

Application of Intelligent Transportation System for Prevention of Traffic Congestion

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Abstract :- The number of vehicles has increased exponentially, but the road width and transportation systems have not developed in an equivalent way to efficiently cope with the number of vehicles traveling on them. Due to this, road jamming and traffic correlated pollution have increased with the associated adverse societal and financial effect on different markets worldwide. WSNs have gained increasing attention in the traffic detection and avoiding road congestion. Many Wireless Sensor Network are being used such as Bluetooth, ZigBee, ultra wideband, and Wi-Fi. Due to its high power consumption, Wi-Fi has many limitations inspite having high data rate and long range distances. Implementation of ZigBee technology, consuming less power and other better prospects help to reduce overall cost, making it economically feasible in the developing countries like India. Sensors and networks are growing in technology faster. Wireless Sensor Network (WSN) is set to form a significant part of the new pervasive Internet. This research paper highlights on its applications as an emerging trend in future transportation management system.

Keywords: - Wireless Sensor Network, ZigBee, traffic detection

I. INTRODUCTION

Traffic congestion is a major problem in cities of developing countries like India. Growth in urban population and the middle-class segment consuming vehicles significantly to the rising number of vehicles in the cities. Congestion on roads eventually results in slow moving traffic, which increases the time of travel, thus stands-out as one of the major issues in metropolitan cities. So, there is loss of life due to the delay in the arrival of ambulance to the hospital in the golden hour. The main reason is that traffic signals are used to manage conflicting requirements for the use of road space often at road junctions by allocating the right side of a way to different sets of mutually compatible traffic movements during distinct time intervals.

Traffic congestion management was recognized as one of the major problems in Pune, which has caused much frustration and loss of man hours. The operation of standard traffic lights which are currently deployed in many junctions, are based on predetermined timing schemes, which are fixed during the installation and remain until further resetting. Municipal governments are shifting away from their analog traffic management systems and are looking for better ways to control and manage the hundreds of busy intersections in their jurisdiction. In order to solve the problem an intelligent ZigBee traffic control has been developed. ZigBee technology with appropriate algorithm will be applied

to a multi vehicle, multi lane and multi road junction area to provide an efficient time management scheme.

Most of the accidents these days are caused because of drivers not knowing the upcoming traffic hurdles like curves, traffic signals, railway lines and etc. If drivers come to know about the upcoming signals, curves, and railways lines etc the accidents can be avoided. The aim is to provide drivers with intelligent roads so that they can receive the information about the curves and the traffic signals ahead. After receiving the information about the signals ahead, drivers will be careful; this will help to avoid the road accidents.

Similarly in mountainous areas where there is lots of rain and snow throughout the year, driving is a tough job. In order to make driving on roads easy, an efficient system is required which informs drivers about upcoming traffic hurdle before a safe distance so that drivers becomes alert. There are many researches going on in the field of ITS (Intelligent Transportation Systems) and already many systems are available but these systems are very expensive which make these systems very difficult to install. ZigBee is inexpensive which reduces the total cost of the system. Similarly its low power consumption makes it useable in areas where there is no power available. This research brings an idea of using short range wireless technology "ZigBee" in Intelligent Transportation Systems.

II LITERATURE SURVEY

Geetha.E, V.Viswanadha, Kavitha.G proposed an intelligent auto traffic signal control system. Traffic congestion is one of the major issues to be considered. Generally Vehicular traffic intersects at the junctions of the road and is controlled by the traffic signals. Traffic signals need a good coordination and control to ensure the smooth and safe flow of the vehicular traffic. During the rush hours, the traffic on the roads is at its peak. Also, there is a possibility for the emergency vehicles to stick in the traffic jam. Therefore; there is a need for the dynamic control of the traffic during rush hours. Hence, they propose a smart traffic signal controller. The proposed system tries to minimize the possibilities of traffic jams, caused by the traffic lights, to some extent by clearing the road with higher density of vehicles and also provides the clearance for the emergency vehicle if any. The system is based on the PIC 16F877A micro controller, IR sensors and Radio Frequency Identification (RFID) technology. The code for this project is compiled in high tech C compiler and the simulated with Proteus software.

