

# Vehicular Adhoc Network – A Review

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**Abstract** Vehicular ad hoc network (VANET) is a most important type of network, which has characteristics to provide vehicle-to-vehicle (V2V) and vehicle to infrastructure(V2I) communication on the road. It is an approach for intelligent transportation system. VANET Works like as mobile ad hoc network. It provides many applications like as message transmission from one vehicle to another, data transmission, map guidance, entertainment and so on. VANET helps to reduce the causes of accidents on a highway. Vehicles can convey messages related to status of the road and other informational messages to each other. Throughout this paper, we will discuss simulation tools, architecture, applications, security concern and routing approaches used for message communication among vehicles. We provide a research review on vehicular ad hoc network.

**Keywords:** VANET, applications, routing, VANET security, vehicles to vehicle communication.

## 1. INTRODUCTION

In the last few years,countries around the world have been implementing VANET. It makes driving more entertaining and interesting. VANET is also known as Road to vehicle communication. VANET is a scalable approach because it has low maintenance cost[3]. Due to rapid increase in number of vehicles we need to setup VANET[1]. If every vehicle comes under a communication network then we can reduce accident ratio which is increasing day by day. During communication they will send message to its neighbors. On the road, vehicles become neighbors of each other for a few seconds.[5]. VANET also helps us to inform near about point of interest. With the help of VANET not only V2V communication but also vehicle to infrastructure communication is possible[4]. If any problem occurs on a particular road then,

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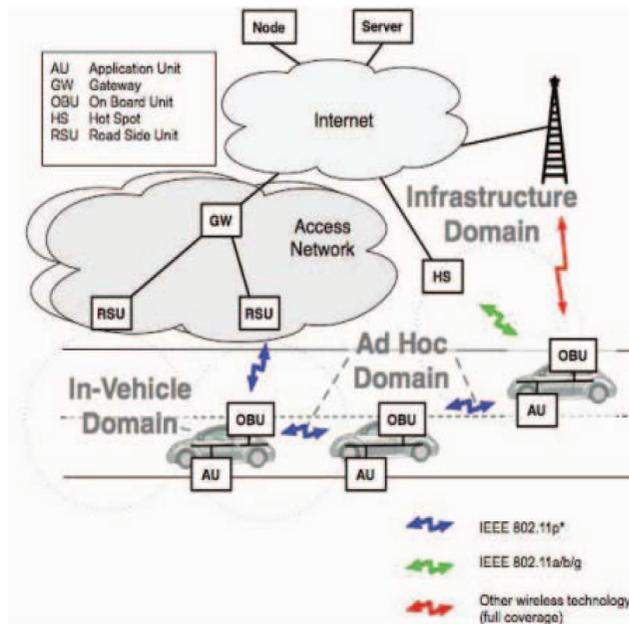
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vehicles start messages transmission to other vehicles to give information about road condition. VANET not only works for informational messae transmission but also works for driver comfort[2]. For the purpose of vehicle safety, manufacturing also companies providing service for vehicle communication[4]. VANET can be setup on the basis of MAC layer and physical layer protocol by using customized version of IEEE 802.11, namely IEEE 802.11b[4].

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## 2. SYSTEM ARCHITECTURE

VANET such a communication network between V2V and V2I[6]. Speed mismatch between different vehicles increase road accidents so that if we want to avoid this we need a communication link between vehicles. VANET architecture is divided into three different domains[6].



**Figure 1:** Architecture of VANET[11].

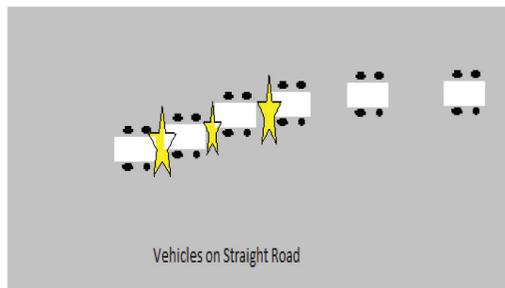
- Ad hoc Domain: Vehicles establish a communication link with RSU. Different OBU helps to setup a link between RSU and Vehicles.
- Infrastructure Domain: RSU helps to setup a link for OBU to communication with remote host using internet for the purpose of non safety applications.
- In Vehicle Domain: A OBU which is a part of vehicle which helps to establish a communication link between AU then vehicle can start applications.

