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# A Survey on Smart Traffic Controller in Ad Hoc Networks

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**ABSTRACT** During the last decades, the total number of vehicles around the world has grown enormously. Therefore road safety has become a main issue for governments and car manufacturers in the last twenty years. The vast development in the wireless technologies emerged a new type of networks, such as Vehicular Ad Hoc Networks (VANETs), belonging to the subcategory of traditional MANETs, which provides communication between vehicles themselves and between vehicles and infrastructure. Various new concepts such as smart cities and living labs[1] are introduced in the recent years where Vehicular Ad Hoc Networks (VANETs) plays an important role. A review of various Intelligent Traffic Systems (ITS) available with respect to our proposed scheme is done in this paper. This paper also introduces a new system that transmits information about traffic conditions that will help the driver to take proper decisions. Our proposed scheme consists of warning messages exchanged between cars, acting as nodes, which provide information to the driver about current traffic conditions.

**KEYWORDS** : VANET, Intelligent traffic Lights (ITLs), Intelligent Traffic System (ITS).

## 1. INTRODUCTION

Road safety has become a main issue for governments and car manufacturers in the last twenty years due to an enormous increase in the number of vehicles which has lead to increasing traffic density and more number of accidents. In India traffic is growing four times faster than the population.

Vehicular technologies focus their efforts on improving road safety. It shifted companies and researcher focus. From the evolution of wireless technologies, it allows the design of communication system in which vehicles can take part as well in network. Thus networks such as Vehicular Ad Hoc Networks (VANETs)[14] are created to facilitate communication between vehicles themselves known as V2V communication and between vehicles and infrastructure known as V2I communication. Vehicular ad hoc network (VANET) is a technology that uses moving cars as nodes in a network to create a mobile network [2]. Vehicular Ad hoc Networks (VANETs) belong to a subcategory of traditional Mobile Ad hoc Networks (MANETs) [12]. New concepts like smart cities have emerged in the last years where vehicular networks play an important role.

Goals of VANETs are: Car accident prevention, pollution, congestion reduction and safer roads. The development of an efficient system in VANETs has many important benefits, from the road operators as well as the driver's point of view. Efficient traffic alerts and updated information about traffic incidents will reduce traffic jams, increase road safety and reduce stress. Furthermore, it also helps in sustainable and economic ways; real- time traffic alerting will reduce time and fuel consumption and therefore decrease the amount of CO2 emissions [3].Therefore, VANETS are considered as one of the most prominent technologies for improving the efficiency and safety of modern transportation systems.

Vehicular ad hoc networks (VANETs) are getting attention due to the various important applications related to road safety and traffic control. Smart cities would like to minimize their transportation problems due to the increasing population that results in congested roads. VANETs aim at solving this issue by improving vehicles'mobility and increasing road safety and also aim at having more endurable cities. At the beginning of the development of vehicular technologies, the more focus was to have more efficient and safer roads. Nowadays, due to the huge development of wireless technologies and their application in vehicles, it is possible to use Intelligent Transportation System (ITS) that will change our way to drive and help emergency services. Communication among vehicles and with fixed infrastructure is possible by using VANETs. This will improve the overall road safety and even raise new commercial opportunities.

## 2. RELATED WORK

During the last decades, Intelligent Transportation Systems (ITS) have emerged as an efficient way to improve the performance of the flow of vehicles on the roads. The goals of ITS is to provide road safety, comfortable driving and distribution of updated information about the roads. Many papers related to ITS have been presented in recent years. In this section some work about ITS in smart cities is discussed.

The work in [4] is a survey about multifunctional data driven intelligent transportation system (D2ITS), which collects a large amount of data from various resources: Vision-Driven ITS (input data collected from video sensors and used recognition including vehicle and pedestrian detection); Multisource-Driven ITS (e.g. inductive-loop detectors, laser radar and GPS); Learning-Driven ITS (effective prediction of the occurrence of accidents to enhance the safety of pedestrians by reducing the impact of vehicle collision);and Visualization-Driven ITS (to help decision makers quickly identify abnormal traffic patterns and accordingly take necessary measures). There are some problems regarding object reorganization in some complex situations.

In such a situation it becomes difficult to recognize each vehicle (object) and perhaps to find out the centroid of each object. Hence it creates problems centroid of each object. Hence it creates problems while calculating traffic density. Another problem is while doing object subtraction, if the colour of vehicle and the background matches then it becomes difficult to uniquely identify the object.

