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Dispersal of Traffic Alert Messages without Missing the Reliability for Environmental Protection

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Abstract

In our day-to-day life due to the usage of more number of vehicles there arises an increasing demand and a big challenge to control the traffic in Vehicular Ad-hoc Network (VANET) which is considered to be a major environmental concern. Generally, the traffic alert information is imparted to vehicles as V2V (Vehicle-to-Vehicle) or V2I (Vehicle-to-Infrastructure) communication medium. The VANET is effectively a subset of MANET (Mobile Adhoc Network). It is a self-forming network which can function without any centralized control. This paper mainly concentrates on enhancing the efficiency, performance and confidentiality in transferring the traffic alert messages ensuring that the data integrity is not lost. In the existing system, the entire information (like vehicle id, location, and position) are transmitted together to other vehicles which leads to major attacks and thereby the confidentiality of the system is compromised (like tracking of vehicles etc). VAMD (VANET-based Ambient Message Dissemination) scheme is thereby proposed so as to support secured dissemination of traffic messages and to filter only the traffic alert messages. SP (Service Provider) is introduced in addition to RSU (Road Side Unit) to deliver the value added services to ongoing vehicles only on demand. It also helps for an efficient, secure, and privacy-preserving algorithm to smoothen the progress of vehicular node participation. In addition, it increases the number of forwarders to participate in the message dissemination.

Keywords: environmental protection, reliability, clarity, secure message dissemination

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INTRODUCTION

The Vehicular Adhoc Network (VANET) is a part of Mobile Adhoc Network (MANET), which means that every node can move freely in the network area and stay connected to the network. In VANET, the moving nodes are vehicles. The traffic information is in the form of V2V (Vehicle to Vehicle) or V2I/V2R (Vehicle to infrastructure or RSU). V2V is used to communicate only between the vehicles whereas in V2I, the communication is made between vehicles and the roadside network. Thus in VANET, the messages can be sent in major forms such as Traffic Information, General Safety Messages, Liability-Related Messages, Beacon Messages, Internet & Multimedia contents (3G & 4G). The VANET differs from MANET based on the following characters influenced by the VANET infrastructure. VANETs are characterized by its distinctive uniqueness that makes a distinction from MANET. Apart from this, VANET allows commercial Service Providers (SPs) to promote their businesses in the form of advertisements that shows great application potential (Alkan et al. 2017).

In VANET, vehicular nodes may receive alert information, 3G/4G Internet, multimedia information and other value added information from other ongoing vehicles on the road. There are certain vehicular nodes found to be selfish that will not forward the traffic alert information among other nodes. Though there are many techniques to transmit information, it is mandatory to have standardized method or component to filter these selfish nodes and also to segregate traffic alert information among all the other information. Hence, RSU (Road Side Unit) and SP (Service Provide) are introduced to disseminate the traffic alert information without missing the reliability and clarity. In this work, RSU is made to act as an authorized entity to segregate traffic alert information where as SP is given the responsibility to provide additional value

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added information to the vehicular nodes only on demand. Segregating alert message is achieved by introducing VAMD (Vehicular Ambient Message Dissemination) Scheme along with DBG-MD (Distance Based Gradient-Message Dissemination) algorithm and thereby it achieves effective message delivery without missing the clarity and reliability.

Reliability plays a vital role in our modern society which is used to predict the success of a product or project or any defined system. In our daily life, the defined system or product may not work well due to careless design, poor construction, irrelevant manufacturing process, human mistakes, bad maintenance, improper usage and lack of protection etc. The significance of product and system failure differs with respect to money, time and security. Introducing reliability analysis is used to moderate the causes of these misfortunes in the system. Reliability is achieved by introducing UGFT (Universal Generating Function Technique) which is an important technique in Mathematical modeling. This technique is used to assess the reliability of the defined system or product by verifying the individual components of the system. It is accomplished by presenting different composition operators over UGF which will anticipate the happenings of the physical environment. Reliability of data dispersal is an imperative goal of this work.

RELATED WORK

VANET is defined as a subnet of Mobile Ad hoc Networks (MANETs) which consists of number of vehicles with the capability of communicating with each other without a fixed arrangement. The aim of VANET research is to built up and enhances vehicular communication system so as to enable quick and cost-efficient transmission of data for the benefits of passenger's security and comfort. Several research papers have been surveyed in the area of VANET for reference.

Riva et al. (2013) have proposed a short-range wireless technology which used a context-aware service model for highly progressive arrangements in MANETs. The service migration took place distinguishably to the client application, which was discussed with a distinctive virtual service end-point. A proof-of-concept method was helpful for the mobile services to compute threshold value that was vehicular speed using short range wireless communication. The experimental results obtained over a mobile ad-hoc network of PDAs have shown the effectiveness of this approach when there is a frequent disconnection. The major advantage of this model was that services were capable of adapting to context changes that often occurred in ad hoc networks by migrating during execution.

