Location Analysis and Fast Recursive Transmission Algorithm (FRTA) In WSN

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Abstract—Vehicular ad-hoc networks (VANETs) technology has emerged as an important research area over the last few years. This article presents state-of-the-art of VANET and discusses the related issues. A reliable transmission protocol is presented based on any cast routing. Using Optimizing Route Request Response Technique as a contribution, control overhead is minimized in the proposed protocol. Signal from the fall detection system is transmitted. Our work enhances the reliability in packet transmission by predicting energy robust and near-by nodes in the data forwarding path towards the destination, using collision Detection avoid algorithm. Consumption without trading off with the speed of data communication which is achieved at the cost of minimal overhead charges. Using Optimizing Route Request Response Technique as a contribution, control overhead is minimized in the proposed protocol. Fast routing protocol is proposed to guarantee the multi-hop wireless link between the source and destination using Fast Location Transmission Algorithm (FLTA). Opposite direction nodes are used to relay emergency packets to intended recipients by using multi-hop routing method. Prevent vehicles from bumping into bad traffic congestions resulted from the unawareness of traffic conditions that could consume long hours of delay. Method is proved competent for establishing a reliable and effective multi-hop very fast Transmission. To achieve such requirement, a routing protocol that is capable of reducing packet loss which results in fast message dissemination and reduced redundancy must be utilized.
Index Terms— communication, Integrated, networks, Adaptive, Sensors, Communication, Vanet.

INTRODUCTION

Vehicular Ad-Hoc Network

VANET is a part of MANET where every node travels generously within the network. It covers the entire network and keeps on connected. Each node communicates with other nodes in single hop or multi hop. The VANET structure, where vehicular networks system consists of large number of nodes, approximately number of vehicles exceeds 800 million in the world today; these vehicles will require an authority to govern it. The improvement in wireless communications technology and the concept of car network has diverted the attention over worldwide. Each vehicle communicates with other vehicles using short radio signals for a range of 1 km., this communication is an ad hoc communication that means each connected node move freely, no wires required.

Vehicular network lacks of long life context, so personal contact of user's device hot spot and require long life password and this will be impractical for securing VC. The connectivity between nodes is highly transient, and will not occur again. The vehicles are traveling throw reporting area and it make association with other vehicles. The connections will be lost as every car has a high mobility, and pass through in opposite direction. Each vehicle has on board unit and connects the vehicle with RSU via short radio signals, and another device is Tamper Proof Device which holds the vehicle secrets, all the information about the vehicle like keys, drivers' identity, trip details, and speed etc.

Vehicular networks bring innovative ways of presenting the road traffic management and safety applications. For the foremost time, it is possible for vehicles to exchange information and build fine-grained knowledge about the current situation, estimating risks and adapting their driving. Central to these applications is the need to exchange information in an extremely dynamic environment, building a view of the modern situation before the surroundings change. This in turn requires the distributed algorithms to join on low error margins quickly. VANET protocols are classified as topology based and position based protocols. Research showed that position based protocols are more suited to VANETs as compared to topology based protocols because geographic routing does not involve an overhead and delay of maintaining routing tables instead geographic position of nodes is used for routing which can be obtained by Global Positioning System (GPS) device on vehicles. In this paper, two geographic routing protocols Anchor based Street and Traffic Aware Routing (A-STAR) and Greedy Perimeter Stateless Routing (GPSR) protocols are evaluated on real city map. Simulation of VANETs on real map scenarios provide accurate results and also useful to design and deploy VANETs in real world. Real world mobility model is important because it reflects

real-world performance of protocols considered. Analysis of performance is carried in terms of throughput, packet delivery ratio, packet loss and average delay. GPSR is based on technique of Greedy Forwarding. Routing around the Perimeter technique is used when condition of local maximum is encountered in the technique of Greedy Forwarding. A-STAR incorporates traffic awareness and it also use recovery technique of anchor paths that is found more efficient in real city environments.

