"VANET" System for Vehicular Security Applications

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Abstract -Today the vehicular security and passenger safety is an alarming issue in the field of automobile industry. The technocrats of the companies are very much varied about this issue. Ad hoc network (VANETs) is becoming the mostsuitable solution for this purpose. It provides vehicle to vehicle connectivity. A vehicular Ad hoc network (VANETs) can be used as an alert system. By this we get the alert about the traffic jam. It helps to create balance in traffic load to reduce travelling time. This system is also useful to broadcast emergency signal to the driver of the vehicle behind the accident. It also helps to send message to ambulance and traffic police in the case of traffic emergency. In this paper, we take the position that VANETs would indeed turn out to be the networking platform that would support the future vehicular applications. We analyze the critical factors in deciding the networking framework over which the future vehicular Applications would be deployed. A reactive research effort is needed for making VANETs a reality in the near future.

Index Terms— LPGs, VANETs, VANETs architecture, V2V.

I. INTRODUCTION

Now a days, the growth of automotive market, the increasing demands of the security of the vehicle and safety of the passenger. The vehicular connectivity is very important. Vehicular ad-hoc networks (VANETs) use Wi-Fi IEEE 802.11p (WAVE standard) and Wi-MAX IEEE 802.16 for user-friendly and effectual communication between vehicles with dynamic mobility [11]. VANET is not foreseen to replace current mobile (cellular phone) communication standards."Older" designs within the IEEE 802.11 scope may refer just to IEEE 802.11b/g. More recent designs refer to the latest issues of IEEE 802.11p (WAVE, draft status)[12]. Due to inherent lag times, only the latter one in the IEEE 802.11 scope is able of coping with the typical dynamics of vehicle operation. The vehicular information can be viewed on electronic maps using the Internet or specialized software.

The advantage of Wi-Fi based navigation system function is that it can effectively locate a vehicle which is inside big campuses like universities, airports, and tunnels. VANET can be used as part of automotive electronics, which has to identify an optimally minimal path for navigation with minimal traffic intensity.

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The other feature of this system is that it can also be used as a city guide map to locate and identify landmarks in a new city.

V2V communication in the VANETs is implemented on the intelligent transportation systems (ITS). Vehicles are enabled to communicate among themselves (vehicle-to-vehicle, V2V) and via roadside access points (vehicle-to-infrastructure, V2I). Vehicular communication is expected to provide safe and secure journey by providing the rode condition and other necessary information to the driver, and also to make travel more convenient. The integration of V2V and V2I communication is beneficial because V2I provides better service sparse networks and long distance communication, whereas V2V enables direct communication for small to medium distances/areas and at locations where roadside access points are not available.

For communication in vehicular ad hoc networks, position-based routing has emerged as a promising candidate. For Internet access, Mobile IPv6 is a widely accepted solution to provide session continuity and reach ability to the Internet for mobile nodes [13]. While integrated solutions for usage of Mobile IPv6 in (non-vehicular) mobile ad hoc networks exist, a solution has been proposed that, built upon on a Mobile IPv6 proxy-based architecture, selects the optimal communication mode (direct in-vehicle, vehicle–vehicle, and vehicle–roadside communication) and provides dynamic switching between vehicle–vehicle and vehicle–roadside communication mode during a communication session in case that more than one communication mode is simultaneously available.

Now a days VANETS is one of the interested research area. The main interest is in applications for traffic scenarios technology, cellular systems, sensor networks and future combat systems. Recent research has focused on topology related problems such as range optimization, routing mechanisms, or address systems, as well as security issues like traceability or encryption. In addition, there are very specific research interests such as the effects of directional antennas for VANETs and minimal power consumption for sensor networks. Most of this research aims either at a general approach to wireless networks in a broad setting or focus on an extremely specific issue which would influence the acceptance of VANETs architecture in future. These applications require data that can be either delay sensitive or delay tolerant. There are also several major challenges that need to be solved before the adaption of VANETs architecture. They include security of data and message privacy, automatic accident detection and collision avoidance capability.

II. VANETs APPLICATION

The application area of VANETs can be divided in to the two parts

A. Safety Related Application:

Safety related application area of the VANETs include the alert message about the traffic condition, accident, weather condition and other warning message which broadcast either by another node in the network or by the security services. The main issue is on timely distributation of safety critical alerts to nearby vehicles.

B. Internet Access Related:

Accessing emails, web browsing, audio and video streaming are some of the internet related applications where the emphasis is on the availability of high bandwidth stable internet connectivity.