Raya and Hubaux (2007) focused on the security of the network which provides a detailed threat analysis and devised appropriate security architecture. The arrangement of security conventions has been advanced with a specific end goal to ensure protection and to examine their strength and effectiveness. Authors outlined a decent case for verification systems, where digital signatures viewed to be the most appropriate procedure notwithstanding their high overhead. This concept mainly dealt with communication aspects of VANET for which most relevant communication aspects are identified and the major threats have been discovered.

Tonguz and Boban (2010) investigated an application for multiplayer games in VANET environment for which various challenges and opportunities for games were discussed. Wireless Access in Vehicular Environment (WAVE) protocol stack along with DSRC (Dedicated Short Range Communication) channel allocation have been defined to increase safety and create more pleasant traveling experience. Distribution of trips by trip purpose and vehicle occupancy per vehicle mile by daily trip purpose and distribution of traffic by time of day have also been discussed by authors. Compared VANET gaming and internet gaming by different connection duration scenarios and dynamics of player interaction. Authors proposed a paradigm shift in multiplayer gaming which consisted of computer generated and virtual reality surrounding among moving vehicles.

Malandrino et al. (2013) outlined the performance limits of vehicular content downloading which required modeling the downloading process. This process was considered as an optimization problem which maximized the throughput of overall system. Dynamic Network Topology Graph (DNTG) was built by considering the road layout corresponding to the mobility trace. Max flow problem has also been taken and discussed by the authors with respect to various constraints such as non-negative flow, flow conservation, overlapping AP coverage and maximum number of AP's. Modeling the transfer paradigms, sampling based solution were considered for content downloading.

Ucar et al. (2016) elucidated multihop clustering based hybrid architecture on IEEE 802.11 P and LET

(Long-Term Evaluation) for disseminating safety message among vehicular nodes. Authors developed this architecture with respect to VMaSC – LTE (Vehicular Multihop algorithm for Stable Clustering) – (Long-Term Evaluation). Relative mobility metric was calculated by average relative speed of vehicular nodes. Also, authors explained that this features were used to decrease the number of cluster head (CHs) while increasing the stability. It has provided minimum intercluster interference by minimizing the overlap of clusters. Sun et al. (2016) investigated the prediction, accuracy, sensitivity and parameter stability which was designed for large-scale propagation path loss models for 5G wireless communications. They used ABG (Alpha-Beta-Gamma) model, CI (Close-In) free-space reference distance model and CIF (CI model with Frequency-weighted path loss exponent). These models were used in urban macrocell, urban microcell, indoor office and shopping mall scenarios. Also, authors discussed that CI model with a 1-m reference distance was suitable for outdoor modeling and CIF model was applicable for indoor models.

Li et al. (2013) defined an ad dissemination model for which SP was used to act as a business entity with a fixed location. SP was made to depend on an RSU which was located at nearer distance to forward the information to set of vehicular nodes. Advertisements were sent to ongoing vehicles on the road by using VAAD (Vanet-Based Ambient Ad Dissemination) scheme. Secure and privacy preserving cash-in algorithm was generated for this ad dissemination process.

Yang et al. (2004) proposed a vehicle-to-vehicle communication protocol which used V2V (Vehicle-to-Vehicle) and V2R (Vehicle-to-Roadside) communications. In this paper, early warnings were generated to reduce the number of road accidents. Authors addressed an important challenge such as low latency and delay while delivering emergency warnings under various scenarios. Authors also addressed the following challenges in which stringent delay requirement immediately after the emergency was the first challenged addressed. Then, support of multiple co-existing AVs (Abnormal Vehicle) over a longer period was addressed which was followed by differentiation of emergency events and elimination of redundant EVMs (Emergency Warning Message). Congestion control policies were also defined for emergency warning with low delay.

Handorean et al. (2005) addressed certain issues related to host interoperability by the service-oriented computing paradigm. Service oriented computing architecture was built by using pictorial representation consisted of the service discovered which was unreachable and the service which was reachable but a lookup was not possible. Follow me session were introduced for strong process migration of the server thread which was explained in a separate session. Migration mechanism and check pointing and saving were also discussed by the authors. Context sensitive binding was explained by policy based selection, metric based evaluation, transparent binding maintenance with mobility and context-sensitive binding.

Llorca et al. (2010) proposed Floating Car Data (FCD) architecture which consisted of three cameras' on the onboard vehicle. Vision-based traffic detection system was used to detect the forward vehicle, rear vehicle and side vehicle by using hardware triggering and Global Positioning System. Vertical and horizontal edges symmetries computation procedure and gray level symmetry computation procedure were used for detecting the vehicles in all the directions. FCD integration was done by traffic load and average road speed.