### 3. VANET APPLICATIONS

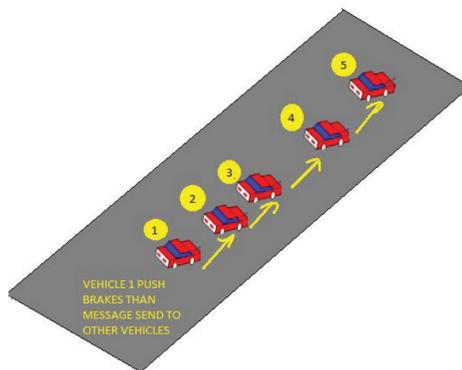
V2V and V2I communication helps to create applications for the better understanding of driver and traveller[7]. With the help of vehicular ad hoc network data message and safety message can transfer from vehicle to another entity.

A. Safety Oriented: It includes safety related applications such as collision on road, road condition, information about road traffic and so on. Safety applications are divided into two parts : one is informational and another is warning message transmission. Warning message transmission provides information about road condition, traffic, post crash and any obstacle on the road[7].

Informational message provide full details about speed limits, work zone , lane navigation and so on[7]. For example, sometime if you apply brakes on your vehicle then a message will be generated and will be sent to all the vehicles which are behind your vehicle. The message transmission should be very fast in order to reduce transmission delay and to reduce crashes.



**Figure 2:** Problem Figure: when one vehicle apply brakes then crash can occur.



**Figure 3:** Solution Figure: This figure helps to avoid crashes between vehicles.

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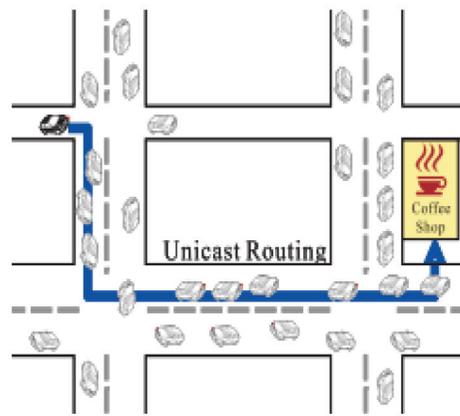
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- B. Commercial: Commercial applications are used to improve comfort level of passengers and to reduce traffic congestion[7]. With the help of vehicular ad hoc network we can find nearest point of interest(wireless advertising,entertainment source, patrol pump). Vehicular ad hoc network help to send or receive messages when it is connected to internet[7].
- Safety applications have some requirements that are used to send and receive safety related messages. Requirements depends on the wireless network technology because every vehicle(sender or receiver) uses different wireless technology [7].

#### 4. ROUTING APPROACH

Vehicular ad hoc network needs a strong link between the different nodes for message transmission. For transferring messages from one vehicle to another routing protocols are needed[2]. In vehicular ad hoc network, carry and forward or multi-hop approach is used because every node receive message and transfer it to next node[5]. Routing protocols are used to find the routes between messages. If one node want to send message to another node protocols help to check route and status of route. If route between two nodes is free then the first node transfer message to another node,unfortunately if route between two nodes is busy then the first node will send message to another node which comes in that region other than second node[5]. Three routing approaches are unicast, multicast and broadcast[2].

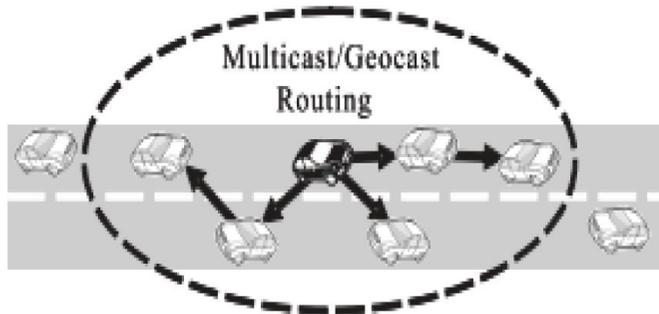
- A. Unicast: In unicast routing one to one communication is setup between source and destination[2]. Multi-hop method sends packets immediately to the destination node whereas carry forward method takes long time for sending message to destination node[2].



