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An Approach towards Traffic Management System using Density Calculation and Emergency Vehicle Alert

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Abstract: *Now a day's many of the things get controlled automatically. Everything is getting controlled using the mechanical or the automated systems. In every field machines are doing the human works. But still some area is controlled manually. For example traffic controls, road control, parking controlling. Keeping these things in mind we are trying to develop the project to automate the traffic tracking for the square. To make any project more useful and acceptable by any organization we need to provide multiple features in a single project. Keeping these things in consideration proposed system is less with multiple methodologies which can be used in traffic control system It is important to know the road traffic density real time especially in mega cities for signal control and effective traffic management. In recent years, video monitoring and surveillance systems have been widely used in traffic management.Hence, traffic density estimation and vehicle classification can be achieved using video monitoring systems. In most vehicle detection methods in the literature, only the detection of vehicles in frames of the given video is emphesized. However, further analysis is needed in order to obtain the useful information for traffic management such as real time traffic density and number of vehicle types passing these roads. This paper presents emergency vehicle alert and traffic density calculation methods using IR and GPS*
Keywords: *Wireless Sensor Networks(WSN), Smart Traffic Light Control System (STLC), Smart Congestion Avoidance System (SCA)*

I. Introduction

Traffic Signal System or traffic monitoring is a vast domain where WSN can be applied to gather information about the traffic load on a particular road, incoming traffic flow, traffic load at particular period of time (peak hours) and in vehicle prioritization. Wireless Sensor Networks deployed along a road can be utilized to control the traffic load on roads and at traffic intersections. Sensors are deployed on either side of roads at intersection points and in emergency vehicles respectively. These sensors run on both solar energy as well as battery. During bright and sunny conditions these sensors have the capability to draw solar energy from sun light and use battery power for functioning during night and cloud and foggy condition Consider a scenario of highly congested area where many vehicles such as personal transport, public transport and emergency vehicles (Ambulance, Fire brigade, VIP cars and other rescue vehicles) have to wait for long for the change of traffic signals at intersection points. Existing traffic light systems have timers that are set at regular intervals. This leads to the wastage of precious time especially in case of rescue vehicles for emergency conditions. In order to control this situation, we have proposed a system consisting of two parts: Smart Traffic Light Control System (STLC) and Smart Congestion Avoidance System (SCA) during emergencies. STLC System controls the change of traffic lights at intersection points giving high priority to emergency vehicles. SCA System is a smart traffic routing system that chooses the shortest routes having the least congestions.

In the last decade, intelligent transportation systems (ITS) [1] have progressed at a rapid rate, which aim to improve transportation activities in terms of safety and efficiency. Car-to-car and car-to-infrastructure communications are important components of the ITS architecture. Communication between cars and traffic lights is one of the important applications which help to have dynamic and automatic traffic lights that can create several benefits such as minimizing the traffic jam, reducing fuel consumption and emissions, etc. Here it deals with decreasing the response time of the emergency cars by changing the traffic lights status with employing the communication technologies.

Here the contribution of is twofold: First, the effect of the changing traffic lights status to green for emergency cars is investigated by using traffic simulator. Second, it uses OMNET++ (Network Simulator) in order to simulate the mentioned scenario as a VANET. Additionally, several statistics about traffic simulation is created for each car such as traveling time, waiting time, emissions, fuel consumption; or complete amount of car emissions in the street during the simulation, fuel consumption, and number of vehicles and so on, for each street.

Here it presents evaluation of an integrated traffic control and route diversion strategy. Traffic density management using GPS is an attempt for the creation of the smooth driving environment through a variety of recent technologies such as GPS and WI-FI [2]. With these technologies we can make people not to wait for a long time in traffic signals with fewer vehicles on the other side of the signal system. This technology makes the signal system to work on the vehicle density basis whereas the existing system is on the time basis. This system can be extended to personnel vehicles also. This technology can serve its purpose greatly when it is implemented on the emergency vehicles such as Ambulances and Rescue vehicles [3]. This technology can play a vital role in fuel savings and pollution control.

