Traffic Congestion Detection and Control Using Wireless Communication

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ABSTRACT

In the era of expanding the modernization of urban areas increasing use of transport services poses a great challenge to the traffic controlling systems in traffic congestion clearance. As technology has developed as a double edged blade, new technologies can be integrated to develop an efficient system to monitor and manage these traffic clearance issues. Several technologies have been proposed for this congestion control, such as using RFID tags of different frequencies, dynamic scheduling based on the emergency are failed to address the power consumption and low frequency of data transmission. This paper proposes a system called smart traffic control that makes easy to clear the traffic congestion by passing emergency vehicles where each of them are embedded with RFID tag that transfer the information to the RFID reader. The proposed system can also used for detecting lost vehicles.IR sensors are used for to control the traffic congestion. The prototype was experimentally tested under different condition and expected results were found.

KEYWORDS: IRsensors, RFID, ARDUINO, GPS and GSM

1. INTRODUCTION

India is the second most crowded Country in the World and is also one of the fastest growing economies. As we see daily there are more number of road congestion issues in the cities, Infrastructure maintenance of these roads is slow as compared to the growth in number of vehicles. It is because of lack of space availability and cost limitations [1]. Additionally, Indian traffic is non-path based and disorganised. There is a need for traffic control solutions, which are different when compared with other developed countries. Proper and Intelligent planning for management of traffic will decrease the negative impact of congestion. As of late, wireless technologies have been used broadly in the road transport as they provide more cost effective [2]. Technologies like IR Sensors, GSM, GPS, RFID etc., can be used for traffic control to provide cost effective solutions. IR Sensor has two light emitting diodes one transmitter and another one is receiver. RFID, a wireless technology utilizes electromagnetic energy to send the data between the RFID tag and RFID reader. A GSM Stands global system for mobile communication is a type of modem, which accepts a SIM card and operates along with mobile operator and works like a mobile phone.

2. RELATED WORK

Congestion is major problem for developing countries especially like India .congestion results in slow traffic and increases time to travel [7]. As per the discussion of green wave system which was actually used as an emergency vehicle by turning all red lights to green on the path where emergency vehicle travels that provides completes green wave to the vehicle which is desired. A green wave is the synchronization of the phase of green traffic signals. Along with green wave GPS inside the vehicle does not require additional power. The main con of green wave is the disturbance can cause traffic problems that can lose synchronization [3].Use of image processing and interruption of beam some problems are raised to overcome those problems used RFID traffic control. Multilane and multi road junction areas provide an efficient time management scheme. In every lane passage of vehicles a dynamic time schedule is worked out. Calculations and the judgments are done based upon the number of vehicles in each lane and the routing. So, in real time operation the system require human intervention. The main con of this work is not discussed about which techniques used for communication between the emergency vehicle and the traffic signal controller [4]. For ambulance an automatic lane clearance system is proposed with an RFID and GPS. Main task of this work is decreases the travel time of an ambulance to the hospital by automatically clearing the lane before it reaches the traffic signal. This can be achieved by operating the traffic signal, in the path of the ambulance, to green when the ambulance is traffic junction. The ambulance and traffic signal post are communicated through the transceivers and GPS. The system is fully automated and no human intervention at the traffic junctions. It requires all the information of the route from starting point to end point this is the main disadvantage of this system. It may not work, if the ambulance takes another route due to some reasons or if the starting point is not known in before [5]. In [6], it proposed RFID based automatic traffic control system. The focus of this work is to reduce the traffic congestion and stolen vehicle detection at junction. The disadvantage is every vehicle is equipped with RFID tags are not same frequency which cant readable by reader which is placed at junction, and very difficult to installation of RFID tags.

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3. PROPOSED MODEL

From the current issue section, it can observe that, existing technologies are not sufficient to handle the problems of congestion control, emergency vehicle clearance, stolen vehicle detection, etc. To solve these issues, here to implement a smart Traffic Control System. IR sensors are arranged at the path of the vehicle at all the four sides of Traffic junction, when a vehicle pass along the IR sensor it read the count of the vehicle and thereby increases the count when each vehicle passes through it at all the four sides by maintaining normal delay of switching ON signals from Red to Green and count is noted at all the junctions. For the emergency vehicle clearance. Here, each emergency vehicle is equipped with an RFID tag. Whenever the emergency vehicle comes in the range of RFID reader, which is placed at certain distance from the traffic lights. RFID reader found the tags and informs the traffic signal controller about the presence of Emergency vehicle.

