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Smart Traffic Light Control System for Emergency and Detection of Stolen Vehicles

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ABSTRACT: Now a day's Traffic congestion is the biggest problem of densely populated countries. So, our project focuses on mainly three areas-Priority mechanism for emergency vehicles like Ambulances, fire engines to control the traffic density and monitoring the traffic junction. This project is a replica of a four way lane crossing of real time scenario. This project proposes primarily the problems faced by emergency vehicles - RFID concept is used to make green for the Ambulances lane and thus providing a stoppage free way for the Ambulance. In addition to the green wave path, the system will track a stolen vehicle when it passes through a traffic light. So, it is an autonomous 2-tier system which will help in the identification of emergency vehicles or any other desired vehicle. It is a novel system which can be used to implement the concept of the green wave. In the existing system manual effort is necessary to control and monitor if any emergency vehicle is approaching or not.

KEYWORDS: MAX232, RFID Reader, GSM Modem, Zigbee, ARM7

I. INTRODUCTION

Traffic congestion is a severe problem in many major cities across the world and it has become a nightmare for the commuters in these cities. The Traffic congestion can also be caused by large Red light delays, etc. The delay of respective light is hard coded in the traffic light and it is not dependent on traffic. Therefore for simulating and optimizing traffic control to better accommodate this increasing demand is arises. One of the major problems faced by heavy traffic is by Ambulances. As we all know that Ambulances are the most important medical means of transport in any country as they carry patients to the nearby hospitals. But due to heavy traffic, one can often see the Ambulances stuck in traffic for long durations thus causing danger to patient's life. So, our project aims to solve this problem of Ambulances. When an Ambulance arrives, its corresponding lane traffic light becomes green and all the others become red, thus paving traffic less way for the Ambulance and thus helping it to reach the hospital swiftly. This is possible by the use of RFID and GSM. The advantage of RFID is that it is a cost effective system which will provide uninterrupted communication in our network even in bad weather conditions.

The work consist of system hardware, flowchart of a system and implementation.The system hardware contains of RFID Readers ,RFID transponders, basestation and user interface for emergency vehicle. The priority of the vehicle, location and the total no. of junctions to be passed through are sent to the system with the help of a GSM module. This data is received by the GSM module of the system and the database is updated.The RFID readers read the information from the tag; this information is fed into the microcontroller unit for the further processing. The information read is unique identification code (UID). Once the vehicle is in the range of the RFID reader, the reader
reads the UID on tag and compares it with UIDs stored in the database

II. BLOCK DIAGRAM

In the proposed system to improve the existing system a new Green wave system is developed. In which the traffic signal management for emergency vehicle is include. To make the proposed system to work, each and every vehicle going for registration is provided with a RFID tag. In which information like vehicle's unique registration number and vehicle type is stored. The vehicle type is mentioned as E (For Emergency) and N (For Normal) in the tag. These data are stored in the database in the Transport office. To read the information in tag a RFID reader is installed in the Traffic

