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VEHICLE ADHOC NETWORK OVERVIEW AND CHALLENGES

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Abstract

Due to its adaptability, low cost, high sensing fidelity, and fault tolerance, the vehicular ad hoc network is one of the most intriguing areas of research. It has opened up a lot of exciting new applications for remote sensing. As a result, it has emerged as a promising tool for sensing, processing, and communicating with wireless sensors to monitor the physical world. VANET is a type of ad-hoc networks that originated from the idea of establishing a network of automobiles for a specific need or circumstance. In recent years, it has become clear that VANETs are dependable networks that automobiles use for communication purposes on highways or in urban settings. As a distinct type of Mobile Ad Hoc Networks, VANET offers the potential to predict and assist drivers and other individuals regarding road safety and other critical conditions, allowing them to make decisions that could affect their lives or death. This paper outlines the VANET definition, its architecture and protocols from a research point of view and future research directions of VANET are provided in the end of paper.

1. Introduction

Vehicle ad hoc networks have recently emerged as one of the most promising areas of research due to the growth of the automobile industry and wireless communication technology. VANETs, which use vehicles as mobile nodes, are a subclass of mobile ad hoc networks (MANETs) that allow for communication between vehicles in close proximity and between vehicles and nearby roadside equipment [1]. However, they appear to have distinct characteristics from other networks. In particular, the moving nodes (vehicles) in VANETs are restricted to the topology of the road; therefore, if road information is available, we can predict a vehicle's future position; In addition, vehicles can afford significant computing,

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communication, and sensing capabilities and the power to transmit data continuously to support these functions [2].

However, VANETs also have a number of challenging features, including the possibility of a large scale and high mobility. The majority of automobiles typically travel at a very high speed and constantly change position, making the vehicular environment much more dynamic. The high mobility also results in a dynamic topology for the network, with links between nodes frequently connecting and disconnecting. Additionally, VANETs have the potential to span the entire road network and include a large number of participants [2]. VANETs have the potential to pique the interest of both academia and industry precisely due to their unique attractive and challenging qualities.

Main Components

We are able to achieve the VANETs system by entities that can be divided into three domains, in accordance with the guidelines provided by the IEEE 1471-2000 [3, 4] and ISO/IEC 42010 [5] architecture standard guidelines: the infrastructure domain, the generic domain, and the mobile domain [6].

The mobile domain can be broken down into two sections, as shown in Figure 1: the mobile device domain and the vehicle domain. All types of vehicles, including buses and cars, are included in the vehicle domain. All portable devices, including smartphones and personal navigation devices, fall under the mobile device category.

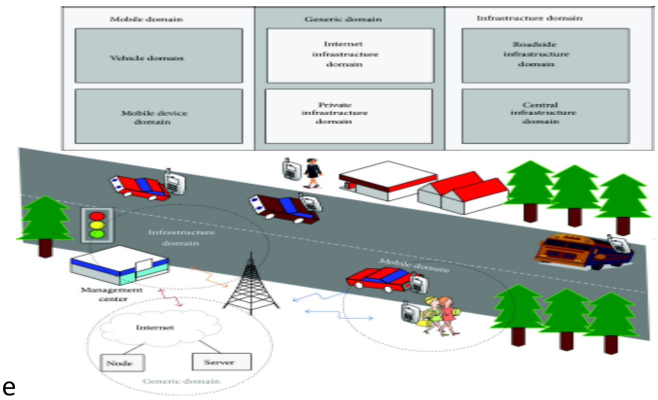

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Figure 1 VANETs system domains.

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There are two domains within the infrastructure domain: the central infrastructure domain and the infrastructure along the road. Roadside unit entities like traffic lights are included in the roadside infrastructure domain. Traffic management centers (TMCs) and vehicle management centers are examples of infrastructure management centers found in the central infrastructure domain [6].

However, the architecture of a VANET is developed differently in different regions. The reference architecture is slightly different in the CAR-2-X communication system that the CAR-2-CAR communication consortium is working on. The major force behind vehicular communication in Europe is the CAR-2-CAR communication consortium (C2C-CC), which released its "manifesto" in 2007. The three domains of this system architecture are as follows: ad hoc, infrastructure, and in-vehicle domains.

The in-vehicle domain consists of an on-board unit (OBU) and one or more application units (AUs), as depicted in Figure 2. They usually connect with wires, but sometimes they connect wirelessly. However, vehicles with OBUs and roadside assistance units (RSUs) make up the ad hoc domain. An OBU and RSU are both considered to be static nodes in an ad hoc network. The gateway allows an RSU to connect to the Internet; RSUs can talk to each other directly or through multihop. RSUs and hot spots (HSs) are the two types of infrastructure domain access. RSUs or HSs allow OBUs to communicate with the Internet. OBUs can use cellular radio networks (GSM, GPRS, UMTS, WiMAX, and 4G) to communicate with one another in the absence of RSUs and HSs [2].