Ayush Kr. Mittal and Deepika Bhandari proposed a green wave system. It is used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle, for this reason providing a complete green wave to the desired vehicle. A "green wave" is the synchronization of the green phase of traffic signals. With a "green wave" setup, a vehicle passing through a green signal will continue to receive green signals as it travels down the road. Advantage of the system is that GPS inside the vehicle does not require additional power. The biggest disadvantage of green waves is that, when the wave is disturbed then the disturbance can cause traffic problems that can be exacerbated by the synchronization. In such cases, the line of vehicles in a green wave grows in size until it becomes too large and some of the vehicles cannot reach the green lights in time and vehicles must stop. This is called over-saturation.

Suresh Sharma, A.Pithora, G.Guptha, M.Goel, and M. Sinha proposed a RFID system. The use of RFID traffic control to avoid problems that usually arise with standard traffic control systems, particularly those related to image processing and beam interruption techniques are discussed. This RFID system [2] deals with multivehicle, multilane, multi road junction areas. It provides an efficient time management scheme, in which a active time schedule is worked out in real time

for the road of each traffic column. The real-time operation of the system gives the judgment of a traffic policeman on duty. Number of vehicles in each column and the routing are proprieties which upon the calculations and the judgments are done. The disadvantage of this work is that it does not discuss what methods are used for communication between the emergency vehicle and the traffic signal controller.

III METHODOLOGY

Intelligent Transportation Systems using short range wireless technologies as a communication medium is an effort to make driving easy. This research is based on a concept that drivers get to know about the upcoming traffic hurdles like traffic signals, curves, railway lines etc before actually reaching at them. This will avoid accidents on road which are caused by sudden confrontation with traffic hurdles. Similarly this system can be very helpful in mountainous areas where there is snow and fog and drivers are actually unaware of upcoming traffic hurdles. ZigBee is a short range wireless technology used in this research because it's very inexpensive and consumes very low power as compared to its other peer short ranger wireless technologies like Bluetooth and Wi-Fi. Since this system is more important for mountainous areas where there is no power in some cases, ZigBee will help with its low power consuming attribute. Although ZigBee is a short range wireless technology but it provides enough range to transfer data from car to traffic hurdles and vice versa. Because of its low cost, this system can be used in developing countries as well. Various research papers say that ZigBee with its low power, low cost and enough data transfer rate is a good choice for Intelligent Transportation Systems of this class.

A. Requirements

Every vehicle should have a ZigBee Host. Along with the ZigBee Host vehicle must be provided with Radio Frequency Indication (RFID) tag that stores a vehicle identification number (VIN). Every vehicle has its unique VIN number that provides the information regarding the priority of vehicle and type of vehicle. With the help of VIN we can uniquely identify the vehicle and its owner.

Vehicle Identification Number: - In the proposed work RFID tag will store vehicle identification number. These numbers is divided in three parts. First part represents the priority of the vehicles. Next part represents the type of vehicle and next digit represents the vehicle number. In the proposed work, different types of vehicles have different type of priorities.

Vehicles are divided into 4 categories:-

1. Ambulance, Fire brigade vehicles and VIP vehicles: These vehicles have a highest priority.
2. Local buses, school and colleges buses: These buses need to reach their destination on time so these vehicles also need a fast service.
3. Private cars, motorcycles and scooters.
4. Heavy vehicle.

Day time priority of 3rd category is high as compare to 4th category but during night hours the priority of heavy vehicles is high.

B. System Description for Traffic Hurdles:



Figure 1

Figure No.1 given above illustrates the concept of this study. Because of the weather conditions most of the times, traffic hurdles become very dangerous and cause road accidents e.g. slippery at curve or invisibility of traffic signals due to fog or heavy snow. In such conditions drivers get aware of these traffic hurdles when they are at it and won't be able to stop the car which results in accidents. This study will emphasize on warning (informing) drivers of upcoming traffic hurdles before actually reaching them.

On each traffic hurdle a ZigBee Sensor is installed and each car is equipped with a ZigBee Host. Whenever car reaches the range of the ZigBee Sensor (for this study we considered this range to be 100 m), the communication between the ZigBee Sensor and Host starts, the ZigBee Sensor sends the signal (in the form of bits) to the ZigBee Host informing about the type of hurdle ahead along with the distance to the hurdle. The ZigBee host after receiving this information will display this information on a screen to driver. Driver then can take appropriate action after getting informed.