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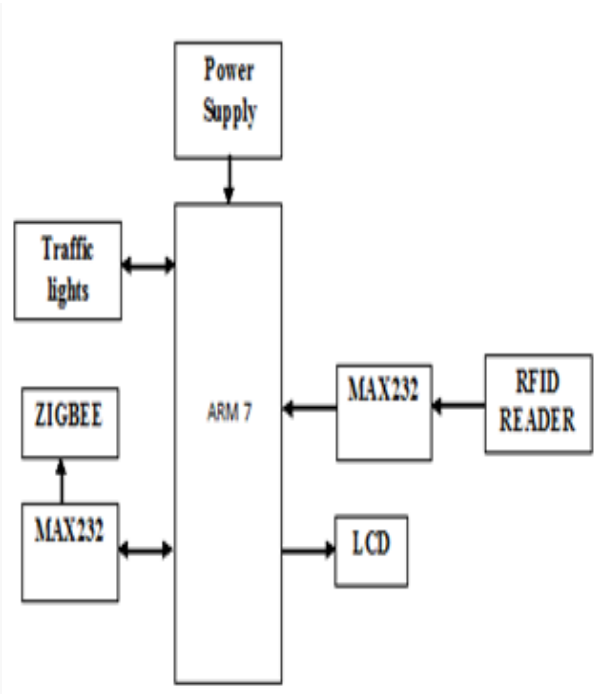
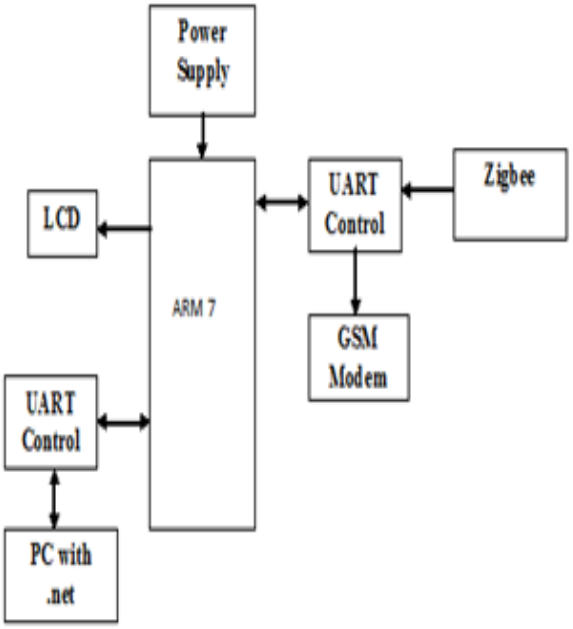
control unit. Block diagram of the control unit is illustrated in fig 1. Whenever the vehicle passed through the signal reader get the vehicle type and gives it to the controller unit. In which if any E (Emergency) type vehicle is found, that lane is made green w.r.to the other lanes. To upgrade further more theft vehicle detection method is used. To find a theft vehicle, the user has to contact the Transport office to update the database of the vehicle with T (for Theft). So whenever a vehicle is passed through the traffic signal, the Control unit picks up the tag details and sent to the Transport office via Zigbee unit. From the obtained value the PC in the Transport office check with the database. If any theft vehicle is found, the control unit in the Transport office will send to Police station about the vehicle passing through the particular signal. Thus the police able to intercept the vehicle in the next possible path.





Thus the single system is used in 2 Tier methods.

Fig 1 traffic signal section **Fig 2 control unit**

The basic block diagram of the system is illustrated in Fig.2 The system comprises of a RFID reader and a RFID tag or transponder. We will use a high frequency reader which will provide long range to the system. During the manufacturing of vehicles, passive tag or transponders [6] are embedded inside the dash board of the vehicle such that it is not easily visible to human eyes. During the registration of the vehicle, each vehicle gets a unique license plate number.In our system a database is maintained, in which table comprises of information like Unique ID of tag against which the vehicle license plate number and its category is stored. We have defined three categories for this system namely Emergency vehicle, Stolen Vehicle and a Normal Vehicle. A Column of priority is also added in table, in which three levels are defined: - low, high and highest. A priority "T" for stolen vehicles. However, as per the demand of the user, more levels and categories can be added easily. Readers are installed on every junction of the city, on top of the roadsThe reader reads the unique ID present on the tag or transponder and sends the information to the main system to check its category and priority in the database and take the desired action accordingly. For immediate update of category of vehicle and also its priority level the database is connected to the GSM module. The RTO database is also connected to the main database, so that regular updating of the system database can be done. As soon as the vehicle is registered with Regional Transport office (R.T.O), the vehicle is registered with our system as well. The microcontroller unit is connected to the police control room, to send the alert signals of any stolen vehicle detected.

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III.SYSTEM HARDWARE

The complete system consists of following hardware

A.RFID Readers

High frequency RFID readers are installed above the roads prior to every traffic light system in all directions in such a manner that the entire area comes under the range of RFID reader.

B. RFID Transponders

Passive RFID transponders are installed inside every vehicle at the time of manufacturing. RFID transponders consist of unique ID. Once the vehicle is registered and gets the license plate number, its data is stored in the database along with the category of the vehicle, either 'Normal' or 'Emergency', which could be changed to any other category as per the requirements.

