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DESIGNING OF REGIONAL TRUSTED AUTHORITY WITH LOCATION BASED SERVICE DISCOVERY PROTOCOL IN VANET

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Abstract-*VANET is a form of Mobile Ad-Hoc Network or MANET and its different from MANET due to high mobility of nodes and the large scale of networks. The proposed location based service discovery protocols(LocVSDPs) will efficiently find services located in an RI (Region of interest) specified by the driver request using an efficient location-based request propagation mechanism and this protocol is make used in RTA (Regional trusted authority) will results in providing scalable network and also assist in reduction of number of packet lost in a network by which it resulting in efficient packet delivery ratio, throughput and overall bandwidth usage. The RTA method will help in improving the security purpose on network which also provides improvement in the performance of the resources on the system and save the bandwidth allocation of the vehicular networks.*

Keywords: VANET, RTA, LocVSDPs, Scalability.

1. INTRODUCTION

1.1. VANET

VANET (Vehicular Ad hoc Network) technology is used to move cars as joint in network to make a transportable network. VANET turns every participating car into a wireless router or node, if cars fall out of the signal range and drop out of the network, other cars can join in so that a mobile Internet is created [1]. Some of the merits of Vehicular networks is to avoid congestion and finds better routes by processing real time. In road side, Departing vehicles will inform other vehicles about their departure on the highway and arriving cars can send warning messages to other cars traversing that intersection. Most of the deaths caused by crashing of cars are avoidable. Reduce (or avoid) traffic jam, Relieve driver effort, Decrease travel times Smooth traffic flow, Decrease Emissions of CO2, Noise etc [2].

VANET mainly aims to provide intelligent transportation systems [3].VANET provides safety application which includes slow/stop vehicle advisor(SVA),emergency electronic brake light(EEBL),post crash notification(PCN), road hazard control notification(RHCN), cooperative collision warning(CCW),convenience applications includes congested road notification(CRN), parking availability notification (PAN), commercial application includes remote vehicle personalization / diagnosis (RVP/D) [4], Service announcement (SA), content map database download (CMDD).Cooperation among vehicular networks must be introduced into transportation networks to improve overall safety and network efficiency. Few challenges faced by VANET are Scalability: if number of vehicles on the road side increases, Reliable communication: vehicular network provide communication with the help of multi hop

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transformation of information by which it tremendously extend the network operators from fixed infrastructure to virtual infrastructure as a result of this reliable communication is a major challenge, Security and privacy: are major concerns in the development and acceptance of services. In our paper we mainly focus on two challenges namely (scalable and security) and besides donate solutions for convalescing those dispute in VANET. RTA (regional trusted authority) generates cryptographic key materials for the RSUs and the vehicles in its region, and delivers these keys to them over secure channels. It manages a list of the vehicles of which participations have been revoked, updates the list periodically, and advertises the list to the network to isolate the compromised vehicles.

Our paper presents in section 2 an overview on VANET structure, section 3 we described major difference in our existing and proposed system, section 4 discuss about our contributions in proposed architecture and section 5 we evaluated the performance of vehicular network in terms of packet loss, packet delivery ratio, and throughput.

2. VANET STRUCTURE

Vehicular networks provide safety by providing promising communication between vehicles to communicate with each other via Inter-Vehicle Communication (IVC) as well as between roadside base stations via Roadside-to-Vehicle Communication (RVC) [6]. Vehicular Ad-hoc Networks are expected to communicate with each other via wireless technologies such as Dedicated Short Range Communications (DSRC) [7] which is a type of Wi-Fi. Other candidate wireless technologies are Cellular, Satellite [8], and Wi-MAX.RSU. Road side base stations are randomly distributed throughout the vehicular networks and the base stations will communicate with each other by means of communication cable represented by Fig 1.

