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An Effective Review on Vehicular Ad Hoc Network Routing Protocol

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ABSTRACT
Vehicular Ad-hoc Network (VANET) is a most vital class of mobile ad-hoc network (MANET) which modifies intelligent communication among vehicles and also among vehicle and roadside base. It is hopeful approach for the Intelligent Transport System (ITS).when VANET is employing there are several challenges to be addressed. It has a very high active topology and constrained mobility which makes the conventional MANET protocols undesirable for VANET. In this review paper we briefly describe the various VANET routing protocols with their advantages and disadvantages.

Keywords: VANET, ITS, active topology, mobility, MANET.

I. INTRODUCTION

Now these days in wireless networks have proceed to the introduction of a new variety of networks known as transport Vehicular Networks. Vehicular Ad Hoc Network (VANET) may be variety of Mobile Ad Hoc Networks (MANET). VANETs provide us with the infrastructure for developing new systems to raise drivers' and passengers' safety and comfort. VANETs are distributed self organizing networks build between moving vehicles equipped with wireless communication devices. This type of networks is developed as a part of the Intelligent Transportation Systems (ITS) to bring vital improvement to the transportation systems performance. One of the most goals of the ITS is to produce greater traveler safety, convenience and comfort, traffic congestion, waiting times, and fuel consumptions, protocols and Equipment should give a lot of more timely and reliable information transfer between network nodes for them to effectively share very information. In the case of WiMAX, network nodes must expeditiously transmit and receive information in a instantly dynamical network surroundings, characterized by the constant entry and exit of nodes. In addition, mobile nodes must hold handoffs between completely different clusters, all while functioning among very strict technical parameters concerning packet loss, delay, latency, and throughput, among others.

The integration of the sensing devices, embedded computers, navigation systems (GPS), digital maps, and the wireless Communication devices beside with intelligent algorithms will facilitate to develop various form of applications for the ITS to enhance safety on the roads. The up to date info provided by the combination of all these systems helps drivers to accumulate time period information regarding road conditions permitting them to react on time. As shown in figure 1. For example, warning messages sent by vehicles required in an accident enhances traffic safety by serving to approaching drivers to take proper selections before getting into the crash dangerous zone (ElBatt et al., 2006) (Xu et al., 2007). And Information concerning the present transportation conditions facilitate driving by taking new routes just in case of congestion, thus saving time and adjusting fuel economic consumption (Dashtinezhad et al., 2004) (Nadeem et al., 2004). To assess VANET protocols and applications, outdoor experiments could be used but it can be difficult and expensive to implement because it involves a high number of vehicles and real-life scenes. To overcome these problems, simulation tools are used extensively for VANET simulations [6].

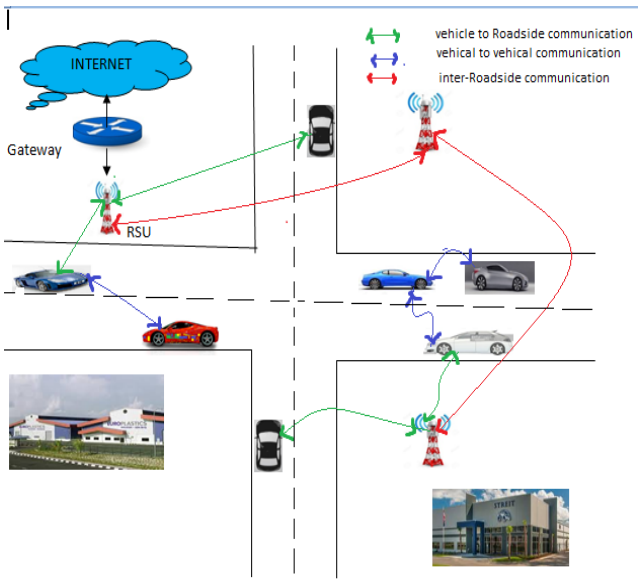

Figure 1: VANET Ad-hoc Network

In addition to safety concerns, VANET can also support different non-safety applications that need a high Quality of Service (QoS) guarantee. This includes Multimedia (e.g., audio/video) and data (e.g: weather information, maps information. toll collection, internet access,) applications. Therefore, it can effectively reduce accidents, improve safety and manage city traffic with high efficiency. It can also helps to share some information between vehicles, such as weather forecast , restaurant addresses and gas station. VANET can also provide music or video download services when it's connected to Internet as terminal networks [7]. It also allows many value added services like traffic management, vehicle safety, automated toll payment, location based services like finding closest restaurant, travel lodge, fuel station and documentary applications just like access to internet [8].