In [5] an adaptive traffic signal control system based on car-to-car communication is presented. This system reduces the waiting time of the vehicles at the intersection along with the reduction in queue length. To realize this system, the concept of clustering is used for the vehicles approaching the intersection. The density of vehicles within the cluster is computed using a clustering algorithm and sent to the traffic signal controls to set the timing cycle. It uses DBCV[13] algorithm. This algorithm is a combination of cluster and opportunistic dissemination technique and is used to gather the required density information. The clusters are created based on the direction of the vehicles in a given geographic region approaching the intersection. This direction parameter is computed within the vehicles by employing GPS and digital maps. Another system [6] that takes the control decisions based on the information coming from the other vehicles. Each vehicle is equipped with a short range communication device and controller nodes are placed in the intersection with traffic lights as shown in following figure. This

controller node at intersection acts as adaptive control signal system.

In [6] two adaptive traffic light systems based on wireless between vehicles and fixed controller nodes deployed at intersections are designed and developed. These systems improve traffic fluency, reduce the waiting time of vehicles at intersections and help to avoid collisions.

The e-NOTIFY [7] system was designed for automated accident detection, which sends the data to the Emergencies Center and assistance of road accidents using the capabilities offered by vehicular communication technologies.

As discussed in [8], several adaptive traffic control systems have been implemented for intersections all over the world. Some of the most important ones include Split, Cycle and Offset Optimization Technique (SCOOT) [8] and Sydney Coordinated Adaptive Traffic System (SCATS) [9]. SCOOT [8] is based on loop detectors placed on every link to an intersection, usually at the upstream end of the approach. SCOOT obtains information on traffic flows from detectors. SCOOT as an adaptive system, respond the change of flow as it depend on traffic data. At every link detectors are normally required. Their location is important and they are usually positioned at the upstream end of the approach link. Even in SCATS also detectors are placed before the stop line at an intersection. Thus, they cannot get accurate data when the queue grows beyond the length of the detector, or when the link is over saturated. Since model based approach is used especially on occupancy, they also have difficulties in differentiating between high flows or intersection stoppage. Reported research shows poor performance when incidents occur [10].

Dash Navigation[11], Inc. a start-up in Sunny Valley, CA started offering a service in 2009 called The Dash Driver Network that allows drivers to broadcast their location and speed in exchange for receiving updated traffic information compiled from other vehicles in the network. This system is relies on wireless internet connectivity which is not widely available on roads and highways and it also require centralization. Because the collecting entity is a central, trusted location, privacy concerns are mitigated.

## 3 METHODS

This describes the scene of an accident in a traffic control enabled smart city. ITLs (Intelligent Traffic lights) are installed throughout the city, which sense the traffic scenario by receiving the traffic situation messages from the victim cars or the nearby cars.

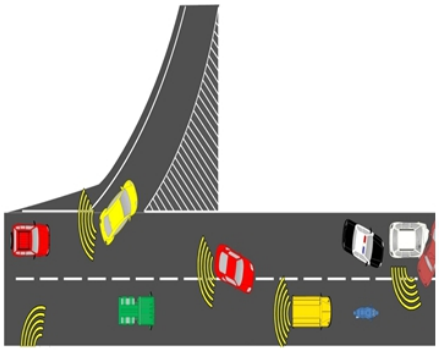

**Figure 1: Proposed Scheme of ITL transmitting TSM**

In figure 1, both side ITL receives a traffic situation message (TSM) about the accident in the left lane of its area and sent this information to mobile nodes to take right lane. These ITLs act as the stationary nodes in the generated ad hoc network (VANET) and the cars on the road act as mobile nodes in the network. Two type of communication exist in the network:

- Vehicle to infrastructure (V2I) i.e. between car and the ITL.
- Vehicle to Vehicle (V2V) i.e. among cars in the generated network.

This ITL transmit this TSM message to the nearby car and it uses flooding[15] over the AODV protocol to transmit this message to all the nearby cars and also to the next installed ITL. This transmitted message will help the cars on the lane either to continue on the same lane or take a turn before the accident spot. This framework can be implemented through in ns2 simulator.

The traffic situation message generated in the network will spread the news of congestion due to accident to the cars in the nearby area so that the drivers can take decisions which route to follow to avoid traffic jam.

The generated network is used to produce TSM message and also can be used for infotainment. This project can even be merged with the present GPS (Global Positioning System) to show the driver the shortest possible path along with the path with least congestion (traffic).

## 4 CONCLUSION

In this paper, we have obtained an in-sight idea of simulating real world scenario of VANET. Different works about Intelligent Traffic System (ITS) are studied. We have proposed a scheme for a smart city in which we include intelligent traffic lights (ITLs) that transmit messages to vehicles to give traffic alerts and traffic statistics.

We can show that the use of ITLs in smart cities can not only improve road safety but also the driver's quality of life through its implementation. The goal is that the driver's assistant device can take proper trip decisions, for instance to avoid congested roads, and therefore reducing the trip time and pollution as well.

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