RESEARCH ARTICLE OPEN ACCESS

PERFORMANCE ANALYSIS OF GEOCAST BASED PROTOCOLS IN VANET

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ABSTRACT

Vehicular Ad-hoc Network (VANET) is a subclass of MANET, which is a promising methodology for the Intelligent Transport System. As regular driving turns out to be more difficult when contrasted with the past period. In this way, it is the need of innovation to oversee transportation brilliantly. For this there is an innovation named as Vehicular Ad-hoc Network (VANET) which can be utilized productively. Vehicular Ad-hoc Network (VANET) prompts street wellbeing, managing the traffic . In this innovation different routing protocols are intended for correspondence between vehicles (V2V) just as infrastructure (V2I). There are sure issues related with the Message Forwarding in recently utilized routing protocols. To defeat those issues Geocast Routing Protocol can turn into a decent arrangement. Its goal is to convey the parcel from source hub to any remaining hubs inside a predetermined geological locale (Zone of Relevance ZOR). The principle motivation behind Geocasting is to deliver the packet from source node to all other nodes within a specified geographical region (Zone of Relevance ZOR). Geocast offers a few types of assistance like discovering companions who are close by, geographic promoting, and mishap or incorrect way driver warning on a motorway. This paper expounds the performance assessment of OLSR, AODV and DSDV utilizing a performance measurement on a scenario produced of Amravati city.

Keywords: - Vehicular Ad-hoc Networks (VANETs), Vehicle Identification Number (VIN), Road Side Unit(RSU),Vehicle to Vehicle(V2V), Vehicle to Infrastructure(V2I),Zone of Relevance (ZOR), Zone of Forwarding (ZOF), Packet Delivery Ratio (PDR).

I. INTRODUCTION

With the sharp increment of vehicles on street as of late, driving has not halted from being more troublesome and riskier. Streets immersed, wellbeing distance and clear and sensible speed are not really worshipped, drivers regularly need sufficient consideration. To improve the wellbeing, security and proficiency of the Intelligence transportation System have been created, which apply rising and arising information technological advances in vehicles and transportation infrastructure. From the network point of view, security is one among the principal and principal drivers for VANETs any place individuals' lives are in question. Vehicular ad-hoc networking is a significant part of Intelligent Transportation Systems. The principal benefit of VANET correspondence is found in active safety systems that increase passenger safety by exchanging warning messages between vehicles. Different applications and private administrations are additionally allowed to bring down the expense and to empower VANET arrangement and appropriation administrations.

II. VEHICULAR AD HOC NETWORK (VANET)

"A Vehicular Ad-Hoc Network, or VANET, is a form of mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles and nearby fixed equipment, usually described as roadside equipment. It is a promising approach for the intelligent transportation system (ITS)[1]."

The plan of routing protocols in VANETs is a significant and important issue for supporting the savvy ITS.
VANETs can be utilized for a wide scope of security and non-wellbeing applications, take into account esteem added administrations like vehicle wellbeing, programmed cost instalment, traffic the board, upgraded route, area-based administrations like finding the closest fuel station, structure or travel hold up[2].

Fig 1: General Scenario of VANET

By introducing vehicular networking technologies. This technology will be applied either in its vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2I) form, stakeholders envision several e-Safety applications that will enhance traffic safety[3]. For instance, applications can offer drivers prior with extra information on traffic circumstances to help them respond fittingly and opportune to expected risks. Clearly, such data can especially valuable on account of crisis reaction activities.

III. OVERVIEW OF ROUTING PROTOCOLS

Classification of routing protocols in vehicular ad hoc network can be done in many ways, but most of those are done depending on routing strategy and network structure.

A. Proactive protocols:

Proactive protocol depend on intermittent trade of control messages and keeping up directing tables. Every node keeps up complete data about the organization geography locally. This data is gathered through proactive trade of fractional routing tables put away at every node[7]. Since every node mindful of the total geography, a node will in time track down the best course to an objective. Nonetheless, a proactive protocol produces huge volume of control messages and this may take up a huge piece of the accessible transmission capacity[6]. The control messages may devour practically the whole data transfer capacity with countless nodes and expanded portability. Destination Sequenced Distance Vector (DSDV) is an illustration of proactive protocol.

B. Reactive Protocols:

In a reactive protocol, a route is found just in the event that it is fundamental. In elective words, the protocol attempts to find a route just on-request, in the event that it is important. These protocols create substantially less controlled traffic at the cost of inactivity, i.e., set aside more effort to discover a route contrasted with a proactive protocol.

Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector (AODV), Geocast Routing Protocol (GRP) are instances of reactive protocols.

IV. CLASSIFICATION OF ROUTING PROTOCOL

In VANET, there are different types of routing protocols: Topology based, Position based, Cluster based, Geocast, Broadcast.