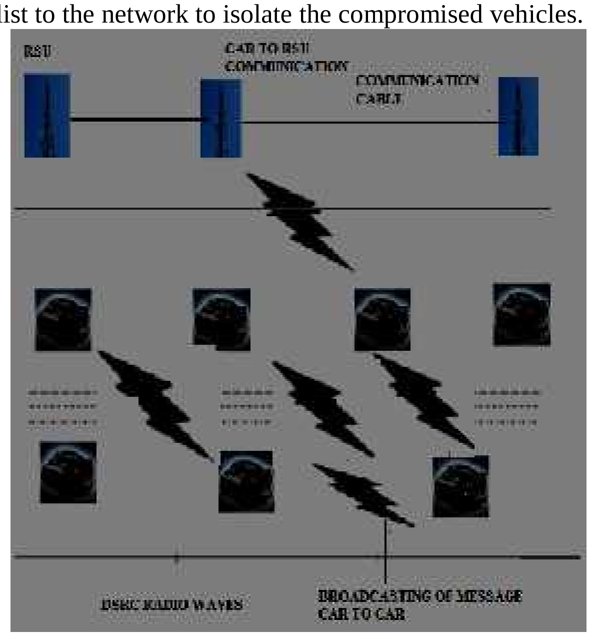

Fig 1: VANET Structure

3. EXISTING SYSTEM

VANET architecture with guaranteed security will basically consists of three components as shown in Fig 2: Road Side Units (RSUs), vehicles (users) and a Regional Trusted Authority (RTA). RSUs are always reliable, while vehicles are vulnerable to being compromised by attackers [9]. Vehicles when entering the vehicular network have to register with Regional trusted authority. For each vehicle, the RTA publishes the certified domain parameters for authentication. All vehicles use symmetric radio channel, and tamper-proof modules (TPMs) are mounted to store sensitive information. The energy of vehicles is adequate and no constrained in a VANET [10]. In previous referred paper vehicle is used as cluster head in VANET refer fig 3.

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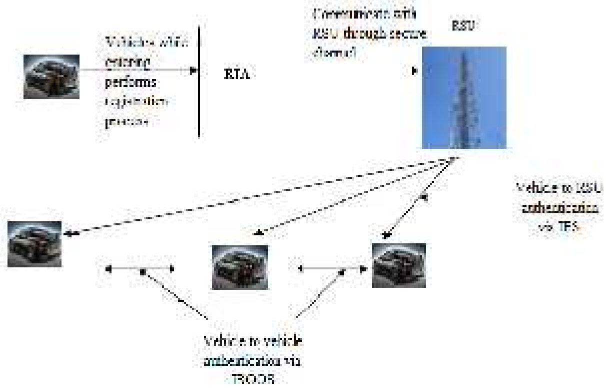


Fig 2: VANET Architecture with RTA

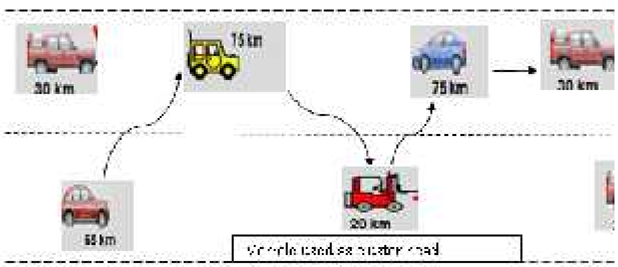


Fig 3: Existing model

4. EXPERIMENTAL ANALYSIS

Exiting VANET architecture with Regional trusted authority will generate the id for each vehicle entering for registration [9] and pass the id through a secure channel to every road side routers and it may lead to loss of packet while communicating with many RSU and it is proved by fig 4 and 5.