II. ARCHITECTURE

Vehicular networks are compiling of mobile nodes, vehicles required with On Board Units (OBU), and stationary nodes called Road Side Units (RSU) connected to infrastructure that will be distributed along the roads. Both OBU and RSU devices have wired/wireless communications capabilities. OBUs communicate with each different and with the RSUs in ad hoc manner.

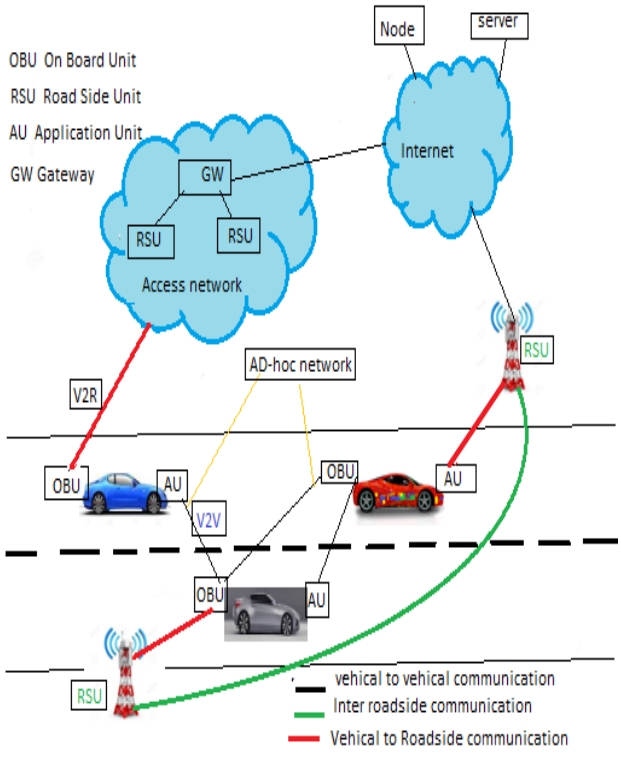

Figure 2: VANET Architecture

There are primarily two types of communications assumption in vehicular networks: Vehicle-to-Vehicle (V2V) and Vehicle-to-RSU (V2R). The RSUs can additionally communicate with each other and with other different networks just like the internet as shown in Figure 2.Vehicular Networks area unit are waited to employ variety of advanced wireless technologies such as Dedicated Short Range Communications (DSRC), that is a raised version of the Wi-Fi technology desirable VANET surroundings. The DSRC is highly-developed to support the information transfer in rapidly changing communication environments, just like VANET, where time critical responses and high information data rates are needed.

III. VANET ROUTING PROTOCOLS

Routing is a mechanism to determine and to pick out a selected a path so as to send data from source to destination [14, 16]. There are numerous routing protocol rule designed for ad-hoc networks. Classification of various VANET routing protocols will be divided in two broad categories: proactive or Table Driven Routing Protocols (DSDV, OLSR, FSR) and reactive or On-demand routing protocols (AODV, DSR, TORA) that shown in figure 3.Here we used AODV protocol.

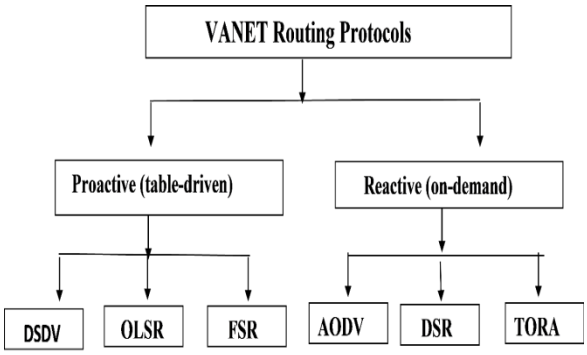

Figure 3: VANET Routing Protocols

IV. AD HOC ON DEMAND DISTANCE VECTOR (AODV)

This AODV is a pure reactive routing protocol that is capable of both uni-casting and multicasting. Ad Hoc network could be a mobile, multi-hop, Self-discipline mobile system, each mobile node have both a router and a host [1]. Ad Hoc network without a fixed network infrastructure can provide communication links for the nodes. In Ad hoc On Demand Distance Vector (AODV), like all reactive protocols, it works on demand basis when it is equipped by the nodes within the network [8, 14]. AODV is a representative reactive routing protocol of

MANET. This protocol has two parts: route discovery and route maintenance. AODV discovers routes on an as needed basis via a similar route discovery process. When source node has to send some data to destination node then initially it distributes Route Request (RREQ) message which is forwarded by intermediate nodes until reached destination node. A route reply data message is unicasted back to the source node if the receiver node is using the requested address, or it has a valid route to the requested address that shown is figure 4.

