department of Civil Engineering
Mangalam College of Engineering Ettumanoor,
Kottayam

Abstract—**Bridge is exceptional type of structures which are characterized by their simplicity in geometry and loading condition. - The presence of skew in a bridge makes the analysis and design of the bridge complex. Design of bridges by using skew angle is becoming more useful in the engineering community, so there is a need for more research to study the effect of skew angle on the behavior of skewed bridges such as shear force, bending moment, torsion and other parameters. Reinforced concrete T – Beam girder of various skew angle (0°, 15°, 30°) with two lane carriageway is considered in this analysis. The analysis is done using STAAD Pro Software. The skew angle is taken at an interval of 15° starting from 0° up to a maximum of 30°. The analysis result is present in teams of bending moment, torsion moment, shear force and deflection for T – Beam girder. After the end of the study conclusion will be made by comparison with a skew bridge with regular bridge.**

Keywords— Skew bridge, staad.pro ,skew angle, girder

1. INTRODUCTION

Bridges are great symbols of humanity's conquest of space. They are the enduring expressions of humankind's determination to remove all barriers in its pursuit of a better and more accessible world. Bridges are lifelines to humanity to connect two communities which are separated by streams, valleys, railroads, etc. All the physical forces of nature and gravity should be understood with mathematical precision, such forces have to be resisted by manipulating the suitable materials in the correct pattern. Hence the design and building of bridges require both the inspiration of an artist and the skill of an artisan. Scientific knowledge about materials and structural Behavior has expanded tremendously, and computing techniques are now widely available to manipulate complex theories in innumerable ways quickly.

The Bridge is a structure that covers a gap ; generally these structures will carry a road or railway over an obstacle such as natural or artificial obstacles like a canal, river or roadway or railway. The Bridge is the most significant component of a transporting system and it is corresponding to the responsibilities in carrying a force flow of transport. These structures are classified based on the distribution of forces in the design such as shear, compression, tension and moment.

2. SKEW BRIDGE

Skewed bridges are commonly used to cross roadways, waterways, or railways that are not perpendicular to the bridge at the intersection. Skewed bridges are characterized by their skew angle, defined as the angle between a line normal to the centerline of the bridge and the centerline of support which is shown in Fig. 1.

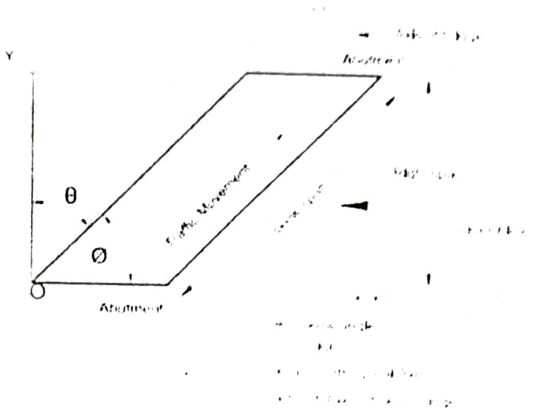


Fig. 1 Skew bridge showing skew parameters

In skew slabs, the load path tends to take a short cut through the strip of the area connecting the obtuse-angled corners and the slab primarily bends along the line joining the obtuse-angled corners. The width of this primary bending strip is a function of skew angle and aspect ratio (skew span: width of the deck). The areas on either side of the strip do not transfer the load directly to supports, but only to the strip as a cantilever. The load is transferred from the strip to the support over a defined length along the support line and then eventually gets redistributed over the whole length. The load transfer mechanism is shown in Fig. 2.

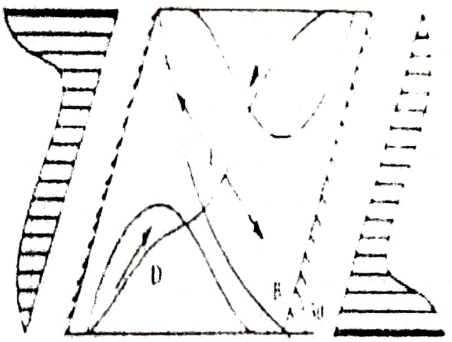


Fig. 2 Load transfer mechanism of skew deck slab

Analysis of Building with Baseisolation and Damper

Sarah Mariam Abraham[1], K S Selman[2], Nithya Mohan[3], Shummu Prasad[4]
[1,2,3,4]UG Students, Department of Civil Engineering, Mangalam college of Engineering, Ettumanoor, Kottayam

Salini Theres N Kurian[5],
[5]Assistant Professor, Department of Civil Engineering, Mangalam College of Engineering, Ettumanoor, Kottayam

***Abstract*—This paper is about the seismic analysis of building. The aim of seismic design is to protect the buildings and reduce the damages occur through the seismic event. There were many studies are done to resist earthquakes. Providing base isolation and damper in building have greater impact to resist earthquake. The principle of base isolation is to alter the response of the building structure so that ground below can move easily without transmitting these motion forces to the building structure above. Using damper it dissipates a significant portion of induced energy so that damage to the building reduces. In the present study, afive story RCC building is analyzed according to IS Code for seismic analysis by ETABS software. In this study a several conditions are taken first considering a normal building, base isolated building, building with damper and building with base isolation and damper.**

Keywords:- Seismic, base isolation,damper,ETABS.

I. INTRODUCTION

Seismic is the factor which generate a lateral forces applied on the base of the structure. The objective of the seismic design is to protect important facilities such as hospitals museums and official buildings etc. In base isolated structure, the energy due to earthquake is dissipated by isolators before travelling through the structure from base to roof. Thus the lateral force resulting an earthquake which is applied on structural elements including nonstructural elements are low in base isolation system compared to conventional construction system. Base isolation define as structural elements that should separate a superstructure from its substructure. Damping also plays a vital role in Earthquake resistant design, which decreases the response of the building when they are exposed to lateral force. The fluid viscous dampers are the more applied tools for regulating responses and dissipating energy of the structures.

II. LITERATURE REVIEW

At first base isolation was registered as a patent in 1800's, with Lead Rubber Bearing (LRB) providing high flexibility and damping. The natural rubber has been has been used for since 1840's through the process of material development synthetic rubber or poly-tetra-fluoro-ethylene(PTFE)which is developed by DuPont was used, and designed for 50 years or more H.W.Shenton compared and analyzed relative results of fixed based and base isolated structure. The concrete fix base structure was designed by referring structural agencies association of California (SEAOC).The base isolated response was compared with fixed base response. The base shear was varying according to the SEAOC recommendation. Three different type of time history, post-earthquake record were selected to perform nonlinear dynamic analysis for fixed base and base isolated structure. Results were compared to 25% and 50%of the specified lateral force by SEAOC.The performance of building was checked for different lateral forces.