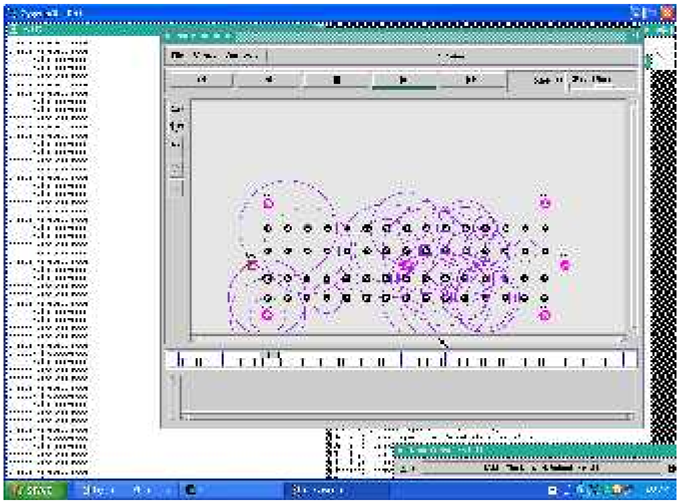


Fig 4. Snapshot to represent communication between RTA and RRs

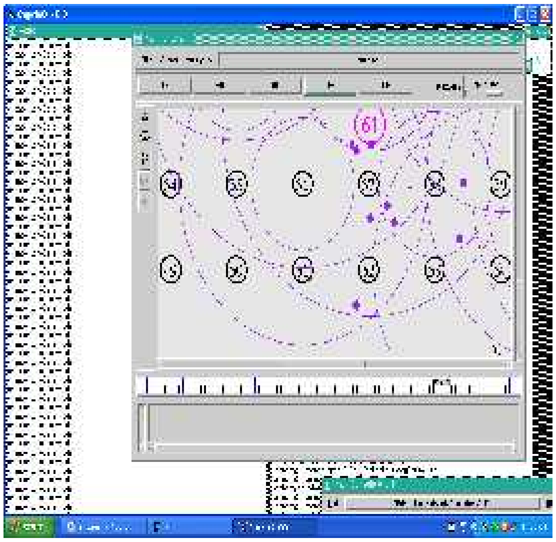
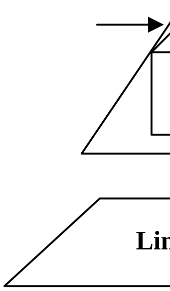


Fig 5.Snapshot to represent the packet loss in VANET while communicating

Our proposed architecture will encompass scalability in addition with security; privacy with the help of Location based vehicular service discovery protocol. To diminish the number of packet failure in RTA LocVSDPs protocol have been making used in vehicular network which will improve the scalability. First with the help of clustering of road side routers and selecting a cluster head among RRs. Second with



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the use of context aware and location based discovery. Finally Multichannel and multi interface are set in VANET which is used to afford channel diversity and sending, receiving of data is done through diverse channel.

5. PROPOSED MODEL

A. LOCVSDPS FRAMEWORK

Service providers will advertise themselves by sending advertisement messages to the surrounding Roadside Routers. An advertisement message is intercepted by the Integrated Modules of the neighboring roadside routers and it is shown in fig 6. In each Roadside Router, the Integrated Module that receives the service advertisement message will separates the discovery information from the routing information. Discovery information is processed by the Service Module and the routing information is processed by the Routing Module. The Service Module adds the service information to its service table [11]. If the service exists in the service table already, then the Service Module updates the information of the existing service. The Routing Module adds the routing information to its routing table. If the routing entry exists in the routing table already, then the Routing Module updates the routing information entry. Services advertise themselves by sending advertisement messages to the surrounding Roadside Routers [11]. In order to guarantee channel diversity, we assign an interface and a channel to every entry in the routing table such that messages are sent and received on diverse channels.

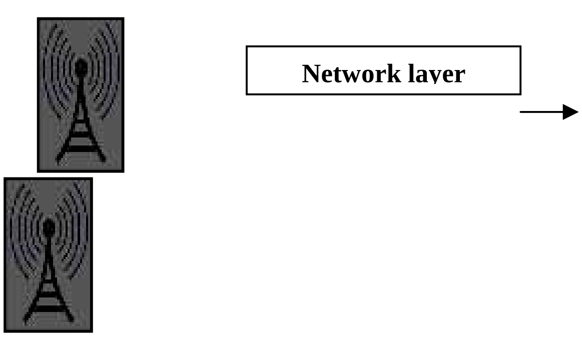

Fig 6: LocVSDPs framework

B. BENEFITS OF LOCVSDPS

1. Specification of region of interest (RI): Service requester will specify the location of the desired service called as region of interest (RI) and service providers need to calculate whether the region of interest is inside or outside the road side routers and it was explained below. After the search not all the services are returned to the requester; only the specified services located inside RI are returned. By which it saves bandwidth usage in the network and improves its capacity [12].