C. Base Station

The Base station is equipped with a microcontroller unit connected to the database consisting of all the information. The database is connected to the GSM module which helps in immediate update of the database. However the database can be updated manually as well. The RFID readers are connected to the base station with the help of XBEE [7] transceivers. The readers will keep on sending the unique identification (UID) of the vehicle from every traffic light to the microcontroller unit (MCU). The MCU will then check for the category and the priority of vehicle in the database and will accordingly send outputs to the traffic lights and Police Control Room.

D. User interface for Emergency Vehicle

An interactive interface for user vehicle is also available, in which the driver of the emergency vehicle will update the priority of vehicle. As in most cases, if there is no patient in the ambulance, its default priority level will be set to low. This interface also helps the driver to select the junctions through which the emergency vehicle will pass. The priority of the vehicle, location and the total no. of junctions to be passed through are sent to the system with the help of a GSM module. This data is received by the GSM module of the system and the database is updated.

IV.FLOW CHART OF SYSTEM

The above flow charts give the basic algorithm of the software developed for the entire system. In Fig. 3, the category 'high' of the vehicle is denoted by "H" and 'highest' is denoted by "HT". In Fig 4, the category of the vehicle stolen is denoted by "T". The category highest has a priority over the high. On an event of two vehicles approaching towards a traffic light junction simultaneously from opposite directions, the priority will be given to the vehicle whose priority is defined as highest. If both the vehicles have registered for the highest priority, the system will serve the vehicles on first come first serve basis. In Fig. 3, the destination information is received by the driver which in turn selects the junctions through which the vehicle has to pass to reach the destination. The GSM module will update the priority of vehicle to 'H' or 'HT', as selected by driver, and will also update the number and position of junctions to be passed through. The system then identifies the emergency vehicle before its arrival on the first junction with the help of the reader, installed 200 meters away from the junction. Now, the priority of vehicle is checked. If the priority is 'H' or 'HT' then the system sends signals to turn. the traffic light to green on the Nth junction and N is decremented by one. Now, if N is less than zero, it means that the vehicle has reached the destination. If N is not less than zero, the system waits for the vehicle to arrive the next junction on the basis of average calculation, assuming the speed to be 60-80 Km/hr, and verifies its arrival with the help of RFID reader. The arrival of vehicle on that junction is verified with the help of reader installed 200 meter before the junction. Then, again, signals are sent to the traffic light to turn green on Nth junction and again the process continues till N becomes less than zero. For detection of stolen vehicles (Fig. 4), the user will notify the system about the vehicle theft via SMS. The system will update the database and set the priority of the vehicle as 'T'. Then, the presence of a GPS module will be checked. If a GPS module is present, the vehicle location will be traced and sent to the police. If the GPS module is not present, then it is checked whether the vehicle is detected by RFID reader. If yes, then it sends the location of junction where RFID reader detects the vehicle. If RFID reader is also not present, it will be checked whether 12 hours have passed or not. If not, then again it is checked if the vehicle is detected by RFID reader or not and this continues. If yes, then it will send an alert to police patrol car. The police patrol car uses hand held high range readers and moves in city in search of vehicle and the vehicle is detected if it is present in the city.

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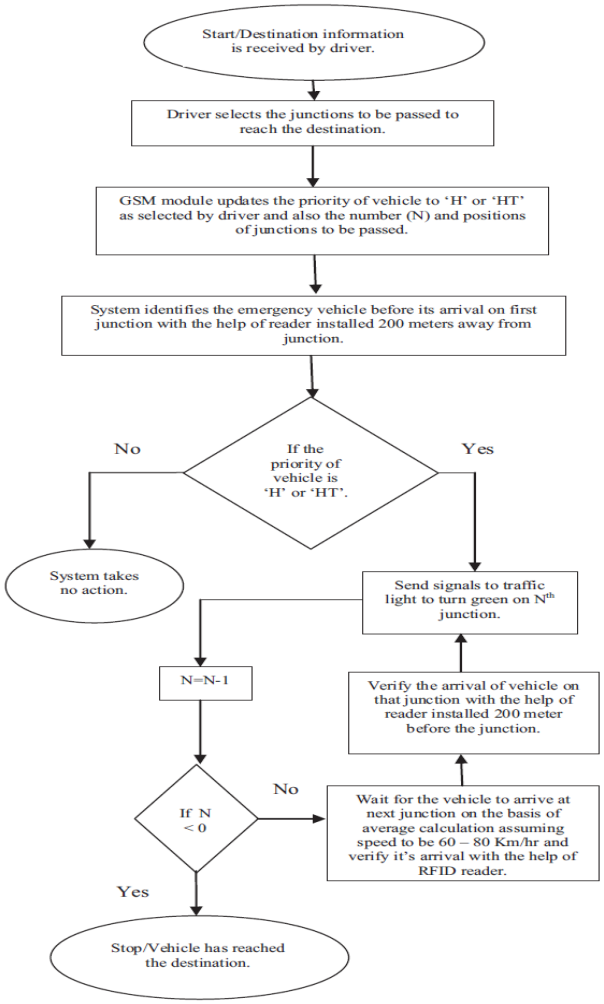