In Chang et al. (2012), an intersection based routing for urban vehicular communications with traffic light considerations were discussed. Hannan et al. (2013) introduced an automatic vehicle classification for traffic monitoring. Fast Neural Network and Classical Neural Network were used as classifiers for automatic vehicular classification. Kucukyildiz and Ocak (2014) presented the development and optimization of a DSP-based real-time lane detection algorithm on a mobile platform. Developed algorithm was tested under various conditions. Rahbar (2013) proposed a fault tolerant broadcasting analysis in wireless monitoring networks. They used non adaptive and adaptive broadcasting scheduling algorithms.

MOTIVATION

In a dynamic network, it is critical to maintain the multicast routing when the topology changes. Conventional multicast protocols generally do not have good scalability. In a dynamic system, it is difficult to keep up the multicast routing when the topology changes. Due to this, the gradient of the message decreases and hence the clarity of the message gets reduced when the distance increases, which leads to a chance for adding unnecessary details in the message and finally causes damage to the vehicle and leaves it in a miserable circumstance. Commercial Service Providers (SPs) are introduced to support their businesses with VANET-based ad dissemination scheme. In a dynamic vehicular network when new vehicle (node) enters the network, it should act as relay to support multi hop routing in order to reach the destination effectively. The clarity of the message decreases when the distance increases before it reaches the certain vehicle. Therefore the vehicles or the Road Side Units should be made to forward the message to other vehicles on the road side. Messages will be traffic alert information, Beacon messages, safety message, 4G/5G/Multimedia contents, Ad Dissemination etc., Hence, here arises the problem for sending the message effectively to the destination without giving chance for any type of attacks. In the previous works, traffic messages were forwarded to vehicles which contain the entire information like identity of vehicle, vehicle number, location information and other extra details which would give chance for the hackers for hacking vehicles, tracking etc. To overcome this, the gradient of message dissemination and the VAMD (Vehicular Ambient Message Dissemination) scheme is used to restrict the unnecessary flow of information like vehicle number, position etc., to other VANET nodes. This process is carried out with the help of threshold value which is used to differentiate and allow the traffic message to reach the end vehicles. This helps to maximize the number of forwarders in multi hop routing with pragmatic cost and effect control.

Sticky Situation & Portrayal

Considering VANET characteristics, it is clear that the nodes in VANET move frequently. Source needs to discover a path to reach the destination. If the destination is nearer to its range then the source can directly send information. If it is not in its coverage the source relies on other intermediate nodes by calculating the shortest path. The packet is dropped when the intermediate node does not meet the destination. The intermediate vehicle is overloaded with unnecessary carrying of messages. In order to avoid this, the road side infrastructures are deployed. By this, the source or the intermediate nodes can broadcast the message to the infrastructure. Then, the infrastructure stores and forwards the packets whenever appropriate. Proposed method allows only sending of traffic messages to the destination. Along with, the traffic messages the needed information is filtered and transmitted to the other ongoing vehicles on the roadside. As already explained, this reduces the chance of attacks or threats on the roadside.

On Hand Approach

In On Hand system, slow vehicles are detected to calculate the traffic density. Event Driven Architecture is used in which only the traffic messages are filtered and disseminated to other ongoing vehicles on the road side. Complex event processing (Adi et al. 2006, Terroso-Saenz et al. 2012) foundation is designed which facilitates the transmission of stalemate information with the help of events that occurs on the road side. Traffic filter agent is designed, such that, it sends a warning messages to other ongoing vehicles on the road side when dangerous situation arises. VANET plays a major role for the service providers for which it disseminates or promotes the business in the form of advertisements. The gradient of messages decreases when the distance between source and destination increases. Thus DBG algorithm is used to find the next nearest node to transmit the Ad packets and designate the node to act as source. The gradient of the messages does not decrease when the distance increases by using DBG algorithm. Thus, this algorithm supports only the dissemination of Advertisements to other vehicles. This provides the incentives for each forwarder (cash-in algorithm) to disseminate the messages which is impossible by some service providers in the practical world. Therefore, in proposed work, Distance Based Efficient Message Dissemination algorithm is used to maximize the achievable effect. But, in existing system, the penetration rate of EDA (Event Driven Architecture) affects its performance and reliability. Traffic is detected with the average number of vehicles, moving below an average speed or either stopped. This is not efficient because the vehicles may slow down for parking or for shopping. This gives the chance for hackers to track the vehicles unnecessarily and forward the wrong information to other ongoing vehicles on the road side. Transmission of messages with the entire information affects its performance and reliability, so the filtered traffic messages are disseminated to other vehicles with the help of DBG-MD algorithm used here.