$(xRR - xO)^2 + (yRR - yO)^2 \geq R^2RI$ then (RR is outside RI).

The Routing Module in location based service discovery protocol generates the appropriate location-based route request L−RReq packet. The Integrated Module generates an L-VRD and Propagate to the neighboring RRs where O is the origin of the requested node and R^2 RI is the region of interest road side routers.

$(xRR - xO)^2 + (yRR - yO)^2 < R^2RI$ then (RR is inside the RI)

If the RR is inside the region of interest then RR will start the election phase. RR generates an election_IDReq_msg and broadcasts to neighbor Road side routers.

2. Clustering of road side routers (RRs): The clustering infrastructure support is suitable for large-scale VANET, and our LocVSDPs rely on a cluster-based infrastructure for the discovery of location-based services. In cluster based architecture VANET area has been split up into a number of clusters using the proposed cluster formation algorithm. Each cluster has a cluster head. The cluster head is chosen as RSU which contain more processing and transmission power when compared to vehicle and it is represented by fig 7. The cluster head is selected by the new cluster head algorithm and it is described in below section. Each cluster

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head has all the service descriptions that are available in the network. All the cluster heads in the VANET are regularly updated if new services enter in the network. All the cluster heads are synchronized in a specific time interval. The cluster heads are synchronized to ensure that the cluster heads have latest service description. Nodes of the clusters are managed by service requests and service updates [12].

Proposed Algorithm for selection of cluster head RSU

```
Proc cluster_head_selection { }
{
 global ns namfile node ($i)
 ClusterID= id;
Vehicle Stopped=false;
Vehicle Slowdown =false;
SpeedAtStop= 10.0;
SpeedAtSlow= 0.10;
last_packet_time= 10.0;
chaneel_set_position_ = 20m
Position node ($i)->update position();
XposR = position node ($i)->X();
YposR = position node ($i)->Y();
if (isClusterHead ())
{
dist= config_.maxDist_;
CurrentCH= node_($i)->nodeid();
currentCHMAC_ = MAC_BROADCAST;
Scheduler::instance ().schedule ()
}
else
{
Cluster head=cluster_id;
if (clusterChoices.empty())
{
CurrentCH = -1;
CurrentCHMAC= MAC_BROADCAST;
SendMyDataToBS ();
else
CH=0;
prinf ("Bottleneck")_Data loss;
Data to BS;
}
}
```

Proposed algorithmic model is used for selection of RSU cluster head among more RSU in a region. Tool used in this is NS2 so it has to enter the global nam file where NAM tool is useful for viewing all the network simulations in NS2. Next step is to configure in which first is to assign ID for electing cluster head RSU, whenever vehicle stops or gets slow down procedure get terminated and send false message to the neighbor routers, as VANET is comprised of moving nodes the nodes are needed to update their position to current (x,y) position and there are time control to get slow and stop, then channels are set in vehicular network for every 20 m to avoid congestion by usage of single channel. If an RSU is selected as cluster head among many RSU in VANET it should have the subsequent quality to sustain and control the vehicular network. First basic thing it should have capability to cover maximum coverage area and full control is now with cluster head RSU and they are responsible if any problem rises. Second work is to assign their current channel of RSU as their node Id and their broadcast capability is assigned to the maximum value. Scheduler is used to represent the time the data are sent in a vehicular network.

