

# A Comprehensive Study on Vehicular Ad hoc Network

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**Abstract**---Vehicular ad hoc network are classified as an application of Mobile ad hoc network(MANET) that has the potential in improving road safety and in providing travelers comfort. It is a promising approach for the intelligent transportation system (ITS).They differs from MANET by their architecture, challenges, characteristics and applications. In this paper we present aspects related to this field.

## I. INTRODUCTION

As the vehicles are growing, the possibility of accidents has also increased. The biggest problem regarding the increased use of private transport is the increased number of fatalities that occur due to accidents on the roads, the expense and related dangers have been recognized as a serious problem being confronted by modern society.VANET is receiving a lot of attention from academicians research &development (R&D) and industrial community, as it plays a vital role in traffic safety besides ensuring a pleasant driving experience.VANET provides a wireless communication between moving vehicles, using a dedicated short range communication (DSRC). VANET inherit some of the characteristics such as mobile nodes and self organizing behavior from MANETS. Session 2 gives unique characteristics of VANET.Session 3 presents VANET architecture. Network challenges and requirements are discussed in session 4. Session 5 will give application enabled by VANET communication. We sum up our paper with a conclusion in session 6.

## II. VANET CHARACTERISTICS

VANET has some unique characteristics which make it more challenging class of MANET are

### A. High dynamic topology:

Since vehicles are moving at high speed the topology formed by VANET is always changing.

### B. Frequent disconnected network:

The highly dynamic topology result in frequent disconnections when they are transmitting information.

### C. Predictable mobility: .

VANET differs from other types of Mobile ad hoc networks in which a nodes move in a random ways .That is it depend on road structure, speed limit, traffic situations and driver driving behavior and so on.

### D. Computational ability:

VANET provides high computational ability. Because the nodes in VANET are vehicles, they can be equipped with a sufficient number of sensors and computational resources such as processors, a large memory capability, advanced antenna technology and global positioning system (GPS).This increases the computational capability of the node and to acquire the accurate information regarding current position.

### E. No Power Constraints:

In modern vehicles battery power and storage is limited. So the power in VANET is not a critical challenge as in MANET.

### D. On Board sensors:

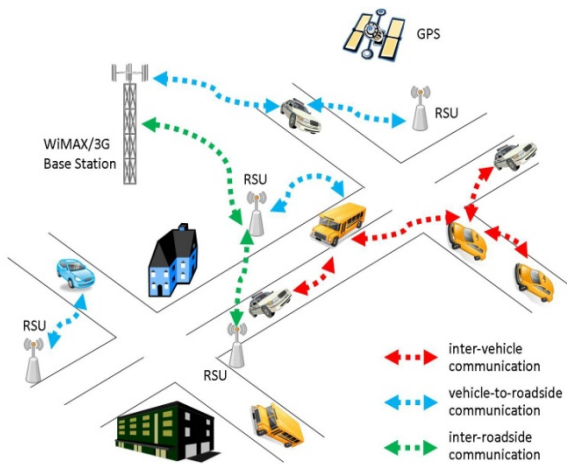
Nodes are equipped with sensors like GPS device to provide current position. It is helpful for effective communication and making routing decision.

## III. VANET ARCHITECTURE

Vehicles can communicate with other vehicles directly forming vehicle to vehicle communication (V2V) or communication with fixed equipment next to the road, referred to as road side unit (RSU) forming vehicle to infrastructure communication. These types of communications allow vehicles to share different kind of information, safety information for the purpose of accident prevention, post accident investigation or traffic jams. The communication between vehicles or between a vehicle and RSU is achieved through a wireless medium called WAVE (wireless access for vehicular environment, a novel type of wireless access dedicated to vehicle to vehicle and vehicle to road side communication. The main system components of VANET are Application unit (AU), On board unit (OBU) and RSU.

### A. On board unit (OBU)

AN OBU is a wave device usually mounted on board a vehicle used for exchanging information with RSUs or with



IV. CHALLENGES IN VANET

Many challenges arise in VANET are

A. Signal fading:

Objects are placed as obstacles between two communicating vehicles are one of the challenges that can affect the efficiency of VANET.

B. Connectivity:

High mobility and dynamic nature of topology lead to a frequent fragmentation in networks and increases the transmission power. This lead to throughput degradation. Accordingly connectivity is considered to be an important issue in VANET.