Todd W Erickson, presented response of the industrial structure under seismic forces, building was designed according to IBC Code. Theresults of superstructure under dynamic loading were found out for an elastic response. All problems related to design analysis, placement of isolator are comparatively discussed

Enrique Luco, determined the soil structure interaction effect on base isolated building .The results showed that the deformation of an inelastic structure is higher when the soil effect has taken into consideration

Vajreshwari Umachagi et.al presents an overview on applications of dampers for vibration control of structures. The review includes different types of dampers like metallic dampers, viscoelasticdampers, frictional dampers etc.it concludes that use of seismic control systems has increased but choosing best damper and installing it into a building is very important for reducing vibration in structures when subjected to seismic loading

III. LEAD RUBBER BEARING

A variety of isolation devices including elastomeric bearings (with and without lead core), frictional/sliding bearings and roller bearings have been developed and used practically for a seismic design of buildings during the last 25 years. Among the various base isolation system, the lead rubber bearing had been used extensively. Itconsists of alternative layers of rubber and steel plates with one or more lead plugs that are inserted into the holes. Due to lateral forces the lead core deforms, yields at low level of shear stresses approximately to 80 to 10 Mpa at normal temperature, so the lead bearing lateral stiffness is significantly reduced. One of the feature of lead core is that it can recrystallize at normal temperature and will not encounter the problems of fatigue failure under cyclic loadings

Seismic Response of RC Framed Building Resting on Sloping Ground

Aswin S Nair[1], Geethu Lal[2]
[1]M.tech students [2]Assistant Professor, Department of Civil Engineering.
Mangalam College of Engineering, Kottayam, Kerala, India

Abstract:- **Framed structures constructed on hill slopes show different structural behaviour than on the plain ground. Since these buildings are unsymmetrical in nature, hence attract large amount of shear forces and torsional moments, and show unequal distribution due to varying column lengths. In this study, two different configurations of hill buildings have been modelled and analysed using ETABS v 9.0 finite element code. A parametric study has been execute, in which hill buildings are geometrically varied in height and length. In all, eighteen analytical models have been subjected to seismic forces along and across hill slope direction and analysed by using Response Spectrum Method. The dynamic parameters obtained from analyses have been discussed in terms of shear forces induced in the columns at foundation level, fundamental time periods, maximum top storey displacements, storey drifts and storey shear in buildings, and compared within the considered configurations of hill buildings. At last, the suitability of different configurations of hill buildings has been suggested.As per analysis, as the number of bay increases seismic performance of the building increases. So in every cases it is not possible to increase the number of bays. So in order to overcome this problem, we are providing shear walls in every corner.A well designed system of shear wall in building frame improves seismic performance significantly.**

Key words: Hill buildings, Step-back and Step-back setback, Response Spectrum method, Earthquake analysis,Shear wall.

1. INTRODUCTION

In the last centuryEconomic development of hill areas has led to the re-examination of building style, optimum use of construction material and construction method. Due to scarcity of the plain land on hills, houses built on steep slopes, pose special structural and construction problems. RC framed structures constructed on hill slopes show different structural behaviour than on the plain ground. Because of steep slopes, buildings are constructed generally in step-back configuration, though a combination of step-back and setback buildingconfiguration is also common. There is a development of torsional moments due to the unsymmetrical nature of these buildings and eccentricity caused by the difference in the alignments of the centre of mass and stiffness at each floor. When the building is subjected to seismic forces an increase in the stress concentration has also been reported at the location of setbacks.A significant amount of research work has been done involving hill buildings. Past research have described different problems and suggested different techniques concerning mathematical modelling formulation and lateral load analysis of step-back and setback buildings.A shear wall structure is considered as one whose resistance to horizontal loading is provided entirely by shear walls. These shear walls have different applications such as a vertical cantilever in the form of separate planner walls and as non-planner assembles of connected walls around elevator, service shaft and stair. Shear walls have been the most common structural elements used for stabilizing the building structures against lateral forces. Their very high in-plane stiffness and strength makes them ideally suited for bracing tall buildings. The usefulness of shear walls in framing of buildings has long been accepted.In the present study three dimensional modelling of two different configurations of hill buildings has been undertaken and the effect of plan aspect ratio has been parametrically studied by varying plan dimensions and height of the models. Results have been discussed in terms of static and dynamic properties of buildings such as shear forces induced in the columns at foundation level, fundamental time period, maximum top storey displacements, storey drifts and storey shear in buildings and compared with in the considered configurations of hill buildings. And then shear walls are provided at the corners and compere the maximum top storey displacement.

2. METHOD OF ANALYSIS

Three dimensional space frame analyses of step-back setbackconfigurations of hill buildings involving the effect of plan aspect ratio have been carried out by parametrically varying plan and height of the models. The seismic analysis is carried out by using equivalent static approach and response spectrum method using finite element code ETABS v 9.0, and seismic parameters such fundamental time period, maximum top story displacement, story shear, story drift and column shear at ground level in each direction, i.e. along slope and across slope of hill, are determined using SRSS modal combination and compared within the considered configurations. Concrete, as constituent material, is assumed to be homogenous, isotropic and elastic in nature with modulus of elasticity and Poisson's ratio of concrete as 25000 N/mm2 and value of Poisson's ratio is 0.2. The yield stress of reinforcement steel is taken as 415 MPa. For seismic analysis, the floor system in the all the configurations is modelled as rigid frame diaphragm and beam and column members modelled as two node beam elements. The foundation in all the models is assumed to be fixed support system. The torsional effects and accidental eccentricity is considered in the analysis as per recommendations of Indian code IS 1893 (Part 1): 2002.

2.1 Geometrical properties

All the models have same geometrical and material properties, and rest on the same inclination of ground

Design Optimization of X-Bracing using SAP2000

Priya Venugopal[1], Revathy Parameshwaran[2], Sruthy K. P[3], Wilfred James[4],
[1,2,3,4]UG students, Department of Civil Engineering,
Mangalam College of Engineering
Ettumannoor, Kottayam

Sankar Bose[5]
[5]Assistant Professor,
Department of Civil Engineering,
Mangalam College of Engineering, Ettumannoor,
Kottayam

***Abstract*—this paper focuses on design optimization by studying the performance vs cost relationship of X-bracings using SAP2000 for an open ground storey structure during seismic loading. Bracings are provided to arrest lateral stress and prevent swaying of the given structure. The open ground storey creates a soft storey condition.**

***Keywords*—Open ground storey; soft storey; bracing; lateral stress, cost.**

I. INTRODUCTION

Steel braced frame is one of the structural systems used to resist earthquake and wind loads in multistoried buildings. Many existing reinforced concrete buildings need retrofit to overcome deficiencies to resist seismic loads. The use of steel bracing systems for strengthening or retrofitting seismically an inadequate reinforced concrete frame is a viable solution for enhancing earthquake resistance. Steel bracing is economical, easy to erect, occupies less space and has the flexibility to design for meeting the required strength and stiffness. Table 2 shows the position of steel bracing.

II. MODELLING

The building used for analysis is a four-storied RC building with a floor height of 3m as shown fig 1. The building is assumed to be located in a seismic zone V and the earthquake zone is plotted using fig 5. The table 1 provides data regarding the G+3 storey building.