Related Study

Lack of Acknowledgment Techniques in IEEE 802.11p Standard

Mozhdeh Gholibeigi et al., (2016) Intelligent Transportation Systems in the domain of vehicular networking, have recently been subject to rapid development. In vehicular ad hoc networks, data broadcast is one of the main communication types and its reliability is crucial for high performance applications. However, due to the lack of acknowledgment techniques in IEEE 802.11p standard, it is challenging to ensure communication reliability. In this work, analytically model a receiver-oriented reliability mechanism, with the objective of on-demand error recovery for multi-hop broadcast vehicular communication. In particular, using absorbing Markov modeling and probabilistic graphical modeling, we analyze its performance in terms of relevant indicators, such as overhead and delivery ratio. Further, the model is validated using simulations. The results are useful in tuning the influential parameters and accordingly adjusting trade-offs and meet performance requirements in various circumstances. In this paper, we analytically modeled and evaluated a reliability assurance mechanism, for multi-hop broadcast setting, as a means of providing detailed insight into the system functionality. Using simulations, we proved the validity of the model. These observations are useful for designing relevant optimization schemes, for reliable data dissemination. For instance, parameters such as nodes' transmission range or, particularly in this case, the number of retransmissions could be tuned, given various network densities and channel conditions.

Anna Pereira et al., (2008) The main objective of Vehicular Ad Hoc Networks (VANETs) is reliable delivery of emergency warning messages so that drivers can make well-timed decisions and prevent mishaps. The dynamic vehicular environment in VANETs makes it necessary to examine its effects on the network to ensure that the messages reach the intended vehicles in its range, on time. The objective of this paper is to monitor the 802.11 broadcasting protocol, 802.11e EDCA, as well as 802.11e EDCA with an adaptive contention window. The performance of these protocols is observed keeping in mind their sensitivity towards modeling of the vehicular environment. The results show that it is extremely important to consider the interaction between various vehicular settings and the network in order to build an efficient, robust and reliable broadcasting protocol, suitable for vehicular networks.

There is a need to examine different elements of the mobility environment when modeling the network topology in VANETs. Some of these parameters like direction of traffic can boost network connectivity if considered during protocol design. Certain elements like signals can be ignored as they do not in any way affect network performance. The impact of the combined interaction of all these factors should also be kept in mind. Factors that degrade performance such as the clustering effect due to congestion and the presence of intersections should be scrutinized carefully, and methods to nullify their influence must be investigated. Muhammad Tahir Abbas et al., (2017) Intelligent Transportation System (ITS) have been attracting a significant attention among the researchers due to its numerous applications that will pave the path towards the faster, safer and enjoyable journeys.

2.2 Infrastructure-Assisted Hybrid Road-Aware Routing

However, these applications require a reliable routing protocol along with a robust, secure and fast connection to infrastructure. In this paper, we propose an Infrastructure-assisted hybrid road-aware routing (IH RAR) and QoS Provisioning for VANETs. I H RAR utilities RSUs to efficiently relay packets towards remote vehicles and IP users. Furthermore, we have proposed an exclusive QoS routing algorithm by opting an approach of localization between intersections of a road segment. I H RAR aims to choose reliable and fast routes between source and destination with the usage of RSU and by calculating QoS parameters. I H RAR does not require the specific deployment of RSUs.

Faisal Khan et al., (2012) Reliability is a critical concern in disseminating safety messages in vehicular ad-hoc-networks (VANETs). Thus far, redundant broadcast (or next relay broadcast) has been used to ensure reliable transfer of safety messages. However, redundant broadcast fails to meet high-reliability requirement owing to lack of a feedback or acknowledgment (ACK) mechanism. In this work, a power controlled negative-acknowledgment (NACK) mechanism is introduced as a feedback technique to ensure reliable reception of safety messages.

Significantly, this work also attempts to cover vehicles present in transmission holes in the broadcast region. Vehicles in the immediate neighborhood detect and recover safety message for a vehicle present in the transmission hole by estimating propagation loss for the vehicle NACK together with whole detection and recovery mechanism nearly guarantees safety-message delivery in VANETs.

Reliability of the proposed technique is formulated mathematically with packet reception ratio (PRR) as the reliability metric. Using theoretical analysis and simulation evaluation in ns-3 we establish that the proposed technique guarantees safety-message reception by mitigating packet loss caused by interference from hidden nodes, and at instances where vehicles are located in the transmission holes. We have proposed the concept of smart neighborhood where we designate neighbors present in a confined immediate neighborhood to carry the responsibility of ensuring successful reception at each of their corresponding neighbors. The proposed technique aims to guarantee the reception of safety messages to all the related vehicles (endangered by an event) on the road. The reception of a message is ensured through the use of negative acknowledgement (NACK) mechanism together with constant observation by the immediate neighbors. NACK, unlike in conventional networks, is broadcasted only in the immediate neighborhood to maintain effective channel utilization. Power controlled NACK broadcast by the given node and its subsequent response from a neighboring node accounts for reporting that the message is received in error and its subsequent rescue (or recovery). Moreover, in order to cover vehicles located in transmission holes we have employed constant observation of the immediate neighborhood by each vehicle.