C. Bandwidth Limitation:

Because of absence of central coordinator and which has the responsibility of managing bandwidth and contention operation. Therefore there is a high probability of channel congestion and bandwidth limitation for VANET application.

D. Security and Privacy :

Receipt of information from sender is important for the receiver is necessary to keep reasonable balance between security and privacy. This trusted information can violate the privacy needs of sender.

E. Routing protocol:

Because of the highly dynamic topology result in frequent disconnections when they are transmitting information. Therefore to design an efficient protocol that can deliver a packet in a minimum period of time with few dropped packets is considered to be a critical challenge in VANET.

V. VANET APPLICATION

Based on V2V and V2I communication allow the development of a large number of application and can provide a wide range of information to drivers and travelers. VANET application are arranged into following classes.

A. Safety application

These applications use the wireless communication between vehicles or between vehicles and infrastructure, in order to improve road safety and avoid accidents. Safety applications can be classified as

1) *Real time traffic:* The real time traffic can be stored at the RSU and can be available to the vehicles whenever and whenever needed. This can play an important role in solving the problems such as traffic jams, avoid congestions and in emergency alerts such as accidents. This is based on V2V or V2I communication. This will include

- a) Warning about violating traffic signal
- b) Warning about violating stop sign.
- c) To make left turn in safe way.
- d) Stop sign movement assistant.
- e) Intersection collision warning.

OBUs. It consists of a resource command processor (RCP) and resources include a read write memory, a user interface and a network device for short range wireless communication based on IEEE 802.11p radio technology.

B. Application unit (AU)

AU is a device equipped with in the vehicle that uses the application provided by the provider using the communication capabilities of the OBU. The AU can be a dedicated device for safety applications or a normal device such as personal digital assistant to run the internet.

C. Road side unit (RSU)

The RSU is a Wave device usually fixed along the road side or in dedicated locations such as at junctions or near parking spaces. It is used for the purpose of communication within the infrastructural network. The main functions of RSU are

- Extending the communication range of ad hoc network by forward the data of OBUs.
- RSU work as information source for running safety applications.
- RSU provides internet connectivity to the OBUS.

The architecture of VANET fall within three categories.

- Pure cellular/WLAN networks.
- Pure Ad hoc networks
- Hybrid networks.

In pure cellular/WLAN architecture the network uses cellular gateways and WLAN access points to connect to the internet. Vehicles communicate with the internet by driving by either a cellular tower or a wireless access point. The system is used for vehicle to infrastructure communication.

Pure ad hoc networks are used for emergency environments. Nodes help each other in conveying information to and for creating connections. The communication between vehicles to vehicle is a pure ad hoc and it is an infrastructure less communication.

The combination of cellular and ad hoc network a hybrid network and the architecture combines both characteristics.

f) Warn drivers if there is a pedestrian crossing the road by collecting information about the walkers via sensors installed in the walk side.

2) Cooperating message transfer for public safety: Slow / stopped vehicles will exchange messages to help other vehicles. The most familiar application with in this category are

a) Approaching emergency vehicle warning

b) Emergency vehicle signal preemption. That is emergency vehicle send message to all traffic light to green on the route to destination using I2V or V2I communication. This will minimize the response time for emergency vehicle.

C. Post crash notification: aims to prevent accident before they happen, a vehicle which is disabled because of accident or foggy weather, send message to other vehicles.

D. Vehicle diagnostics and maintenance

This will include safety recall notice, just in time repair notification

E. Information from other vehicles:

This uses V2V communication, I2V communication or both to perform applications functions. This include cooperate forward collision warning, road condition warning, emergency electronic brake lights (EEBL), road condition warning, visibility enhancer etc.

*B. Non safety application*

This will provide the driver with the entertainment and services such as web access, streaming audio and video. This includes Commercial applications, convenience application and productive application. Commercial AP

lication includes remote vehicle personalization, internet access, digital map downloading, real time video relay etc.

Convenient application includes route diversion, electronic toll collection, parking availability etc.

Productive applications include environmental benefits, time utilization, fuel saving etc.

## CONCLUSION

This paper presents a comprehensive survey, dealing with all issues facing VANET. In this paper we first give a characteristics followed by architecture in session 3. Session 4 discuss difference challenges faced by VANET. Session 5 gives various application based on its classification. This investigation enables the researchers to focus on the issues surrounding VANET and its application, showing the great deal of understanding of how to tackle all issues related to VANET.

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