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Efficient Packet delivery framework using Geo-cast Routing approach for a Vehicular Ad-hoc Network (VANET)

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Abstract—In recent years, the technology of Vehicular Ad-hoc Networks(VANET's) communication has become more popular, allowing people to share road information with each other and use it while driving.Vehicular Ad-hoc Networks are special type of Mobile Ad-hoc Networks (MANET's) in which nodes are highly motile, so the network topology changes very fast. In order to form the communication there are several routing protocols provide to optimal path for delivery of packets. In this paper, the Geo-cast routing(GPRs) are applied for both urban and highway areas based on traffic environment. The two protocols Coverage Aware Geo-cast Routing(CAGR) in urban vehicular networks and Information Propagation Speed Analysis(IPSA)in highway vehicular networks are discussed.The path formation from source vehicle to destination vehicle based on different criteria are considered. The results are analyzed using MATLAB.

Keywords—Vehicular Ad-hoc networks, CAGR , IPSA .

I. INTRODUCTION

In Vehicular Ad-hoc Networks (VANET's) vehicles circulate information with each other and with nearby fixed Road Side Unit (RSU) [1]. As the vehicles are randomly changing their position the mobility is high and having rapidly changeable topology. A VANET provide both vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) communication. Vehicular communication is considered as anempower for driverless cars of the future. Presently, the vehicular communication is used for application such as safety messaging, traffic and congestion monitoring and general purpose internet access[2].There are different routing protocols for VANET which has been classified in many ways according to the aspects such as protocol characteristics, techniques used, routing information, quality of service, network structure and so on.

Geo-cast routing refers to the routing the information or instruction to a group of nodes identified by their geographical locations[4].In [3] authors have presented a geo-cast routing scheme for both city and highway scenarios based on the idea of finding the relay node selection. The main characteristics of urban traffic environment are high vehicle denseness, changeablespeed of vehicles, highly deviation in speed, large number of onward road options and obscure effect because of presence of many obstacles on road side that make it distinct from highway traffic environment. The rest of this paper is organized as follows section 2-Background research, section 3-VANET Lane formation section 4-CAGR algorithm section 5-IPSA algorithm section 6 -Conclusion of paper.

II. BACKGROUND RESEARCH

A very important outline of VANET is to develop an efficient,

reliable and secure routing protocol. Vast research has been conducted in this area [4] [5] [6] [7] [8] [9] [10]. Geo-cast routing protocols follow the principle of routing data packets from a single source vehicle to all vehicles belonging to the areacalled Zone of Relevance(ZOR) consist of destinationvehicle[11] [12]. To send the messages in a geo-cast region Bachir et al [2] proposed a geo-cast for inter-vehicle communication based on routing schemes [14]. Joshi et al[13] also proposed changeable geo-cast routing protocol for inter-vehicles communication as the topology changes frequently and network fragmentation. The geo-cast routing [12-15] satisfyingly transmit messages to a geo-cast region in VANETs. There are different routing protocols in VANETs providing multi hop wireless communication over an autonomous mobile environment [16].

There are several routing protocols existing in geo-cast routing but the optimal path delivery of packets for urban and highway are not possible because of cost effectiveness and highly mobility of vehicles. In the proposed work the algorithms like CAGR,IPSA are used to build the communication between urban and highway traffic environment which gives better reliability ,efficiency and less cost effective than the previous work that has been implemented. There are many aspect that has to be consider before going through the algorithms like lane formation, relay node selection are the basic terms which has been used and briefly explain in the below sections.

III. VANET LANE FORMATION

To simulate the presence of vehicles across multiple lanes the vehicle deployment algorithm is used. The vehicles can be deployed in the given area between x_{min} *to* x_{max} & y_{min} *to* y_{max} .where $x_{min}$is the minimum area limit, x_{max} is the maximum xarea limit,y_{min} is the minimum y area limit &y_{max} is the y maximum area limit.Area deployment algorithm is used to distribute the vehicles across multiple lanes in the given network and assign all vehicles Lane ID's. The Road Side Unit (RSU) can be placed near to each lane either

uniform or hotspot technique. Control server is responsible for communication between RSU's.

A. SELECTION OF RELAY VEHICLE

The relay vehicle is selected for each lane based on the following criteria

a) Vehicle Id's of a Specific Lane and RSU Location.

b) Number of Iterations and Packets ,RSU ACK count will be measured for each iteration.