2.3 Vanets In Order to Provide Reliable and Scalable Communication

Golnar Khomami et al., (2013) VANETs (Vehicular Ad-hoc Networks) safety applications use broadcasting to disseminate the critical safety related messages among dynamic multi-hop vehicular networks. The flooding (blind broadcasting) method poses several technical challenges like packet redundancy, contention and collision problems. However, VANETs face different challenges in different environments. There are different techniques that have been proposed to address the challenges of broadcasting safety messages in VANETs in order to provide reliable and scalable communication to enhance application benefits. This paper provides a review of related techniques for V2V communication of safety messages from two perspectives: first the solutions to VANETs challenges in general, and second the techniques for specific environments (highway, urban or rural areas).

At the end of this paper a novel approach towards solving broadcast storm problem will be discussed. However, it ought to be noted that, in case of broadcast storm problem in dense networks, any extra transmission could worsen the highly congested channel and in many cases due to broadcast storm even the beacons might not be received. Although there are some beacon control mechanisms to adjust beacon generation rate, it is important to find a solution to check the density of the network without adding extra load to the channel and at the earliest stage possible. Since messages will arrive first at physical layer a possible solution for broadcast storm detection could be evaluating and analyzing the effect of the density of the network on physical layer variables. The collected information from the physical layer can be used in higher layers as valid data for a reliable Broadcast Storm detection technique.

Ata Ullah et al., (2019) with the rapid growth in connected vehicles and related innovative applications, it is getting keen interest among the researchers. Vehicular ad-hoc networks (VANETs) comprise of interconnected vehicles with sensing capabilities to exchange traffic, weather and emergency information. Intelligent transportation system (ITS) supports better coordination among vehicles and in providing reliable services. In VANET, topology is dynamic due to the high mobility of vehicles, therefore, the existing topology-based schemes are not suitable. In this paper, we have explored position based routing (PBR) protocols for VANETs by presenting a taxonomy. The existing survey papers have focused on PBR schemes but we have further focused on considering PBR for the city environment along with connectivity aware routing schemes. Moreover, linear programming, genetic algorithms, and regression-based schemes are also included. To further evaluate the strengths and weaknesses of PBR schemes, a categorical evaluation of different architectures, path strategies, and carry-forward strategies are presented. Currently, no architecture is presented for FoG-oriented VANET using parked vehicles as guards for anchor points or junctions. To fill this aspiring demand, we have presented a FoG-oriented VANET architecture that can support the PBR by utilizing road junctions for path selection. It also involves the vehicles in the parking area for packet transmission. Further, we have proposed to use parked vehicles near junction as an option for selecting guarding vehicle along with IT'S as well. It reduces the probability of extensive carry forward-based communication due to the absence of guarding nodes. The records at parked vehicles can be upgraded at neighboring parked vehicles as well during the beaconing or exchange of data messages. The architecture supports better packet delivery ratios,

end-to-end delay, transmission time, and communication cost. Moreover, opportunities and challenges of the proposed architecture are also explored to attract researchers toward this area of research.

2.4 Particularly Important For Extending Range Of Safety

Kazi Atiqur Rahman et al., (2014) The DSRC/WAVE system is standardized to disseminate safety critical information using IEEE 802.11p as a MAC protocol. Studies show that IEEE 802.11p does not address adverse effects of asymmetric radio link and mobility related problems in vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communications. This paper presents a cross-layer (i.e. MAC and network) algorithm to address these problems for making the V2V and V2I communications efficient and reliable. The analysis shows that the proposed cross-layer algorithm removes contention in channel accessing and confirms a better channel utilization. The solution can be used to disseminate information up to three hops without using a routing protocol. This is particularly important for extending range of safety critical and emergency related messages in the vehicular network. A cross-layer based MAC algorithm, called CESFRA, is presented to disseminate the network layer information up to three hop neighborhood. The proposed protocol resolves contention for channel access effectively and reduces collisions due to HS, MHS, and ARL problems successfully. With these improvements, CESFRA provide DSRC/WAVE to achieve its objectives in safety and emergency communication scenarios.