ESTIMATED SYSTEM

The purpose of this work is to reduce the operating cost caused in the existing work and also to reduce the threats/attacks while transferring the packets. The main objective is to forward the traffic messages to other ongoing vehicles on the road side with low cost and effort control. By allowing only the traffic message to be forwarded, the throughput gets increased and the delay gets reduced which leads to increase in number of forwarders to vehicles. As a result, the number of

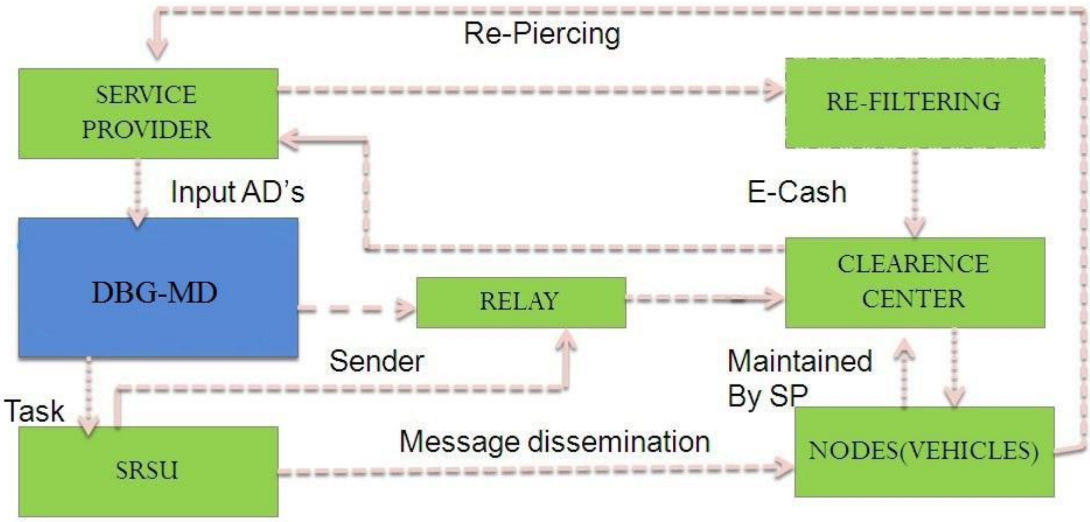

Fig. 1. VAMD with DBG-MD Scheme

Table 1. Parameters List

Parameter	Abbreviation
IDtr	Identity of the message transferred. Tr denotes the traffic message
TSPsp	Timestamp of the message transferred
SEQno	Sequence number of the message transferred
LOCtr	Location where the traffic occurs
IDpre, IDnext	Identity for predecessor and successor
IDsp, TSPsp	Identity and timestamp for Service Provider
IDSRSU,LOCSRSU	Identity and Location of Source Road Side Units

accidents will be reduced and this helps to keep the traffic under control. VAMD (Vehicular Ambient Message Dissemination) scheme is used to send the traffic messages effectively by restricting the flow of unnecessary information to other vehicles. DBG–MD (Distance Based Gradient-Message Dissemination) algorithm is used to calculate the shortest distance among the nodes and designate the node with the shortest average distance to be the next forwarder (**Fig. 1**). This allows each vehicle to act as a source. Since this algorithm is used to allow only the dissemination of traffic messages to ensure pragmatic cost and effect control. Thus the content of the message is reduced by avoiding unnecessary details which leads to major threats and also to calculate the threshold value for each type of message.

Comparing to other mechanism, this paper presents secure format to send the messages to other VANET nodes. This prevents the attacks like hacking and tracking of vehicles on the roadside. Secure Packet Format consists of the following parameters that are listed in **Table 1**.

$$Secure\ Packet\ Format\ = Pa = \{IDtr, SEQno, LOCtr, TSPtr, IDpre, IDnext, DATAtr\} \quad (1)$$

$$DATA_{tr}\ = Data = \{ID_{sp}, TSP_{sp}, ID_{SRSU}, LOC_{SRSU}\} \quad (2)$$

Thus with the help of the above equation, this algorithm filters only the traffic message with the help of threshold value and neglect other unwanted information to avoid tracking and hacking of vehicles on the road side. The information can be passed from the RSU to Vehicles and also from Vehicles to RSU. Thus the Timestamp, Location and Identity of both RSU and vehicle are stored in warehouse repository. $DATE_{tr}$ is generated and maintained by the RSU. This information will not be transmitted to other vehicles, only the authorities can access it. Packet drop will be reduced by using this approach using the possibility of the packet loss. When the hacker tries to hack the packet, attacker can easily be recognized with the help of the identification value. By avoiding the extra information and payload value, this algorithm performs better when comparing the existing approach. The performance enhancement is shown in delivery ratio and increase in number of forwarders ratio. Therefore, the following equation also shows the increase in probability ratio of forwarders. The forwarders mentioned here are the vehicles that are actively taking part in transmission process due to the threshold value of the message.

