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# Towards Protocols for Vehicular Ad Hoc Networks (VANETs)

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**ABSTRACT**

Vehicular Ad Hoc Networks are becoming popular all over the world. Like Vehicle to Vehicle and Vehicle to Infrastructure is major types of communications in VANETs. The design of routing protocols is one of the important research areas that deal with the problems of frequent topology change and quick movements of vehicles. One of the major challenges of VANETs is routing the packets in effective and efficient manner. In this paper we will studies different security aspects and communication protocols.

***Keywords:*** *Video Error Concealment, Artificial Intelligence, Velocity of Macroblock, Estimation Macroblock Position, Video Compression, Video Communication.*

## 1. INTRODUCTION

The advancement and widely deployment of wireless and cellular technology brings the advancement in human life style. Now a day's almost all auto mobile companies are working to equip the cars with technology that allows the drivers to communicate with others and find the location. This will leads us towards vehicular ad hoc network (VANET).

VANET the drivers and the passengers communicate with others cars and also communicate with road side stations (RSS) to find the information about road accidents and easy path to reach towards destination.

Different routing and communication protocols are used for this. Due to inter vehicle communication the ad hoc network are also called vehicle to vehicle communication (V 2V).Now VANETs are emerging new technology to integrate the capabilities of new 3G wireless networks to vehicles. Mobile ad hoc networks are more technically subgroup of VANETs.

In VANETs the exchange of message greatly influences the behavior of driver, for example driver drive carefully and slowly when he receives glaze warning.

No doubt VANET has potential to increase road safety and comforts. But despite of all these advantages there are many challenges of security and privacy in VANET.

## 2. VANETS CLOUD

VANET-cloud provides different types of services in vehicular applications. They effort the help system for vehicles to access the conventional cloud. A pure cloud formed by vehicles is to be proposed by [03]. It is a new service paradigm called sensor. The vehicle's communication platform that makes components which is including by vehicle's sensor's and it is also called sensor-cloud-service. This take use for traditional cloud to improve computing capacity.

We reads many vehicles like VCs, HC, RSUs, VuCs, V2C, VC and many other system. These systems provide many computing system in vehicles and VANET-cloud system. It is a traditional service who approach many resources for vehicles and did not computing other resources. These resources have two links (a) automobile user and (b) is infrastructure providers. It is also have three security models which control authorization and access control modules and an assurance module. We correlate management actions with the help of desired requirements to achieve these systems.

Structure of VANETs

In vehicular ad hoc network (VANETs) the exchange of message greatly influences the behavior of driver, for example driver drives carefully and slowly when he receives glaze warning and driver might change route in emergency.

In Figure 1 it is clearly shown that driver change his route, when he receives message about road accident.

In VANETs vehicles which act as mobile nodes as well as routers for other vehicle due to radio-enabled infrastructure. Following are some features of VANETs;

Computing Power: The computing is the fundamental characteristic of VANETs nodes. The vehicles must have some sort of processing and storage power.

***Communication constraints:*** VANETs use geographical type of communication. In city, due to large buildings it becomes much more complex to communicate efficiently.

***Topology:*** As the topology is change dynamically, the effective time of routing become shorter.
***On-Board Units:*** On-Board unit of vehicle is equipped with communications tools. The tools are used for communication with RSU and with other vehicle also.
***Real Time Communication:*** VANETs required real time communication. The delay in message may leads towards leads towards heavy loss.
***Mobility Model:*** The mobility models are very important for protocol designing for VANETs.
***Connectivity:*** The connectivity in VANETs is via radio-enabled network, so hard weather badly effects the quality of connectivity
***Certificate Authority (CA):*** This authority is responsible for the registration and renewal of the vehicles in this network. It is connected to the backbone RSU network.
***Figure 1:*** The drivers change their route, as they receives road accident message. Likewise, other cars change their lane when they come to know about crash. Mesh router 1 first receives signal of an accident and it transmit it to router 2, the router 2 generate change lane message for nearest cars. Router 3 generate route change signal to coming cars and inform then road blockage due to an accident.