A. Topology based Routing protocols:

"It uses link information that exist within the network to perform packet forwarding. The packets are perpetually broadcasted and flooded among nodes to maintain the path, then a table is built within a node which indicates the next hop node towards a destination."

B. Position based Routing protocols:

"Position based Routing protocols share the property of using geographic positioning information so as to pick the next forwarding hops. The packet is sent no any map knowledge to the one hop neighbour that is nearest to destination[9]."

C. Broadcast Routing protocols:

"It is often used in VANET for sharing, traffic, weather and emergency, road conditions among vehicles and delivering advertisements and announcements. Broadcasting is employed once a message needs to be disseminated to the vehicle beyond the transmission range i.e. multi hops are used[10]. Broadcast sends a packet to all nodes in the network, typically using flooding. This ensures the delivery of the packet however bandwidth is wasted and nodes receive duplicates."

D. Geocast Routing Protocols:

"It is basically a location-based multicast routing. Its purpose is to deliver the packet from source node to all other nodes within a specified geographical region (Zone of Relevance ZOR). In Geocast routing vehicles outside the ZOR are not alerted to avoid unnecessary hasty reactions[8]."

E. Cluster Based Routing Protocols:

"Virtual Infrastructure is created through clustering of nodes in order to provide scalability. Each cluster can have a cluster head, which is responsible for secure communication between inter-cluster and intra cluster coordination in the network [10]."

IV. GEOCAST ROUTING PROTOCOL

The main purpose of Geocast routing protocol is forwarding message to nodes within a geographical region. Geocasting, a form of the conventional multicasting problem, distinguishes itself by specifying hosts as group members within a specified geographical region termed as Zone of Relevance[10].

There exists multiple Geocast routing protocol in VANET: OLSR, AODV, DSDV, etc.

A. Optimized Link State Routing(OLSR)

It is a proactive routing protocol where the routes are always immediately available when needed. OLSR may optimize the reactivity to topological changes by reducing the maximum time interval for periodic control message transmission. Furthermore, as OLSR continuously maintains routes to all destinations in the network, the protocol is beneficial for traffic patterns where a large subset of nodes are communicating with another large subset of nodes, and where the [source, destination] pairs are changing over time.

OLSR protocol is well suited for the application which does not allow the long delays in the transmission of the data packets. The best working environment for OLSR protocol is a dense network, where the most communication is concentrated between a large numbers of nodes[11].

B. Ad Hoc on demand Distance Vector (AODV):

It is a routing algorithm is a routing protocol designed for ad hoc mobile networks. AODV is capable of both unicast and multicast routing[4].

It is an on-demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources. AODV uses sequence numbers to ensure the freshness of routes. It is loop-free, self-starting, and scales to large numbers of mobile nodes through the network in order to discover the paths required by a source node[12]. An intermediate node that receives a RREQ replies to it using a route reply message only if it has a route to the destination whose corresponding destination sequence number is greater or equal to the one contained in the RREQ.

The RREQ also contains the most recent sequence number for the destination of which the source node is aware.

C. Destination Sequenced Distance Vector Routing (DSDV):

It is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. The DSDV protocol can be used in mobile ad hoc networking environments by assuming that each participating node acts as a router[5].

Each node must maintain a table that consists of all the possible destinations. In this routing protocol, an entry of the table contains the address identifier of a destination, the shortest known distance metric to that destination measured in hop counts and the address identifier of the node that is the first hop on the shortest path to the destination.

Each mobile node in the system maintains a routing table in which all the possible destinations and the number of hops to them in the network are recorded. A sequence number is also associated with each route/path to the destination[13].

V. METHODOLOGY

The objective of this paper is to compare and analyse the performance of various Geocast routing protocols in a traffic scenario. This could be further used to develop a modern intelligent traffic management system which will help to reduce accidents, handle emergencies and manage the traffic in an efficient manner. We have developed a traffic scenario in Sumo simulator using OpenStreetMap. This scenario is tested in Network simulator NS3 by applying three Geocast routing protocols named OLSR, AODV and DSDV on the resultant traffic scenario generated. The performance of the Geocast routing protocols is analysed by using a statistical approach of bar graphs.

VI. IMPLEMENTATION DETAILS

We have used Sumo 1.9.2 and NS3 3.29 to implement geocasting routing protocols that are Optimized Link State Routing (OLSR), Ad Hoc on demand Distance Vector (AODV), Destination Sequenced Distance Vector Routing (DSDV).

Fig 5(a) Area from OpenStreetMap-RajKamal Square

Fig 5(a) shows the selected area i.e. RajKamal Square, Amravati, Maharashtra, India in open street map using Open Street wizard. It is a location-based selection which takes live coordinates from OpenStreetMap.