RSU ACK count=Number of REPLY/Number of Packets Generated.

c) Total RSU ACK count=Summation of RSU ACK count for all iterations.

d) The Vehicle which has maximum RSU ACK count acts Like Relay Vehicle.

B. VANET PACKET DELIVERY MECHANISM

The packet or the information can be send from source vehicle to destination vehicle. The communication can be within lane and between lane. If the communication is within lane then Relay vehicle and the Destination vehicle are on same lane.

If the communication is between lanes then the Relay vehicle and Destination vehicles are not on same lane.then the format of packet delivery will be,

Source RSU--->control server--->destination RSU--->destination relay vehicle--->{packet delivery mechanism}--->destination vehicle.

The simulation results can be shown below;

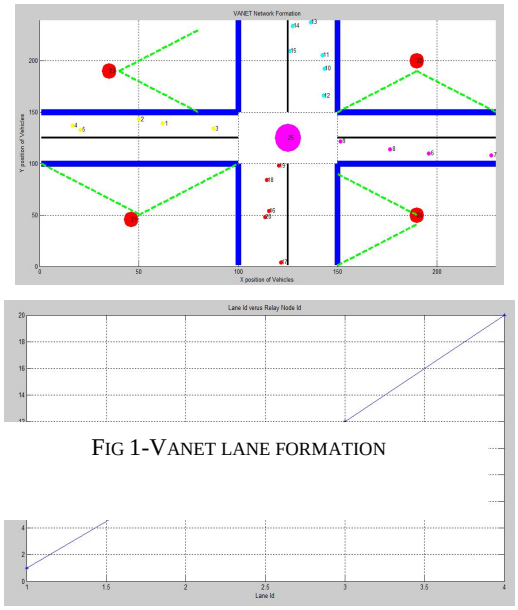


FIG 1-VANET LANE FORMATION

X-AXIS :LANE ID Y-AXIS RELAY NODE ID

FIG 2- RELAY NODE SELECTION

IV. COVERAGE AWARE GEO-CAST ROUTING (CAGR) IN URBAN VEHICULAR NETWORKS

CAGR is used to deliver the packets from the source vehicle to destination vehicle. The CAGR algorithm will first generate the Vehicular Routing Tables (VRT). VRT consist of local vehicles in the Fresnel zone and few vehicles of frauhoffer zone. Fresnel Zone are the vehicles which are present within the range of $'R'$ and then vehicles set which are present in the Fraunhoffer region which are in the range of $> R \& < 2R$. The flow chart is as follows;

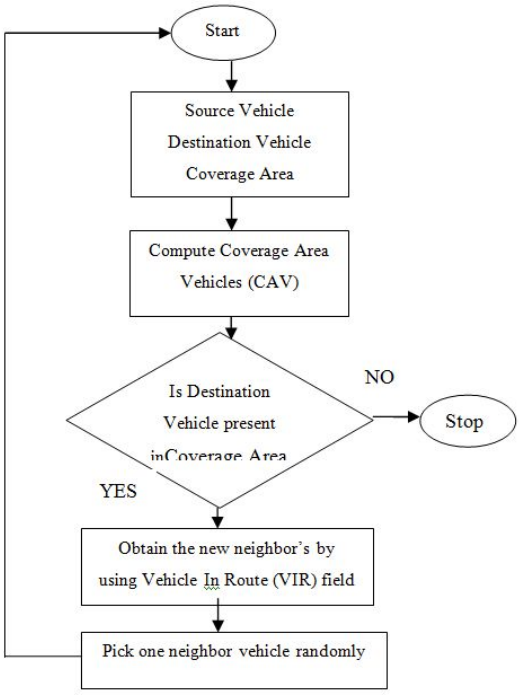
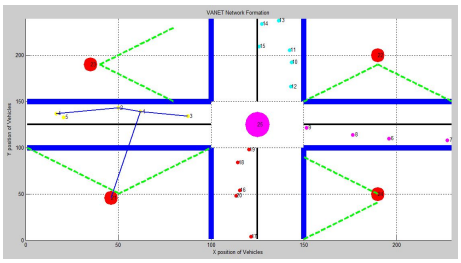


