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Real Time Communication Model for Vehicular Communication in VANET

Amol S. Dudhe , Dr. Salim Y. Amdani , Dr. Suresh. S. Asole
Department of Computer Science and Engineering, Babasaheb Naik College of Engineering, Pusad, Maharashtra, India

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ABSTRACT

According to the general goal of VANETs (i.e. making a safe and reliable environment for VANETs' users), the emergency messages should be broadcasted without delay and lost. However, the congestion control strategies do not differentiate between the emergency and the other types of messages in critical situations. This issue is more important in the real-time safety applications. In VANETs, the safety messages are usually sent with high transmission range (power) to immediately broadcast the safety messages in a larger area and increase the number of receivers. However, when the transmission range is high, the probability of collision increases in the channels due to the increasing number of nodes that compete to acquire the channel. The transmission rate also has a significant impact on the channel saturation. When the transmission rate increases, the applications of VANETs can perform more efficiently due to updating the information. However, the channel can be saturated frequently by increasing the transmission rate. Beacon messages are a kind of safety messages that periodically broadcast some information about the vehicles, including position, velocity, and direction. These messages are transferred in the control channel. Due to the high beaconing rate in high vehicle density, the control channel may face overloading as well as congestion. On the other hand, by decreasing the beaconing rate, the operation of safety applications encounters many challenges due to failure in receiving the beacon message and updated information.

Keywords: VANET, Transmission Rate, Face Overloading

I. INTRODUCTION

As indicated by the overall objective of VANETs (for example making a protected and dependable climate for VANETs' clients), the crisis messages ought to be communicated right away and lost [2]. Nonetheless, the blockage control procedures don't separate between the crisis and different sorts of messages in basic circumstances. This issue is more significant in the constant security applications [24]. In VANETs, the wellbeing messages are normally sent with high transmission range (power) to quickly communicate the security messages in a bigger region and increment the quantity of recipients. Nonetheless, when the transmission range is high, the likelihood of impact expansions in the channels because of the rising number of hubs that contend to procure the channel. The transmission rate likewise altogether affects the channel immersion. Whenever the transmission rate builds, the uses of VANETs can perform all the more proficiently because of refreshing the data. In any case, the channel can be immersed regularly by expanding the transmission rate [10], [14]. Signal messages are a sort of security messages that intermittently communicated some data about the vehicles, including position, speed, and heading. These messages are moved in the control channel. Because of the great beaconing rate in high vehicle thickness, the control channel might confront over-burdening as well as blockage. Then again, by diminishing the beaconing rate, the activity of wellbeing applications experiences many difficulties because of disappointment in getting the reference point message and refreshed data [28], [25]. Along these lines, tuning the transmission reach and transmission rate importantly affects what is going on of the channels and can assist with controlling the blockage in the channels. Notwithstanding, tuning transmission reach and rate are provoking in VANETs because of high vehicle thickness, high pace of geography changes, and high versatility of hubs. Different elements (for example vehicle speed, vehicle thickness, message size, distance among shippers and recipients, and number of paths) can affect acquiring the appropriate qualities for transmission reach and rate. Furthermore, transmission rate and reach ought to be tuned in sensible chance to fulfill the unwavering quality prerequisites of the wellbeing applications [12], [20], [26]

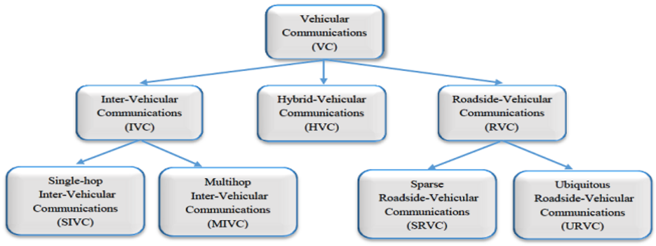

Figure 1.1 : Communication patterns in VANETs.

II. Related Work

Vehicular ad-hoc Networks (VANETs) are employed by Intelligent Transport Systems (ITSs) to work wireless communications within the vehicular environments. VANETs are designed to supply a reliable and safe environment for users by reducing the road accidents, traffic jams, and fuel consumptions, and so on. The VANETs' users are often informed of hazardous situations by vehicular communications and exchanging the knowledge about surrounding environments [1], [2]. VANETs are a kind of Mobile unplanned Networks (MANETs). Although VANETs inherit most of the characteristics of MANETs, VANETs have some unique characteristics like high mobility, high rate of topology changes, and high density of the network, and so on. Thus, VANETs have different characteristics as compared with MANETs [1], [3]-[7].

Traffic accidents are most of the day's results of the driver's failure to access quickly and properly the driving conditions. Normally drivers have imperfect information about road situations, speed and position of vehicles around them and typically are compelled to form decisions like breaking and lane changing without the benefit of whole data. The need for communication when the deployment of any fixed infrastructure is impossible and therefore the advancement of computer and wireless communication technologies, led to the event of Mobile Ad-hoc Networks (MANETs) [15]. Vehicular Ad-hoc Networks as a subset of Mobile Ad-hoc