II. Literature Survey

In the recent past, researchers have tested a wide array of technologies in an attempt to find improved methods of monitoring traffic conditions. This research in traffic surveillance has ranged from studies of traditional loop detection methods to the use of anti-submarine warfare technology. h. A brief survey of technologies explored during the past decade and a half is given below to provide an understanding of the level of research interest in traffic surveillance technologies.

Bohnke and Pfannerstill [4][5] acknowledged a need for more reliable traffic data acquisition than localized data collection generated by traditional loop detectors (1986). The pair introduced a pattern recognition algorithm which could utilize unique vehicle presence signatures generated by successive series of inductance loop detectors. By identifying and reidentifying platoons of vehicles traveling across links bounded by loop detection equipment, vehicle travel times could be obtained.

Ju and Maze performed simulations on incident detection strategies using the FREQ8PE simulation model (1989). Their research evaluated a comparison of incident detection strategies using police patrol versus the use of motorist call boxes at 1 km spacing. The motorist call boxes formed the backbone of the modeled freeway surveillance and control system (FSCS). This FSCS yielded a benefit-to-cost ratio of 2.69 as it generated benefits from travel-time reduction and reduced fuel consumption. These benefits were brought about by reduced incident detection time afforded by the motorist call boxes.

AT&T [6] experimented with the use of applied acoustic and digital signal processing technology to produce a vehicular traffic surveillance system (Nordwall, 1994). Labeled the SmartSonic Traffic Surveillance System (SmartSonic TSS-1), the project was intended by AT&T to replace buried magnetic loop9 detection systems. This technology was originally developed from research used by the U.S. Navy for submarine detection purposes. Mounted above passing vehicles, the SmartSonic [7] TSS-1 listens to the acoustic signals of vehicles and is capable of distinguishing between larger trucks or buses and smaller vehicles. Applications were to include traffic monitoring and vehicle counting, with the potential for incident detection being an area for further research.

In their discussion of video-based surveillance, Berka and Lall continue the discussion of improving upon the use of loop detection to gather traffic data (1998). The authors claim that loop detection reliability is low, and that maintenance and repair of such a pavement-based system creates safety risks for repair crews. Berka and Lall maintain that non-intrusive technologies such as video surveillance provide reduced traffic disruption during installation or repair. In addition, video surveillance is capable of detecting incidents on the sides of roadways, outside of the detection range of loop detectors.

III. Methodology

The proposed system describes to overcome the problem of traffic jam on intersection at the Traffic Signal system [8] [9] is introduced. Here the first objective is to calculate the density of vehicle on the road for flow traffic smoothly without congestion. Second objective is, developing Priority Based Signaling which helps to give the priority to the emergency vehicles.

This approach is used to control the traffic smoothly. It is also helpful to overcome the traffic jam problem to reducing the delay problem and avoiding congestion. It also helps in providing the emergency services like Fire Brigade Vehicle, Ambulance or Police on pursuit at right time. Traffic Signal Management when properly designed, operated and maintained yields significant benefits like less congestion, saving fuel consumption. Vehicle emissions are also reduced and it also improves the air quality.

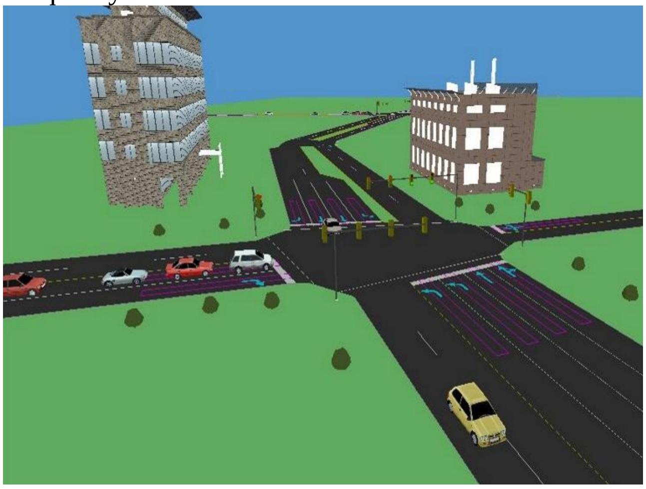

Fig. 1. Traffic Scenario showing vehicles on one lane with the other three lanes as empty.