Table 1. Design data of G+3 storey building

Sr.No.	Content	Description
1	No. of Storey	G+3
2	Floor Height	3m
3	Material	Concrete(M25) & Reinforcement (Fe415)
4	Size of Column	C1=300mm×300mm All column of G.F & Outer column
		C2=280mm×280mm Interior column for Ist & IInd Floor
		C3=250mm×250mm Interior column for IIIrd floor
5	Size of Beam	230mm×450mm

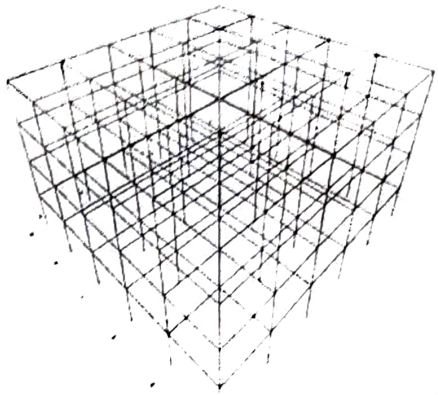


Fig 1. Base model of G+3

Fig 1 shows a G+3 Storey building with 5 bays in X & Y directions. Fixed restrains are provided at the bottom.

Table2. Different cases of providing bracing

Sr.No.	Designation	Position of bracing
1	Model 01	Without Bracing
2	Model 02	Bracing throughout
3	Model 03	Storey (1+2+3)
4	Model 04	Storey (2+3)
5	Model 05	Storey (3)
6	Model 06	Storey (1+3)
7	Model 07	Storey (G+2)
8	Model 08	Alternative direction

The X-bracings are provided at the exterior parameter of the structure. Soil conditions are considered medium stiff and a damping ratio of 5% and the importance factor taken is 1. The loads are provided as per IS 1893:2002 (Part 1). The structural data is the same for all the structures.

Investigation of Damages in Plan Irregular Buildings Due to Seismic Excitation

(Details for Structural Project and Analysis)

Amith. M. M[1]
[1]PG Student, Department of Civil engineering,
Mangalam College of Engineering,
Kottayam, Kerala.

D. Ramesh Kumar[2]
[2] Associate Professor, Department of Civil engineering.
Mangalam College of Engineering.
Kottayam, Kerala

Abstract— **Buildings suffer much less damages in earthquake than buildings with irregular configurations having simple regular geometry and uniformly distributed mass and stiffness in plan as well as in elevation. In the present study, an attempt has been made to analyze the seismic behavior of G+9 regular building and an irregular re-entrant corner building in zone V seismic zone using Etabs 2016. Irregularity can be vertical as well as horizontal. Vertical irregularities can be classified into four depending upon the distribution of mass, strength, stiffness and vertical setback. Horizontal irregularities are those with asymmetrical plan shapes, re entrant corners, diaphragm discontinuity and also irregular distribution of mass, strength, and stiffness along plan. Parameters such as base shear and time period are found out for the regular building. Base shear, time period, overturning moment and maximum storey displacement of re-entrant corner irregular building is found out. From this study, it is concluded that the re-entrant corner irregular buildings have much lower base shear force produce under earthquake forces as compared with the regular building with same structural configurations.. As a future scope seismic response of more re-entrant corner models with same structural details can be found and comparison can be done.**

Keywords—Regular building; irregular building; re-entrant corner; Seismic Analysis; ETABS2016; IS 1893:2002

I. INTRODUCTION

In this fast moving world, it is important to contribute more from the field of construction for a developing country like India. Demand of low rise buildings increases nowadays and within these buildings, irregular buildings comes due to increase in aesthetic preference and structural demands. The multistorey residential buildings can provide higher number of houses and requires less space of land. Most buildings are constructed by irregular in both plan and vertical configuration. Buildings suffer much less damages in earthquake than buildings with irregular configurations having simple regular geometry and uniformly distributed mass and stiffness in plan as well as in elevation. Irregularity can be basically divided into vertical irregularity and horizontal irregularity. Vertical irregularities can be classified into four depending upon the distribution of mass, strength, stiffness and vertical setback. As per IS 1893:2002, a storey in a building is said to contain mass irregularity if its mass exceeds 200 percent than that of the adjacent storey. If stiffness of a storey is less than 60 per cent of the adjacent storey; in such a case the storey is termed as weak storey, and if stiffness is less than 70 per cent of the storey above, then the storey is termed as soft storey. Strength irregularity and setback irregularity referring to sudden change of strength and geometry results in irregular distribution of forces or distribution over the height of the building. Horizontal irregularities are those with asymmetrical plan shapes, re entrant corners, diaphragm discontinuity and also irregular distribution of mass, strength, and stiffness along plan. An L-, U-, E- or other in plan shaped building where two wings may oscilate out-of-phase, leading to large shear stresses in floor and/or roof diaphragms. If the plan setback is at least 15 % of both plan dimensions, then the setback is considered to form a re- entrant corner. In architectural planning, setbacks on the facade, sections or parts placed at different angles, different plan solutions compared to basic geometries to adapt to the land are common design choices. The shape of H, L, T, U, Y, cross, or a combination of these forms are the typical examples of building configuration which have projections or wings in plan constituting re entrant corners. The building corners formed inwards, or outwards are one of the most common applications of geometric irregularities. These applications are subject to energy concentrations under the dynamic earthquake effects, resulting in severe stress concentration in the corners. Maver (1970) and Peña and Parshall (2001) defined architectural design as a trial-and-error process, which consists of several variables related to economy, aesthetics, functionality, and strength. The architectural design process is the stage of construction where the various features of the building are identified, and decisions are made concerning building characteristics that affect the building's structural behavior. In this phase, earthquake-resistant structure design should be considered if the structures are constructed in regions of high earthquake risk. A suitable structural system for architectural and functional design is determined by architects during the preliminary design phase. Architects need to comprehend the concepts of the necessary structural system and earthquake-resistant design to produce quality structures. Earthquakes usually cause damage to weak spots in the configuration of a building. If the decisions taken in the architectural design phase, which are crucial for the building's behavior against earthquakes, are based on the right information and using the right methods, design success will be increased, and a long-lasting and sustainable structure against earthquakes will be achieved. At this point, it is possible to say that the most acceptable design of the

Effects of Irregularities on the Seismic Response of A High-Rise Structure in ETABS

Paul Joseph[1]
[1]M Tech Student
Department of Civil Engineering
Mangalam College of Engineering
Kottayam, Kerala

Reni Kuruvilla[2]
[2]Assistant Professor
Department of Civil Engineering
Mangalam College of Engineering
Kottayam, Kerala

Abstract—**Structural engineers often come across buildings, which exhibit certain degrees of plane symmetry. It may even exist in a nominally symmetric structure, because of the uncertainty in the distribution of floor loads, uncertainty in the evaluation of the center of mass and center of stiffness, inaccuracy in the measurement of dimensions of structural elements, or lack of precise data on the material properties. The performance of asymmetric buildings under seismic excitation is very bad and its behavior is highly complex when compared to that of regular buildings. This paper focuses on the seismically induced torsion in symmetric RCC buildings. The equivalent Lateral Force Method is adopted as per IS 1893(Part-1)-2002 codal provisions to study the induced torsion. ETABS software package is used to carry all the static and dynamic analysis by keeping these models in different seismic zones from Zone II to Zone V. The discontinuities in a lateral force resistance path, such as vertical offsets, are also considered here. The main framework involved studying the effect of the irregular distribution of mass, asymmetric distribution of stiffness, and irregular plan configurations and comparing it with the seismic response of a regular structure. The results showed that Base shear and lateral displacement were increasing with an increase in the seismic intensity from Zone II to Zone V. Also the Base shear for mass irregularity is found more compared to all other irregularities.**

Keywords—Plan asymmetry; mass irregularity; irregular plan configuration; ETABS, seismic response; RCC structures; IS: 1893 (Part-1) - 2002.