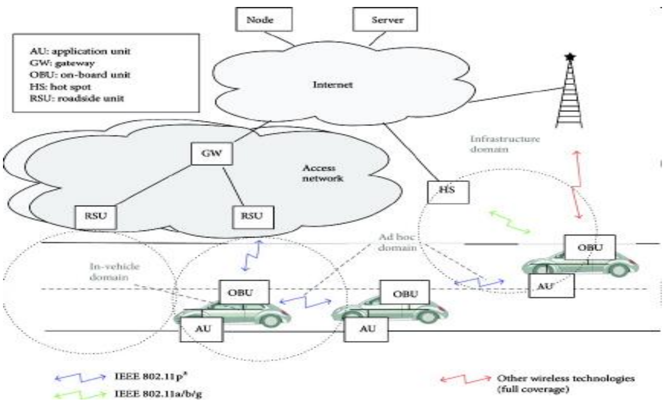

Figure 2 C2C-CC reference architecture [7].

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TRANSMISSION PROTOCOLS

The vehicles' data collection and exchange necessitates a set of rules or protocols that enable transmission to occur in an organized and systematic manner. Routing protocols are what enable nodes in a VANET to exchange data with one another. The distribution of a data packet among various nodes is governed by these protocols. The five categories of routing protocols in VANET are as follows: Broadcast, geocast, position-based, topology-based, and luster-based routing protocols are all examples of routing protocols. These protocols are categorized according to the application or area for which they are best suited [8].

Protocols for routing based on topology: For packet forwarding, these routing protocols make use of the network's links data. Proactive and reactive are further subdivided. When routing information, such as the next forwarding hop, is proactive, it is maintained in the background despite communication requests. The following are examples of proactive routing protocols: FSR and LSR When a node needs to communicate with each other, reactive routing only opens the route. AODV, PGB, DSR, and TORA Position Based Routing Protocols are the various types of reactive routing protocols. The class of routing algorithms is called position-based routing. They both share the ability to select the subsequent forwarding hops by making use of GPS data. The packet is sent to the one hop neighbor that is closest to the destination without knowing the map. The two main types of position-based routing are:

Delay-tolerant protocols and position-based greedy V2V protocols Position-Based Greedy V2V Protocols In a greedy strategy, the intermediate node in the route forwards messages to the neighbor that is farthest away from the current destination. The greedy approach requires that the intermediate node be in its own position, in the position of its neighbor, and in the position of its destination, such as GPCR, CAR, or DIR. The Delay Tolerant Protocols In a city where there are a lot of cars, it is easy to find a node to send a message. However, in a rural highway or at night in a city, where there are fewer cars, it is hard to find an end-to-end route. In such instances, sparse networks must therefore take certain factors into account. MOVE, VADD, and SADV are the various Delay Tolerant Protocols.

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Protocols for Cluster-Based Routing: In clusters, cluster-based routing is preferred. A node designated as the cluster head will broadcast the packet to the cluster after a group of nodes declares their membership in the group. COIN and LORA_CBF are the various Clusters-based routing protocols.

Protocols for Geo-cast Routes: Geocast routing is essentially multicast routing based on location. Its goal is to get the packet from the source node to all the other nodes in a certain zone of relevance (ZOR). To prevent an overly hasty response, Geo cast routing does not notify vehicles outside the ZOR. Within a specific geographical area, Geo cast is regarded as a multicast service. The IVG, DG-CASTOR, and DRG geocast routing protocols are some examples.

Protocols for broadcast routing: In VANET, broadcast routing is frequently used to distribute advertisements and announcements, share traffic, weather and emergency information, and road conditions among vehicles. Broadcast routing protocols include DV-CAST, BROADCOMM, UMB, and VTRADE.

APPLICATIONS

Safety-oriented, convenience-oriented, commercial-oriented, and convenience-oriented are the four main types of VANET applications [9, 10]. Applications for safety will keep an eye on the road's surface, curves, surrounding traffic, and approaching vehicles. The majority of convenience applications will be traffic management-based. The driver will have access to entertainment and services such as streaming audio and video via commercial applications. In addition to the aforementioned applications, there are productive applications.

Applications in safety: Real-time traffic, cooperative message transfer, post-crash notification, road hazard control notification, cooperative collision warning, and traffic vigilance are all included in this category once more.

Applications for Convenience: This is again arranged into Course Redirections, Electronic Cost Assortment, Stopping Accessibility, and Dynamic Forecast.