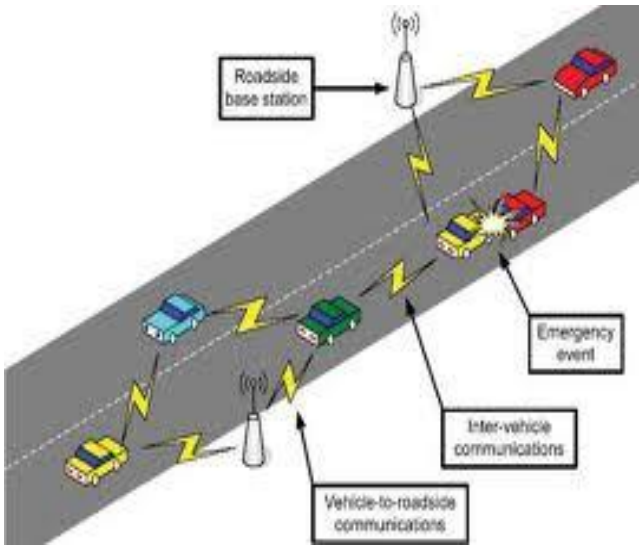

Figure 1: A VANET consists of vehicles and roadside base stations that exchange safety messages to give the drivers the time to react to life-endangering events.

Vehicular network application require wireless communication network there are many possible way for wireless communication for example cellular network, Ad hoc network, wireless LAN and info system [1, 2]. So choice of network depends upon the application requirement for this reason we need to have a clear insight into these application and their requirement. Generally on the basis of the connectivity application area can be divided in to four main groups: car to car, vehicular to home and routing based application. Another application is reception of commercial advertisement and wireless adversity. The company can set up stationary gateways for transmit marketing data when the customer pass through it. The main issue about this application is that the commercial data can not be interface with the security and privacy of the driver. Before implementing this type of the application we have to resolve this issue. One possible way is that we have to install two different devices in the car one for the VANETs data and the other for the commercial data. By implanting this setup customer privacy can be maintain.

III. VANETs ARCHITECTURE OVERVIEW

VANETs is a mobile ad hoc network to provide communication among nearly vehicle and between vehicle and nearby vehicle or vehicle and nearby fixed equipment, so this called vehicle to vehicle (V2V) and vehicle to infrastructure communication.

As we discuss above the main application area of the VANETs is to provide safe, secure and enjoyable ride for the passengers For this each vehicle places a special electronic device inside the vehicle so that vehicle can connect to the ad hoc network. In the VANETs network there are no fixed infrastructure and server communication. Each vehicle has a VANETs device which works as a node in the ad hoc network. The entire vehicle can communicate with each other by using the wireless network [14].

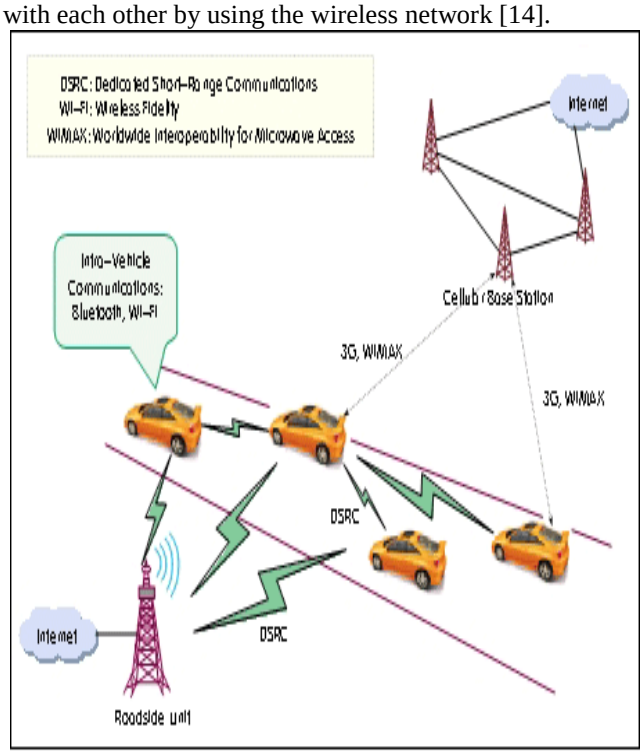

Figure 2. Wireless technologies for future vehicular communications.

There are also internet and multimedia facility for passenger. The VANETs system also sends the emergency signal to the other vehicle in the case of the accident or sudden breaking. The other advance improvement in the architecture is driver assistant system. In this the driver can assist the thing beyond his field of vision. By this security system the driver can get information about accident traffic jam, signal information, resulting in more efficient and safe driving.

IV. CHARACTERSTICE OF VANETs

Though VANETs could be treated as a subgroup of Mobile Ad Hoc Networks (MANETs) and a component of ITS systems, it is still necessary to consider VANETs as a distinct research field, especially in the light of security provisioning. The unique characteristics of VANETs include:

A. High Mobility: The nodes (vehicle) in VANETs usually are moving at high speed. The node motion is constrained by the road topology and layout

***B. Rapidly Changing Network Topology*:** Due to high node mobility, the network topology in VANETs tends to change frequently.

***C. Unbounded Network Size*:** VANETs could involve the vehicles in one city, several cities, or even a country. So the VANETs network should not be dependent on the number of the nodes.

***D. Anonymous Naming*:** Most applications in VANETs require identification of the vehicles in a certain region, instead of the specific vehicles. So, anonymous naming system should be followed to protect the privacy of the driver.

***E. Delay-sensitive Data Exchange*:** In the VANETs network the message transfer should be transfer without delay because security related application need message delivery without any delay.

***F. Potential Support from Infrastructure*:** Unlike common MANETs, VANETs can actually take advantage of infrastructure in the future. This property has to be considered to make any protocols and schemes for VANETs better.