I. INTRODUCTION

Seismic forces are caused by the inertia of the structure, which tries to resist the ground motions. As the shifting ground carries the building foundations along with it, inertia keeps the rest of the structure in place for a short while longer. The movement between two parts of the building creates a force, equal to the ground acceleration, time and, mass of the structure. To have a minimum force, the mass of the building should be as low as possible since there can't be control on the ground acceleration. The point of application of this inertial force is the center of gravity of the mass on the floor of the building. Once there is a force, there has to be an equal and opposite reaction to balance this force. The inertial force is resisted by the building and the resisting force acts at the center of rigidity (CR) on each floor of the building. An earthquake Ground Motions (EQGMs) are the most dangerous natural hazards where both economic and life losses occur. Most of the losses are due to building collapses or damages. An earthquake can cause damage not only on account of vibrations that result from them but also due to other chain effects like landslides, floods, fires, etc. Therefore, it is very important to design the structures to resist, moderate to severe EQGMs depending on its site location and the importance of the structure. If the existing building is not designed for earthquake then its retrofitting becomes important. Real structures are almost always irregular, as perfect regularity is an idealization and it very rarely occurs. Structural irregularities may vary dramatically in nature and principle, are very difficult to define. Regarding buildings, for practical purposes, major seismic codes distinguish between irregularity in plan and the elevation, but it must be realized that quite often structural irregularity is the result of a combination of both. To identify the torsionally irregular structures, IS 1893(Part-1)-2002 has given clear definitions of irregular buildings in Clause 7.1. An expression for the design eccentricity, which is very much needed for the analysis of torsionally unbalanced structures, is given in Clause 7.9 of the same. According to Clause 7.8.1, the method of analysis to be used for a structure depends on its irregularity, in addition to the total height of the structure and the seismic zone where it is situated. To understand the importance of codal provisions, which are specially meant for asymmetric buildings, an attempt is made in the present study considering various parameters, which are contributing to torsional irregularity.

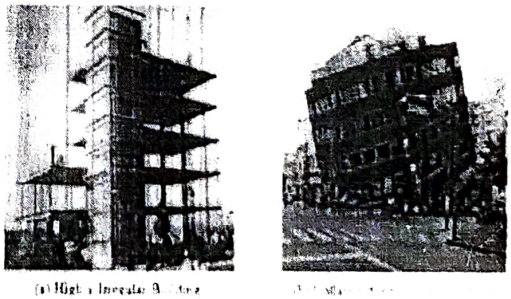


Figure 1:Asymmetric Structures and their Collapse

One of the greatest causes of damage to buildings has been the use of improper architectural-structural configurations. Building configuration is an important characteristic that affects building response. In more complex T-shaped or L-shaped buildings, forces concentrate at the inside corners

Sustainability, Agri, Food and Environmental Research, (ISSN: 0719-3726), 10(X), 2022:
http://dx.doi.org/

Sustainable water treatment technologies: a review. Tecnologías sustentables de tratamiento de aguas: una revisión.

Dr. Asha P Tom[1], Dr. Renu Pawels[2]

[1]Civil Engineering Department Mangalam College of Engineering Ettumanoor
Kerala Technological University Kerala, India
[2]Civil Engineering Department Cochin University of Science and Technology
Cochin, India
Corresponding author mail id: ashaptom@gmail.com, renupawels@gmail.com

ABSTRACT

The sustainability concept is emerged to maintain and strengthen "the ability of future generations to meet their own needs". The adaptive capacities of the world population can be strengthened by eradication of poverty and provision of healthy living conditions which takes the priority. This can be achieved by provision of education and basic infrastructure to the people, worldwide. Availability of high quality drinking water and assurance of hygienic safety is one of the most basic needs of any community, and subsequently a precondition of sustainable development of rural or municipal areas. Decentralized water management should be seriously taken into account in the present scenario of extremely varying climatic changes affecting the potential water resources of the world. Also the energy requirement of centralized water supply schemes is fueling the energy scarcity. Therefore, effective utilization of ground water resources can be the intelligent step the towards achieving sustainable living conditions. Additionally, the water demand in the agricultural industry has become an important concern, considering that more than 70% of freshwater is used for crop irrigation. Desalination is considered a promising solution for water production challenges, but the sustainability of the same needs a detailed study. The treatment of waste water is another necessary criteria to satisfy the basic demands of good quality water for human life and industrial use. In the present review, different methods of water treatment technologies are studied, to assess their contribution towards sustainable development. Water treatment technologies for drinking purpose, waste water purification and desalination were deliberated and the effectiveness of each in attaining sustainable habitat has been portrayed in this review. It was observed that sustainable technologies for water treatment can be a better solution to face the water scarcity challenges in the world as they are self-reliable while compared to other methods.

Keywords— Sustainability, Ground water, Desalination, Waste water, Biochar.

A Multiple Regression Approach for Compressive Strength Modelling of Recovered Coarse Aggregate (RCA) Impregnated Concrete Matrix

Dr.G.K.Arunvivek[1], Dr.D.Rameshkumar[2] Dr.D.Ambika[3]

1. Assistant Professor Department of Civil Engineering, Karpagam College of Engineering, Coimbatore, India. E-mail: arun.vivekgk@gmail.com.
2. Associate Professor, Department of Civil Engineering, Mangalam College of Engineering, Ettumanor,Kottayam, Kerala. India. rameshcivil2002@gmail.com
3. Assistant Professor Department of Civil Engineering, Kongu Engineering College Perundurai, Erode, India. ambikaceg@gmail.com

Abstract

The application of Multi-Linear Regression Analysis (MLRA) for strength prediction of concrete offers a technical guide for the designers. Strength characteristics of concrete are influenced by several parameters. In this study, an attempt has been made to predict the 28 days compressive strength of recovered coarse aggregate (RCA) incorporated concrete. An empirical model capable of predicting the compressive strength of recovered coarse aggregate (RCA) incorporated concrete is proposed. The empirical model consists of a rational polynomial equation having six independent variables. Mix proportioning elements were considered as the variables in the model. The developed empirical model is validated for conventional concrete and also for recovered coarse aggregate incorporated concrete. 28 trials were conducted with different mix proportions and the data obtained from the experimentation was utilized to develop the model. The developed model exhibits a reliable prediction of compressive concrete strength at 28 days with excellent efficiency. The predicted strength was in complete agreement with experimentally obtained values.

