Implementing Intelligent Traffic Control System for Congestion Control Ambulance Clearance and Stolen Vehicle Detection

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Abstract

Traffic congestion is a major problem in cities of developing Countries like India. Growth in urban population and the middle-class segment consume vehicles 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 be notable as one of the major issues in metropolitan cities. Emergency vehicles like ambulance and fire trucks need to reach their destinations at the earliest. If they spend a lot of time in traffic jams, valued lives of many people may be in danger. Here the image sequences from a camera are analyzed using various edge detection and object counting methods to obtain the most efficient technique. Then, the number of vehicles at the intersection is evaluated and traffic is efficiently managed. The traffic signal indication continuously glows to green as long as the emergency vehicle is waiting at the traffic lane. After the vehicle crossed the junction, automatically the traffic signals follow the previous pattern generation of traffic signals. This can be implemented in LABVIEW.

Keywords: Terms: Embedded Technologies, RFID, GSM and GPS

1. Introduction

In developing countries traffic congestion is one of the major problems. Congestion is the root cause of various problems including traffic jams, traffic rule violation and accidents. This has adverse effects on human lives. Traffic lights play an important role in traffic management. Traffic lights are the signaling devices that are placed on the intersection points and used to control the flow of traffic on the road. The problem of traffic light control can be solved by RFID based system. With this system, we can consider the priority of different type of vehicles and also consider the density of traffic on the roads by installing RF reader on the road intersections [1]. Radio frequency identification is a technique that uses the radio waves to identify the object uniquely. RFID is a technique that is widely used in the various application areas like medical science, commerce, security, Electronic toll collection system, access control etc. There are three main components of RFID: RFID tag, RF Reader and Database. RFID is a wireless technology that

uses radio frequency electromagnetic energy to carry information between the RFID tag and RFID reader. Some RFID systems will only work within the range inches or centimeters, while others may work for 100 meters (300 feet) or more. Various types of tags are available but we can mainly divide them into two categories: passive tags and active tags. The passive tags don't contain any internal power source. The active tags contain a battery as an internal power source used tooperate microchip's circuitry and to broadcast the information to the reader. The range and cost of these tags is more as compare to passive tags [2]. 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. GPS is also used along with the RFID in order to locate the position of vehicle whenever theft occurs. PIC 16F877A is used here to control all the processes that are involved [3].

2. Related Work

2.1. Dynamic Traffic control system:

The work in [16] proposed a smart traffic control system based on the wireless sensor network and an alerting system for red light crossing scenario to alert the drivers on other sides to save their lives. This technique is based on the queue length of the vehicles on the traffic lights [4]. They also represent the simulation of 4 models which are used in the different parts of the world and shows competing results in the

terms of waiting time and number of vehicles not served first time.

2.2. Intelligent Traffic Lights Based on RFID

This paper states that the traffic management is the critical issue of the road. Traffic lights play an important role in the traffic management. The existing traffic lights follow the predetermined sequence. So these lights are called static traffic lights. These traffic lights are not capable to count the number of vehicles and the priority of the vehicles on intersection point. As a result some vehicles have to wait even there is no traffic on the other side [5]. The vehicles like Ambulanceand Fire Brigade are also stuck in traffic and waste their valuable time. The proposed system provides quality of service to Emergency vehicles and improves the accuracy of Automatic Traffic Light Violation Detection system as well as helps to trace out the stolen vehicles using RFID [6].

2.3. Dynamic Traffic Light Sequence Using RFID

It avoids problems that usually arise with Standard traffic control systems, especially those related to image processing and beam interruption techniques. This RFID technique deals with a multivehicle, multilane, multi road junction area [13]. It provides an efficient time management scheme, in which a dynamic time schedule is worked out in real time for the passage of each traffic column. The real time operation of the system emulates the judgment

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of a traffic policeman on duty. The number of vehicles in each column and the routing are proprieties, upon which the calculations and the judgments are based [11].

3. Implementation

3.1 Proposed System:

The proposed method provides an intelligent traffic control system to pass emergency vehicles smoothly. Here, each individual vehicle is equipped with special radio frequency identification (RFID) tag which is placed at a specific location which cannot be removed easily. This method makes use of RFID reader, max 232, and PIC16F877A system-on-chip to read the RFID tags attached to the vehicle. If the RFID-tag-read belongs to the stolen vehicle, the location is tracked using GPS and then a message is sent using GSM to the police control room [10]. In addition, when an ambulance is approaching the junction, it will communicate to the traffic controller in the junction to turn ON the greenlight until the ambulance passes and the red light for the other path should be turned red.
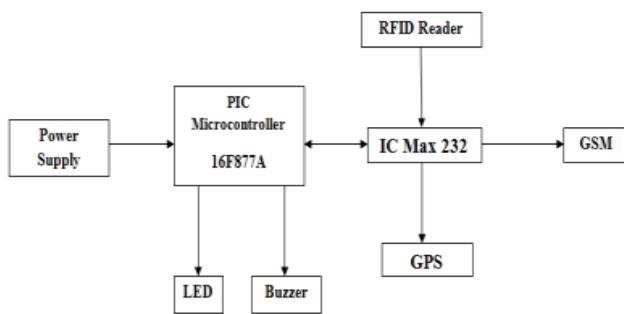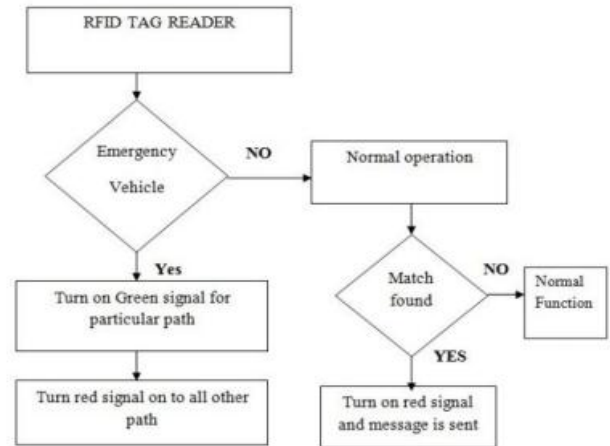