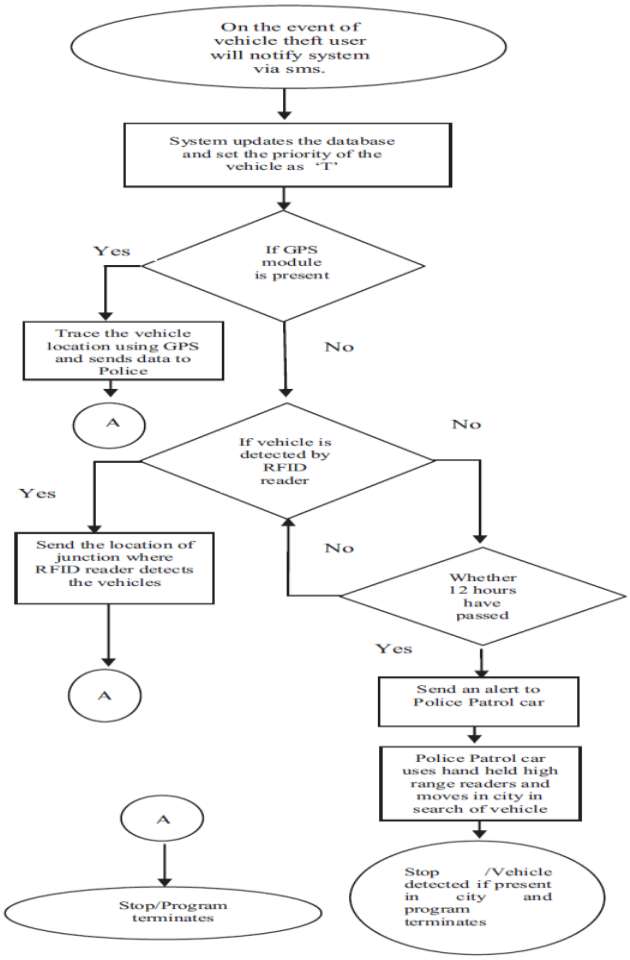

Fig 3 Flow of Software for Green wave

Fig 4 Flow of Software for Detection of Stolen vehicles

V.IMPLEMENTATION

The RFID readers read the information from the tag; this information is fed into the microcontroller unit for the further processing. The information read is unique identification code (UID). Once the vehicle is in the range of the RFID reader, the reader reads the UID on tag and compares it with UIDs stored in the database. If it corresponds to any of the category defined, then the LCD displays the category of the vehicle. If the vehicle category is 'emergency', the traffic light module is activated. Assuming the average speed of the emergency vehicle, the red light is turned to green and the process goes on for all the junctions through which the emergency vehicle shall be passing. The timing of the red lights is such that the red light turns to green only when the vehicle is 300m away from the junction, so that a green wave is given to the emergency vehicle only. Now, if a stolen vehicle passes from any of the junctions and its information is already updated on the system, the system will give an alert signal using red LED indicating that a stolen vehicle has passed from the junction. If a normal vehicle is passed, no action is taken by system. In that case, the reader just detects it and that data can be used for data monitoring purposes. The drawback of the prototype is that if one or the other vehicle approaches, the LCD goes blank and it does not detect any of the vehicles hence it does not support anti-collision feature for passive tags. The system uses low frequency tags and readers. Hence, we get a low range of operation that is just 4 to 5 cm. To resolve all these issues which are mentioned above we used readers with anti collision features. To increase the overall range of the system, we used high frequency readers. By using the above mentioned techniques, the major drawback of the prototype was resolved. A highly efficient prototype is finally developed.