Networks which provide data exchange via Vehicle-to-Vehicle (V2V), Vehicle to Roadsides (V2R) and Vehicle to Infrastructure (V2I) communications and a car which takes part in such a network is equipped with a WLAN and cellular communication device [8]. VANETs is additionally defined as a wireless communication technology which is additionally ready to enhance driving safety and velocity by exchanging real-time transportation information, and “it should upon implementation, collect and distribute safety information to massively reduce the quantity of accidents by warning drivers about the danger before they really face it” [9]. In addition, VANETs are also able to minimize incidents and improve traffic conditions by providing vehicles, drivers and passengers with information about the road condition. VANET has its own unique characteristics in comparison with other sorts of MANETs, the unique characteristics of VANET include: predictable mobility, lack of powers constraints, variable network density, Rapid changes in network topology, High computational ability and large scale networking [10]. Safety services information such as traffic accidents and road congestion which are sensitive to reliable and real-time communication should be broadcasted immediately. Data transmission in such environment is critical and has got to be distributed in multiple paths to enhance the end-to-end delay. Some stale routes are generated in the routing table which leads to unnecessary routing overhead causing frequent link failures as well as route discoveries. Therefore the discovered route between couple of vehicles should be as stable as possible to satisfy QoS requirements [11]. The intermit-tent nature and short-live of these algorithms, make the created clusters to provide scalability with lower communication overhead [11]. Rapid change in topology, owing to time varying vehicle densities and other factors; both external and internal, makes preserving a route very difficult and this in turn incurs high routing overheads as well as low throughput [12]. A cluster on demand minimum spanning tree with prims algorithm has been proposed in [13] for VANET. In this approach the vehicles has been clustered by accounting the intra-cluster QoS. An extended Kruskal algorithm has been proposed in [14] to support QoS.

III. Architecture of VANETs

Figure 1.2 depicts three district domains of VANETs including In-vehicle domain, Ad hoc Domain, and infrastructure domain. In-vehicle domain is formed of OBUs. Each vehicle is considered to be equipped with OBU

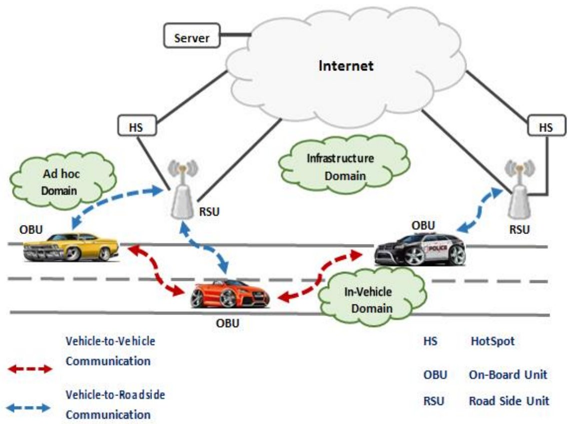

Figure 1.2 : VANET system architecture.

Major standardization groups (e.g. IEEE, IETF, and ISO) and consortia (e.g. car-to-car communication consortium (C2C-CC)) define standards for vehicular communications. In North America, the Federal Communication Commission (FCC) defined a new standard for VANETs that called Dedicated Short Range Communication (DSRC) [3], [4]. This standard allocates a 75 MHz of spectrum in 5.9GHz bandwidth for carrying out the vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications. In DSRC, the defined transmission range and rate are 10-1000 m and 3-27 Mbps, respectively. Wireless Access in a Vehicular Environment (WAVE) is employed in DSRC standard to generate a norm for the performance of communications of VANETs in PHY and MAC layers. WAVE is composed by two protocols of 5 IEEE standard including IEEE 802.11p and IEEE

1609 protocols that are defined to manage the network services, resources, security services, and multi-channel operations, and so on [1]-[4], [6].

IEEE 802.11p is a convention that indicates the elements of IEEE 802.11 convention in PHY and lower a piece of MAC layers to move information in vehicular conditions. This convention utilizes a MAC layer convention in light of Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) for scattering information in VANETs. IEEE 1609 conventions handles the functional capacities and intricacies of the presentation of DSRC. IEEE 1609.1 is characterized in application layers for dealing with the exercises of uses to make associations between the OBUs and other organization assets. To be sure, IEEE 1609.1 standardizes the activity of VANETs' applications in view of WAVE standard. IEEE 1609.2 gives the security in WAVE by characterizing secure configurations for messages and completing the protected handling on the messages. IEEE 1609.2 likewise gives the security of message trade. IEEE1609.3 is characterized in the organization layer for steering and tending to the messages. At long last, IEEE1609.4 lives in the upper piece of the MAC layer that gives the multi-direct activities in VANETs and handles the tasks of higher layers disregarding the actual divert boundaries in lower layers.

IV. CONCLUSION

In VANETs, the mobile nodes are the vehicles that can move with very high velocities (e.g. 120 -140 Km/s in highways). Therefore, one of the most significant characteristics of VANETs is high mobility. Also, in VANETs, the topology can change very frequently because of rapid movement of the vehicle, the drivers can randomly choose the paths, and so on.Due to the dynamic nature of the traffic in roads, some gaps could also be created between the vehicles and consequently isolated node clusters are often created within the road. Also, because of the high topology change in VANETs, the connection duration of the link is extremely short. The nodes need to frequently choose the new route for transferring data. Also, when the density of network decreases, the rate of disconnections increases. The high rate of link disconnections makes some issues in the performance of VANETs. This issue can be solved using roadside units and relay nodes. These issues of VANETs lead to carry out new researches to maintain the seamless connectivity and decrease the effects of fading in VANETs.

VANETs mobility model is limited to the plan of highways, roads, and streets. However, it's necessary to understand the position of nodes and their movement direction to raised predict the longer term driver decision and stop the link disconnection. In addition, changing the mobility model (i.e. highways or urban environments) influences the planning of the control algorithms in VANETs. The highway mobility model is straightforward thanks to one-dimension movements of vehicles, whereas, in urban model, some features like street pattern, high node density, two-dimension movements of vehicles, obstacles and interferences via tall buildings and trees must be considered. These features make the design of VANETs in urban environments different and more complex.

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