Tankut Acarman et al., (2015) Vehicular Ad-hoc Network (VANET) is an emerging solution introduced to enhance active safety and to disseminate infotainment messages in the dynamically changing vehicular network. Communication between vehicular nodes in VANET enables information exchange about road hazards and traffic situation with the capability of extending sensing range via relaying and broadcasting the data packet. But Vehicle-to-Vehicle (V2V) communication requires fast, reliable and lossless data transmission for a large set of services. In this study, the navigation map data and routing information is used to forward the data packet towards its destination. Mainly, routing decision is made at the intersection zones.

In order to assure fast and lossless packet delivery performance, distance on the road map and wireless access measurements are used to calculate the cost. Finally, the presented local routing algorithm routes the data packet towards a vehicular node in a neighbor intersection zone to relay the data packet towards its destination. Simulation scenario of an urban area is implemented in the vehicular network simulator (ns-3) and mobility (SUMO) simulator platforms. As a proof-of-concept, the effectiveness of using local routing algorithm taking into account the wireless access measurements is demonstrated.

2.5 A Timeout Mechanism Causes Retransmission

Local routing algorithm is developed in this paper. VANET measurements are leveraged to choose the intersection for relaying purposes in order to assure fast and lossless packet delivery. A timeout mechanism causes retransmission of the data packets in VANET if the relaying vehicular node in the selected intersection cannot deliver the data packet in a given timeout duration. The local routing algorithm and reliable transmission protocol can be implemented in an urban area by using a commercial navigation map data, connectivity information of road IDs and an inexpensive GPS receiver.

Shaik Shafi et al., (2016) Cooperative routing has gained promising approach in Adhoc networks where nodes are assumed to be static. Recently there has been an increased heed in the cellular and vehicular Adhoc Networks (VANETs) where links between vehicles to vehicle are not fixed and inefficient. Towards this there exists only one cooperative routing scheme, Cross layer Cooperative Routing (CLCR) for route discovery on the fly similar to AODV, which requires more transmission power and energy consumption due to redundant transmission of Hello messages. Here an efficient cross layer routing mechanism is identified by the use of weighted Neighbor stability algorithm (WNS), which provides more stable, reliable routing path. Furthermore based on the simulation results using Network Simulator 2(NS-2) shows the new routing mechanism shows graceful performance in terms of packet delivery ratio, average end to end delay and throughput. In this paper we have presented an improvement of Cross Layer Cooperative Routing (CLCR) protocol by proposing a new metric to evaluate routes. This metric is based on nodes weight computed by combining two parameters which are the power of node and its stability assumed to be the most important parameters in choosing routes. Despite the large number of research done and fast significant progress that being made in cooperative routing in recent years, numerous techniques for research is remain.

Keming DU et al., 2010 which aims at providing the vehicle passengers with a low-cost access to the Internet via on-road gateways. This paper introduces a new strategy for deploying Internet gateways on the roads, together with a novel scheme for data packet routing, in order to allow a vehicle to access the Internet via multihop

communications in a VANET. The gateway placement strategy is to minimize the total cost of gateway deployment, while ensuring that a vehicle can connect to an Internet gateway (using multihop communications) with a probability greater than a specified threshold. Ad hoc networks have characteristics such as flexibility, fast and easy deployment, and robustness which make them an interesting technology for various applications. Ad hoc networks are considered as the most promising terminal networks in future mobile communications. Providing sufficient bandwidth for multimedia applications in ad hoc networks is an urgent task because of the rising popularity of multimedia applications and potential commercial usage of ad hoc networks.

Bandwidth is more difficult to guarantee in ad hoc networks than in other types of networks, and providing end-to-end bandwidth guarantee is a critical and challenging problem in ad hoc networks because of multihop, mutual radio interference and node mobility. The fundamental property, which distinguishes ad hoc networks from other wireless architectures, is that all nodes are capable of moving and can be connected dynamically in an arbitrary manner, nodes mobility causes the network topology to be continuously changed. To satisfy the requirements of ad hoc networks, lots of new routing algorithms are brought forward. A route of approximately maximum bandwidth can be found rapidly by this bandwidth-aware routing protocol so that data can be transferred promptly from the source node to the destination node with sufficient throughput.

Methodology

EXSITING SYSTEM

The protocol also shortens the latency of path recovery by initiating route recovery from the intermediate routers of the original path. Traffic and end-to-end transmission delay are the results observed from the above schemes. Emergency messages to adjacent nodes not intimation on the opposite road. Intended recipients are nodes moving on the same direction with the sender but by using totally delay packets Transmission. Collision not mention for the process cost effective.