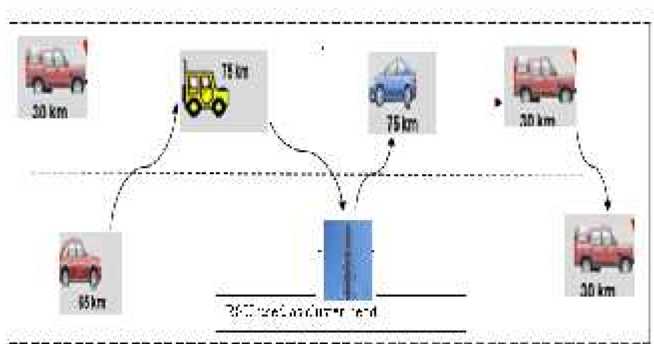

Fig 7: Proposed model

If an RSU is not capable to act as Cluster head in VANET their channel should to set to -1 value to represent their lowest broadcasting capability and send the data to the nearby base stations if the above message doesn't reaches neighbor it results in bottleneck.

2.1. Responsibility of Cluster Head

Each cluster head has all the service descriptions, which are regularly updated, if a new service enters into the network. All the Cluster heads are periodically synchronized to ensure that the cluster heads have latest service description. Liability of Cluster head is to provide [13]

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1. Service announcement
2. Service discovery

2.1.1. Service Announcement

The exchange of information in the Service Announcement heads. Only the cluster heads receive new service is introduced, then all the cluster heads are immediately updated with information or data. The local cluster head multicasts the service description to all other cluster heads [13]. The cluster head receives the service description and stores the service information and update their local database and then it informs the local cluster head.

Algorithm for service advertisement

While (true)
Begin while
If a node introduce a new service
Begin If
Find all the cluster heads in the network
Multicast new service information to all the cluster heads presents
End If
End While

2.1.2. Service Discovery

Fig 8 represents the flowchart description of service description. If the new service is not available, then the algorithm synchronizes all cluster heads in the VANET immediately [13]. After synchronizing the procedure, again it searches the cluster head for the availability of the required service. Again if the service is not available, it just informs the needed cluster service node.

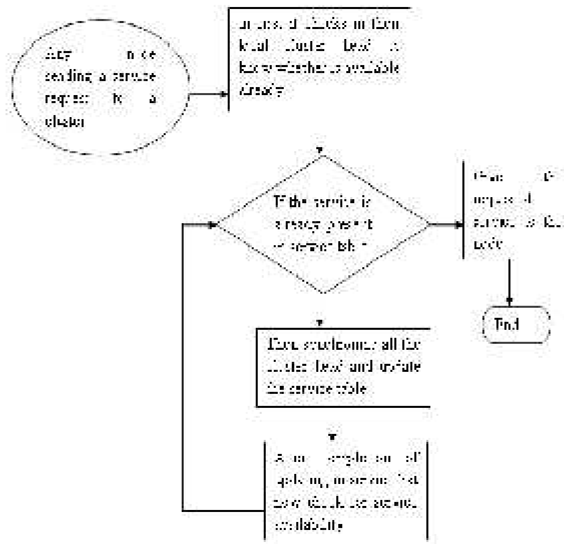

Fig 8.Flowchart for service description

2.2. Challenges Faced by VANET and Solution Offered by Clustering

The dynamic topology causes routing difficulties, congestion from flooding, and dense network will leads to the hidden terminal problem. By clustering the vehicles are grouped by similar mobility, communication between neighbors nodes will be reduced which leads to intra-cluster stability and also the hidden terminal problem can be diminished. Another issue is broadcast storm problem [14], when the network is clustered, only the cluster head participates in finding routes, which greatly reduces the number of necessary broadcasts.

3. Multichannel and multi interface LocVSDPs: In LocVSDPs, the communication between RRs uses multiple radio interfaces and diverse channels for the exchange of discovery and routing packets. The purpose for using channel diversity is to decrease the congestion on single channels, thus decreasing the service discovery transaction delay.

C. PROPOSED MODEL OF RTA WITH LOCVSDPS

Fig 9 represents the design of RTA with LocVSDPs protocol procedure and it condenses packet loss in VANET. Vehicles while entering the vehicular network register themselves with regional trusted authority and state their location of interest (RI) where they necessitate to accomplish.RTA then engender the unique ID for each vehicle and send

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through a protected channel to the cluster head of road side router.

