An Intelligent Transportation System

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ABSTRACT

This paper presents the traffic control system. It includes Ambulance clearance, Anti-theft of vehicle and congestion control. Each vehicle is equipped with RFID tag and reader which counts the number of vehicle passes on a particular path. Based on the vehicle density the green light is on at the particular path. When the ambulance or any emergency vehicle arrives at the junction using RF transmitter, it communicates to receiver placed on the traffic signal and the emergency vehicle moves smoothly and PIC16F887 is used to control all the operation .Each vehicle is controlled by passing a message by ON or OFF through GSM .When the ignition key is enabled, the message is sent to the owner. The owner has to send ON message to the vehicle and it moves. GPS is used to identify the current location of the vehicle by owner. Hence there is no chance of stealing the vehicle.

Keywords: RF Transmitter and RF receiver, PIC16F887, RFID reader and RFID tag, GPS, GSM, Emergency vehicle, vehicle control, and congestion control.

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1. INTRODUCTION

INDIA is the one of the fast growing country. It also known as the second most populous Country in the World. It is facing terrible road problems like congestion in cities. The growth of automobile was increased as compared with the growth of infrastructure. Moreover; the ambulances were often stuck in the traffic congestion, where all the other vehicles try to move in to all the available direction so as to move ahead as soon as the signal turns green. Also, Indian traffic is and chaotic. It needs a traffic control solutions, which are different from the developed Countries. Intelligent management of traffic flows can reduce the negative impact of congestion. Nowadays wireless plays a vital role in communication, the road transport as they provide more cost effective options in wireless communication. Most of the technologies like RFID tag, GSM, GPS, RF transceivers etc. RFID Tag and Reader are used to count the vehicles which communicate with in the certain range based on the frequency .RF transmitter and receiver is the communication between ambulance and the traffic light. A GSM modem is a specialized type of modem, which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone. AT commands are used to control modems. These commands come from Hayes commands that were used by the Hayes smart modems. The Global Positioning System is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

2. RELATED WORK

There are various research carried out in current scenario for traffic management, prevention of stolen vehicle and ambulance clearance. In this [1] the congestion is controlled by performance of RFID and the detection of stolen vehicle is achieved by sending message through GSM. The advantage is the emergency vehicle is moved across the signal. The main disadvantage is the location of the vehicle cannot be known. There is no possible to prevent the vehicle to be stolen. In traffic light control system [2], the arrival of the emergency vehicle is intimated to the traffic signal by triggering the switch attached with the RF transmitter .Manually the switch has to trigger when it arrives. The continuous monitoring of the density in the traffic on the particular way using RFID readers , the disadvantage is the readers have placed either side of the roads ,both the readers has the chance of detecting the same RFID tag.[3]. Traffic congestion is the main issue in the cities, here I have an example ,Bangalore city refer fig. the congestion occur due to improper movement of vehicles in the signals[4] .the arterial roads and intersection on the road ways makes congestion when there is over population of automobiles. A 'green wave' is the synchronization of the green phase of traffic signals. With a 'green wave' setup [5], a vehicle passing through a green signal will continue to receive green signals as it travels down the road. In addition to the green wave path, the system will track a stolen vehicle when it passes through a traffic light. Advantage of the system is that GPS inside the vehicle does not require additional power. The disadvantage is there is no security system. The detection of stolen vehicle is no easy to track in the congestion

network. Signal coordination systems are installed to provide access they provide access to the intersection signal controller for maintenance and operations [7]. The more complete and convenient the access, the more efficient the operator will be and the more effective the system.

