An Traffic Collision Avoidance System due to Driver Impairment using Vehicular ad hoc Networks (VANETS) : A Review

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ABSTRACT

Increasing traffic load on existing infrastructure is resulting in bottlenecks on vehicular movement. Frequent traffic jams and accidents impose severe restrictions on passenger Safety and comfort. This can affect the response time of emergency vehicles such as ambulances and fire bridges in reaching their destination. A new kind of ad hoc network is hitting the streets: Vehicular Ad Hoc Networks (VANETS). The VANET has come up with lot of ideas. Mostly VANET is been used for communication between Vehicles. Not only for communication purpose, VANET also structured for traffic controlling, Navigation, and other application in VANET. Therefore this paper proposes An Traffic Collision Avoidance System not only to eliminate accidents and damage to the vehicles and people but also to save our time by providing information about busy traffic on ongoing road using Vanet.

Keywords: VANET, Intelligent transportation systems, alert, safety

1. INTRODUCTION

Millions of people around the world die every year in vehicle accidents and many more are Injured. These incidents are often a result of the driver’s inability to assess quickly and correctly the driving situations at high vehicular speeds. Normally a driver is forced to make decisions like braking and lane changing without the benefit of complete information about road and vehicles around them. There are many solutions proposed to avoid the problem. Vehicular Ad-hoc Network (VANET) is becoming the most suitable solution for driving assistance and traffic monitoring in the current scenario. Vehicular Ad Hoc Networks collect and distribute safety information to massively reduce the number of accidents by warning drivers about the danger before they actually face it. If a driver needs to brake or change lanes, he will periodically broadcast/receive warning messages to/from neighbouring vehicles. This helps him and other drivers react faster, thereby avoiding the likelihood of accidents.

VANET is subgroup of MANET. VANET is a technology that creates a mobile network in which moving cars act as nodes. In VANET every participating car behaves like wireless router or node, every node creates a wide range network. The nodes are detecting to each other approximately 100 to 300 meters range. If cars or nodes are faraway to the given range the signal drop out from the network and on the other hand new cars or nodes can detect the other and join into the network, that’s by a mobile Internet is created. VANETs have several advantages over the conventional wireless networks such as UMTS (Universal Mobile Telecommunication System), LTE (Long Term Evolution) and Wi-MAX networks. The VANET has several advantages likeself-organization, lower local information dissemination time, low cost of implementation and low cost of maintenance.[3]. The main aim of VANET is to develop the vehicular communication system to provide the secure and cost-efficient for the benefit of passenger safety and comfort.
2. OVERVIEW OF VANET

2.1. Intelligent Transportation System

Vehicular ad-hoc network or VANET is also known as intelligent transportation system (ITS). A VANET consists of vehicles and roadside base stations that exchange primarily safety messages to give drivers the time to react to life-endangering events (fig.1). The communicating nodes in VANETs are either vehicles or base stations. Vehicles can be private (belonging to individuals or private companies) or public (i.e., public transportation means, e.g., buses, and public services such as police cars). Base stations can belong to the government or to private service providers.

![VANET Architecture](image1)

**Fig-1: VANET Architecture**

In intelligent transportation systems, each vehicle takes on the role of sender, receiver, and router to broadcast information to the vehicular network or transportation agency, which then uses the information to ensure safe, free-flow of traffic. There are three possible communication configurations in intelligent transportation systems. These include vehicle-to-vehicle, vehicle-to-roadside, and routing-based communications.

2.1.1. Vehicle to vehicle communication (V2V)

Vehicle to vehicle (V2V) communication (fig.2) perform the operation (sender, receiver and broadcasting) between vehicles. In vehicle to vehicle or inter vehicular communication has two types of message forwarding. First one is Naive broadcasting and another one is Intelligent broadcasting.

In naive broadcasting, vehicles send broadcast messages periodically and at regular intervals. In this method broadcast message generated by the in front vehicle and the receiving vehicle sends its own broadcast message to other vehicles behind it. The prime disadvantage of this method is that the large number of collision occurs due to the broadcasting message by this the whole process and the delivery of message becomes slow.

In intelligent broadcasting, if the vehicle detecting that they receives the same message from behind, it assumes that at least one vehicle in the back has received it and stop broadcasting. The assumption is that the vehicle in the back will be responsible for moving the message along to the rest of the vehicles.

![Inter-vehicle communication](image2)

**Fig-2: Inter-vehicle communication**
2.1.2. Vehicle-to-roadside communication

The vehicle-to-roadside communication configuration (fig. 3) represents a single hop broadcast where the roadside unit sends a broadcast message to all equipped vehicles in the vicinity.

![Vehicle-to-roadside communication](image)

Fig-3: Vehicle-to-roadside communication

Vehicle-to-roadside communication configuration provides a high bandwidth link between vehicles and roadside units. The roadside units may be placed every kilometer or less, enabling high data rates to be maintained in heavy traffic. For instance, when broadcasting dynamic speed limits, the roadside unit will determine the appropriate speed limit according to its internal timetable and traffic conditions. The roadside unit will periodically broadcast a message containing the speed limit and will compare any geographic or directional limits with vehicle data to determine if a speed limit warning applies to any of the vehicles in the vicinity. If a vehicle violates the desired speed limit, a broadcast will be delivered to the vehicle in the form of an auditory or visual warning, requesting that the driver reduce his speed.

2.1.3. Routing-based communication

The routing-based communication configuration (fig. 4) is a multi-hop unicast where a message is propagated in a multi-hop fashion until the vehicle carrying the desired data is reached.