Fig.1 Proposed model prototype

Accordingly Green signal will be turned on at the path of the Emergency vehicle for clearance of traffic and the vehicle moves smoothly along the path. Once the Emergency vehicle passes through, the RFID receiver no longer receives the presence of vehicle and the traffic light is turned to red. For focused on stolen vehicle detection Here, the vehicle is equipped with a GPS and GSM Technology, GPS system that is employed for finding the exact location of the vehicle because the path in which location of the vehicle goes on dynamical endlessly, the GPS location area unit recorded. These coordinates square measure communicated to another by GSM electronic equipment.

A. Microcontroller

Arduino is an extension of a Micro-controller on a Board with other peripherals hence, it is a Development Board. A micro-controller is fixed over the board. In our project we use Arduino Mega, controller used is ATMega 2560. Arduino has advantages like, low voltage requirement. Atmega 2560 because of the following reason. Ready to use: The structure makes it useful in an easy way. It does not require more power supply. Simple microcontroller is not easy to coding; Arduino mega software is very easy to write code which has much built-in predefined function .A huge community of people working in the same environment. A large assortment of included libraries for interfacing to a wide range of hardware. Ease of use. The Arduino Uno has built in pin outs for providing you with 5v, 3.3V, ground, analog input, digital output, SPI, I2C which comes in handy. The number of people using the Arduino platform and post their code and also the responsive community of individuals on-line who can answer our specific queries is that the greatest advantage of the Arduino.

B.IR Sensors

An IR sensor is an electronic device that is used to sense certain properties of its surroundings by either emitting or detecting infrared light. IR sensors are also having the capacity to calculate motion of the object. Infrared rays are not visible to the human eye. Within the spectrum, infrared light may be found between the ranges of wavelengths 0.75 to3μm. The infrared waves typically have wavelengths between 0.75 and 1000μm. The region between 3 and 6μm is thought as the mid-infrared and infrared light that includes a wavelength greater higher than 6μm is known as way infrared. Infrared technology have many applications everyday life products.. The key benefits of IR sensors need low power sources, and simple circuit and their portable features. The IR Sensor consists of IR Transmitter and IR Receiver. IR transmitter emits the infrared rays and reflects back from the surface of an obstacle and reflected rays are received by the IR receiver

C.RFID

RFID stands for radio frequency Identification (RFID). It's a small electronic device consisting of a chip and an antenna attached to it. The chip carries 2,000 bytes of information or less. It's a system that transmits signals without any gadgets without any physical connection. It is classified under automatic technology. The system uses RFID tags are equipped to different to components these tags are store the information about those product. The tag contains integrated circuit to transmit its information to the reader. There are two types of RFID categories one is active and other passive tags. The tags which do not use power are as passive and they are operated by an antenna to enable the tag to receive electromagnetic waves from the reader. On the other hand, active tags rely on power and they have inbuilt batteries which enable it to send and receive signals from RFID reader. RFID tags range depends on some factors such as transmit capacity; receive sensitivity and efficiency, antenna, frequency, tag orientations, surroundings. Typically, the RFID range from a few centimetres to over hundred meters.

D.GSM

A GSM modem is connected to the microcontroller. This allows the system to use the GSM module to communicate to the mobile network These GSM module are most commonly utilized to provide mobile Internet connectivity, and transmitting the information through messages and multimedia. GSM module support with an "extended AT command set" for sending/receiving SMS messages. GSM modems are cost effective for receiving SMS messages.

E.GPS

GPS is a space-based satellite navigation system. It provides the location and time information of the vehicle in all weatherconditions.GPS receivers are used for navigation, positioning, time dissemination etc.The GPS consists of satellites that orbit around the earth. These satellites are geosynchronous with an orbital period that is the same as the Earth's rotation period. So they maintain exactly the same position with respect to the earth below them. GPS satellites transmit radio signals, which are captured by a GPS receiver which are located on earth and used to calculate its geographical position. A minimum of four satellites require required to find exact location.GPS determines the space between a GPS satellite and a GPS receiver by measuring the quantity of time taken by a radio wave to travel from the satellite to the receiver.

