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A Latest Development and Opportunity in VANET

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Abstract: The Vehicular Ad-hoc NETwork (VANET) is used in many metropolitan and smart cities to perform inter-vehicular communication for stationary conveyance, moving conveyance, autonomously operated conveyance, dealing drones, phone and other ad-hoc networking systems of organizations. Through this, we can achieve a lot of cognition, like as to reduce the Reaching Time (RT) of firefighter troops, ambulance, drones and to reduce the number of accidents/disasters in cities. It plays a vital role in the efficient management of city traffic by preventing traffic jams and effective control of drones as well. VANETs are deployed in two dimensional as well as three-dimensional networks in accordance with the applications to attain energy efficient routing and easy handoff. The determination of appropriate topology and characteristics of VANET is of prime importance for densely deployed 2D/3D networks. VANET is compatible with 5G technologies and able to deliver high throughput suffering lower delay providing higher energy efficiency. The objective of this paper is to present a review on the latest development on VANET to spread the awareness of this emerging field. It is an attempt to review and present the work which has already been done by eminent researchers in this field. The aim is to motivate researchers to contribute in this field.

Keywords: VANET, VC, TWU, BTS, RSU

1. INTRODUCTION

The core consideration about VANET is to wireless access between vehicles with roadside applications. Now a day it is used in many cities for VC (Vehicular Communication). The VC is a process of communication between vehicles. These vehicles are maybe roadside vehicles, unmanned aerial vehicles, underwater vehicles and also on water vehicles. The VC is applicable to improve the safety in transport and to achieve traffic efficiency. It is also applicable to convey information about stationary and moving conveyance, automatically operated conveyance, dealing through drones, phones and other ad-hoc network systems of edifices, watercrafts, aircrafts, etc. This technology is used in Japan, USA, and few European countries for army, navy, and air force projects. It is also efficiently used in a lot of industries of MEMS (micro electro mechanical system) of these countries to achieve economic and organizational goals as per requirements. It is also useful for the marketing application through drones. In present competition timing, the fast delivery is a crucial requirement of the market. So as to reduce the reaching time of drones the VC is very helpful. As per the data analysis of WHO the vehicular disaster are increasing continuously after 2000 in maximum nations, which should decrease [1]. On the other hand, according to current warfare environment of global nation's (e. g. USA, China, South Korea, North Korea, Russia, UK, India, Pakistan, etc.) air weapon expansion is required. Hence, VC system is helpful to decrease and increase the vehicular disaster in all countries as per requirements. This VC system is not possible without advanced networking of VANET to unceasing security and rapid data swapping. Just from last two years, the research papers are increasing extensively on IEEE Xplore about the following things of VANET. These are: The Deployment of VC, Characterization of VC, Two dimensional and/or Three dimensional scenario of VC, Routing in VC, Energy consumption of VC, Hand-off in VC, Modulation scheme in VC, System operating margin in VC, Security in VC, Velocity Change in VC, Delay in VC, Throughput in VC, Clustering in VC, Packet delaying in VC, Congestion in VC. In these researchers, to judge actual estimate of execution of the VC, we implement it on various network and marching simulators. Hence, the research and demand of vehicular communication system are increasing broadly. The VC system will increase more broadly in overall world because it is not established till now in many countries. The principle purpose of this review paper is to provide help and motivation in the development of artificial intelligence in the field of vehicles. Hence, the focus of this review paper is centralized technically on the Deployment, Characterization of the VANET in 2D/3D with energy efficient routing and handoff. The layout of this review paper is as following: second segment presents an overview about the VANET, third segment presents review about deployment in VC, fourth segment presents review about characterization of VANET in VC, fifth segment presents review about simulation tools, sixth segment presents application of VC, seventh segment focuses on featured research problems and conclusion of overall review paper.

2. VANET BASICS

A. VANET Architecture

The architecture of VANET is established with only three thinks V, TWU, and SD [2]. These are V (Vehicles, e.g. car, drone, submarine, etc.), TWU (Transport Way Unit, e.g. roadside unit, airways unit, waterways unit), and SD (substructure domain). The VC in this architecture can be established using wireless standards like as IEEE 802.11p. In this architecture, TWU works as the router. Which range (coverage) should be higher than vehicles range. In this VANET architecture for VC the vehicles are established with OBU (On Board Unit). This OBU consists of a lot of technologies (e.g. Global Positioning System, Radio detection, Radar ranging, Laser technology, satellite communication, etc.) so that vehicles can track location and situation of each other including destination location. In these vehicles of VC an ELP (Electronic License Plate) is induced. In this architecture an AOC (Authority of Certification) is exist. So that, many facilities (e.g. safety, TCP/IP) and applications can be provided. Fig. 1 shows VANET architecture with an example of vehicular communication (vehicle to vehicle communication) which is also indicating V2SD (vehicle to substructure domain) and SD2V (substructure domain to vehicle) linking.