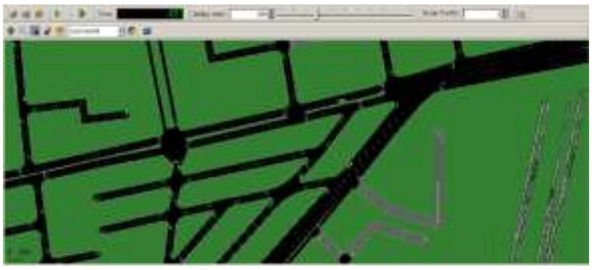

Fig 5(b) View of Selected Area in Sumo Simulator

Fig 5(b) shows that the selected area from Open Street Map is integrated into Sumo Simulator. It shows lanes, signals and traffic embedded in the simulation.

Fig 5(c) Zooming Area in Sumo Simulator

Fig 5(c) shows the zoomed in area of RajKamal Square, Amravati which shows traffic signals, lanes and traffic simulation in the Sumo simulator.

VII. RESULT AND DISCUSSION

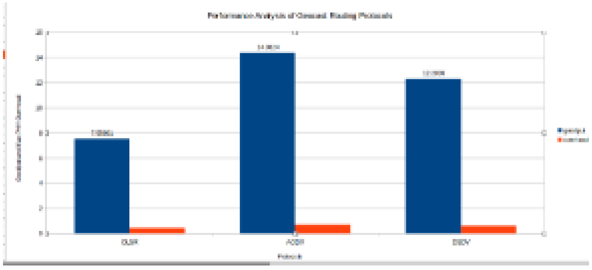

Fig 5(d): Performance Analysis of Geocast Routing Protocols.

Fig 5(d) shows the performance analysis of three geocast routing protocols named OLSR, AODV, DSDV. The parameters for comparison are goodput and mac phy overhead. It shows that AODV has the highest goodput but OLSR surpasses other protocols by having lowest packet loss ratio i.e., overhead.

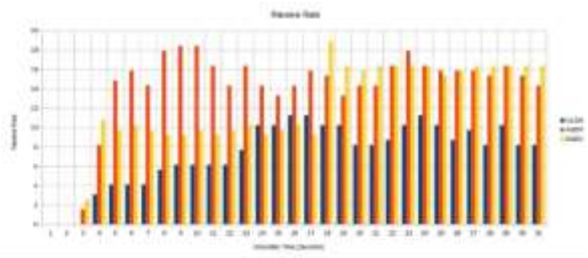

Fig 5(e): Receive Rate of Geocast Routing Protocols.

Fig 5(e) shows the packet receive rate of three Geocast routing protocols named OLSR, AODV, DSDV. It shows that DSDV and AODV are neck to neck and surpass OLSR.

Fig 5(f): Packets Received in Geocast Routing Protocols.

Fig 5(f) shows the number of packet received by the three Geocast routing protocols named OLSR, AODV, DSDV. Here the protocols AODV and DSDV are neck to neck and both received more packets successfully than OLSR.

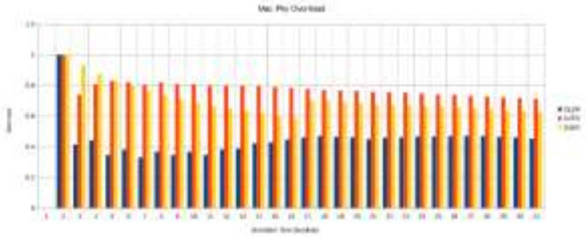

Fig 5(g): Mac Phy Overhead in Geocast Routing Protocols**.**

Fig 5(g) shows the MAC PHY overhead in the cases of three Geocast routing protocols named OLSR, AODV, and DSDV. It shows the loss of packets is the lowest in OLSR.

We have analysed the performance of geocasting routing protocols that are Optimized Link State Routing (OLSR), Ad Hoc on demand Distance Vector (AODV), Destination Sequenced Distance Vector Routing (DSDV). From the above graphs Fig 5(d), Fig 5(e), Fig 5(f), Fig 5(g) we resulted that the AODV protocol has the highest goodput among the three while loss of packets is the lowest to be found in OLSR protocol.

VIII. CONCLUSION

We introduced the Geocast Routing Protocol (GRP), especially intended for vehicular Ad-hoc network dependent on the incomplete information about the organization geological state and help of the city guide. In this paper we found that in light of the boundaries receive rate, packets receive, goodput and MAC PHY overhead OLSR outflanks in the chosen situation. Utilizing VANET innovation to convey extra data about vehicle positions, velocities, and courses to other traffic members and infrastructure can assist with making such tasks more secure and quicker, and subsequently conceivably safe lives.

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