The above given figure. 1. explains the phase-1 i.e. the traffic scenario in which only one lane consists of vehicles and other lanes being empty, but still the vehicles need to wait for the signal to get green. The delay for the vehicles waiting for the signal to get green is very large, so the solution to this problem is to re-time the green signal if the density on the other lanes is very low. If this solution is not provided to the signals then the tendencies of road disasters may occur such as accidents because if by chance a vehicle arrives from one lane and the vehicles on the other lane don't hesitate to wait for a long time and moves forward, then there is a chance of a disaster. Maximum density [10] [11] of traffic will allow traffic with maximum default timing assigned.Minimum density of traffic will allow traffic with minimum defined timing assigned [12]. It explains that if the traffic density of the lane increases, then the green timing increases accordingly. The below given graph in figure. 2. explains about this.

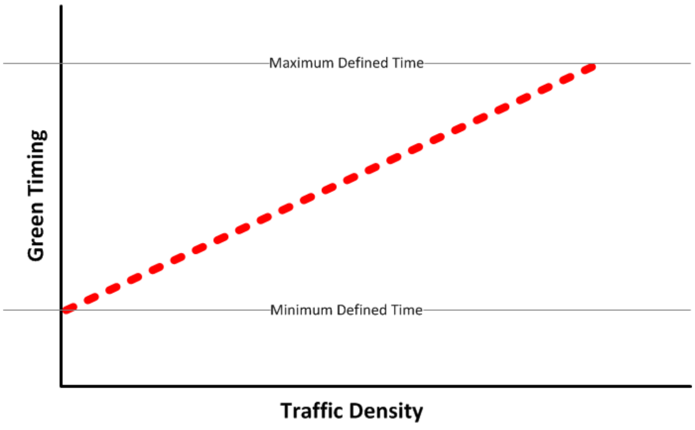

Fig. 2. Traffic Density vs. Green Timing

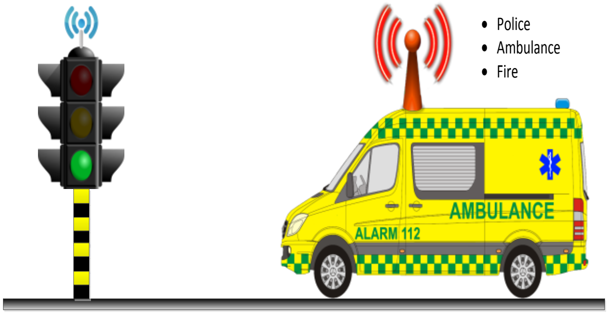

Fig. 3. Showing Emergency Vehicle Alert

The above given figure. 3. shows emergency vehicle alert [13] [14] that will transmit the vehicle geo-location which will then be received by the road side unit at signal and it will start the green light and this light will be in ON state till the vehicle is within the GPS range. This will be useful for the emergency vehicles such as Fire Brigade, Ambulance, Police cars.

IV. Conclusion and Future Scope

Here the two objectives, that are, first, calculating the density of the vehicle on the road for the flow of the traffic smoothly without congestion and second, developing Priority Based Signaling which will help to give the priority to the emergency vehicles are studied successfully. This Traffic Signal Management approach when properly designed, operated and maintained yields significant benefits like less congestion, saving fuel consumption.

The proposed approach will consider not only the priority of the vehicles but also the density of the vehicles on the road and also will control the traffic light sequence efficiently and more accurately and the accuracy of the GPS is more than that of a Camera. This system aims at saving a large amount of man-hours caused by traffic problems and accidents, where prevention can save lives and property. It is able to manage priority emergency tag vehicles.

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