$$d'AB = dtrAB/(2/PrAB) = PtrAB/2 * dtrAB \quad (3)$$

$$2 * d'AB = PtrAB * dtrAB \quad (4)$$

Here, PtrAB is the probability of successful information dissemination between node A and node B, dtrAB indicates the distance between A and B to send the filtered traffic message. By referring equation (1), A needs 1/PrAB transmissions for sending query to send one multimedia packet to B, on average, and 1/PrAB transmissions for replying in each and every dissemination of messages, so d'AB indicates the expected efficiency of message that is being forwarded between A and B (Equation 3). Equation 4 is derived from Equation 3 which clearly denotes that the expected efficiency is more which is approximately twice when the distance between nodes and probability of transferring the traffic information are taken. When compared with the existing method, there is no need of sending acknowledgement when there is the message dissemination among nodes. The acknowledgement or replying is needed only on demand when it is being recommended by higher authorities on the road side namely the metropolis, etc… Thus the efficiency and the number of forwarders are increased by obtaining the Nmax which represents the maximum number of forwarders.

$$Nmax = [1/PtrAB] \quad (5)$$

In this proposed paper, the delay of reaching the destination is reduced and the delivery ratio is increased and also it is examined and illustrated with various parameters as shown in results and discussions. Other information can also be delivered on demand when it is requested by higher authorities with the help of threshold value. Threshold value indicates the weight of the message which is calculated with the help of content packed inside the message.

VAMD scheme mainly focuses on filtering the traffic information that are transferred to ongoing vehicles on the roadside. This method also helps for the Service Provider (SP) to broadcast the advertisements to the vehicular nodes for their benefits to earn utmost profit. VANETs need to guarantee that message is transmitted under cost control without giving shot for any assailants furthermore to keep away from message storms. The VAMD Manager (VM) is acquainted to organize the interaction amongst SPs and VANETs. After getting a dissemination request from one SP with cost and impact particulars, the VM will acquire appropriate approval from VANET Authority to ask for either SP or RSU to convey the message as indicated by the details.

VAMD ensure the reliable delivery of traffic information from a source vehicle to all the other vehicles in a network. In VANET, reliability is evaluated as the probability of successful delivery of message from a source to target vehicle. This is achieved by using UGFT (Universal Generating Function Technique). In recent years, UFGT is used as an important technique in various optimization problems that require generating function of probability theory. The UGFT is straightforward, effective and universal (Yeh 2009).

The UGFT outperforms other related methods and has an effective approach to analyze the reliability of a network. It allows us to find the reliability of a vehicular node in VANET by introducing vehicular node UGF with appropriate composition operators used to predict the outcome of a defined product or system. UGF assumes a fundamental part in discovering the expected capacity with respect to each traffic path involved in the VANET. For example, reliability of a vehicular node is stated as a polynomial in X such that

$$u(S) = P_{S:SP:D} X^D \quad (6)$$

where $P_{S:SP:D}$ is the probability of passing the information from source vehicle to destination vehicle through Service Provider. This helps the SP to send the advertisements without missing the clarity and reliability.

If RSU takes the responsibility to filter the traffic messages, then the reliability of a vehicular node is defined as follows,

$$u(S) = P_{S:RSU:D} X^D \quad (7)$$

where $P_{S:RSU:D}$ is the probability of transferring the traffic information from a source to target vehicle via RSU. Here information is first transferred from source vehicle to RSU. Data exchanged in VANET may be Traffic safety / Road conditions, Advertisements, Internet 3G/ Multimedia content etc. in which traffic safety / road conditions are filtered using RSU. Finally RSU transfers the filtered traffic information to the desired destination vehicle. This algorithm is used to transfer the alert information from a vehicle to group of vehicles at a particular instance of time.

In a day-to-day life, we face many difficulties to reach our destination on time due to accidents, traffic congestion and unnecessary parking of vehicles on the road. Alert messages should be delivered to vehicular