**Figure 4:** (a) Unicast Routing[2].

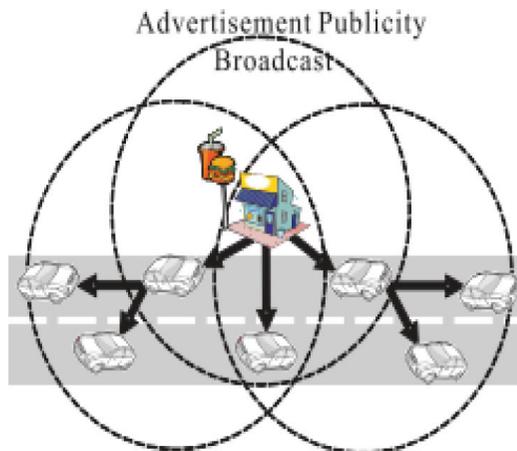
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- B. Multicast and Geocast Routing: With the help of multicast routing approach a message will be sent from one node to some nodes only which comes under the same region[2].



**Figure 4:** (b) Multicast Routing and Geocast Routing[2].

- C. Broadcast Routing: In this approach message is sent to all the nodes which comes under VANET. During disseminating, message from source to destination is broadcasted over a network that every node can receive[2].



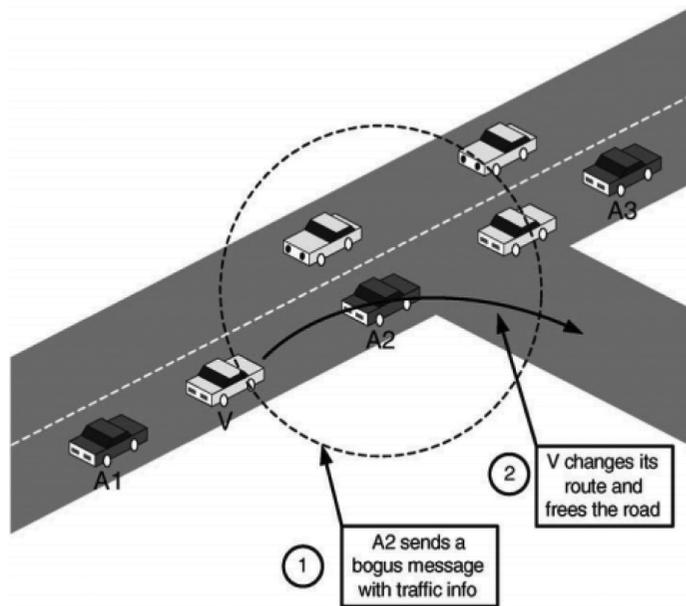
**Figure 4:** (c) Broadcast Routing[2].

## 5. SECURITY CONCERNS

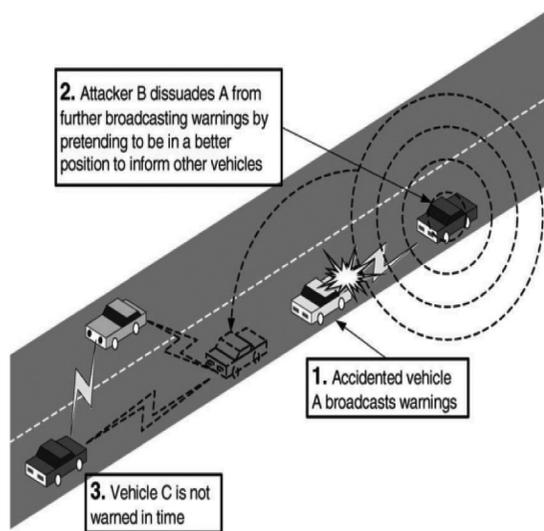
In vehicular ad hoc network security and privacy is the main concern. It is required, while transferring messages from one vehicle to another, the information apart from the message does not transfer along with it, which give