Keywords: Concrete matrix, Multiple regression, Recovered Coarse aggregate (RCA), Strength modelling.

Journal of Computational Electronics (2021) 20:855–863
https://doi.org/10.1007/s10825-020-01649-5

DC performance analysis of III–V/Si heterostructure double gate triple material PiN tunneling graphene nanoribbon FET circuits with quantum mechanical effects

Ritam Dutta[1] · T. D. Subash[2] · Nitai Paitya[3]

Received: 25 November 2020 / Accepted: 28 December 2020 / Published online: 25 January 2021

Abstract

In this article, the electrical behavior of laterally grown novel short-channel III–V/Si heterostructure double gate triple material PiN tunneling graphene nanoribbon field effect transistor (DG-TM-PiN-TGNFET) has been studied based on their quantum mechanical effect (QME). Firstly, by varying the device process parameters of the novel TFET structure, the DC parameter responses viz. threshold voltage, electric field and surface potential are investigated. Further these responses are analyzed by considering the QME for better device performance. Two-dimensional numerical device simulator (SILVACO TCAD) tool is used for simulating the quantum and semi-classical models. The simulation work has been validated by extensive analytical modeling, that reflected in our accurate graphical representations. Finally, to investigate the QME effect in circuit level applications, an TFET inverter circuit has been designed and its DC performance viz. power dissipation and propagation delay analysis is performed.

Keywords Graphene nanoribbon · Tunnel FET · Semi-classical model · Quantum model · Quantum mechanical effect (QME) · Numerical device simulator

1 Introduction

In last two decades, the device scaling has encouraged a new paradigm of nanodevice modeling and fabrication. The conventional device structures of metal oxide field effect transistors (MOSFET) have been outplayed for many limitations viz. short channel effects (SCE), drain-induced barrier thinning (DIBT) issues, scattering, etc., due to which the subthreshold swing also got limited to 60 mV/decade [1–5].

With the advent of device engineering and inclusion of multi-gate metal contacts, the limited subthreshold swing (ss) results much better than earlier structures. But continuous device scaling also got restricted, when the power dissipation and heat generation comes into the picture.

A new device physics, i.e., quantum tunneling came into this research domain, which outplayed the SCE, DIBT and many other limitations at ease. The tunneling field effect transistors (TFET) with double gate becomes more encouraging solution to limited swing, and also it boosts its drive current (I_{ON}) [6–8]. There were several multi-gate TFET structures that faced detrimental effects, viz. short channel effects, drain-induced barrier thinning (DIBT) and quantum mechanical effects (QME) [9–14]. After a detailed study of recent literature survey on DC performance of modified TFET structures, graphene nanoribbon-lapped double gate triple metal transistor (DG-TM-PiN-TGNFET) has been established by R. Dutta et al. [15] and validated by analytical modeling. The graphene material is used as a ribbon to reduce the energy gap, by virtue of which a better tunneling window was obtained in the energy band diagram (EBD).

✉ Ritam Dutta
ritamdutta1986@gmail.com

T. D. Subash
tdsubash2007@gmail.com

Nitai Paitya
nitai.p@smit.smu.edu.in

[1] Department of Electronics and Communication Engineering, Surendra Institute of Engineering and Management, Siliguri, West Bengal 734009, India

[2] Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kottayam, Kerala 686631, India

[3] Department of Electronics and Communication Engineering, Sikkim Manipal Institute of Technology, Rangpo, Sikkim 737136, India

Silicon
https://doi.org/10.1007/s12633-020-00739-0

ORIGINAL PAPER

Utilizing Radiant Nanoparticles in Silicon for Balanced White Color Adapters

Eugene Peter [1,2] · T. D. Subash [3,4] · T. D. Subha [5] · Alsufiyan Nazim [1,2]

Received: 3 August 2020 / Accepted: 24 September 2020

Abstract
This work fully depends on the silicon nanoparticles. It is represented as SiNPs. This depends on the transparent LEDs color converters. The spectrum obtained is fully white, so it is called as transparent spectrum. The wavelength of the spectrum ranges from ~460 to ~545 nm. For the construction of transparent spectrum, the color converters play a major role. The efficiency of the spectrum obtained by using this technique is 13 lmW^{-1}. The size of the nanoparticles is ~3.7nm.

Keywords Paracrystalline · Electroluminescence (EL) · Photoluminescence · White-emitting LED · Phospheres · Phosphor-converted white LEDs

1 Introduction

The radiant nanoparticles are too fine with 1 and 100 nm of diameter [1]. It is really risk to work with these fine radiant particles. To protect the workers from this risk World Health organization introduced some guidelines in 2017. The concentration of radiant fine particles is lower while comparing with the locations. The resolution of these particles is too high with highest efficiency [2]. The atomic number of a silicon element is 14. This silicon element is made by using particle called semiconductors [3]. The scientist Antoine Lavoisier clearly described about the concept of silicon in the year 1787. The chemical reaction for oxygen is high. So, it is better to choose silicon as a basic nanoparticle for obtaining radiant spectrum.

The concept nanoparticle silicon consists of a variety of properties in the silicon thin layer in the transition region through amorphous to ceramic particles stage. The microcrystalline silicon is simply called as nanocrystalline silicon. The structure of a nanocrystalline silicon is paracrystalline structure. The main advantage of nanocrystalline silicon is a greater versatility in electronics and higher stability [4]. By using geological, biological and meteorological processing, nanoparticles were generated [5]. In the fourth century, the nanoparticles were used by potters and glassmakers [6]. The term nanoparticles were first coined by the scientist Micheal Faraday. The nanoparticles are in different shapes like nanoflowers, nanospheres, nanochains, nanoboxes, nanorods, etc. [7].

The spherical shaped particles were called as micrometrics. The nanoparticles were applicable in cosmetics, polymers, soil, etc. The carbon materials play a major role in the electronic era [8]. The light-emitting diode (LED) is a light source

✉ Eugene Peter
eugene.peter@mangalam.in

T. D. Subash
tdsubash2007@gmail.com

T. D. Subha
tds.ece@rmkec.ac.in

Alsufiyan Nazim
alsufiyannazim5@gmail.com

[1] Department of Electrical & Electronics Engineering, Mangalam College of Engineering, Ettumanoor, Kerala, India

[2] Department of Electrical & Electronics Engineering, APJ Abdul Kalam Technological University, Thiruvananthapuram, Kerala, India

[3] Department of Electronics & Communication Engineering, Mangalam College of Engineering, Ettumanoor, Kerala, India

[4] Department of Electronics & Communication Engineering, APJ Abdul Kalam Technological University, Thiruvananthapuram, Kerala, India

[5] Department of Electronics & Communication Engineering, R.M.K. Engineering College, Kavaraipettai, Tamil Nadu, India

Published online: 02 October 2020

Silicon
https://doi.org/10.1007/s12633-020-00599-8

ORIGINAL PAPER

A Novel Approach to White Light Radiation from Silicon Based Tunnel Junction LEDs