3. PROPOSED MODEL

I have proposed a model an intelligent transportation system to overcome the current problem situations like traffic congestion, formal movement of emergency vehicle, stolen vehicle and so on. In this system, it includes three sections. The first section is about anti-theft of the vehicle, it is done by controlling the motor of the vehicle through GSM. The owner has to send the message to the vehicle ON and OFF respectively. The motor is controlled by relay .If its ON relay opens and the vehicle moves .If OFF the operation will be vice versa. The second section is about the congestion control by automatic control of traffic signal. This is done by each vehicle is tagged with RFID tag and reader is placed on the traffic header to count the tags passes on to a particular direction for a specific duration and it determines the traffic density. According to that the signal displays the green light to the particular path. The last section is emergency vehicle clearance even when the congestion occurs, a wireless communication is used to move the emergency vehicle informally in the traffic signal .Each emergency vehicle is placed with RF transmitter and the receiver is implemented on the signal .When the emergency vehicle arrives the transmitter communicates to the traffic signal and the signal switches to the green signal, the hassle movement of emergency vehicle is achieved.

A. Pic Microcontroller 16F887:

PIC (peripheral interface controller) is based on RISC architecture. PIC is a family of modified Harvard architecture microcontrollers. It is a 16f series. It has 40 pin, 36 input output pins to interface and 256 bytes EEPROM. Its operating frequency from 0 to 20MHZ. Power consumption is from 2.0V to 5.5V.It has 14x ADC channels .It is easy to store and to perform the control operation of the traffic. The PIC16F887 refer figure 1. controls the performance of the RFID reader. The reader counts the vehicle when the tags come into the range of the traffic signal. The counted tags are stored in the memory of the controller .Based on the counted values the signaling time of the traffic signal is determined. On the other side the RF transmitter is interfaced with the controller communication between the emergency vehicle and the traffic signal. In anti-theft vehicle, the controller interfaces many devices to the vehicle to prevent theft.

Figure 1: The hardware image of PIC16F887.

B. Rfid Tag And Reader:

Radio frequency identification is the transferring of electronically stored information using radio frequency electromagnetic fields through wireless and non contact media. The RFID system works on three frequencies, there are low frequency, high frequency and ultra high frequency. The RFID tags as shown in the figure.2 are attached to the vehicle. The tags are classified as active and passive tag. The passive tags are powered by external magnetic fields and the active tags are energized by battery, which have longer range. Here, the active tags are used, which is equipped in the vehicle. The reader as shown in fig.2 uses 125KHZ with a range of 10cm.Finally the RFID range is from a few centimeters to over hundred meters. The reader detects the tag, when it comes into the range. The detected tags are counted depending upon the value the traffic signal light is displayed. For, experimental analysis passive tags are used. The density of the vehicle is shown by using IR sensors.
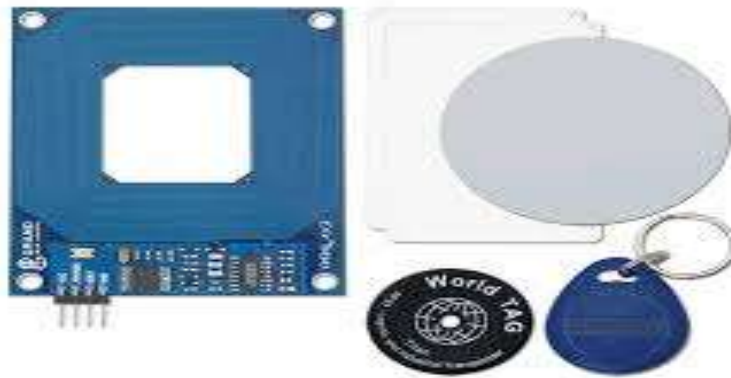
Figure.2: RFID tag and reader.

C. GSM.

Global system for Mobile Communication is a complete dual band GSM solution in a SMT module .It is connected to the PIC microcontroller which communicates over mobile network. It can be operated with the help of extended AT command set to send and receive the message. The power controlled by using29302WU IC. As shown in fig .3GSM modem is a highly flexible plug and play quad band SIM900AGSM modem as shown in figure .3for direct and easy integration to RS232 applications. It Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack. The modem can either be connected to PC serial port directly or to any microcontroller through MAX232. It can be used to send/receive SMS. The message is transmitted and received by the vehicle using AT commands. The vehicle sends the message to the owner and reply is given to start the vehicle .the same process to stop the vehicle. The hardware module of GSM .It is used to communicate between the owner and the vehicle.