C. Flow of Information:

In this system a ZigBee sensor is installed at each traffic hurdle that contains all the information about that hurdle e.g. Hurdle ID, Distance from ZigBee Host etc. Each car in this system is equipped with ZigBee Host. As soon as car enters the communication range of the traffic hurdle, ZigBee Host in the car starts communicating with ZigBee Sensor at the traffic hurdle.

The information flow between the car and the traffic hurdle, in this case the Traffic Signal. The numbers 1~5 are described below;

- 1) Car (ZigBee Host in the Car) sends its ID to the Sensor at Traffic Signal.
- 2) Sensor acknowledges the ID.
- 3) Car asks for the information about the upcoming traffic hurdle.
- 4) Sensor sends the information about the traffic hurdle.
- 5) Acknowledges the information received from traffic hurdle.

Intelligent Transportation Systems can not only be used for traffic congestion control but also can be used for Ambulance clearance and stolen vehicles detects.

1. First part contains automatic signal control system. Each vehicle equipped with an RFID tag. When it comes in the range of RFID reader, it will send the signal to the RFID reader. The RFID reader will track the how many vehicles have passed through for a specific period and determine the congestion volume. Accordingly, it sets the green light duration for the path.

2. Second part for is the emergency vehicle clearance. Here each vehicles contain Zigbee transmitter and Zigbee receiver will be implemented at the at the traffic junction. The buzzer will be switched ON when the vehicle used for emergency purpose.

3. If a match is found, it sends SMS to the police control room and changes the traffic light to red, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action

D. PROPOSED MODEL for these three parts:-

From the current problem section, existing technologies are congestion controller, emergency vehicle clearance, stolen vehicle detection, etc. To solve these difficulties, we propose to implement our

Intelligent Traffic Control System. It largely covers of three parts.

- ❖ First part contains automatic signal control organization. Here, each vehicle is equipped with an RFID tag. When it originates in the range of RFID reader, it will send the signal to the RFID reader. The RFID reader will track how countless vehicles consume passed through for a specific period besides determines the congestion capacity. Accordingly, it sets the green light period for that track.
- ❖ Second part is for the emergency vehicle clearance. Here, each alternative vehicle contains ZigBee transmitter module besides the ZigBee receiver will remain implemented by the traffic junction. The buzzer will be switched ON once the vehicle is rummage-sale aimed at emergency resolution. This will send the signal through the ZigBee transmitter to the ZigBee receiver. It will make the traffic light to change to green. Once the ambulance passes through, the receiver no longer receives the ZigBee signal and the traffic light is turned to red.
- ❖ The third part is responsible for stolen vehicle detection. Here, when the RFID reader reads the RFID tag, it compares it to the list of stolen RFIDs. If a match is found, it sends SMS to the police control room and changes the traffic light to red, so that the vehicle is made to stop in the traffic junction and local police can take appropriate action.

IV CONCLUSION

This research study highlights that with the help of ZigBee technology drivers come to know about the upcoming signals, curves, and railways lines etc and hence the accidents can be avoided. With automatic traffic signal control based on the traffic density in the route, the manual effort on the part of the traffic policeman is saved. The design and implementation of this technique is directly targeted for traffic management so that emergency vehicle on road gets clear way to reach their destination in less time and without any human interruption. As the entire system is automated, it requires very less human intervention. The stolen vehicle can be detected by the signal automatically, which turns red, so that the police officer can take appropriate action, if he/she is present at the junction. Also SMS will be sent regarding the location obtained using GPS, so that they can prepare to catch the stolen vehicle at the next possible junctions.

Emergency vehicles like ambulance, fire trucks, need to reach their destinations at the earliest. If they spend a lot of time in traffic jams, precious lives of many people may be in danger. With emergency vehicle clearance, the traffic signal turns to green as long as the emergency vehicle is waiting in the traffic junction. The signal turns to red, only after the emergency vehicle passes through. This system was proved to be effectual to control not only ambulance but also authoritative vehicles. Thus the proposed system if implemented in countries with large population like INDIA can produce better results. The system is more accurate with minimum possible duration. This system will definitely help the traffic police to give the way to the ambulance when there is heavy traffic on the road. It is very smart to find the location of stolen vehicle and help police to take necessary actions.

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