Bibin Vincent[1] · S U Aswathy[2] · T D Subash[3] · T D Subha[4]

Received: 30 April 2020 / Accepted: 10 July 2020

Abstract
This paper examines another kind of white light radiating half and half diode, made out of a light producing GaN/InGaN LED and a layer of semiconductor nanocrystals for shading transformation. In contrast to standard white LEDs, the gadget is arranged to accomplish high shading transformation effectiveness by means of non-radiative vitality move from the essential LED to the nanocrystals. Driven structures with sub-10 nm partition the between quantum well and the surface and designed standard brilliant LEDs are considered for the half and half gadgets, which require closeness of the nanocrystals to the quantum well. The advancement of the cross breed diode creation counting process methods for GaN LED and joining of the nanocrystals are given the accentuation on the distinctions with standard LED preparing. Results and investigation of optical and electrical portrayal counting photoluminescence (PL), smaller scale PL, time-settled PL and electroluminescence (EL) together with current-voltage qualities are exhibited to assess the gadget execution. An away form of non-radiative vitality move was found in the transporter elements of both the LED and the nanocrystals when the quantum well – nanocrystals partition was under 10 nm. Examination of the outcomes shows that in request to accomplish adequate for the white LED shading transformation, better surface passivation and nanocrystals with shorter exciton lifetimes and more vulnerable auger recombination are required.

Keywords GaN · LEDs · Tunnel junction · Droop · MQW

1 Introduction

A striking advancement inside the field of light-discharging diodes (LEDs) has been accomplished during the previous a very long while. LEDs became ground-breaking and simultaneously vitality effective, with an assortment of distinctive discharge wavelengths from UV and violet (AlGaN and InGaN based) to dark red (in view of GaP and its sets of three) single wavelength diodes, just as multicolor and white LEDs [1, 2]. This innovation has formed into strong state lighting (SSL), dislodging other light sources after some time and along these lines pulling in immense consideration from the clients and makers. The makers were willing to improve nature of white LEDs and cut its manufacture costs utilizing new advancements, so as to make LEDs progressively alluring for the clients.

Despite the fact that white LEDs are broadly utilized now, both their significant expense also, somewhat more awful shading rendering contrasted with the customary bulbs push innovation to imagine and create better and less expensive gadgets by finding new ways, arrangements and materials. The greater part of as of now accessible white LEDs are based

✉ Bibin Vincent
bibin001@gmail.com

S U Aswathy
aswathy.su@gmail.com

T D Subash
tdsubash2007@gmail.com

T D Subha
tdsubha2010@gmail.com

1 Department of Computer Science and Engineering, KMEA Engineering College, Ernakulam, Kerala, India

2 Department of Computer Science and Engineering, Jyothi Engineering College, Thrissur, Kerala, India

3 Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kottayam, Kerala, India

4 Department of Electronics and Communication Engineering, R.M.K. Engineering College, Chennai, Tamilnadu, India

Published online: 03 August 2020

Peer-to-Peer Networking and Applications
https://doi.org/10.1007/s12083-020-00971-w

Security improvement in block chain technique enabled peer to peer network for beyond 5G and internet of things

S. Perumal Sankar[1] · T. D. Subash[2] · N. Vishwanath[1] · Deepa Elizabeth Geroge[1]

Received: 1 April 2020 / Accepted: 21 July 2020

Abstract
Secured data transmission and data sharing have always been a challenge on the Internet of things-based networks. Blockchain-enabled peer to peer (P2P) networks are suitable infrastructure for the Internet of Things (IoT) and Beyond 5G (B5G) applications. The advantage is that the distributed nature of architecture and security services provided by this network extends its use in all sort of financial transactions. There are many issues related to IoT based networks; Heterogeneous IoT devices, security, energy issues. This paper implements data security by employing private blockchain in SDN and public blockchain for peer to peer communication and a secured authentication method to validate the blocks in the network. To increase confidentiality and non-repudiation, it implements an additional component; here, the sender signs the particular operation while transferring the data from one user to another user. It is published with a public key and Public-key value-based signature generated with the private key of the transaction. Nodes authenticate this operation based on Public key value-based signature thus generated. The cryptography with hashing process provides better immutability. The results show enhanced security during data transmission and improved throughput, response time, reduction in end-to-end delay and overhead when compared to the existing methods. This work uses Pyethereum tester tool under the Ethereum platform.

Keywords Blockchain · Peer to peer network · Software DefinedNetworks · D2D communication · Internet of things · 5G services · Secure network

1 Introduction

The advent of 5G and Beyond 5G technologies provides faster speeds and improved reliability. Usage of the Internet has seen phenomenal growth with the implementations of these technologies. Communication engineering has been exploring its high technical intelligence to cover the entire applications, namely 5G and B5G. The world witnesses massive changes, for the benefit of humans, in the name of information services and IoT, courtesy these technologies. The Technology, IOT which connect all appliances with wireless (CAW) has introduced the change in the whole scenario of the society, fetch everything in its place in a jiffy. This technology helps in presenting smartness everywhere to meet the futuristic requirements of All Time Connectivity (ATC) with the amplest capacity and extensive coverage. But, with the heterogeneity of IoT devices, the vulnerability in data security and non-availability of the central controller, communication among IoT devices in the network face more significant challenges. These new generation networks shall have to find solutions to all sort of problems in communication with an assured security level, guaranteed bandwidth and no latency (Table 1).

The solution for the issues could be achieved by involving novel multi-skilling techniques to a common platform and integrate with advance technologies. We have to propose an architecture that ensures data security and availability of the central controller. Over the years, peer to peer networking has crafted an exact network configuration by offering shared network nodes with equal responsibilities without a central server to share the files in both directions. The association of blockchain technology with peer to peer network still deeply entrench the security level of the P2P network, making it the most popular and trusted network for sharing the critical files. In such a scenario, we have to provide a network connecting

This article is part of the Topical Collection: *Special Issue on P2P Computing for Beyond 5G Network and Internet-of-Everything*
Guest Editors: Prakasam P, Ajayan John, Shohel Sayeed

✉ S. Perumal Sankar
spsankar2004@yahoo.co.in

[1] Toc H Institute of Science and Technology, Ernakulam, Kerala, India

[2] Mangalam College of Engineering, Kottyam, Kerala, India

Published online: 01 August 2020

Silicon
https://doi.org/10.1007/s12633-020-00546-7

ORIGINAL PAPER

InAs/Si Hetero-Junction Channel to Enhance the Performance of DG-TFET with Graphene Nanoribbon: an Analytical Model

Ritam Dutta[1,2] · T. D. Subash[3] · Nitai Paitya[2]

Received: 25 March 2020 / Accepted: 1 June 2020

Abstract
In this paper, a new two-dimensional analytical model for our proposed InAs/Si based double-gate dual-metal tunnel field-effect transistor (DG-TFET) with graphene nano-ribbon is presented. Incorporating group III-V material in source – channel junction, which in turn forms heterojunction results better device performance. Moreover, thin graphene nano-ribbon placed over intrinsic channel can tune the energy gap to larger extent, which supports better band-to-band (B2B) tunneling in our model. Direct tunneling model is used for Indium Arsenide (InAs), since it is direct bandgap material. Obtained V_{th} as 0.19 V, sub-threshold swing (SS) as 20.76 mV/decade and I_{ON}/I_{OFF} ratio as 10^8 for the case of InAs/Si DG-TFET with graphene nano-ribbon shows an improvement of 48%, 36% and 10 decades respectively compared to conventional all-Si DG-TFET. Using 2-D TCAD numerical device simulator the proposed device model is designed and validated well with analytical data.