Figure.3: GSM 900A module.

D. GPS.

The Global Positioning System (GPS) as shown in figure. 4 is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on the Earth. There are 24 satellites are located around the earth to position the system. The current GPS consists of three major segments. These are the space segment, a control segment, and a user segment. A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages to the earth. The information of the longitude, altitude and latitude of the receiver is messaged to the corresponding owner. The GPS is able to map the way for the destination place. It sends the current location of the vehicle to the owner.

Figure.4: GPS receiver module

E. RF Transmitter and Receiver.

The RF module operates at radio frequency; the corresponding frequency range varies between 30KHZ to 300GHZ. In this RF system, the digital data is represented as variations in amplitude of carrier wave. This kind of modulation is called ASK. Amplitude shift keying in the context of digital communications is a modulation process, which imparts to a sinusoid two or more discrete amplitude levels. These are related to the number of levels adopted by the digital message. The RF signals can travel larger distances making as the intimation to the traffic signal .The receiver detects the signal from the transmitter then traffic signal displays a green light. The transmitter and receiver pair operates at frequency of 434MHZ.The transmission rate from 1kbps to 10 kbps. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder.

F. MAX232.

The MAX232 is an integrated circuit as shown in figure.5, converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals. The drivers provide RS-232 voltage level outputs are approx. ± 7.5 V from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply EIA-232 voltage levels from a single 5-V supply. Each receiver converts EIA-232 inputs to 5-V TTL/CMOS levels. These receivers have a typical threshold of 1.3 V and a typical hysteresis of 0.5 V, and can accept ±30-V inputs. Each driver converts TTL/CMOS input levels into EIA-232 levels. The receivers reduce RS-232 inputs are which may be as high as ± 25 V, to standard 5 V TTL levels. When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15 V, and changes TTL Logic 1 to between -3 to -15 V, and vice versa for converting from RS-232 to TTL. This can be confusing when you realize that the RS-232 Data Transmission voltages at a certain logic state are opposite from the RS-232 Control Line voltages at the same logic state.

Figure.5: MAX232 module

4. WORKING MODEL

This contains three sections as follows,

A. Congestion Free Module.

In this section, RFID tags are placed in the vehicle, the reader is mounted on the traffic signal .when the vehicle moves the reader counts the number of vehicles pass through it refer figure.6. Each tag has a specific identity when it comes in to the range of reader. Hence it counts the vehicle, based on the vehicle density the green light will be displayed and finally the congestion can be controller. The LCD display is used to view the counted values. The counted values are stored in the PIC microcontroller which the memory can be reused for further counting's.
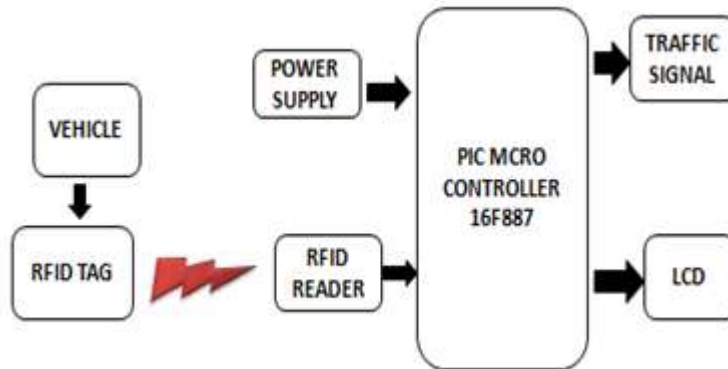
Figure.6: Block diagram of congestion free module.