FIG 3-CAGR FLOW CHART



X-AXIS: X POSITION OF VEHICLES; Y-AXIS: Y POSITION OF VEHICLES

FIG 4- CAGR WITHIN LANE

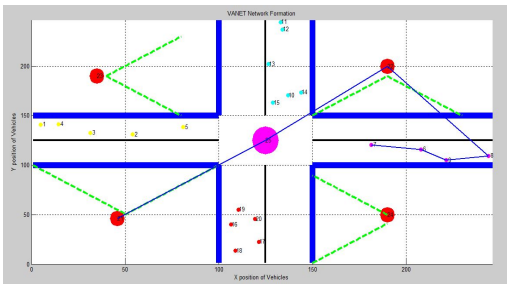


FIG 5- CAGR BETWEEN THE LANES

V. INFORMATION PROPAGATION SPEED ANALYSIS (IPSA)

IPSA algorithm does not require VRT. IPSA algorithm main strength is based on the density of the vehicles. The next forward vehicle will be picked based on which neighbor vehicle has the maximum density. Density of vehicles is defined as the count of number of vehicles falling in range. One of the special case is that if the density of two vehicles is maximum and is the same then the vehicle with low vehicle id is considered to move forward and vehicle which is closer to destination vehicle is considered .

IPSA algorithm can be described by the following flowchart;

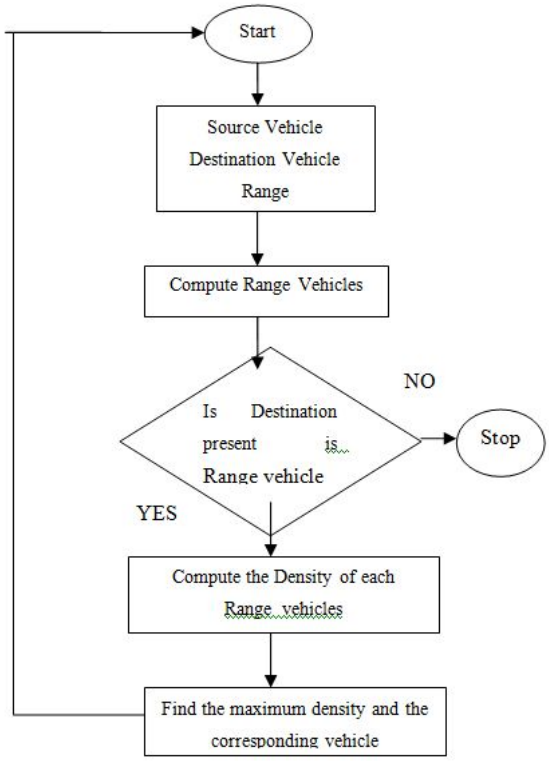


FIG 6-FLOW CHART OF IPSA ALGRITHM

The IPSA Algorithm simulation results of communication between the lanes and within lanes can be shown below by considering the density of vehicles.

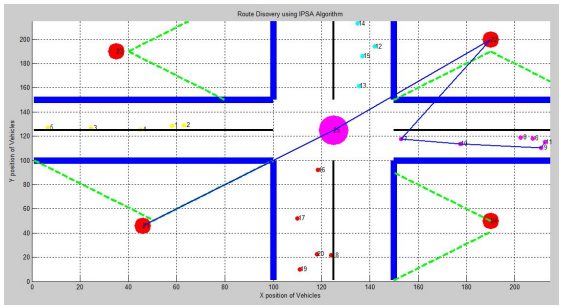


FIG 7-IPSA COMMUNICATION BETWEEN THE LANES

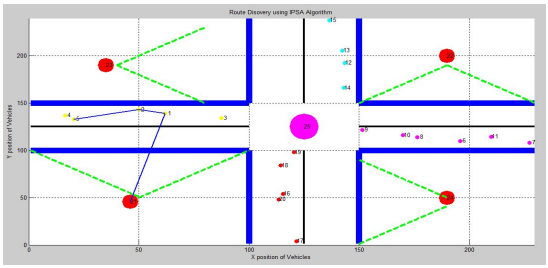


FIG 8-IPSA COMMUNICATION WITHIN LANE

VI. CONCLUSION

Vehicular Ad hoc Networks (VANETs) are becoming popular in Intelligent Transportation Systems, they have been designed to provide road safety and services for passengers comfort, given their importance related to the safety of humans lives. In this paper, we have presented different Geo-cast routing protocols in VANETs based on traffic environment. The implementing result shows that how the messages sent over the network. The messages can be send within lane and between lanes using different routing protocols CAGR for urban and IPSA for highway traffic environment.

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