Keywords Graphene nanoribbon · Tunnel FET · Subthreshold swing · Band-to-band tunneling (B2B) · Work function · TCAD numerical device simulator

1 Introduction

In the era of nanoelectronics, the device dimensions are getting curbed and scaled down rapidly for transistors. This continuous scaling degradation issues have been limiting the metal oxide field effect transistor (MOSFET) models for better device applications. Limited theoretical subthreshold swing of 60mV/decade has now been outclassed for low power applications. In this backdrop, a new device physics focusing the band-to-band quantum tunneling is explored through tunnel field effect transistors (TFETs) [1–3].

It earned its popularity by providing steep slope i.e., less subthreshold swing (SS), controlled leakage current (I_{OFF}), better threshold voltage and drain current. Several research works help us to find further limitations of tunnel FET [4, 5]. One of the major limitations is poor drain current (I_{ON}). Various research works on device engineering and material engineering have been performed and validated with experimental data in recent times. Multigate and dual metal incorporation boosts the carrier transport through intrinsic channel [6–9]. This in-turn, shrink the tunnel barrier width and open an overlapping window between the energy bandgap of source and channel regions of n-type material. Various research works also highlighted on the improvement issues for using hetero-gate dielectrics, dual gate metals, multi gate, gate-source/drain overlap – underlap designs. Earlier works on single metal gate and double metal gate is thoroughly investigated for identifying its limitations [10–13].

In this work, the group III-V materials viz. Indium Arsenide is introduced for its less energy bandgap compared to Silicon, better electron mobility, hole mobility and auger recombination rate. For further device performance enhancement, recent literature surveys on nano-transistor device trend with typical nano-tubes or nano-wires are studied [14].

✉ Ritam Dutta
ritamdutta1986@gmail.com

T. D. Subash
tdsubash2007@gmail.com

Nitai Paitya
nitai.p@smit.smu.edu.in

1 Department of Electronics and Communication Engineering, Surendra Institute of Engineering & Management, Siliguri, West Bengal 734009, India

2 Department of Electronics and Communication Engineering, Sikkim Manipal Institute of Technology, Rangpo, Sikkim 737136, India

3 Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Ettumanoor, Kerala 686631, India

Published online: 10 June 2020

Silicon
https://doi.org/10.1007/s12633-021-01147-8

ORIGINAL PAPER

Improved DC Performance Analysis of a Novel Asymmetric Extended Source Tunnel FET (AES-TFET) for Fast Switching Application

Ritam Dutta[1,2] · T. D. Subash[3] · Nitai Paitya[2]

Received: 24 March 2021 / Accepted: 5 May 2021

Abstract
A two-dimensional analytical model for asymmetric extended source tunnel field effect transistor (AES-TFET) has been developed to obtain better device performance. The proposed device model has been analytically modelled and performed by solving 2-D Poisson's equation. Surface potential distribution, electric field variation and band-to-band tunneling (BTBT) rate have been investigated by this numerical modelling. The source region of novel structure of TFET has been extended (varied 2 nm to 6 nm) to incorporate corner effect, which allows BTBT through a thin tunneling barrier, with controlled ambipolar conduction. This eventually produces better source-channel interface tunneling for a *n*-type AES-TFET. 2-D numerical device simulator (SILVACO TCAD) has been used for simulation work. The simulated work has been finally validated by analytical modelling of AES-TFET. Better I_{ON}, I_{OFF} and switching ratio has been obtained from this novel TFET structure.

Keywords AES-TFET · Surface potential distribution · Electric field variation · BTBT · TCAD · Numerical modelling

1 Introduction

With the advent of nanoscience and nanotechnology in nano-scaled devices, the physical sizes of transistors have been scaled down categorically. By following the ITRS road map, the device parameter miniaturization has reached its limit for metal oxide filed effect transistors (MOSFETs) [1]. In this connection, various scaling issues has been emerged in last two decades viz. short channel effects (SCE), drain induced barrier lowering (DIBL) [2]. To overcome these issues, continuous research is going on in novel structures of MOSFETs. But in present scenario, the limited subthreshold swing (SS) of MOSFETs at around 60mV/decade has been a major drawback for researchers.

Keeping all device parameter scaling issues in mind, a new device physics has been inculcated in nanodevice engineering. In this case quantum tunneling has been introduced as a solid replacement of earlier FETs [3]. The typical energy band structure with ultra-thin barrier helped researchers to develop tunneling junction devices (TJD) using band to band tunneling (BTBT) phenomenon. In this paper, prior to this work, several literatures were surveyed based on structural and material engineering [4–14]. The effect of homogeneous and heterogeneous material in tunneling junctions [15], effect of pocket intrinsic doping on single as well as multi gate tunneling FETs [16, 17], effect of device performance based on various high-*k* materials [18], stress-strain effects in source-channel (*n*-type) and drain-channel (*p*-type) TJDs [19], usage of carbon nano-tubes (CNT) in tunneling FETs [20], nano-wire tunneling FETs [21], capacitive effects in modified TJD structures [22], various symmetric and asymmetric tunneling device structures has been studied to meet the earlier mentioned scaling issues and device performance factors.

In our paper the typical extended design of source region has been modelled to introduce corner effect in source-channel junction for *n*-type TFET. The entire device structure

✉ Ritam Dutta
ritamdutta1986@gmail.com

T. D. Subash
tdsubash2007@gmail.com

Nitai Paitya
nitai.p@smit.smu.edu.in

[1] Department of Electronics and Communication Engineering, Surendra Institute of Engineering & Management, MAKAUT, West Bengal 734009, India

[2] Department of Computer Science and Engineering, Sikkim Manipal Institute of Technology, Sikkim 737136, India

[3] Department of Electrical and Electronics Engineering, Mangalam College of Engineering, Kerala 686631, India

Published online: 18 May 2021

[illegible]

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

COVID 19 an infectious disease influenced in modern era - recent survey in India

[illegible] Subash [a], [illegible] Subha [b], [illegible] [c], Abuliyan Nasim [d], Eugene Peter [e]

[illegible] Department of Electronics & Communication Engineering, [illegible] College of Engineering, [illegible], Kerala, India
[illegible] Department of Electronics & Communication Engineering, [illegible] Engineering College, [illegible], Tamil Nadu, India
[illegible]
[illegible] Department of [illegible] Engineering, [illegible] College of Engineering, [illegible], Kerala, India
[illegible] Department of [illegible] Engineering, [illegible] College of Engineering, [illegible], Kerala, India

ARTICLE INFO

Article history:
Received [illegible] September 2020
Accepted [illegible] October 2020
Available online [illegible] October 2020

Keywords:
SARS-CoV (Severe Acute Respiratory System Coronavirus)
WHO (World Health Organisation)
MERS (Middle East Respiratory Syndrome)
[illegible]

ABSTRACT

The virus which is called as corona spoiling many of human lives as well as countries growth. Coronavirus is an infectious disease, so spreading from one person to other easily. Till now there is no medicine for corona. World Health Organization (WHO) taking lot of steps to control it. In India many of them get affected by coronavirus called COVID 19. A household survey is conducted nationally through online. This survey is a method for checking knowledge about the infectious virus. In this online survey some questionnaires were asked. People take their own interest and submit their reply through mobile phone and laptop/desktop devices. After analyzing the survey, it is clearly proved that people didn't have enough knowledge about COVID-19.