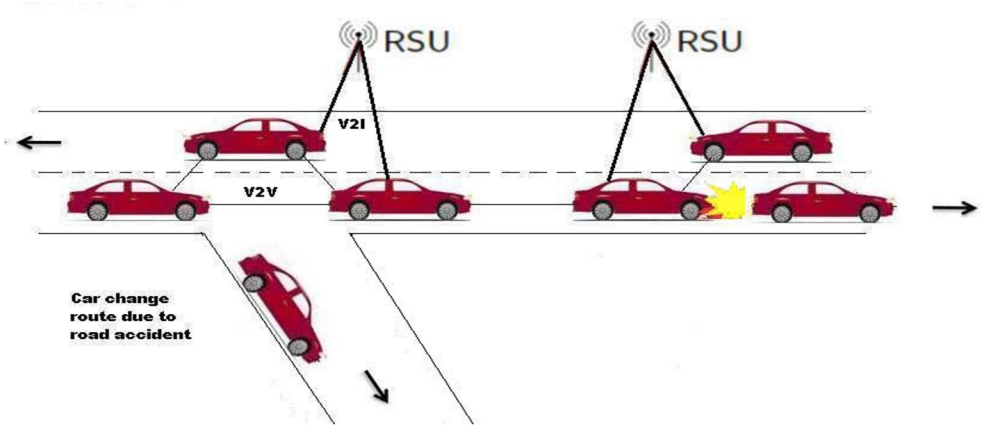


*Fig. 1. Example of Route Change due to accident*

## 3. APPLICATION OF VANETS

According to [1], with respect to privacy and security issues, we divide VANTEs application in three major types.

### 3.1 Telematic Message Exchangement

In telematic mess-age Exchangement, the security requirements are very high, because the exchanged message and warnings highly influence the behavior of drivers and passengers. All vehicles exchange message about current speed and traffics jams also.
The telematic message Exchangement is further divided in to two sub categories; active and passive. In active transmission, a vehicle recognized a message before transmission, if message recognized a problem then it is transmitted to other vehicles; where as in passive transmission, vehicles transmit message regarding their current status, by using geocasting.

### 3.2 Alarming signals

Alarming signals are exchanged regarding emergency movement like ambulance and fire brigade etc. security requirements are very high for this because exchanged message greatly influence the behavior of drivers. All these casting is done via geocasting technique.
Miscellaneous services: Different service message like restaurants, next stop, fuel station and hotels etc are provided via geocasting in VANETs. In this type of communication, security and privacy vary from service to service.

### 3.3 Requirements of VANETs

Following are some important requirements of vehicular ad hoc networks:

- Evolability
- Integrity
- Availability
- Integration
- Confidentiality
- Scalability
- Reliability
- Authentication
- Privacy

## 4. SECURITY ISSUES IN VANETS

As we know that the purpose of certification authority is to register and renew the vehicles in the network. Once a car is registered or renewed, it has no further interaction with CA.

The malicious activities should be addressed to avoid massive distraction in the network which may occur during authentication. Such attacks that affect networks are authentication include, Sybil attack, impersonation attack, spoofing replay etc.

An attacker tries to represent itself with multiple fake identities to accomplish a particular task. The multiple identities are generated from the pseudonyms set of their own on board units or they impersonate other vehicles identities to make it malicious [14].

### 4.1 Malicious Vehicle Detection [15]

We know that, there is a higher probability that the privacy of the vehicle is not safeguarded if ID of the vehicle is disclosed. So some authors have suggested the use of pseudonyms. So a vehicle should randomly picks one pseudonyms and sign it using public key cryptography when he need to report. Because the malicious user can misuse these pseudonyms and can generate multiple messages from a single entity and show as if it generated from different entities. Vehicle are expected to obtain new set of pseudonyms from their nearly RUS. Once when their pseudonyms are about to expire. This is not successful because we cannot expect the vehicle to the near particular RUS when its pseudonyms are about to be expire. The entire messages are sending from same position. However if the network is dense, the localization errors leads to false positives. When the vehicle speed is less then 30km/hr it stop broadcasting message during this silent period pseudonyms are changed.

### 4.2 Routing Protocols in VANETs

The mechanism through which two nodes communicate with each other is called routing protocols. Different routing protocols are used in VANETs for communication. A stable protocol is required to ensure that the message is being transmitted efficiently and correctly with safety. Two major types of protocols are topology based protocol and Position based protocol

## 4. TOPOLOGY BASED PROTOCOL

Following are some topology based protocols.

### 4.1 Table driven or Proactive Protocol

In this type of protocol, a table is maintained for topology related information in the form of table. The table is updated frequently as the topology is changed. But band width constraints are major drawback of this protocol.

### 4.2 On-Demand or Reactive Protocol

In this protocol, the routing table is updated periodically. This periodical up gradation overcomes the problem of table driven protocol. This protocol use flooding process to find so they are unsuitable for safety application.

### 4.3 Hybrid routing or Zone Based Protocol

This protocol contains the characteristics of Table-driven and On-Demand protocols. This is efficient and scaleable routing protocol, as nodes are divided in to different zones. That is why this protocol is also called zone based.

### 4.4 Ad Hoc on Demand Vector routing protocol

Ad Hoc on demand vector routing protocol is most important routing protocol. Route Error Message Control message, Routing Request and Route Reply are three control messages in this protocol. The two further categories of Ad Hoc on demand vector routing protocol (AODV) are Prior-AODV proposed by Omid Abedi [4] and Improved-AODV, proposed by Zehua Chen [5]. These both protocols are called AOVD enhancements.