B. Hassle Movement Of Emergency Vehicle.

In this module, The RF transmitter is placed on the emergency vehicle. The RF receiver is attached to the traffic signal. When the ambulance arrives the transmitted signal is decoded by the receiver. The decoded signal interrupts the microcontroller to switch the signal to green light. The interrupt is raised when the transmitted signal is detected. If already the traffic signal displaying green light, the decoded signal matches with it and hence it continues until the ambulance passes. Thereby the emergency vehicle or ambulance can be moved easily in the traffic signal .The priority is applied here to informal movement of the ambulance to guard human life.

C. Prevention of Stolen Vehicle.

Each vehicle is operated only by the vehicle owner through message .The block diagram of this section is referred in figure 7.The GSM is equipped in the vehicle to communicate between the vehicle and the owner. The LCD display is used to view the message of the vehicle. When the ignition key is enabled the message is indicated to the owner that ignition is detected .The vehicle waits for the owner message. The owner has to send the reply message ON to the vehicle, then the motor runs. The motor is controlled by relay. If owner has to stop the vehicle, this can be done by sending OFF message .The GSM is controlled using AT commands to transfer and receive message. If any chance of stealing of vehicle, the GSM will send the message to the owner that IGNITION IS DETECTED.GPS is used to localize the position of the vehicle.
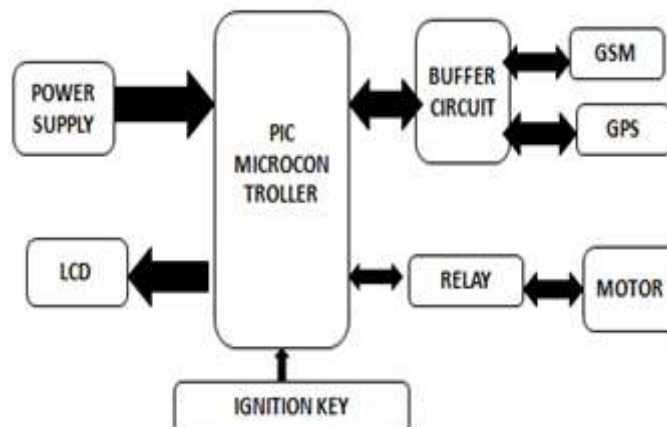

Figure.7: Block Diagram Prevention of Stolen Vehicle.

The buffer circuit is interfaced between the PIC microcontroller and the communication devices. The buffer circuit is used to avoid conflicts between the GSM and GPS refer figure.9.the buffer circuit is connected to Max232 circuit and this is connected to the UART of the PIC microcontroller which controls the GSM and GPS respectively. The Max232 Interface with the RS232 to convert the TTL logic to the RS232 level logic. This is done to communicate between the devices in the system.

5. THE RESULT AND IMPLEMENTATION

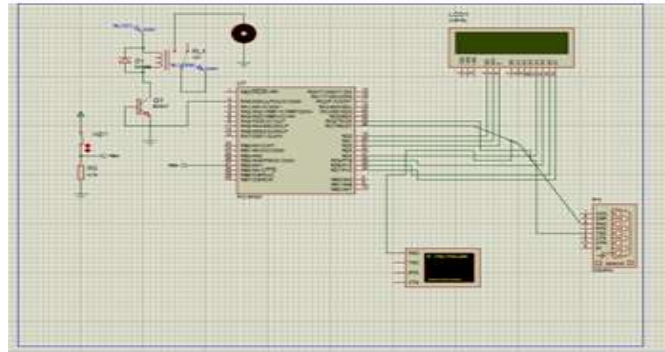### I. The Result of Prevention of Stolen Vehicle.

Figure .8: The simulation output of the prevention of stolen vehicle.