B. Brilliant Transportation System

Brilliant Transportation System (BTS) is an example of artificial intelligence. In this, a vehicle itself is capable to transmit information, receive information and also works as a router for the broadcasting of information. This BTS can be used in roadways traffic system, drones traffic system, etc. The BTS provide two type of VC. First is V2V (Vehicle to Vehicle communication) and second is V2SD (Vehicle to Substructure Domain) or substructure domain to vehicle (SD2V) communication. Fig. 1 shows this concept with help of roadways traffic system. For the transmission of information, V2V uses multi-hop communication and V2SD uses single hop communication. Here inter-vehicle communication is also classified into two categories. First is naïve broadcasting and second is intelligent broadcasting. The first one is applicable to produce beacons at regular intervals. But in this, the collisions of messages are occurring due to the large generation of messages. Whereas, in the second method, the messages are generated only on demand. Hence, the collisions of messages are reduced in the second method. The high bandwidth linking is provided between TWU and vehicles in this system. Hence TWS can detect the speed of vehicles. If the speed of a vehicle is greater than the range of TWS, then TWS produce a visual alarm message for the vehicle.

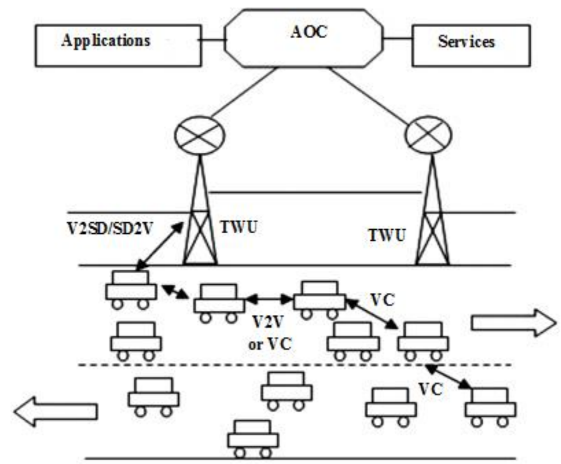

Fig. 1 VANET Architecture

C. VANET Standards

Product development is possible with help of VANET Standards. These are used to assist users for comparison and verification of products. As per requirement of used protocol these standards (e.g. DSRC, WAVE) are used. Dedicated short range communication (DSRC) standard is processed by USA but it is also used in Japan and Europe. It is short to MRCS (medium range communication services). DSRC [3] is utilized for V2SD and V2V. It includes seven channels, where each channel has 100MHz band. In this standard data rate was not higher. But due to BTS functionary high data rate is required. To overcome this problem a new standard is developed, that is Wireless Access in Vehicular Environment (WAVE).

3. DEPLOYMENT IN VC

The VC system is currently advancing their TWU deployment. The deployment in VC with minimum budget is a demanding research work. Velasco et al. [2] introduce a RSU (Road Side Unit) deployment of three merger techniques. First is deploying RSUs on stable spot, second is deploying RSU on public mobile transportation, and last is deploying RSU on absolutely manageable vehicles. In which firstly, a map of city area into a grid graph is designed. Then, a new optimization problem is formulated and shows its NP-hardness. In [4], Zhang et al. study an on-road base station (SCS) is proposed, to utilize renewable energy harvesting, mm-Wave backhaul, and data caching style to attain pliable, continual, and economical VC. With help of 5G technologies, SCSs can allow "drop-and-play" deployment, green operation, and low-latency data dispatch, paving the way to economical VC. Zheng et al. [5] study provides a stochastic geometry scheme for a performance analysis and network layout. In this linking outage and confidential outage probabilities are examined for a typical statutory connection, and show that the linking outage probability is raised by enabling copious FD receivers but decreases the confidential outage probability. In [6], Cavanagh et al. study Ad hoc electrical networks are formed by connecting power sources and loads without planning the interconnection structure (topology) in advance. They are designed to be installed and operated by individual communities-without central oversight and as a result are well-suited to addressing the lack of electricity access in rural and developing areas. However, ad hoc networks are not widely used, and a major technical challenge impeding their development (and deployment) is the difficulty of certifying network stability without a prior knowledge of the topology. We develop conditions on individual power sources and loads such that a micro-grid comprised of many units will be stable. We use Brayton-Moser potential theory to develop design constraints on individual micro-grid components that certify transient stability-guaranteeing that the system will return to a suitable equilibrium after load switching events. Our central result is that stability can be ensured by installing a parallel capacitor at each constant power load, and we derive an expression for the required capacitance.