#### 4.4.1 Prior Ad Hoc on Demand Vector Protocol (P AODV)

In this protocol, we reduce control overhead by different ways. First is to reduce control overhead is to restrict the number of route request packets and second restricting route mechanism based on distance.

#### 4.4.2 Improved Ad Hoc on Demand Vector Protocol (I AODV)

The main benefit of this protocol is that it reduces the control overhead and provides route stability.

### 4.5 Position based protocol

These protocols are classified into two categories; City Environment and Highway Routing protocol.

#### 4.5.1 City Environment Routing

There are many obstacles like trees, buildings and junctions etc in city, that effects communication. Following are some types of city environment routing protocols.

##### 4.5.1.1 Geographic Source Routing

This is the first position based protocol. In this protocol, source nodes use Dijkstra algorithm to find the shortest path from map of street [6].

##### 4.5.1.2 Greedy Perimeter Coordinator Routing:

This is a map independent protocol. In this protocol, with out the external information it takes advantages of street and junction from a natural planner graph [7].

4.5.1.3 Directional Greedy Routing Protocol

This protocol uses the direction of vehicle that is moving towards the destination. This method reduces the number of hops and is closest to destination node [8].

4.5.1.4 Predicated Directional Greedy Routing Protocol

This is an upgraded version of Directional Greedy Routing Protocol. In this protocol, weight score is calculate based on packet, current neighbors and possible future neighbor in very near are shown in it [9].

4.5.1.5 Three Dimensional Oriented Routing Protocol

This is first 3D protocol and this protocol give solution for routing in 3D scenarios. This protocol follows the Road Mode, Intra layer transaction pattern and inter-layer transaction pattern. [10]

4.5.2 Highway Environment Routing Protocol

As we know that in highway there are multiple lanes for one way or two way traffic. Highway has low nodes density and high mobility; following are some protocol for highway scenario.

4.5.2.1 Greedy Perimeter routing for wireless Networks

This is a position based protocol for highway. In this protocol, nodes know the geographical position of neighbor nodes by beaconing. Greedy forward and perimeter forwarding are two most important mechanism used in this protocol [11].

4.5.2.2 Distributed Vehicular Broadcast Protocol

In this protocol, flag variable is used by all vehicles to conform the duplication of packets. Well connected, disconnected and a sparsely connected are three categories in this protocol [12].

4.5.2.3 Dynamic Time Stable Geocast Routing Protocol

To function even on networks with meager concentration is fundamental objective of this protocol and this protocol consists of two phases named; Pre-Stable and Stable Period [13].

## 5. CONCLUSIONS

In this paper, we discuss several routing protocols recently proposed for VANETs. The performance of a routing protocol in VANETs depends heavily on the mobility model. So a universal routing solution or standard evaluation criterion for routing protocols in VANETs are very hard.

Table 1 summarizes the characteristics of these routing protocols (i.e., what protocol routing types, topology and position based information and simulator type). It is found that, due to geographical barrios position-based routing and geo-casting are more promising than other routing protocols for Vehicular Ad Hoc Networks.

There are still some challenges need to investigate for example, security issues and effective data communication are major issues. Because we need to design specific routing protocol and mobility model to fulfill its requirements for certain applications.

| Sr. No | **Protocol** | Protocol Type | Casting Type | Simulator Type |
|---|---|---|---|---|
| 1 | Proactive | Topology Based | Unicast | Simple Road |
| 2 | Reactive | Topology Based | Unicast | Simple Road |
| 3 | Zone Based | Topology Based | Broadcast | Simple Road |
| 4 | P-AODV | Topology Based | Unicast | Simple Road |
| 5 | I-AODV | Topology Based | Unicast | Simple Road |
| 6 | Geographic Source Routing | Position Based | Geocast | City Model (From Map) |
| 7 | Greedy Perimeter Coordinator Routing | Position Based | Broadcast | City Model |
| 8 | Directional Greedy Routing | Position Based | Broadcast | City Model |
| 9 | Predicated Directional Greedy Routing | Position Based | Broadcast | City Model |
| 10 | Three Dimensional Oriented | Position Based | Broadcast | City Model |

| | | | | |
|---|---|---|---|---|
| | Routing | | | |
| 11 | Greedy Perimeter Routing for Wireless | Position Based | Geocast | Highway Model |
| 12 | Distributed Vehicular Protocol | Position Based | Broadcast | Highway Model |
| 13 | Dynamic Time Stable Geocast Routing | Position Based | Geocast | Highway Model |

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