1. Introduction

The word corona described from the Latin word Crown. Coronavirus is a virus which affects animals during 19th century. M.C. Hawn and Arthur Schalk from North Dakota described about coronaviruses [1] affected chickens in 1930's. The virus spreaded chicken is called as IBV (Infectious Bronchitis Virus). In 1940's the coronaviruses which spreaded for animals are called MHV (Mouse Hepatitis Virus) and TGEV (Transmissible Gastroenteritis Virus) [2]. British Medical Research Council give a description about coronavirus in the year 1960 [3]. In 1960's coronavirus first discovered was a large family of viruses [4]. Due to this illness for people and animals are affected a lot. These viruses severely affect the respiratory system. So, it is called as Severe Acute Respiratory System Coronavirus (SAR CoV). Many of them affected mildly were recovered without any kind of special treatment. But severely affected persons were unable to recover. In 2019, it introduced in Wuhan (China) followed that it spreads throughout the world [illegible]. If it is infected by a person, its unable to predict for the first 14 days. Due to this reason, it's difficult to avoid spreading. The symptoms include fever, difficulty in breathing and flu like symptoms. The precaution measures are maintaining social distance of 2 m, staying home, wearing mask and washing hands for every 20 min.

The origin of human virus is shown in Fig. 1. Two kinds of coronaviruses are detected, 1) SARS (Severe Acute Respiratory System) and 2) Middle East Respiratory Syndrome (MERS). In 2002 to 2003 SARS occurs around the world, nearly 800 death and around 8,000 people infected [5]. In 2012 MERS sporadically occurs, due to these 900 deaths and around 2,500 people infected [6]. The common human coronaviruses are a) Alphacoronaviruses (HCoV 229E, HCoV NL63) and b) Betacoronaviruses (HCoV OC43, HCoV HKU1). Dorothy Hamre and John Procknow the medical students of the University of Chicago discovered a new cold virus called 229E which affects kidney well in 1965 [7]. In 1967, June Almeida, a Scottish Virologist gave a study about two novel strains B814 and 229E at St. Thomas Hospital in London [8]. A virus called IBV (Infectious Bronchitis Virus) is a mouse hepatitis and a novel cold virus is known as coronaviruses introduced in Wuhan in 2019 [12]. In Wuhan, there is a wet market, in that large number of fishes, birds and animals were sold. Due to this the viruses easily jumped from animals to humans. Thus Covid 19 has been identified. Within a

* Corresponding author.
E-mail address: [illegible] (E. Peter).

https://doi.org/10.1016/j.matpr.2020.[illegible]
2214-7853/© 2020 Elsevier Ltd. All rights reserved.

Silicon
https://doi.org/10.1007/s12633-020-00739-0

ORIGINAL PAPER

Utilizing Radiant Nanoparticles in Silicon for Balanced White Color Adapters

Eugene Peter[1,2] · T. D. Subash[3,4] · T. D. Subha[5] · Alsufiyan Nazim[1,2]

Received: 3 August 2020 / Accepted: 24 September 2020

Abstract

This work fully depends on the silicon nanoparticles. It is represented as SiNPs. This depends on the transparent LEDs color converters. The spectrum obtained is fully white, so it is called as transparent spectrum. The wavelength of the spectrum ranges from ~460 to ~545 nm. For the construction of transparent spectrum, the color converters play a major role. The efficiency of the spectrum obtained by using this technique is 13 lmW^{-1}. The size of the nanoparticles is ~3.7nm.

Keywords Paracrystalline · Electroluminescence (EL) · Photoluminescence · White-emitting LED · Phospheres · Phosphor-converted white LEDs

1 Introduction

The radiant nanoparticles are too fine with 1 and 100 nm of diameter [1]. It is really risk to work with these fine radiant particles. To protect the workers from this risk World Health organization introduced some guidelines in 2017. The concentration of radiant fine particles is lower while comparing with the locations. The resolution of these particles is too high with highest efficiency [2]. The atomic number of a silicon element is 14. This silicon element is made by using particle called semiconductors [3]. The scientist Antoine Lavoisier clearly described about the concept of silicon in the year 1787. The chemical reaction for oxygen is high. So, it is better to choose silicon as a basic nanoparticle for obtaining radiant spectrum.

The concept nanoparticle silicon consists of a variety of properties in the silicon thin layer in the transition region through amorphous to ceramic particles stage. The microcrystalline silicon is simply called as nanocrystalline silicon. The structure of a nanocrystalline silicon is paracrystalline structure. The main advantage of nanocrystalline silicon is a greater versatility in electronics and higher stability [4]. By using geological, biological and meteorological processing, nanoparticles were generated [5]. In the fourth century, the nanoparticles were used by potters and glassmakers [6]. The term nanoparticles were first coined by the scientist Michael Faraday. The nanoparticles are in different shapes like nanoflowers, nanospheres, nanochains, nanoboxes, nanorods, etc. [7].

The spherical shaped particles were called as micrometrics. The nanoparticles were applicable in cosmetics, polymers, soil, etc. The carbon materials play a major role in the electronic era [8]. The light-emitting diode (LED) is a light source

✉ Eugene Peter
eugene.peter@mangalam.in

T. D. Subash
tdsubash2007@gmail.com

T. D. Subha
tds.ece@rmkcc.ac.in

Alsufiyan Nazim
alsufiyannazim5@gmail.com

[1] Department of Electrical & Electronics Engineering, Mangalam College of Engineering, Ettumanoor, Kerala, India

[2] Department of Electrical & Electronics Engineering, APJ Abdul Kalam Technological University, Thiruvananthapuram, Kerala, India

[3] Department of Electronics & Communication Engineering, Mangalam College of Engineering, Ettumanoor, Kerala, India

[4] Department of Electronics & Communication Engineering, APJ Abdul Kalam Technological University, Thiruvananthapuram, Kerala, India

[5] Department of Electronics & Communication Engineering, R.M.K. Engineering College, Kavaraipettai, Tamil Nadu, India

Published online: 02 October 2020