This resulted in farther nodes having lower reservation ratio. Less reliability of transmission thus contribute to low success rate of receptions. However, if there is more than one node receiving duplicate packets.

PROPOSED SYSTEM

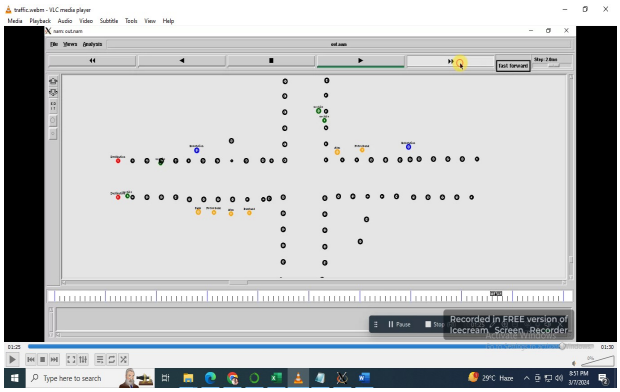
Many routing protocols have been proposed to meet various requirements and scenarios. They are also known as northbound and southbound interface a path labeling scheme, whose selection is optimally done by controller. The various stages of routing include labeling the path, also storing the path in case of failure recovering the path. The various scenarios are designed using various topologies tree, ring and spanning tree. The placement of switches is done as per designed topology. All these routing protocols have to deal with the frequent link-break problem, which is usually caused by either the mobility of the nodes or the instability of the wireless channels.

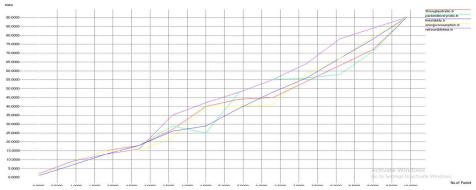
FAST LOCATION TRANSMISSION ALGORITHM

Directly on the controlled object intrinsic implicit parallelism, easy to distributed computing, rather than rapid decline in trap into local optimal solution, which can quickly search out all solution in the space. Fast Location Transmission Algorithm (FLTA) by using the probability optimization method, it can automatically acquire and optimize the search space, and self-adaptive adjust the search direction. It has higher global searching and optimizing ability. Collision avoidance dynamic system mathematic model based on ship separation type motion mathematic model combined with classical Control theory. Conventional partial path planning methods provided a certain reference for ship collision avoidance.

However these methods usually consider ship as a particle, ignoring its maneuvering characteristics and the influence of external conditions on ship sailing. However, in complicated marine environment, when ship avoids obstacles, at the same time it also affected by the storm flow. Therefore, such ideal method of ship collision avoidance is limited in practical significance on the sea. Ship collision avoidance should not only consider how to plan path on fixed encounter case, the path planning under the dynamic environment also need to be taken in consideration.

Results and Discussions





Conclusion and Future Scope

Traffic and end-to-end transmission delay are the results observed from the above schemes. To adjacent nodes not intimation on the opposite road. Intended recipients are nodes moving on the same direction with the sender but by using total Avoid delay packets Transmission. Some protocols typically discard the whole original path and issue a new round of route discovery process even if only one link of the path breaks. This is inadvisable and inefficient. While a data packet travels towards the destination, each node along the path fills the risk field with its route information before forwarding the packet, and the corresponding downstream node checks this field whether the upstream node maintains an updated route.

Future Enhancement

In future work selecting the optimal transmission route and guaranteeing the effective and reliable Deep Packet Inspection techniques can help to classify flows, but are currently implemented in electronic hardware, which imposes limitations in terms of speed the algorithm Multi-hop transmission link constructed by wireless relay nodes is a feasible solution to long range . Security is an important issue for routing in VANETs, because many applications will effect life-or-death decisions and prohibited tampering can have devastating consequences.

REFERENCES

[1] Mozhdeh Gholibeigi, Mitra Baratchi, Hans van den Berg, Geert Heijenk "Towards Reliable Multi-Hop Broadcast in VANETs: An Analytical Approach"2016 IEEE Vehicular Networking Conference (VNC), pp - (1-8).

[2] Anna Pereira, Hamid Shahnasser "The Vehicular Environment and its Effect on Broadcast Protocols in VANETs" IEEE 2008, pp - (553-558).

[3] Muhammad Tahir Abbas,Wang-Cheal Song "Infrastructure-assisted Hybrid Road-aware Routing and QoS Provisioning in VANETs" IEEE 2017, pp - (370-373).