![Routing-based communication](image)

Fig-4: Routing-based communication

When the query is received by a vehicle owning the desired piece of information, the application at that vehicle immediately sends a unicast message containing the information to the vehicle it received the request from, which is then charged with the task of forwarding it towards the query source.
3. LITERATURE REVIEW

Irshad A Abbasi et.al.[1], describes traffic flow oriented routing (TFOR) protocol, a routing protocol for VANETs. It includes two major phases: first, it selects the next junction optimally, based on directional as well as the non-directional density, and secondly, it uses two-hop neighbour information for routing between the junctions. Simulation outcomes in urban scenarios show that TFOR minimizes average end-to-end delay and routing overhead by on average 15.3% and 19.5%, respectively, compared to GPSR. It reduces routing overhead up to 17% compared to GSR. TFOR maximizes packet-delivery ratio on an average of 17.5%, 10.7%, and 7.2% compared to GPSR, GSR, and E-GyTAR, respectively.

Sherali Zeadally et.al.[2], describes some of the simulators currently available to VANET researchers for VANET simulations and assess their benefits and limitations. In addition to this, this paper reviewed some of the main areas that researchers have focused on in the last few years and these include security, routing, QoS, and broadcasting techniques.

Harjinderjeet Singh et.al.[3], describes model to offer the collision free movement in the VANET cluster. The proposed model has been designed to work in the three layered model which comprised of point of collision detection, probability of collision calculation and collision avoidance methods. The proposed model is intended to solve the maximum problems arising in the VANETs in the case of collisions. The expected outcome must be obtained in the form of collision rate, probability of detection, probability of false alarm, etc. The experimental results are expected to solve the problems of collision and to overcome the problems in the existing model.

Wenshuang Liang et.al.[4], describes VANETs research methodologies, some mobility models and simulator tools. This paper also provides an analysis on VANETs research challenges and future trends. The key challenges in VANETs are Fundam Limit and Opportunities, Standards, Routing Protocols, Connectivity, Cross-Layer, Cooperative Communication, Mobility, Security and Privacy, Validation.

Rukaiya Shaikh et.al.[5], describes Many attacks in vehicular adhoc network can be prevented or detected using cryptography methods. This paper proposes various asymmetric encryption algorithms such as RSA, ECC in details with their advantages and limitation. From the comparison between RSA and ECC we can say that if messages are too short, RSA at 1024 bits, consumes less time with a high security level, otherwise ECIES is the best choice.

4. APPLICATION

Applications in vehicular environment usually can increase the road safety, improve traffic efficiency, and provide entertainment to passengers. In most cases, VANETs applications can be roughly organized into two major classes: safety applications and user based applications.

4.1. Safety Applications

Traditionally the intention of safety applications is accident prevention, and thus this kind of applications is the main motivation for developing vehicular ad hoc networks. These applications can be further categorised in following way.

1. Collision Avoidance: According to some studies, 60% accidents can be avoided if were provided a warning half a second before collision. If a driver get a warning message on time collision can be avoided.
2. Cooperative Driving: Drivers can get signals for traffic related warnings like curve speed warning, Lane change warning etc. These signals can co-operate the driver for an uninterrupted and safe driving.
3. Traffic optimisation: Traffic can optimised by the use of sending signals like jam, accidents etc. to the vehicles so that they can choose their alternate path and can save time.

4.2. User Based Applications

VANET can also provide following services to the user apart from safety. These application are called as User Based Application. User Based Application applications can be classified into several subclasses.
1. Peer to peer application: Services like sharing music, videos etc. among the vehicles in the network can be provided through these applications.
2. Internet Connectivity: People always want to be on Internet all the time. Hence VANET can be used to provide the constant connectivity of the Internet to the users.
3. Supplementary services: VANET can also provide other user based application such as payment service to collect the toll taxes, to locate the fuel station, parking slots, restaurant etc.

5. CHARACTERISTICS OF VANET

In addition to the similarities to ad hoc networks such as MANET, VANETs possess unique network characteristics that distinguish it from other ad hoc networks which can be summarized as:

1. High Mobility: The nodes in VANETs usually are moving at high speed. This makes harder to predict a nodes position and making protection of node privacy.
2. Rapidly changing network topology: Due to high node mobility and random speed of vehicles, the position of node changes frequently. As a result of this, network topology in VANETs tends to change frequently.
3. Unbounded network size: VANET can be implemented for one city, several cities or for countries. This means that network size in VANET is geographically unbounded.
4. Frequent exchange of information: The ad hoc nature of VANET motivates the nodes to gather information from the other vehicles and road side units. Hence the information exchange among node becomes frequent.
5. Wireless Communication: VANET is designed for the wireless environment. Nodes are connected and exchange their information via wireless. Therefore some security measure must be considered in communication.
6. Time Critical: The information in VANET must be delivered to the nodes with in time limit so that a decision can be made by the node and perform action accordingly.
7. Sufficient Energy: The VANET nodes have no issue of energy and computation resources. This allows VANET usage of demanding techniques such as RSA, ECDSA implementation and also provides unlimited transmission power.
8. Better Physical Protection: The VANET nodes are physically better protected. Thus, VANET nodes are more difficult to compromise physically and reduce the effect of infrastructure attack.

6. CONCLUSION

Accidents are being major problem in roadways in both urban and rural areas. Accident leads to loss of human life, Injury to human, traffic congestion, and may also leads to other accidents. So there is a necessity to find a way to reduce or prevent these accidents. In the proposed scheme, the accident can be prevented by giving an alert to the driver . This alert can be provided through the VANET communication usingV2V communication and V2I communication .Vehicular networks will not only provide safety and life saving applications, but they will become a powerful communication tool for their users

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