rise to the need of developing a system which is more reliable and secure. To remove bogus messages from the network we need authentication of a vehicle before receiving a message from an unknown sender[9]. The sending vehicle needs to be assured while sending the message that its receiving vehicle is authenticated or not. After that the receiver checks whether the received data is original or modified. This can be checked with the help of time overhead[4]. If all the parameters are true then the receiver accepts the message and give response. In this paper we are going to define some possible attacks which are effect vehicular ad hoc network.

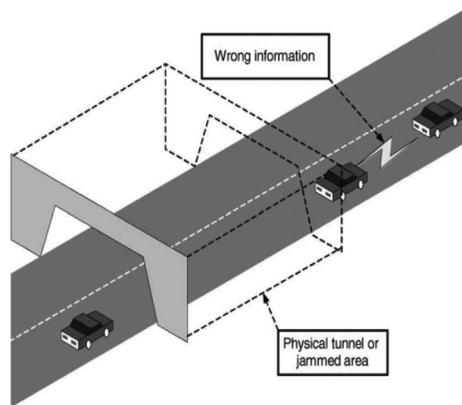
- a) *Bogus information Attack*: A problem occurs when a vehicle sends wrong information to its neighboring vehicles[4]. It can change the behavior of a driver and driver can try to choose another way.
- b) *Hidden Attack*: In hidden attack a hidden vehicle sends a warning message to its neighboring vehicles[4]. When fake information is spread over VANET then all the vehicles gets wrong information which can create problem to vehicles and they can follow the wrong path.
- c) *Tunnel Attack*: During the tunnel attack, on the way signal of ad hoc network can disappear and due to this situation an attacker can send wrong information to the receiver which may cause jam inside the tunnel.



**Figure 5:** (a) Bogus Information Sent by an attacker[4].



**Figure 5:** (b) Hidden vehicular attack.



**Figure 5:** (c) Tunnel Attack[4].

## 6. SIMULATION TOOLS

- a) *Network Simulators(NS2 and NS3)*: It is c++ based simulator. With the help of this we can simulate TCP as well as routing protocols. For the simulation Object Tool Command Language(OTcl) file is generated from c++ file after that OTcl file open in NS2[12]. Main purpose of generation of OTcl file is that it helps to speed up simulator because c++ files run very slow. In this simulator links can be either wired or wireless. On the other

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hand NS2 is an open source simulator. It is totally different than NS3. It provides an architecture for integrate different open source software.

- b) *Move*: This simulator is based on java platform. It provide graphical user interface. During simulation trace files are captured from Google earth then open into SUMO(Simulation of Urban Mobility) tools and then we can receive output with respect to the network[13].
- c) *TraNs*: Traffic and network simulator environment is java based environment. It helps to provide a strong interface between SUMO and NS3 then we can make a VANET environment[15].
- d) *GlomoSim*: After NS3 GlomoSim was introduced. It provides more facilities than other simulators. In this simulator a complete network can divided into several networks and each sub network can run as an independent process[14]. This feature makes it different from other simulators because other simulators do not have this functionality.
- e) *VANET MobiSim*: It supports V2V to V2I communication. In this simulator we can setup traffic lights and other mobility models to get a valid output[9].

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## RESEARCH CHALLENGES

We feel that our effort will certainly offer multiple directions. Signal fading is the main issue. When any vehicle wants to communicate with another vehicle then many obstacles can occur and communication between vehicles can be slow. To overcome this problem we have to setup special purpose central system. On the other hand, we have to design some new models for vehicle ad hoc network because a single model can not apply in all countries. Besides this we have another problem in existing network which is related to bandwidth of the VANET network. In the high density environment we have to maintain a special type of system which can help us to use bandwidth in efficient manner. In our future work we will propose a new solution for these problems and test it by simulation.

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