4. VC PROJECTS

All stationary and moving vehicles can be directed from one cell to another cell using cellular automata (e.g. Nagel and Schreckenberg model (N-SCHR) [7]. In the urban areas of few European countries, Japan and USA the VC system is implemented [1]. Currently the VC system is growing on the basis of protocol substructure (DSRC, IEEE 802.11p & WAVE). And, the VC system is including new ideas like as messaging system and application architecture. A lot of motorcar manufacturing industries are using VC system concepts to improve the safety of travelers (e.g. BMW, Nissan, Audi, Ford, Daimler, General Motors, etc). For the development of VC system USA is working on the VSC (Vehicle Safety Communication) government project. Few European nations are working on C2C-CC (Car-to-Car Communication Consortium) government project. Japan is also working on ASV (Advance Safety Vehicle Program) and VII (Vehicle Infrastructure and Integration) government projects under these schemes [1].

5. SIMULATION TOOLS

1) Mainstream Cams: Out of all surveyed papers mostly used simulator is ns-2 [8]. It regards a received packet if the received power exceeds a particular threshold while supposing a constant distortion floor, depended on the selected channel cam.

2) Custom Channel Cams: In [8] paper a custom simulator is described. It is dependent on a static transmission spectrum cam with consideration of the impact of reflection and diffraction near edifices.

3) Unspecified Channel Cam Citations: In our literature review, we observe that no more particular data is available on the preference of channel cam. Actually, the second-most usual "channel cam" is unspecified. So, it is crucial to find out the generality of the simulation outcomes obtained in these literatures. That's why reviewed papers are lacking about the details of channel cam configuration, then specify the simulation framework in utilization, which produces intuition into cam which may have been utilize.

6. APPLICATION OF VC

Now a days VC provides applications for e-Safety, security, emergency, establishes strong relations of producer with consumer, traffic management, stationary conveyance, moving conveyance, automatically operated conveyance, driver comfort support, enhanced maintenance, dealing through drones, maintenance, media services, marketing through drones, fast delivery through drones, gaming, micro electro mechanical system, e-shopping, crime investigation, defense, and so on. VC produces applications for vehicle manufacturers and consumers to avail superior facilities and services.

TABLE 1: THE ANALYZE ALGORITHMS WITH THEIR ESTABLISHED METHODOLOGIES [8]. IMPORTANTLY SURVEYED FOR NETWORK SIMULATOR- NS-2 AND NS-3.

Algorithm	Simulator	Channel Model	Comparison	Based Upon
GDMAC	ns-2	Static R_{Tx}	DMAC	DMAC
RMAC	ns-2	Static R_{TX}	DMAC	Original
K-hope	ns-2	Two-Ray	None	MOBIC
C-RACCA	ns-2	Two-Ray	None	Original
CMGM	ns-2	Two-Ray	None	C-RACCA
MI-VANET	ns-2	Static R_{TX}	None	Original
PPC	ns-2	Static R_{TX}	LID, HD	Original

TC-MAC	ns-3	Static R_{TX}	LID, HD, UF	UF
APROVE	ns-2	Static R_{TX}	MOBIC, ALM, PPC	Original
SBCA	ns-2	Static R_{TX}	CCP	CCP
VPC	ns-2	Static R_{TX}	PC	PC
FBLA	ns-2	Nakagami	APROVE, CCP	Original
UOFC	ns-2	Unspecified	LID, UF	UF
DBA-MAC	ns-2	Static R_{TX}	None	Original
CPTD	ns-2	Static R_{TX}	None	Original
MCA-VANET	ns-3	FSPL+Fading	MOBIC	Original
DMCNF	ns-2	Unspecified	K-Hop	Original
VMaSC	ns-3	Static R_{TX}	K-Hop, MDMAC	Original

7. Future Scopes and Conclusion

As we all know vehicles are increasing in roadways, aerial ways and under waterways. The VC is getting its momentum day by day. The deployment, characterization of VANET with energy efficient routing is necessary for the safe and cooperative transportation. Hence, the future work can be recommended in VC system for the expansion of Vehicular cloud, MAC layer protocol, Fault Tolerance, and Mobility model. Several previous literatures and taxonomies of deployment, characterization of VANET with energy efficient routing in VC system, such as [8] and [1], have recognized the demand to utilize more of the unique facets of the VC. This literature review includes introduction of VC system which is using currently in roadways, aerial ways and under waterway. This is not possible without VANET, that's why after this we discussed basics of VANET. And then we discussed about deployment in VC which is main topic of our paper. In the present time VC system is mainly used for roadways but in future, it will also expand for aerial ways and underwater way. Few examples of VC projects which is running for safety on roadways is given after the deployment. Then we summarize the simulation tools and wider application of VC.

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