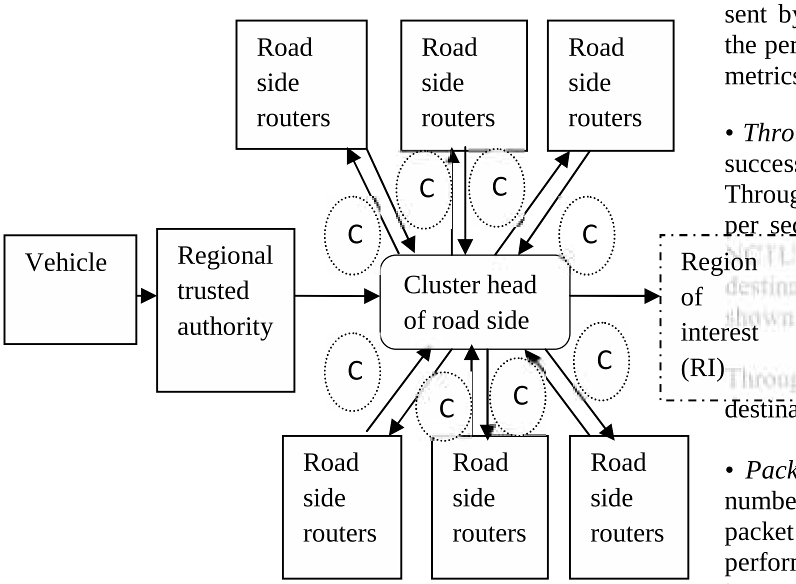

Fig 9: Proposed RTA Model with clustering technique

Then cluster head responsibility is to send those Ids through channel to their local road side routers and be supposed to identify the region the interest and send the service reply to the requested vehicle.

6. PERFORMANCE EVALUATION

In this section, we present the performance evaluation of our location-based service discovery protocol (LocVSDPs) usage in RTA model. Then, we present the results of comparison of our protocols using parameters like packet loss, packet delivery ratio and throughput providing better performance of protocol [15]. In our experiments, we want to prove that our LocVSDPs protocols are scalable in a highly dense vehicular network and with the increasing number of requests. LocVSDPs will provide efficient mechanism to locate service providers and how to reach them which results in overall bandwidth savings [16]. We also presented graph based result to represent the difference between a cluster head RSU and normal RSU in a vehicular network

Experimental results: In this section, we report on simulation experiments using a highway traffic model. In the course of our experiments, we define the request number as the number of service queries sent by vehicle clients [17]. We choose to evaluate the performance of our algorithm using the following metrics:

• *Throughput* which indicates the average number of successful packet transactions without any loss [18]; Throughput is calculated in bytes/sec or data packets per second. The simulation result for throughput in NCTUns shows the total received packets at destination in KB/Sec, mathematically throughput is shown as follows

Throughput = total number of packet received destination*packet size/total simulation time

• *Packet delivery ratio* which indicates the average number of packets delivered to the destination, if the packet delivery ratio is greater it means that the performance level is better. This metrics also takes into account several factors such as transmission and message processing delay.

• *Packet lost* denotes the number of packets dropped during the simulation. The reason for packet drop may arise due to congestion, faulty hardware and queue overflow etc. Packet drop affects the network performance by consuming time and more bandwidth to resend a packet. If the packet loss metrics is lower it indicates the performance level is better.

• *Bandwidth usage* which measures bandwidth needed to satisfy the driver's service requests. If the above mentioned metrics (througput,packet delivery ratio,packet loss) performance level are better then it contribute the limited bandidth usage of vehicular network.Fig 11 it shows that there wont be unwanted utilization of bandwidth usage as there are greater packet deliver ratio and throughput and remaining in lower number of loss of packet.

Fig 10 is used to represent the performance level of cluster head road side unit (RSU1) and normal road side unit (RSU2).the graph based result indicates that cluster head RSU1 contain more transmission and processing power and capable of handling more number of service requests resulting in scalability of our proposed architecture when comparing with normal RSU2.