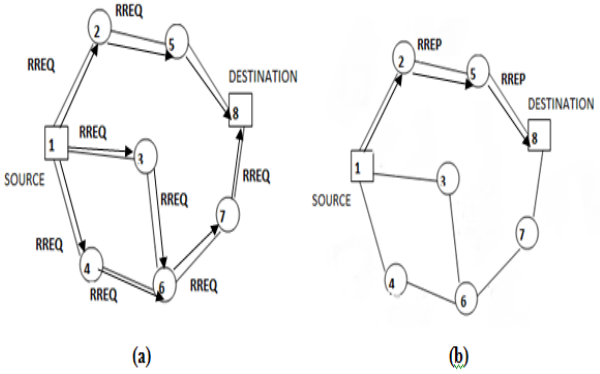

Figure 4: AODV Route Discovery Process. (a) Propagation of the RREQ. (b) Path of the RREP to the source.

V. ADVANTAGE OR DISADVANTAGE OF AODV

Main and an important advantage of AODV protocol is that routes are effected on demand and destination sequence number is used to find the most recent route to the destination. The connection setup delay is less. The HELLO message supporting the route maintenance are range limited, so they do not cause unneeded overhead in the network.

One of the disadvantages of AODV protocol is that intermediates nodes may lead to inconsistent routes if the source sequence no. Is very old and the intermediates nodes have a higher but not most recent destination sequence no. Thereby having stale entries. Also multiple route reply packet to a single route request packet can lead to heavy control overhead [21].another disadvantage of this protocol is that the periodic beaconing leads to unneeded bandwidth consumption.

VI. VANET CHARACTERISTICS AND CHALLENGES

VANETs are characterized by its unique characteristics that makes distinguish them from MANET. Some special characteristics are summarized as succeed:

1. **High mobility**: VANET nodes are characterized by their high relative speed that makes VANET environment more active.
2. **Predictable and limited mobility patterns**: Unlike random mobility of MANET, in VANET node's movements are governed by limited rules (traffic flow theory rules), that make them predictable at least on the short run.
3. **Rapid topology modification**: VANET nodes are characterized by its high speed. This leads to frequent network topology modification, which introduces high communication overhead for replacing new topology information.
4. **No power constraints**: Every vehicle is equipped with a battery that is used as an infinite power supply for all computation and communication tasks.
5. **Localization**: Vehicles can also use the Global Positioning System (GPS) for identify their locations with high accuracy.
6. **Abundant network nodes**: Dissimilar MANETs those are characterized by a small network sizes, another place VANET networks can be very large due to high density of the vehicles.
7. **Hard delay constraints**: provide Safety messages to the receiver is the main goal of VANETs. Therefore, safety messages should be given high priority and must be delivered on time.

Above these unique characteristics create new challenges that need to be broke up in the vehicular network surrounding area. According to (Torrent-Moreno et al., 2005), the main challenges of the vehicular Ad-hoc networks can be summarized as succeed:

• Frequent neighborhood change due to high mobility.
• Day by day increasing channel load (high density environment).
• Temporary connectivity due to the variation of the received signal power.
• Packet loss due to obscured and exposed terminal problems.

However, lots of efforts have been made to resolve these issues. This literature contains an immense amount of studies addressing these challenges in all aspects. The studies tried to deal all layers related issues ranging from lower layers (physical and MAC layers) enhancement to upper layers (application) evolution.

VII. APPLICATIONS OF VANET

The VANET application can be divided into two major classes [10]

A. Safety
B. Non-safety.

A. Safety applications

Safety applications have the capability to improve general safety to and reduce traffic accidents. These can be

further divided into safety-critical and safety-related applications. In the design of security, it should be made sure that safety messages are not forged.

A(a). Safety-critical

These applications are used in the case of hazardous situations (e.g. like collisions) [11]. It includes the situations where the danger is high or danger is approaching [12]. Safety-critical applications involve communication between vehicles (V2V) or between vehicles and infrastructure and also infrastructure and vehicles (V2I/I2V).As shown in figure A(a).

Figure A(a) : safety critical

A(b). Safety-related

These safety applications includes where the danger is either low (curve speed warning) or lifted (work zone warning), but still predictable [12]. In safety-related applications, the latency requirements are not as rigorous as in the case of safety-critical ones. Safety-related applications may be V2V or V2I/I2V. As shown in figure A(b).