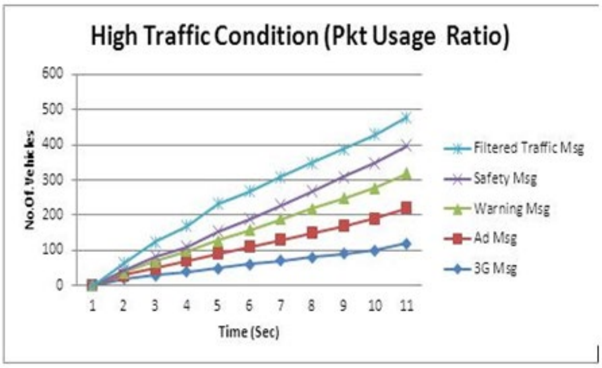

Fig. 2. High Traffic Condition

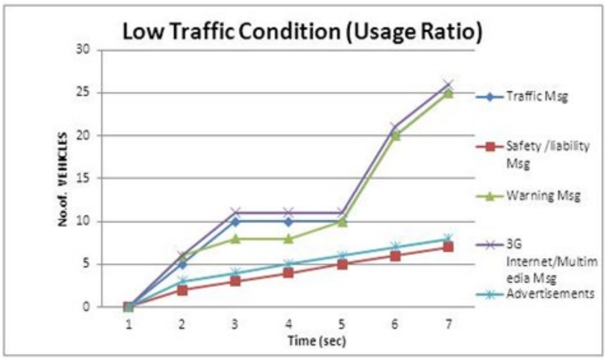

Fig. 3. Low Traffic Condition

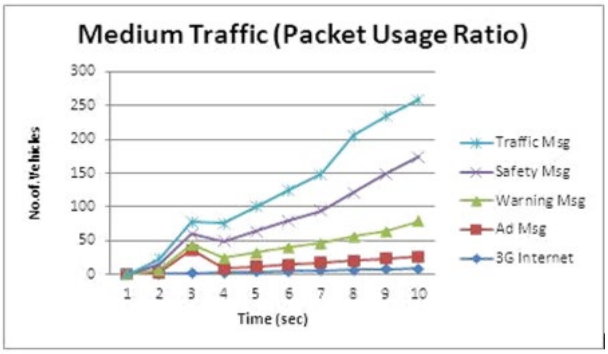

Fig. 4. Medium Traffic Condition

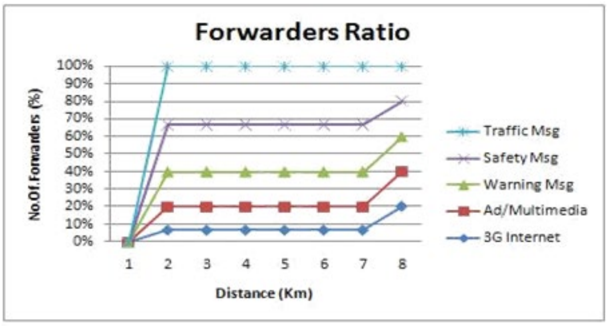

Fig. 5. Probability of Forwarders

nodes when an accident or emergency situation occurs. Hence, the vehicles that are coming towards the accident spot would take another direction to reach the desired place. This reduces unwanted traffic and congestion in the road. This is possible only when the alert message is transferred to group of vehicles at a time. UGFT technique with VAMD scheme is used to achieve this by defining the reliability among the group of nodes.

It reduces the overhead and the delay in delivery with low cost and less effort. It is highly confidential and reliable. The network can be configured in the geographic range. The technique used for the message transmission encourages the vehicular nodes to participate in transmission. This approach is the very first technique that uses UGFT technique to define the reliability by using probabilistic approach.

RESULTS AND DISCUSSIONS

Node creation and arrangement comprises of creating the nodes by the topology produced and characterizing the node characteristics before making them. They comprise of addressing structure utilized as a part of the simulation, defining the network components for mobile nodes, turning on and off, the trace options at Agent/Router/MAC levels, selecting the classification of routing protocol for mobile nodes with the energy level. Network simulator is used for implementing the defined model through simulation. As shown in **Figs. 2-4**, the messages are compared and evaluated based on the traffic conditions that occur on the road side. These evaluations are simulated with the help of NS2 simulation tool. The traffic conditions are broadly classified into three types. They are High, Medium and Low Traffic Conditions. The number of vehicles is more in High Traffic Condition when compared to other two traffic conditions (**Table 2**). These are plotted with the help of Vehicles and Time in seconds. In this approach, we propose Distance Based Gradient-Message Dissemination algorithm based on the threshold value to pass the messages to other ongoing vehicles on the roadside. Based on the requirement of messages needed, it can be acquired with the help of threshold value and disseminated to other vehicles on the roadside. Therefore, the messages are broadly classified into five types. They are Filtered Traffic Messages, Advertisements, 3G Multimedia/Internet Downloadable messages, Safety/Liability Messages and Warning Messages.

In this approach, each vehicle is made to act as a source, a destination and also as a relay. Thus based on the simulations performed, in all the three traffic conditions, Filtered traffic messages take less time to reach the destination than other messages like 3G Internet, Advertisements, Multimedia messages etc.., From the **Fig. 5**, the weight of the messages is calculated

Table 2. Comparison of Parameters

MESSAGES EXCHANGED	HIGH TRAFFIC CONDITION			LOW TRAFFIC CONDITION			MEDIUM TRAFFIC CONDITION			PROB.OF.FORWARDERS			EVOLUTION OF MSG EXCHANGED		PACKET DELAY RATIO		PACKET LOSS RATIO		TOTAL BANDWIDTH		TOTAL.NO.HOPS		DELAY VS COMM PARTNER DISTANCE	
	1	2	3	1	2	3	1	2	3	1	2	3	1	3	3	1	3	1	3	1	3	1	1	3
FILTERED TRAFFIC MESSAGE	√			√			√			√			√		√		√		√		√			√
SAFETY/LIABILITY MESSAGES	√			√			√			√			√		√		√		√		√			√
WARNING/RELIABILITY MESSAGES		√		√			√			√			√		√		√		√		√			√
3G MULTIMEDIA/INTERNET DOWNLOADABLE			√		√			√			√			√		√		√		√		√	√	
ADVERTISEMENTS		√			√			√			√			√	√			√		√		√	√	

1*-High, 2*-Medium, 3*-Low

with the help of threshold value which leads to increase the number of forwarders within the coverage area. The coverage area is calculated by distance in kilometers. Higher the weight of the message, it takes high threshold value which takes more time to reach the destination. Thus the number of forwarders will not actively take part in the transmission of messages.