4. SYSTEM MODEL

### A. Traffic Congestion Detection Control System

In fig.2, Here IR sensors are used when vehicle comes in the range of the Transmitter the IR signal will get reflected back and received at the Receiver section. The microcontroller connected to the IR Sensor will count the number of vehicles. Based on the number of vehicles in any direction green light will glow. For testing purpose, here considering four way junction road and the red and green light duration set to 10 seconds.
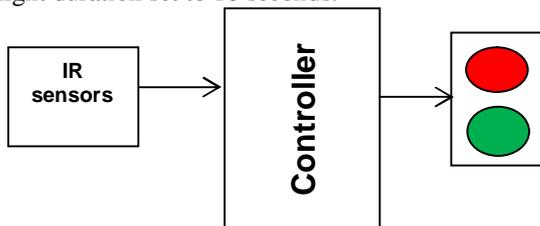
Fig.2 Block diagram of Traffic control system

### B. Emergency Vehicle Clearance System

In fig 3, there are 2 parts, first part which is RFID reader section in which RFID tag is attached to the emergency vehicle. When the RFID Reader detects the presence of RFID Tag, it informs the controller about the presence of Emergency vehicle. The Tag contains unique id. Second part is the receiver, which is placed at traffic pole. It also contains AtMega 2560 microcontroller. First, the receiver part is turned on. The red and green signal will be on for 10 seconds duration. Secondly, Emergency vehicle into the range of RFID reader. Then the signal will turn to green for duration of 30 seconds and buzzer on.
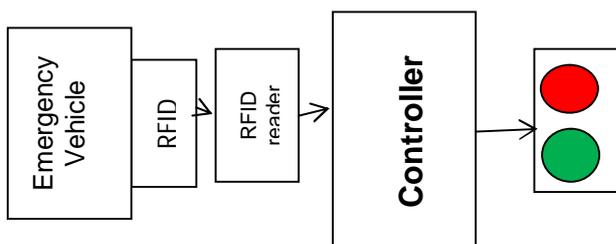
Fig.3 Block diagram for emergency vehicle clearance

C. Stolen Vehicle Detection System

In fig 4, here attach the GPS setup to the vehicle. Whenever vehicle stolen just by send an SMS to GSM SIM which is placed in GSM module. GPS send the signal to the GSM system and information about the coordinates are received from the SIM placed in the GSM Module. When GSM Module is attached to the computer it shows the location of the vehicle.
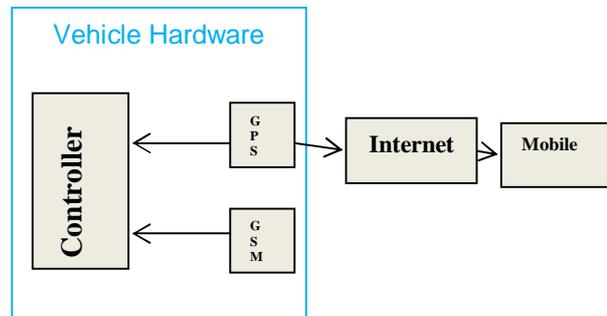
Fig.4 stolen vehicle detection system

5. RESULTS

The model of our traffic control system is developed partially to some extent. Considering the cost and time constraints and the ambulance unit and the traffic junction have been developed. But for the prototype model using different sensors for emergency vehicles and traffic congestion.Figure 2. Shows the traffic congestion unit here using detecting and control the congestion based upon the density of vehicles. Figure .3 shows emergency vehicles here using RFID technology. Emergency vehicles are equipped with RFID tags, whenever the vehicles came into range of RFID reader it sends the information to traffic control system. Figure 4. Shows detecting a stolen or crime vehicle unit, a vehicle consisting of GPS module and GSM module, which tracks the current position of the vehicle all the time and send information to GSM respectively.

Advantages
1. Reduces the human efforts.
2. Specific identification for emergency vehicles so easy to clear the traffic
3. Easy to find the stolen vehicles.

6. CONCLUSION

As the entire system is fully automated by considering the four-way junction, it requires very less human intervention. It can easily control the traffic congestion and dynamic time schedule is work out. It clears the traffic for Emergency vehicles and protects many lives from risk. And finally, it detects the stolen vehicle and tracks the exact location of the vehicle.

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