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Uses in the business sector: Remote Vehicle Personalization and Diagnostics, Internet Access, Digital Map Downloading, Real-Time Video Relay, and Productive Applications fall into the following categories: Environmental Benefits, Time Utilization, and Fuel Saving are the three categories for these.

CHALLENGES

The difficulties can be thought of as a possible direction for future research or as open research issues for which there is still room for improvement and solutions. A portion of these difficulties which client can take as examination issues are [11], [12]:

Problems with Vehicle Security: There are numerous security threats to VANET, which can be broken down into a few groups. The five distinct attack classes were chosen with the intention of making it simple to identify each class by its association. Attack level and priority will be represented differently by each class. Network Attack, Denial of Service Attack, Sybil Attack, Application Attack, Fabrication Attack, Alteration Attack, Social Attack, Tunnel Attack, Monitoring Attack, and Eavesdropping are the proposed categories of attacks.

Issues with Vehicular Networks: Bootstrap Vehicular Technical Challenges: Mobility, Volatility, Privacy versus Authentication, Privacy versus Liability, Network Scalability Control of congestion and collisions, environmental impact, network management, MAC design, and security QoS: When current routing paths become unavailable due to changes in node velocity, node positioning, network topology, or the distance between vehicular nodes, QoS support over VANETs remains a challenge. Utilizing the VANET's allocated bandwidth to improve message delivery and develop adaptive QoS routing protocols that will quickly and efficiently establish new routes may be a challenging issue for researchers and network engineers alike.

Routing: An effective routing algorithm is required in order to send data packets from one node to another in a timely and correct manner. In VANET, an efficient routing algorithm is one that maximizes system capacity, reduces computational complexity, and minimizes delay. An active area of research in VANET is the design of such an algorithm that satisfies all of the aforementioned properties and can be implemented in multiple network topologies.

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CONCLUSION

VANET is a promising wireless communication technology for enhancing information services and highway safety. However, there are a number of obstacles to overcome, and VANETs' profitable impact on traffic safety and efficiency must be demonstrated. The fundamental overview of what a VANET is all about is provided in this paper. From a system and communication perspective, the architecture of VANET is further developed in subsequent sections, which then discuss the various protocols utilized by VANET. From a research perspective, the following section explains VANET's application areas. The paper concludes with a discussion of unresolved research issues that need to be addressed.

References:

[1] Sivasakthi M., Suresh S. Research on vehicular ad hoc networks (VANETs): an overview Journal of Applied Sciences and Engineering Research 2013 2 1 23-27
[2] Moustafa H., Zhang Y. Vehicular Networks: Techniques, Standards, and Applications 2009 Boca Raton, Fla, USA CRC Press
[3] Maier M. W., Emery D., Hilliard R. Software architecture: introducing IEEE standard 1471 Computer 2001 34 4 107-109
[4] Maier M. W., Emery D., Hilliard R. ANSI/IEEE 1471 and systems engineering Systems Engineering 2004 7 3 257-270
[5] Emery D., Hilliard R. Every architecture description needs a framework: expressing architecture frameworks using ISO/IEC 42010 Proceedings of the Joint Working IEEE/IFIP Conference on Software Architecture & European Conference on Software Architecture (WICSA/ECSA '09) September 2009 Cambridge, UK 31-40
[6] Kosch T., Schroth C., Strassberger M., Bechler M. Automotive Internetworking 2012 New York, NY, USA Wiey
[7] CAR 2 CAR Communication Consortium Manifesto, 2007, http://elib.dlr.de/48380/1/C2C-CC_manifesto_v1.1.pdf
[8] Rakesh Kumar and Mayank Dave, A Comparative Study of Various Routing Protocols in VANET, IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 4, No 1, July 2011.
[9] Kamini and Rakesh Kumar, VANET Parameters and Applications: A Review, Global Journal of Computer Science and Technology, Vol. 10 Issue 7 Ver. 1.0 September 2010.
[10] Vishal Kumar, Shailendra Mishra and Narottam Chand, Applications of VANETs: Present & Future, Communications and Network, 2013, 5, 12-15 doi:10.4236/cn.2013.51B004 Published Online February 2013.
[11] Ms. Divyalakshmi Dinesh and Prof. Manjusha Deshmukh, Challenges in Vehicle Ad Hoc Network (VANET), International Journal of Engineering Technology,

ISSN: 2583- 083X
Impact Factor 7.52
DOI: 10.5281/zenodo.8144395

Management and Applied Sciences, Volume 2 Issue 7, ISSN 2349-4476, December 2014.

[12] Er. Gurpreet Singh, Overview of Challenges in VANET, International Journal of Innovative Research in Science and Engineering, Vol.No.2, Issue 08, August 2016.