Therefore the forwarders for messages will be reduced or they will not forward the message to other vehicles because of content and arrival time of the message. As shown in the **Fig. 5**, we obtain the result with the help of Distance Based Message Dissemination algorithm which automatically avoids sending the message when vehicle moves out of coverage area. When comparing the results obtained, the numbers of forwarders are actively taking part in transmission of messages because of low cost and effect control.

We have compared and evaluated the parameters and described them in the table format showing their results. Filtered traffic messages are compared with the following messages; Safety / Liability messages, Warning / Reliability messages, 3G Multimedia / Internet Downloading, Advertisement under High, Medium and Low traffic conditions with respect the following parameters; Packet Delivery Ratio, Packet Loss Ratio, Number of Forwarders, Bandwidth

Table 3. Traffic Losses with Mobility

Metrics	Performance Metrics in Existing System	DBG Message Dissemination with Backbone Units
Hope	20%	10%
Mate	69%	20%

Table 4. Traffic Losses for Different Size Packets

Parameters	Performance Metrics in Existing System		Proposed DBG Message Dissemination with backbone Units
	Hope	Mate	Loss Ratio(Improved Performance)
Traffic Msg	24%	20%	10%
Safety/Liability Msg	31%	30%	12%
Warning Msg	30%	25%	15%
3G multimedia/Internet	37%	35%	29%
Advertisements	35%	34%	26%

Consumption and found that filtered traffic messages are delivered very efficiently with very less delay. Percentage of Delay and Loss Ratio are shown in **Tables 2-4**.

As shown in the **Figs. 6** & **7**, the response time for each message is calculated based on distance with respect to time. The graph is plotted with respect to the number of diffusions on the roadside with respect to

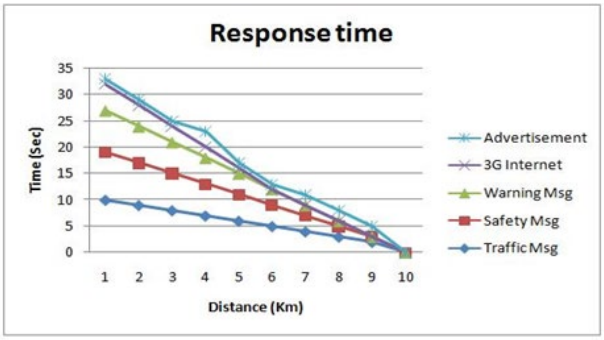

Fig. 6. Response Time & Ratio

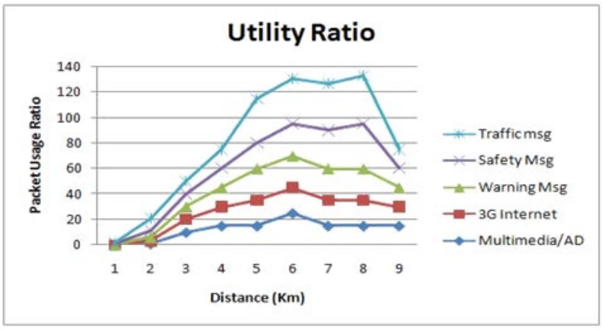

Fig. 7. Packet Utility Ratio

time interval in seconds. Based on the road conditions like flooding, periodic flooding, normal weather conditions and earthquakes, the utility of traffic message is evaluated. Therefore in all the situations, the filtered traffic message does not contain any threats, successfully transmitted in less time with low cost and effect control.

Similarly, the same filtered traffic message is evaluated, based on the utility ratio. This graph is plotted with respect to number of vehicles on the road side and the distance. The utility ratio is calculated based on the forwarders usage condition. Thus lighter the weight of the message, the packet usage ratio will be higher.

Again the response time for this filtered traffic message performs best in all the below specified geographical conditions like static and mobile event in direction, non-direction dependent areas. The areas are classified as restricted, large, Medium and highways.

As shown in **Figs. 8-10**, the messages are classified and evaluated based on the packet loss, delay and delivery ratio with respect to number of packets, time, distance and delivery ratio. In this approach, the filtered traffic message results in low loss, less delay and highest in delivery ratio when compared to other messages like 3G Internet/Multimedia, Advertisements.

