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Vanet Routing With Cognitive Radio Network over High Density Road

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Abstract - Ad-hoc network is used to transmit various types of message over the network. Safety message has to transmit for the security reasons on the vehicle and road transportation various routing protocols have been utilized for the purpose of message transmission. GPRS, AODV, DSR, PUMA these are various routing protocol utilizes for message transmission VANET scenario is used for mainly V2V and V2R purposes. V2V is vehicle to vehicle communications and V2R is vehicle to roadside communication. In various scenarios message transmission is done according to vehicle density available on the road. Based on the real time road density vehicle establish reliable route for the communication on packet delivery. The main issue of road density is due to high load on road message communication get overhead due to less amount of network bandwidth to overcome this issue cognitive radio bandwidth can be utilize for data transmission by channel sensing and message can be transmit through cognitive radio channels.

Keywords: VANET, V-2-V & V-2-R Communication, ITS, DSR, AODV, GPRS, PUMA.

I. INTRODUCTION

1.1 VANET

VANET uses cars as mobile nodes in a MANET to create a mobile network. A VANET turns turn participating car into a wireless router or node which allowing cars 100 to 300 meters of each other to connect and create a network with a wide range. As cars fall out of the signal range and drop out of the network, other cars can join in, connecting vehicles to one another so that a mobile network is created. It is estimated that the first systems that will be this technology are police and fire vehicles to communicate with each other for the purpose of security [1].The connectivity is done among one vehicle to other vehicle and vehicle to road side infrastructure and vehicle or road side infrastructures to the central authority responsible for the network maintenance.

1.2 CHARACTERISTICS OF VANET

VANET is an application of MANET but it has its own distinct characteristics which can be summarized as:

- High Mobility

The nodes in VANETs usually are moving at high speed. This makes harder to predict a node's position and making protection of node privacy [2]. Rapidly changing

- Network topology

Due to high node mobility and random speed of vehicles, the position of node changes frequently. As a result of this, network topology in VANETs tends to change frequently.

- Unbounded network size

VANET can be implemented for one city, several cities or for countries. This means that network size in VANET is geographically unbounded.

- Frequent exchange of information

The ad hoc nature of VANET motivates the nodes to gather information from the other vehicles and road side units. Hence the information exchange among node becomes frequent.

- Wireless Communication

VANET is designed for the wireless environment. Nodes are connected and exchange their information via wireless. Therefore some security measure must be considered in communication. Time Critical: The information in VANET must be delivered to the nodes with in time limit so that a decision can be made by the node and perform action accordingly.

- Sufficient Energy

The VANET nodes have no issue of energy and computation resources. This allows VANET usage of demanding techniques such as RSA, ECDSA implementation and also provides unlimited transmission power.

- Better Physical Protection

The VANET nodes are physically better protected. Thus, VANET nodes are more difficult to compromise physically and reduce the effect of infrastructure attack.

1.3 ROUTING PROTOCOLS IN VANET, S

The characteristic of highly dynamic topology makes the design of efficient routing protocols for VANET is challenging. The routing protocol of VANET can be classified into two categories such as Topology based routing protocols & Position based routing protocols. Overall classification of VANET routing protocols use link's information within the network to send the data packets from source to destination. Topology based routing approach can be further categorized into proactive (table-driven) and reactive (on-demand) routing.

1.3.1 Proactive (table-driven)

Proactive routing protocols are mostly based on shortest path algorithms. They keep information of all connected nodes in form of tables because these protocols are table based. Furthermore, these tables are also shared with their neighbors. Whenever any change occurs in network topology, every node updates its routing table.

- FSR

Fisheye State Routing is an efficient link state routing that maintains a topology map at each node and propagates link state updates with only immediate neighbors not the entire network. Furthermore, the link state information is broadcast in different frequencies for different entries depending on their hop distance to the current node. Entries that are further away are broadcast with lower frequency than ones that are closer. The reduction in broadcast overhead is traded for the imprecision in routing. However, the imprecision gets corrected as packets approach progressively closer to the destination.

1.3.2 Reactive (On Demand)

Reactive routing protocol is called on demand routing because it starts route discovery when a node needs to communicate with another node thus it reduces network traffic

- AODV

In Ad Hoc on Demand Distance Vector (AODV) routing, upon receipt of a broadcast query (RREQ), nodes record the address of the node sending the query in their routing table. This procedure of recording its previous hop is called backward learning. Upon arriving at the destination, a reply packet (RREP) is then sent through the complete path obtained from backward learning to the source.

- DSR

DSR uses source routing, that is, the source indicates in a data packet's the sequence of intermediate nodes on the routing path. In DSR, the query packet copies in its header the IDs of the intermediate nodes that it has traversed. The Destination then retrieves the entire path from the query packet and uses it to respond to the source. As a result, the source can establish a path to the destination.