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Fig 10: Comparison of cluster head RSU with normal RSU

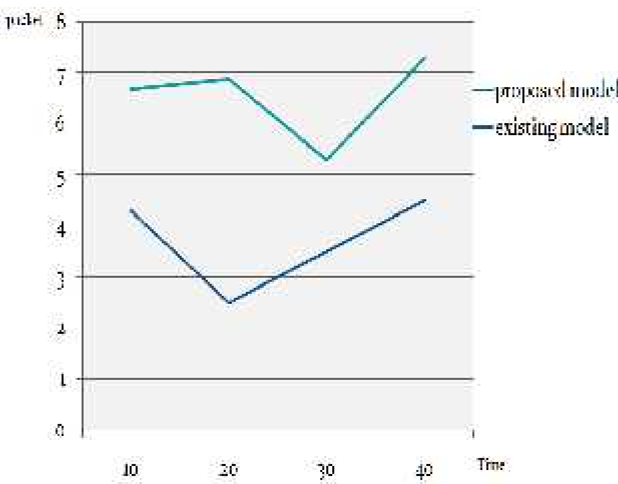

Fig 11(a): Throughput Performance Level

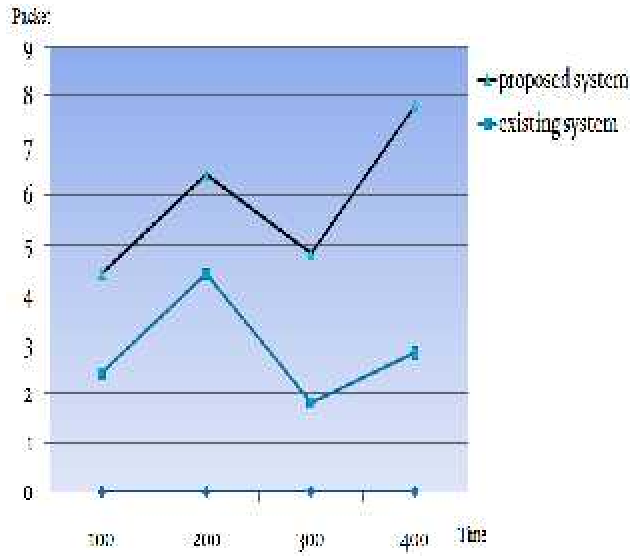

Fig 11(a): Performance Level of Packet Delivery Ratio

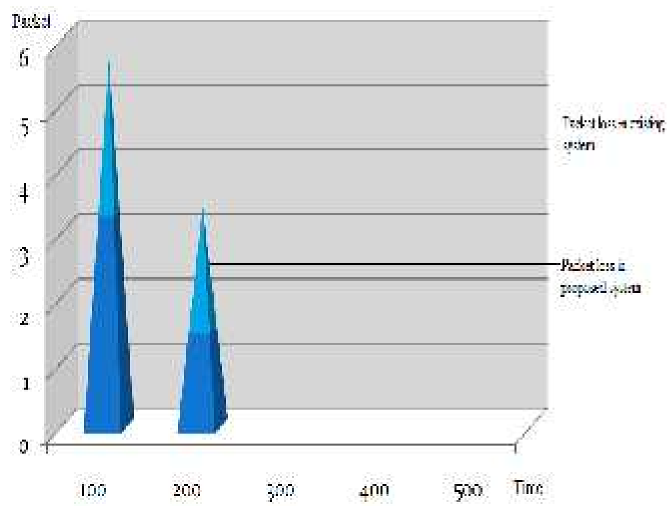

Fig 11(c): Performance Level to Measure Packet Loss

CONCLUSION:

The principle of VANET's is to ensure the road safety applications and to provide comfort for vehicle drivers. In this way, the vehicle act as communication nodes which exchange data to ensure the collision prevention and accident warning, and provides services such as traffic information, breakdown, fuel services, office locations. Through

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this paper we made a wide analysis on the VANET structure, and advantages. We also confer LocVSDPs protocol, their merits to improve the scalability of vehicular network and RTA model providing authentication of vehicle, security, privacy in existing model. Finally through the experimental analysis proved that LocVSDPs protocol used in RTA model will reduce the packet loss in VANET.

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