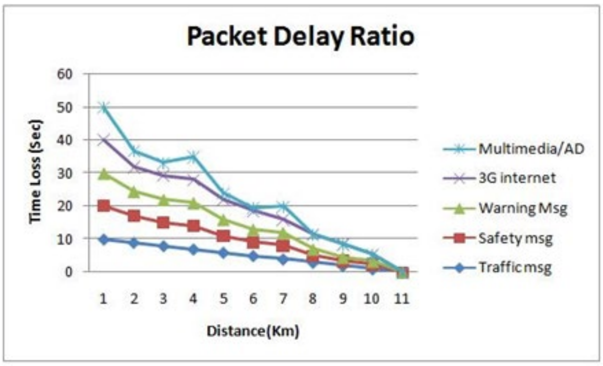

Fig. 8. Packet Delay Ratio

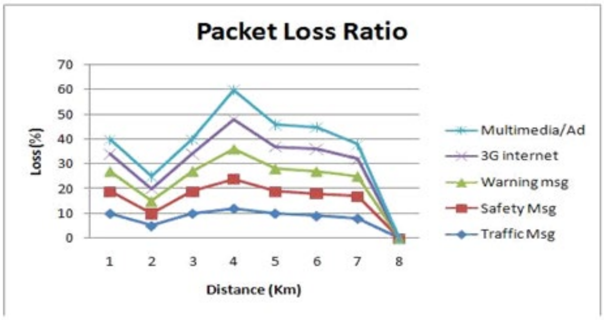

Fig. 9. Packet Loss Ratio

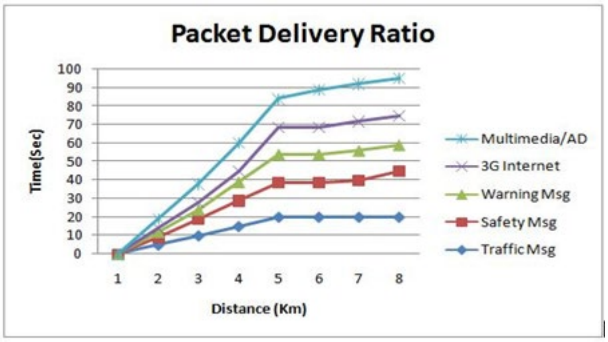

Fig. 10. Average Delivery Ratio

Next to traffic messages, safety/reliability and warning messages results in lowest delay and loss.

Comparing to all these messages, in this approach, advertisements and 3G Internet downloadable messages suffer from low delivery ratio, high cost and effect control.

From **Figs. 11** & **12**, according to message dissemination algorithm, messages are classified and simulated by the bandwidth and number of hops (relay) needed to transfer the messages.

CONCLUSION & FUTURE WORK

To reduce the environmental collisions caused due to spatially-correlated contention, we developed a protocol in which we divide network into groups and employ scheduling among these groups. VAMD

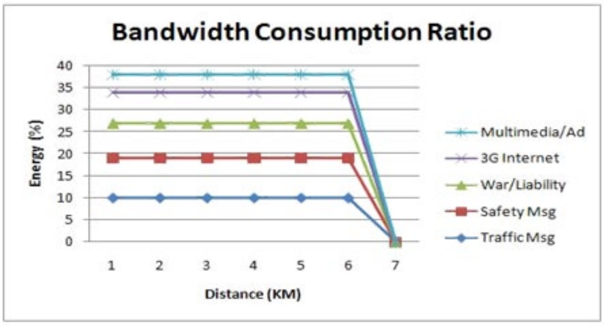

Fig. 11. Bandwidth Consumption

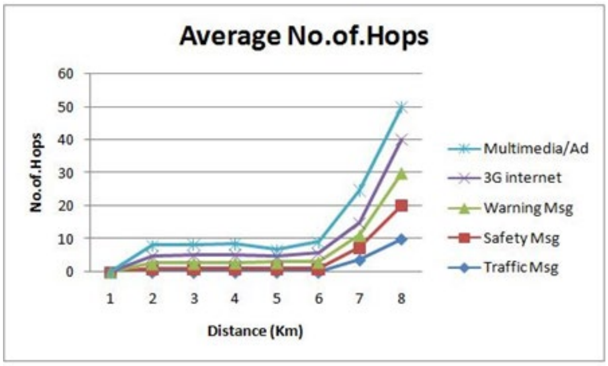

Fig. 12. Average No. of Hops

algorithm is proposed to disseminate the filtered traffic messages efficiently to other ongoing vehicles on the road side to increase the environmental protection. In addition to VAMD, DBG-MD algorithm is also proposed to make the number of forwarders actively participate in the delivery of traffic messages. The message is disseminated with pragmatic cost and effect control. The privacy in VANET is achieved by delimitating the unnecessary flow of information like identity of vehicle or location information to other ongoing vehicles. Simulation results also put forward that the penetration rate of the message does not affect its performance and reliability and on the contrary, it increases the number of forwarders to actively participate in the message transmission. Filtered traffic messages are compared with messages like Multimedia Advertisement, 3G Internet, Warning Message and Safety Message in the simulation environment with respect to different parameters. These are some of the concrete measures taken to overcome environmental hazards. In future, automatic route discovery process will be implemented and drivers behavior can be analyzed which enhances the overall throughput and performance.

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