- TORA

Temporally Ordered Routing Algorithm (TORA) (Park, 2007) routing belongs to a family of link reversal routing algorithms where a directed acyclic graph (DAG) toward the destination is built based on the height of the tree rooted at the source. The directed acyclic graph directs the flow of packets and ensures reach ability to all nodes.

1.4 APPLICATIONS OF VANET'S

Based on the type of communication either V2I or V2V, we are arranging the applications of VANETs into following classes:

- Safety oriented
- Commercial oriented
- Convenience oriented
- Productive Applications

1.4.1 Safety Applications

- Real-time traffic

The real time traffic data can be stored at the RSU and can be available to the vehicles whenever and wherever needed. This can play an important role in solving the problems such as traffic jams, avoid congestions and in emergency alerts such as accidents etc.

- Co-operative Message Transfer

Slow/Stopped Vehicle will exchange messages and co-operate to help other vehicles. Though reliability and latency would be of major concern, it may automate things like emergency braking to avoid potential accidents. Similarly, emergency electronic brake-light may be another application.

- Post Crash Notification

A vehicle involved in an accident would broadcast warning messages about its position to trailing vehicles so that it can take decision with time in hand as well as to the highway patrol for tow away support as depicted.

- Road Hazard Control Notification

Cars notifying other cars about road having landslide or information regarding road feature notification due to road curve, sudden downhill etc .

- Cooperative Collision Warning

Alerts two drivers potentially under crash route so that they can mend their ways.

- Traffic Vigilance

The cameras can be installed at the RSU that can work as input and act as the latest tool in low or zero tolerance campaign against driving offenses.

1.4.2 Commercial Applications

- Remote Vehicle Personalization/ Diagnostics

It helps in downloading of personalized vehicle settings or uploading of vehicle diagnostics from/to infrastructure.

- Internet Access

Vehicles can access internet through RSU if RSU is working as a router.

- Digital map downloading

Map of regions can be downloaded by the drivers as per the requirement before traveling to a new area for travel guidance. Also, Content Map Database Download acts as a portal for getting valuable information from mobile hot spots or home stations.

- Real Time Video Relay

On-demand movie experience will not be confined to the constraints of the home and the driver can ask for real time video relay of his favorite movies.

- Value-added advertisement

This is especially for the service providers, who want to attract customers to their stores. Announcements like petrol pumps, highways restaurants to announce their services to the drivers within communication range.

1.4.3 Convenience Applications

- Convenience application mainly deals in traffic management with a goal to enhance traffic efficiency by boosting the degree of convenience for drivers.
- Route Diversions

Route and trip planning can be made in case of road congestions.

- Electronic Toll Collection

Payment of the toll can be done electronically through a Toll Collection Point.

1.4.4 Productive Applications

- Environmental Benefits

AERIS research program is to generate and acquire environmentally-relevant real-time transportation data, and use these data to create actionable information that support and facilitate "green" transportation choices by transportation system users and operators. Employing a multi-modal approach, the AE-RIS program will work in partnership with the vehicle-to-vehicle (V2V) communications research effort to better define how connected vehicle data and applications might contribute to mitigating some of the negative environmental impacts of surface transportation.

- Time Utilization

If a traveler downloads his email, he can transform jam traffic into a productive task and read on-board system and read it himself if traffic stuck. One can browse the Internet when someone is waiting in car for a relative or friend.

- Fuel Saving

When the TOLL system application for vehicle collects toll at the toll booths without stopping the vehicles, the fuel around 3% is saved, which is consumed when a vehicles as an average waits normally for 2-5 minutes.

II. LITERATURE SURVEY

Alwakeel, S et. al. [1] "A virtual P-Persistent bandwidth partitioning manager for VANET's broadcast channel" In VANET'S Safety messages is very much important so that it must have the highest assurance of delivery. But safety message can be rejected due to its low bandwidth. In this message we implement a approach to block minimum numbers of safety messages. But if you kept non safety message it can be penalized you. Through virtually partitioned VANET's bandwidth and by applying P-Persistent scheme to reduce message congestion an improved performance of message dissemination in VANETs can be achieved.