The PIC microcontroller controls the overall performance of the vehicle shown in Figure. 8. The RS232 is an interface and used to transmit and receive the message from the owner and the vehicle and vice versa. The Relay is used to drive the motor.LCD display is used to view the communication of the vehicle to the owner.
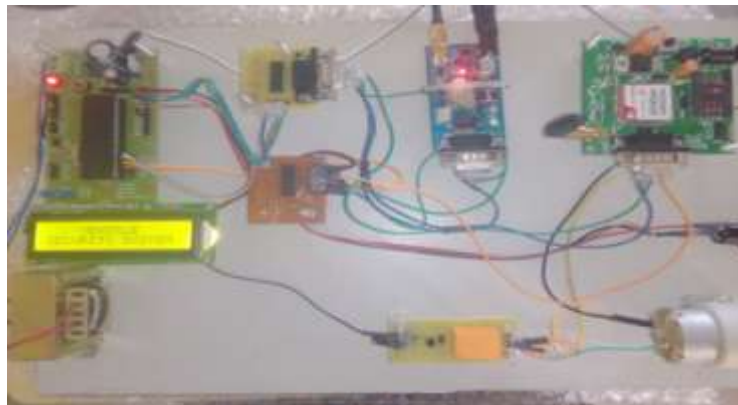

Figure.9: The experimental setup of anti theft vehicle hardware design

When the system is switched on, the LCD displays vehicle security system. The setup is considered to be a Vehicle, as shown in figure. 9 and GPS Transmitter detects the signal and it is connected to the receiver, the navigation can be displayed in the LCD display

Figure.10: The Ignition Detected Message Display.

When the ignition is triggered, the LCD displays that IGNITION IS DETECTED!! Refer figure.10. And the message is sent to the owner .then the owner has to send the reply message to the vehicle to move the vehicle.

Figure.11: The vehicle responds to the owner

The reply has to send from the owner, until the vehicle waits for the message refer figure.11, then ON message is sent and the motor moves forward. When the owner wants to stop the vehicle, OFF message is sent .so that the vehicle will be stopped. The GSM is the communicating between the vehicle and owner, the information is transmitted and received through wireless like mobile communication. Hence there is no loss of data between the owner and the vehicle.

Figure .12 The screenshot of the message from the vehicle.

The message from the vehicle is shown in figure.12.when the ignition key is detected in the vehicle, the message will be send to the owner with the navigation of the vehicle. The owner sends the reply message to start the vehicle. If the owner wants to stop the vehicle then OFF message is sent.

II. The Result of Automated Traffic Signal:

The Automated traffic includes congestion free and hassle movement of ambulance.

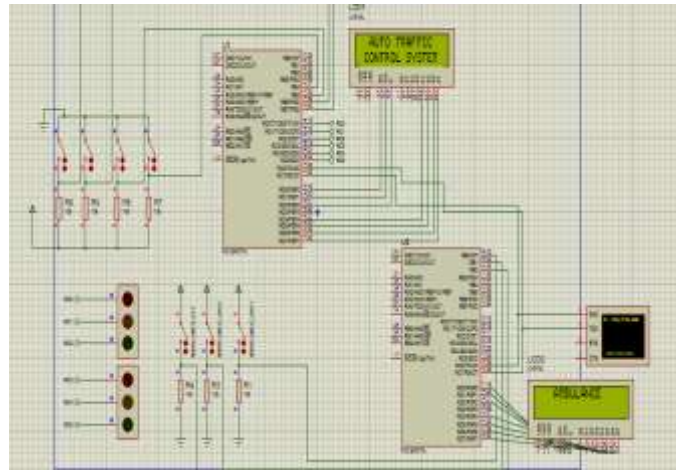The Simulation Output of the Automated Traffic Signal:

Figure .13: the simulation of the automated traffic signal.

