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Vehicular Ad-hoc Network

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Abstract

In today's scenario, there are various rising applications of intelligent transportation system that lead to the development of a new kind of ad-hoc network. Nowadays, this network is hitting the streets as Vehicular Ad-hoc Network (*VANET*). VANET allows vehicles to communicate with each other and also with a roadside infrastructure that provides multiple applications from transit safety to driver assistance and browsing worldwide web (*internet*). It is a form of mobile ad-hoc network which usually utilize the roadside equipment. In this manuscript, we'll further discuss this topic by studying and analyzing the localization process in VANET applications and finally focus on how these techniques can be combined to localize the vehicles.
Keywords-Vehicular adhoc, internet, localization, data fusion, protocols, mobility

1. Introduction

There is a number of interesting and desired applications of Intelligent Transportation Systems (ITS) that are encouraging a new kind of ad hoc network: Vehicular Ad Hoc Networks (VANETs). In 1999, the Federal Communication Commission (FCC) allocated a frequency spectrum for vehicle-vehicle and vehicle-roadside wireless communication. In 2003, it then established Dedicated Short Range Communications (DSRC) Service. DSRC is a communication service that uses the 5.850-5.925 GHz band for the use of public safety and private applications [1] [getpdf]. This allocated frequency and other newly developed technologies allow the vehicles and roadside devices to form Vehicular Ad Hoc network to communicate wirelessly with each other and central access point. In these networks, vehicles can exchange messages with each other in Vehicle-to-Vehicle communication (V2V) and also with a roadside base station Vehicle-to-Roadside Communication (V2R). An Intelligent System

allows safe and free flow traffic. It uses GPS and DGPS equipped devices. It uses various technologies such as wireless communications, computational technology, sensing technology, inductive loop detection, video vehicle detection, bluetooth detection. From the last few years, many research efforts has been investigated on various issues related to V2R, V2V. The manuscript is organized as section 2 consists of the necessary background of VANET. In section 3, we proposed the use of ad hoc network in transportation and various emerging challenges faced by it. We have proposed the security issues in section 4.

2. Overview Of VANET

VANET has become an important research in the field of mobile ad hoc network, use to communicate with each other and the central access point. It is used in localization based system. In the localization, we identify the physical location (e.g. latitude, longitude and altitude). For instance, we can compute the exact location of vehicle using Global Positioning
System (GPS) receiver's with Geographic Information System. It is a very rational approach since installation of GPS receiver's is quite easy and affordable in vehicles. But GPS leads to inefficiency by not always being available and not robust too for some applications. To overcome this limit, multiple localization techniques such as Dead Reckoning, Image-Video localization has been used in VANETs.

2.1 *Intelligent Transportation System*

In intelligent transportation system, each device acts as sender, receiver and router in order to broadcast information across the network, which then uses to improve traffic safety and comfort of driving and travelling. In order to communicate between vehicles and roadside units (RSUs), a device called OnBoard Unit (OBU) is inside the vehicle which processes the data collected from various sensors fitted inside the cars and gives conditions of the vehicles is responsible for communication with outside network. Vehicles should also be fitted with hardware that enables relevant information such as Global Positioning System (GPS) or a Differential Global Positioning System (DGPS) receiver. The RSU should remain fixed in order to facilitate communication. The number and distribution of roadside units is dependent on the communication protocol is to be used.

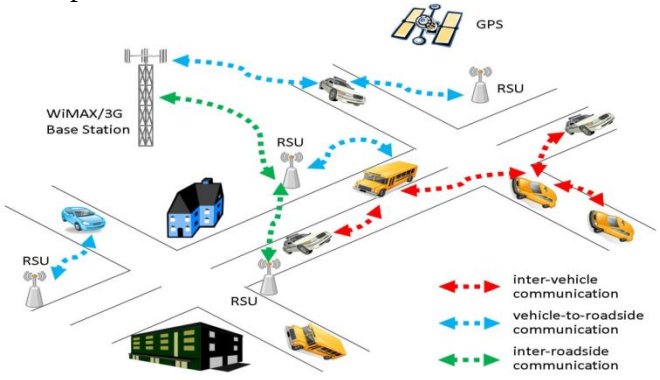

Fig 1: Block Diagram of VANET

2.2 *Inter-Vehicle Communication*

In inter-vehicle communication or V2V, each vehicle uses multi-hop multicast to transmit traffic related information over different stations. Two types of broadcasting are used in vehicle communications: *naïve broadcasting* and *intelligent broadcasting.* In native broadcasting, vehicles broadcast traffic related information periodically. If the vehicle receives the message from another vehicle that is behind it, it will simply ignores the message. Else, if message is received from the vehicle in front, the vehicle received the message broadcasts its own message behind it. This confirms that all the vehicles moving in forward direction are receiving all broadcast messages from one another.