Varshney, Neeraj et. al. [2] "Security protocol for VANET by using digital certification to provide security with low bandwidth" Wireless communication is done like between vehicle to vehicle or between vehicle to road. So security is so much important. In VANET some serious network attacks such as man in middle attack, masquerading is possible. Author introduced an algorithm to overcome these network attacks via low message passing and try to reduce the bandwidth at the time of authentication, message passing. For analysis and check the security of our protocol author have analyzed the proposed protocol with the existing protocol based on computational cost and performance time

Ghosh, T. et. al. [3] "Congestion control by dynamic sharing of bandwidth among vehicles in VANET" For the safe transmission of message author use the control channel and service channel is use for the transmission of unsafe message. Each node computes its own priority depending upon the number of waiting messages in control queue and service queue. Each node reserves a fraction of control channel and service channel dynamically depending upon the number of waiting messages in its queue. The unsafe messages at a node may also be transmitted using control channel provided the control channel is free and service channel is overloaded which helps to reduce the loss of unsafe message at a node which in turn reduces the congestion level of a node and also improves its quality of service

Gandhi, U.D et. al. [4] "Request Response Detection Algorithm for detecting DoS attack in VANET" The sub category of MANET is VANET which is used to create a mobile network that is based on mobile vehicles. It allows every participating vehicle into a wireless node, allowing it approximately 100 to 300 meters of each other to connect and in turn, create a wide range network. Vehicle can join one another between these ranges. It is used for ITS (Intelligence Traffic System). Very well-known automotive companies like BMW and Ford promotes this term. The mobile nodes are well equipped with ORT (On board Radio Transponder) that is useful in communication with other nodes in a network. In order to establish communication among the vehicles VANET comes with communication points by road infrastructure. Lot of security attacks happen in VANET like Sybil attack, selfish driver attack. In this paper we proposed a Request Response Detection Algorithm (RRDA) which is used to detect DOS after APDA response Time and Security Increase.

Meriam, E. et. al. [5] "VANET adaptive and Reliable Broadcast protocol", Safety is most important in VANET. A major application of VANET is safety warning. Broadcasting of safety messages requires an effective broadcast mechanism. Selection of the probe node is the major problem in VANET broadcasting. The process of the probe node selection and broadcasting of safety messages must be achieved in a limited time. Meanwhile, the transmission reliability must also be preserved. Multi behavior and Reliable Broadcast (MRB) protocol is especially designed for an optimum performance of safety applications and addresses these constraints

III. APPROACHES USED

Intelligent Traffic System (ITS)

An Intelligent Traffic System (ITS) involves a much closer interaction between all of its components: drivers, pedestrians, and public transportation and traffic management systems. Adaptive signal systems, driver advisory and route planning and automated vehicles are some of the goals set up to increase the efficiency of actual systems. a decentralized architecture is developed for city traffic control where intersections are port-based agents. A self-adaptive system would be able to respond quickly to the changes in the road conditions, modifying signal policies and rerouting drivers to prevent congestions. Research issues include distributed control architecture and optimization, inter-agent communication and driver models. Different traffic simulators are being used together with the port-based agent architecture.

AODV (AD-HOC ON-DEMAND DISTANCE VECTOR)

The AODV (Ad-Hoc On-Demand Distance Vector) routing protocol is a reactive routing protocol that uses some characteristics of proactive routing protocols. Routes are established on-demand, as they are needed. However, once established a route is maintained as long as it is needed. Reactive (or on-demand) routing protocols find a path between the source and the destination only when the path is needed (i.e., if there are data to be exchanged between the source and the destination). An advantage of this approach is that the routing overhead is greatly reduced. A disadvantage is a possible large delay from the moment the route is needed (a packet is ready to be sent) until the time the route is actually acquired. In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection.

Request Response Detection Algorithm

VANET is used to create a mobile network that is based on mobile vehicles such as cars. It is a sub category of MANET. It allows every participating vehicle into a wireless node, allowing it approximately 100 to 300 meters of each other to connect and in turn, create a wide range network. In this network vehicles can join into one another so that a mobile internet is created. It is used for ITS (Intelligence Traffic System). Very well-known automotive companies like BMW and Ford promotes this term. In VANET the mobile nodes are well equipped with ORT (On board Radio Transponder) that is useful in communication with other nodes in a network. In order to establish communication among the vehicles VANET comes with communication points by road infrastructure. There are several security attacks possible in VANET such as Sybil attack, selfish driver attack. In this paper we proposed a Request Response Detection Algorithm (RRDA) which is used to detect DOS after APDA. This increases the response time and maximizes the security-in-VANET.

IV. CONCLUSION

VANET is vehicular Ad-hoc network which is used for intelligent transport system for the drivers the ad-hoc network is used to transmit various types of message over the network. Safety message has to transmit for the security reasons on the vehicle and road transportation various routing protocols. VANET scenario is used for mainly V2V and V2R purposes. V2V is vehicle to vehicle communications and V2R is vehicle to roadside communication. In various scenarios message transmission is done according to vehicle density available on the road. The main issue of road density is due to high load on road message communication get overhead due to less amount of network bandwidth to overcome this issue cognitive radio bandwidth can be utilize for data transmission by channel sensing and message can be transmit through cognitive radio channels.

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