***G. Abundant Resources*:** The VANET nodes have abundant energy, computation resources. This allows for schemes involving usage of resource demanding techniques, such as ECDSA, RSA, etc.

***H. Better Physical Protection*:** The VANET nodes are better protected than those nodes in other MANETs. Thus, VANET nodes are more difficult to compromise, which is also good news for security in VANETs.

V. RESEARCH CHALLENGES IN VANETs NETWORK

In this section we discuss the issue regarding the VANETs network.

Low latency architecture: In the VANETs application safety is on the top priority. Safety application like collision alert, road condition warning etc. require message to be transmitted from one point to the other point with low latency. The 3G based cellular data access network provides the connectivity but has a low bandwidth which can result a long delays. So the major issue is developing V2V infrastructure is to be cheap and has low latency for safety application.

Privacy and security: Security and Privacy is the issue that needs to be carefully assessed and addressed in the design of the vehicular communication system. There are lots of threats such as fake message causing traffic jam leaking of private information etc. so a real message authentication has to be there.

Wherever privacy is also a major issue that will need to be addressed, in which communication network should not make the vehicle tracking or identification possible for non trusted parties. Generally in the network, each node would carry a unique, permanent MAC address, and then it could be possible to trace that car. To remove this problem IEEE 802.11p introduce dynamically assigned MAC address, along with a mechanism for duplicate MAC address discovery. Integrating security is a big challenge for high speed communication as well as group communication. In the group communication group key agreement is the biggest bottlenecks which increase the latency time.

Routing issues: in the VANETs network there is no fixed route of the packet a packet is carried by a node until it could be forwarded to a node being closer to destination. So based upon the carry and forward concept there are three possible routing algorithms opportunistic forwarding, trajectory based forwarding and geographic forwarding. Also a hybrid solution, mixing 2 or 3 different approaches, could be developed. In opportunistic forwarding works efficient in broadcasting mode, but fails when the target is a single node.

Broad casting and message dissemination: The VANETS system requires a large amount of the data for the transmission between the vehicles so several broadcasting techniques are taken into account because Broadcasting appears to be an attractive solution due to its low cost and large potential volumes of data. There are already some services available that based on DAB broadcast and TPEG protocol, offer real time traffic information. Location-aware broadcasting would limit the broadcast range only to the site of interest, thus reducing overhead .Clustering is another approach to optimize the message dissemination process: neighbor nodes form clusters, manageable units that limit the broadcasting range. E.g. in a clustering method called Local Peer Groups (LPGs) is proposed, where nodes can either form static or dynamic clusters.

A. V2V Data Distribution

An important issue that has to be solved in VANETs is how to exchange traffic information among vehicles in a scalable fashion. For this there are two possible approaches: push model and other is pull model. It is believed that broadcast-based applications have the potential of bootstrapping vehicular ad-hoc networks. The goal of the data push communication model is to exchange information about the position and speed of the vehicle among a set of moving vehicles in order to enable each individual vehicle to view and assess traffic conditions in front of it. Two main mechanisms could be used to achieve this goal: flooding and dissemination [15]. In the flooding mechanism, each individual vehicle periodically broadcasts information about its position, road condition, traffic jam and all the necessary information to the other vehicle. When the other vehicles receive the broadcast message it stores the message and immediately rebroadcast the message. This approach is useful for the applications which are delay sensitive. However the main problems arise in this approach is *network congestion*. When a large number of the vehicles enter in to the network they broadcast its message and a number of the broad cast message flooded in the network. Several techniques to avoid the broadcast problem have been proposed. Timer based, geographic forwarding, opportunistic forwarding are the examples. Several Networks coding protocol has been proposed to solve the problem of scalability related to flooding. Network coding improves the performance of content system for scalable traffic data dissemination and visualization in VANETs.

B. V2I / I2V dissemination

It can be wither Push based or Pull based. Studies have shown that vehicle-to-infrastructure communication is feasible .The pull based approach is useful in the case of the emergency signal because every vehicle has to receive that type of the signal .but this approach is not beneficial in every type of the application. Its drawback is that everyone might not be interested in the same data. In Pull based communication, a Request – Response model is followed. This is useful for unpopular / user-specific data like Email, Webpage requests. Its drawback lays in lots of cross traffic that result in Contention, Interference, and Collisions.

C. Extensive growth of interactive and multimedia applications

The recent years have witnessed a tremendous increase in the number of multimedia applications, interactive games, and location based services and most of these applications require either intermittent or continuous internet connectivity. A pure V2V based solutions cannot address these application domains and there is a definite need for V2I infrastructure and VANETs have this V2I support as well.

VI. CONCLUSION

In this paper, we analysis the VANETs infrastructure for the future application. We start with discussing the possible structure of the VANETs network followed by the application of the VANETs; in the latter section we discuss the critical issues in the development of the VANETs. We show that there are several challenges including security, privacy protocol and data dissemination. Actually it is not a surprise that VANETs is most suitable for delivering content in vehicular application but there are also a lot of issues which has to be solved before practical implementation of the VANETs network.

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