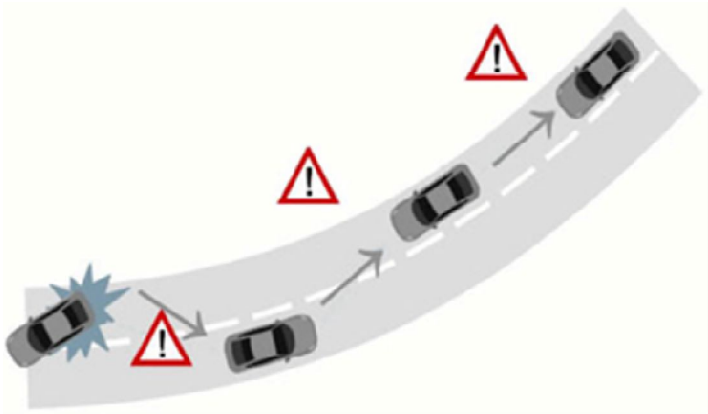

Fig 2: V2V communication

2.3 Basic Component of VANETs

- *Communication*:- Wireless Access in Vehicular Environment (WAVE): IEEE 1609.2 Standard also Known DSRC 802.11p Supports Multi-Hop communication for vehicles out of range (Max. Range DSRC is 1000m)
- *On-Board Unit (OBU)*:- A device which is inside the vehicle which processes the data collected from various sensors fitted inside the cars and gives conditions of the vehicles is responsible for communication with outside network i.e with other vehicles and infrastructure.
- *Road Side Unit (RSU)*:- Infrastructure for communication between the cars for sharing and information from various vehicles.

2.4 Applications of VANET

There are various ways in which VANET can be used such as vehicle collision warning, security distance warning, driver assistance, cooperative driving, cooperative cruise control, Internet access, map location, automatic parking, congestion detection, road conditions warning, stoplight assistant, emergency vehicle warning, deceleration warning, toll collection, border clearance, drive-through payment, merge assistance , public safety applications, traveller information support applications, comfort applications, air pollution emission measurement and reduction, law enforcement, broadband services and many more.

3. Wireless Access In Vanets

There are various standards used that relate to wireless access in vehicular environments. It consists of some set of rules that can be applied to transport messages between equipment.

3.1 *Dedicated Short Range Communication (DSRC)*

Dedicated Short Range Communications (DSRC) is service from short to medium range communications that was developed to support vehicle-to-vehicle and vehicle-to-roadside communications. A wide range of applications such as vehicle-to-vehicle safety messages, traffic information, toll collection, drive-through payment, and several others are supported by this communication. The objective of DSRC is to provide high transmission rate and low communication latency in small communication zones.