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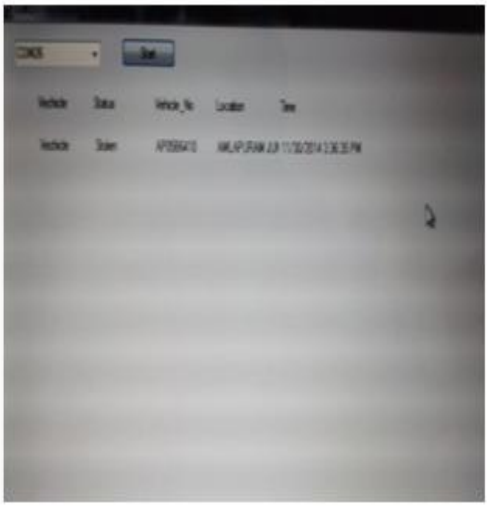
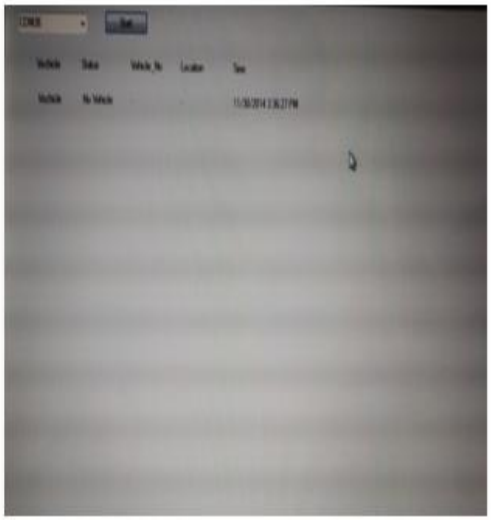
VI.RESULTS





The program was successfully burned on the micro-controller using USB programmer and when an emergency vehicle approaches this reader, it is successfully detected by the system as an emergency vehicle and traffic light module is activated. On the other hand, if any stolen vehicle is detected, it is displayed on the LCD. The system is efficient. This prototype presents a novel solution to implement the concept of green wave in urban cities. The overall system is quite cost effective and has various advantages over the conventional technologies. Below table 2 compares the conventional technologies and our developed system. In traditional systems, to track the vehicle so as to provide green wave, GPS is used. The cost of a GPS module is very high as compared to a RFID transponder. The transponders are not only very cheap to manufacture but are also very small in size. The small size of transponder gives an advantage over the GPS, GPS can be easily removed by anyone, whereas it is very hard to locate a RFID transponder and remove it. We also systems, to track the vehicle so as to provide green wave, GPS is used. The cost of a GPS module is very high as compared to a RFID transponder. The transponders are not only very cheap to manufacture but are also very small in size. The small size of transponder gives an advantage over the GPS, GPS can be easily removed by anyone, whereas it is very hard to locate a RFID transponder and remove it.

VII.CONCLUSION

We also have an option of updating the system dynamically with the help of a SMS through the GSM module. In some of the cases, to identify the vehicle, image processing based system is used, which has a major drawback during the bad weather conditions. Bad weather may be due to heavy rain, fog, dust storm. On the other hand, our system is not affected by any of these bad weather conditions. Our system can work in any weather, so it has the capability to provide a 24x7x365 surveillance without any disruption. The traditional system can't provide 24x7x365 surveillance. This system is very helpful in building a smart city. The city equipped with the developed system will never have any issues related to traffic management. Moreover it will make the city more secure in context of detection of stolen vehicles. Green wave also helps in saving environment as it will reduce emission of CO, NOx, PM10 [1]. It will also reduce the consumption of fuel by the vehicles which are provided with the green wave. Moreover, vehicles travelling in platoons will get a clear way without any traffic.

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