Here the switches acts as RFID readers, when the vehicle moves along the traffic signal, the reader placed on the traffic signal which counts the vehicles passing by, refer figure.13. The same process is done in adjacent side of the traffic signal. The controller compares the density between traffic signal then the GREEN wave led is ON .Once the density is reduced the other signal has the greater ,hence the green wave is switched on that traffic signal.
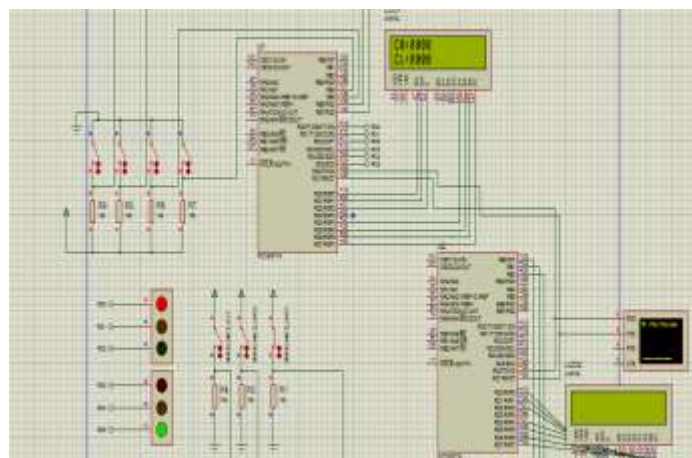

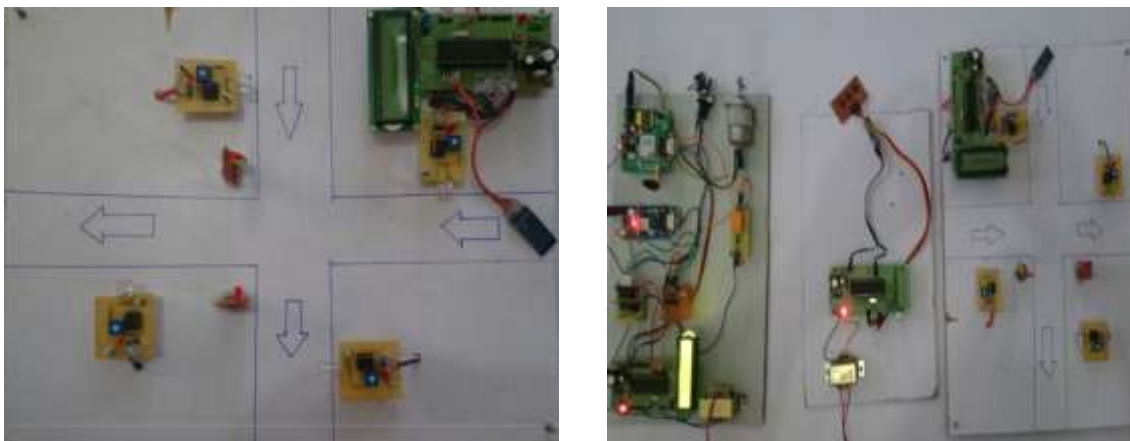**Figure .14: the simulation output of ambulance or any emergency vehicle.**

Figure.15. the hardware setup of the traffic control system and the overall setup of the system.

The ambulance clearance in the traffic signal is mainly depends on the wireless communication .whenever the ambulance signal is detected in the traffic signal , immediately the traffic signal displays the GREEN wave refer figure 14 . The highest priority is given to the ambulance so that the life of the human will be saved. If there already green wave exists in the traffic signal then it continues until the ambulance leaves the signal. The hardware setup of traffic signal and hassle movement of the emergency vehicle is shown in the figure.15

Finally, the automated traffic signal is set up is designed to save the life of the human by priority of the emergency vehicle in the traffic signal and hence congestion is also cleared by the RFID tags and readers which is implemented in the traffic system.

CONCLUSION

This system presented the traffic control aims to reduce the congestion, prevention of stolen vehicle and ambulance clearance. This reduce the human intervention, everything is automated in this system. The congestion is controlled and hassle movement of ambulance is done by the automated traffic signal and prevention of the stolen vehicle is done by GSM and GPS respectively .hence there is no chance of stealing the vehicle and it will be secure and lives of the patient will be saved.

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