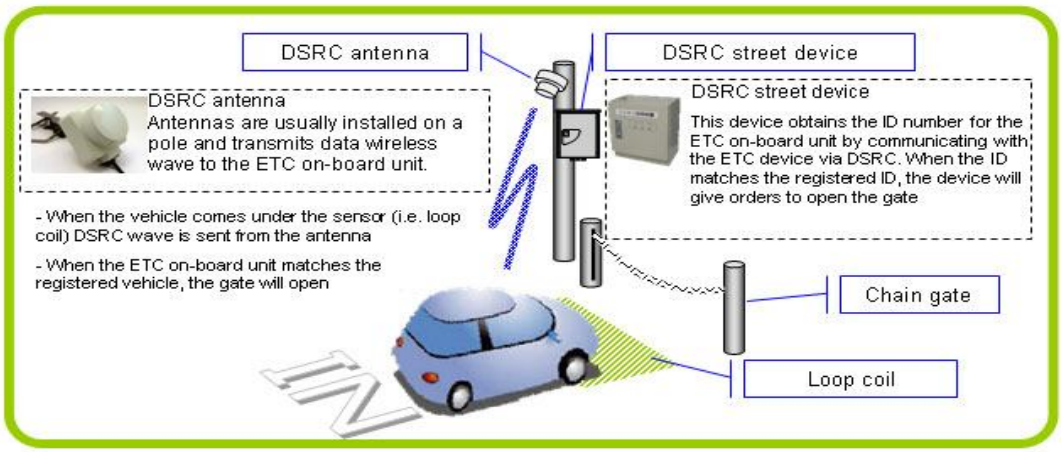

Fig 3: Short Range DSRC

3.2 *Localization Techniques used in VANETs*

A similar procedure of using data-fusion techniques to compute the exact location of vehicles produces a new model for localization in which various techniques are combined which is more précised than GPS system. Every VANET-devised vehicle acts as a *node* in ad-hoc network and communicates through wireless network. These nodes will act as *router* to another node and terminals act like *repeaters*.

3.2.1 *Dead Reckoning*

Using dead-reckoning , the current and accurate position of vehicle can be easily calculated based on its last location and finding various movement information such as direction, speed, acceleration, etc. The last position of vehicle is considered as '*fix*' and can be obtained using GPS receivers. Sensors are used to obtain the displacement information i.e. how long a vehicle has travelled from its last accurate position using sensors as digital compasses and gyroscopes. Practically, dead-reckoning localization technique is suitable only for short periods of GPS unavailability. Such techniques is being used to compute errors easily over a long periods of time and thus can be considered only as a backup system for periods of GPS outage in which after entering

into tunnel, vehicle loses its GPS connection.

3.2.2 *Image/Video Processing*
This technique is used for localization purposes such as mobile robot guidance systems. We can use cameras in order to provide security in parking lots and tunnels. It is used to feed Data Fusion algorithms to predicts the vehicle accurate position. With the image and video information, the actual parameters of vehicle can be calculated. The video processing techniques can be used to predict the sides of lanes in video images.

3.3 *Research Field in VANET*
The use of data fusion techniques is not properly explored in today's scenario. The most important challenging factor in VANET is the development of infrastructure localization systems that is being used in tunnels which is the most critical phase of VANET environment. Tunnels are actually act as a bridge that connects various regions which are naturally separated from one another. Thus bad tunnel may provide an adverse impact on the city or region. Research field in VANET is as follows:

3.3.1 *Routing*: device used to connect one network to another. It consists of large end-to-end delays and decreases packet delivery ratio.

3.3.2 *Security Frameworks*: It is a light weight, scalable authentication frameworks. It needs reliable system to provide comfort to the passengers. It should be fast and cost should not be the barrier in order to exchange or broadcast traffic related information.

3.3.3 *Broadcasting*: The message is spread over the network in VANET environment. It should take care of not colliding with each other which may lead to data deficiency, data lost and data redundancy.

4. Security Measures Of VANET

VANET is a rising area in the field of ad hoc network. We should look upon its security so that along with accuracy, it must provide reliability and security. This is one of the major challenge being faced by the VANET in order. Limited attention is given to it. Security is crucial. For instance, it is necessary to make sure that information should not be inserted or deleted by a third party. However, the system is able to help in providing freedom to drivers but at the same time, it should secure the data as per the privacy of drivers and passengers is concerned. These concerns look similar to other encountered communication network but they are not.

5. Conclusion

In this manuscript, Localization Systems were studied and analyzed in vehicular environments. Here, we got to know how the GPS receivers were the common source of information. Also, how VANET overcome the limit of GPS receivers using various

localization techniques. There were various localization techniques such as dead-reckoning, image/video processing and many more that were being used to compute the exact location of vehicle either by calculating the previous location or by using GPS for short range communication. In this paper, we talked about various researches being done on VANET. We also talked about vehicle to vehicle communication, vehicle to roadside equipment communication, inter vehicle communication. VANET is an emerging development of transportation system.

6. References

[1] Federal Communications Commision, "FCC 99-305," FCC Report and Order, October 1999.
[2] The FCC DSRC (Dedicated Short Range Communications) web site. http://wireless.fcc.gov/services/its/dsrc/.
[3] www.slideshare.com
[4] www.cs.nthu.edu.tw
[5] www.csie.ntpu.edu.tw/~yschen/course/96-2/Wireless/.../Location-1.pdf
[6] https://koala.cs.pub.ro/redmine/attachments/70/JCS275.pdf
[7] www.ieeeexplore.org/iel5/4068497/4068498/04068700.pdf