[4] Faisal Khan, Yusun Chang, SungJin Park, John Copeland "Towards Guaranteed Delivery of Safety Messages in VANETs" IEEE 2012, pp - (207-213).

[5] Golnar Khomami, Prakash Veeraraghavan "Achieving a Reliable V-2-V Communication for Safety Messages" 2013 IEEE 11th Malaysia International Conference on Communications, pp - (550-555).

[6] Ata Ullah , Xuanxia Yao, Samiya Shaheen, and Huansheng Ning "Advances in Position Based Routing Towards ITS Enabled FoG-Oriented VANET–A Survey" IEEE transactions on intelligent transportation systems 2019, pp - (1-13).
[7] Kazi Atiqur Rahman and Kemal E. Tepe "Towards a Cross-Layer Based MAC for Smooth V2V and V2I Communications for Safety Applications in DSRC/WAVE Based Systems" IEEE 2014, pp - (969-973).
[8] Tankut Acarman, Çağdaş Yaman, Yavuz Pekşen, and Ali Ufuk Peker "Intersection Based Routing in Urban VANETs "2015 IEEE 18th International Conference on Intelligent Transportation Systems, pp - (1087-1092).
[9] Shaik Shafi, B.N.Bhandari, D.Venkata Ratnam "An Improved Cross Layer Cooperative Routing for Vehicular Networks" International Conference on Research Advances in Integrated Navigation Systems (RAINS - 2016), pp - (1-4).
[10] Keming DU, Yahui YANG "A QoS routing for Maximum Bandwidth in Ad Hoc Networks" IEEE 2010 Page No (343-345)
[11] Shijun Shen, Ge Fu and Xinran Liu "Route Information Piggybacking in Multihop Wireless Networks" IEEE 2013 Page No (586-590)
[12] Antonio M. Ortiz, Nedal Ababneh, Nicholas Timmons and Jim Morrison "Adaptive Routing for Multihop IEEE 802.15.6 Wireless Body Area Networks"
[13] Yamuna Devi C R, Shivaraj B, S H Manjula, K R Venugopal "Multi-Hop Optimal Position Based Opportunistic Routing for Wireless Sensor Networks " IEEE 2014 Page No (121-125)
[14] Yuxin Chen, and Jeffrey G. Andrews "An Upper Bound on Multihop Transmission Capacity With Dynamic Routing Selection" IEEE 2012 Page No (3751-3764)
[15] Chung-wei Lee "Energy Efficiency of QoS Routing in Multi-Hop Wireless Networks" IEEE 2010
[16] C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - Journal of ELECTRICAL ENGINEERING, Vol.63 (6), pp.365-372, Dec.2012.
[17] C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, Electrical Engineering, Vol.93 (3), pp.167-178, September 2011.
[18] C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, Electric Power Components and Systems, Vol.39 (8), pp.780-793, May 2011.
[19] C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- Iranian Journal of Electrical & Electronic Engineering, Vol.8 (3), pp.259-267, September 2012.
[20] Nagarajan C., Neelakrishnan G., Akila P., Fathima U., Sneha S. "Performance Analysis and Implementation of 89C51 Controller Based Solar Tracking System with Boost Converter" Journal of VLSI Design Tools & Technology. 2022; 12(2): 34–41p.
[21] C. Nagarajan, G.Neelakrishnan, R. Janani, S.Maithili, G. Ramya "Investigation on Fault Analysis for Power Transformers Using Adaptive Differential Relay" Asian Journal of Electrical Science, Vol.11 No.1, pp: 1-8, 2022.
[22] G.Neelakrishnan, K.Anandhakumar, A.Prathap, S.Prakash "Performance Estimation of cascaded h-bridge MLI for HEV using SVPWM" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:750-756
[23] G.Neelakrishnan, S.N.Pruthika, P.T.Shalini, S.Soniya, "Perfromance Investigation of T-Source Inverter fed with Solar Cell" Suraj Punj Journal for Multidisciplinary Research, 2021, Volume 11, Issue 4, pp:744-749
[24] C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
[25] M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", Journal of Environmental Protection and Ecology, Volume 23, Issue 2, pp: 520-530,2022
[26] M Suganthi, N Ramesh, CT Sivakumar, K Vidhya, "Physiochemical Analysis of Ground Water used for Domestic needs in the Area of Perundurai in Erode District", International Research Journal of Multidisciplinary Technovation, pp: 630-635, 2019.