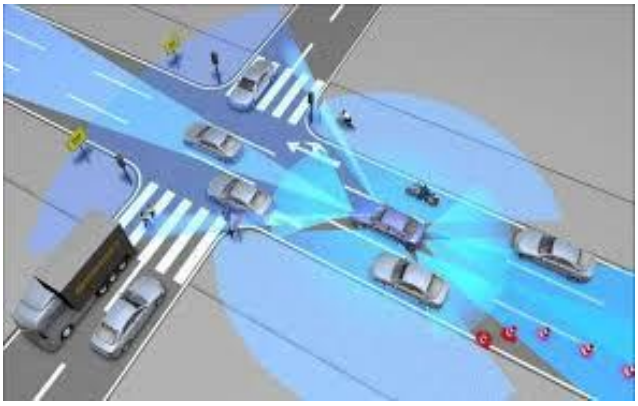

Figure A(a): safety related

B. Non-safety applications

These are applications that afford traffic information and boost driving comfort. Non safety applications mostly engage a V2I or I2V communication [10] [11]. These services access the channels in the communication system, except the control channel. They right to use the channel in a low priority mode compared to safety applications. As shown in figure B.

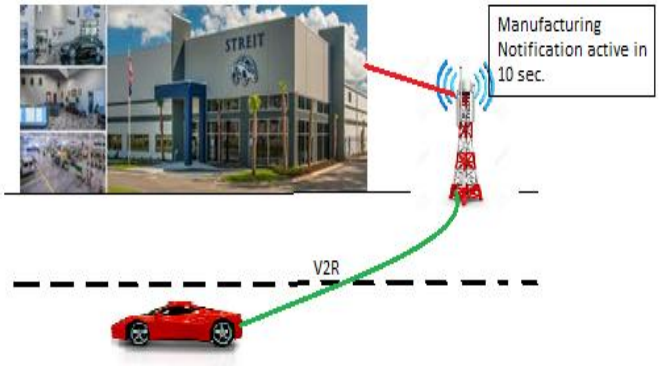

Figure B: Non-safety

Non-safety applications have a number of applications for [10,11]

B(a). Traffic optimization

Traffic information and recommendations, superior route guidance etc.

B(b). Infotainment

The Infotainment services are Internet access, media downloading, instant messaging etc.

B(c). Payment services

Payment services just like Electronic toll collection, parking management etc.

B(d).Roadside service finder

Searching nearest fuel station, hospitals, restaurants etc. This involves communication of vehicles along road side infrastructure and the associated database.

VIII. LITRERATURE REVIEW

Omid Abedi. et al. [1]: Here authors wants to improve stability and overhead of AODV routing protocol making it usable for VANET. In their work for improve route stability and overhead authors used GIOMOSIM simulator. The main objective of this work is to eliminate route discovery phase by restricting neighbour's distance and number of discovered routes. Finally authors can solve this problem by making a trade off between overhead and throughput and this throughput always take best allowable RREQ and distance threshold can satisfy the goals.

Jing zno. et al. [2]: Here authors evaluates the performance of routing protocol in VANET with vehicle node density. In their work for evaluate performance of

routing protocol authors used OMNET++ tool. The main objective of this work firstly increase the node density in high density urban areas, second performance of which protocol is better in between AODV and OLSR third why fewer data rates are delivered. Finally they conclude that performance of routing protocol based on realistic mobility models for VANET, with increasing vehicle node density around receiver and to showing results of protocol AODV is better than OLSR and fewer data delivered because of lack of routes and this problem short out by increasing vehicle node density near receiver increase to nodes in routing protocol.

Shaikhul Islam Chowdhury. et al. [3]: Here authors wants to performance analysis of any routing protocol in realistic environment for vehicular Ad-hoc network .in their work testing the protocol for the VANET in realistic environment authors used NS2 NETWORK SIMULATOR. The main objective of this work is to testing of different protocol that is AODV (Ad-hoc on-demand distance vector), AOMDV(Ad0hoc on-demand multipath distance vector)and DSDV(Destination sequence distance vector) protocol for VANET creates realistic environment and in different density region like low, medium and high. After getting simulation result authors conclude that AODV and AOMDV is able to give better PDR consistency as compare DSDV protocol.

Venetis Kanakaris. et al. [4]: Here authors wants to improve AODV performance using dynamic density driven route request forwarding. The main objective of this work is to reduce broadcast storm like unnecessary retransmission, causing congestion and packet collision in the network by comparing different protocol in this work to evaluate protocols authors used NS2 NETWORK SIMULATOR. After getting simulation result authors conclude that on comparing different protocol (AODV, DSDV, DSR, and OLSR).AODV has been modified to use a probalistic approach for transmitting route request message.

CONCLUSION AND FUTURE SCOPE

VANET is a hopeful technology and with the significant advancement in wireless technology, vehicles are turning a critical part of global network. VANET will not only provide life saving applications but will also gives a powerful communication tool for users. Here, focus is paid on basic architecture of VANET, routing, .simulation, attack and application. Fulfilling the requirements and facing challenges will result in an efficient communication tool which can also provide life saving tools to the users [6].

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