Fig 1. Block Diagram.

Fig 2. Flow Diagram.

4. Experimental Work

Each vehicle is equipped with an RFID tag [9]. PIC microcontroller is used here for the control of traffic signals. The coding for the proposed system is done using MP LAB. Simulation results are done using PROTEUS software. In this simulation software two PIC microcontrollers is employed. One of the controller is assumed as an ambulance and the communication between two controllers are done using UART. A

virtual terminal is used as a wireless communication. When the switch connected to the relay is in open condition, the normal traffic signal operation is performed. The normal operations like red will be on for 10 seconds, next green for 10 seconds and yellow for 5 seconds and these are displayed in LCD. This cycle goes on continuously until an interrupt occurs. Whenever the switch is closed which is connected to relay and a buzzer is pressed, a

signal is transmitted to the controller 2(ambulance is detected). At the time when the signal is received at controller 2, it turns on the green signal for the particular direction in which the ambulance is passing [8]. The LCD displays "Emergency vehicle give way". And also it turns on the red light for remaining part of the junction. As soon as the ambulance passes it will continue its normal operation. Here a blue led is also used just to represent the emergency situation. In the case, for wireless transmission a virtual terminal is used. In this simulation, 'A' is assumption of emergency vehicle and '1' is for stolen vehicle [7]. Whenever the character "A" is typed in the terminal, the LCD automatically displays Emergency vehicle and the signal turns to green. And when integer "1" is typed in the terminal this will make the LCD to display "Stolen vehicle" and the signal is turned to red for that path alone.
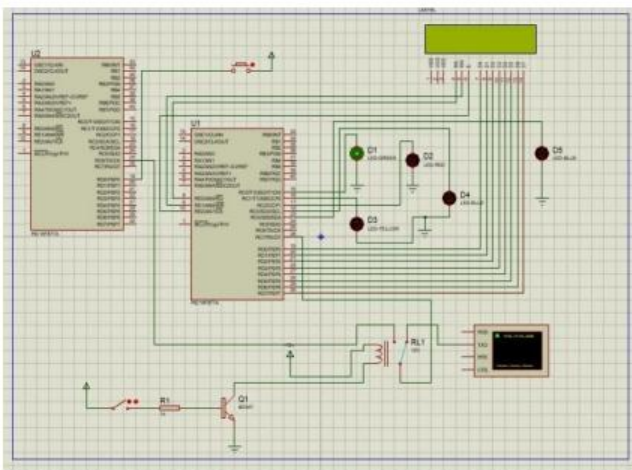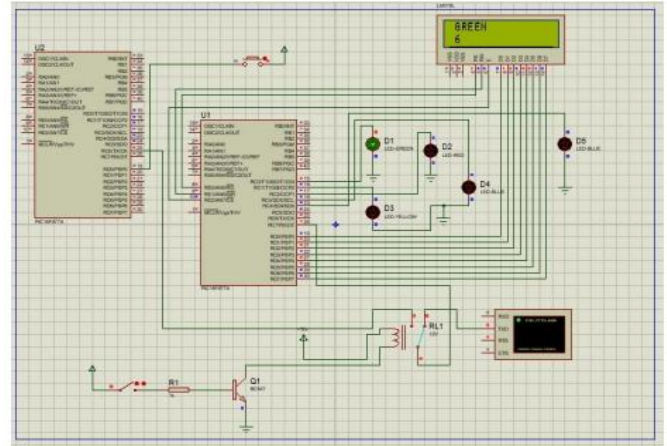

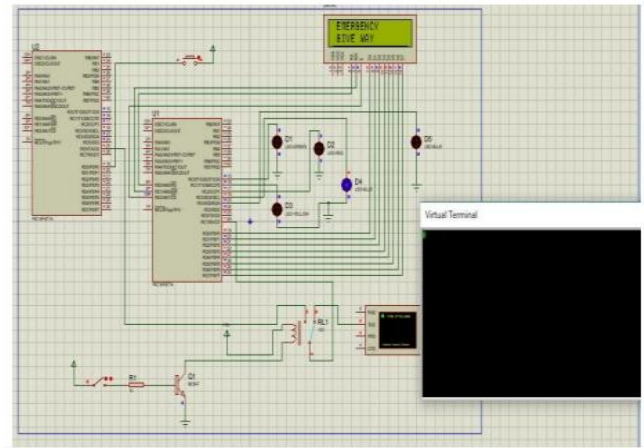Fig 3. Result of Normal condition

Fig 4. Results showing Green

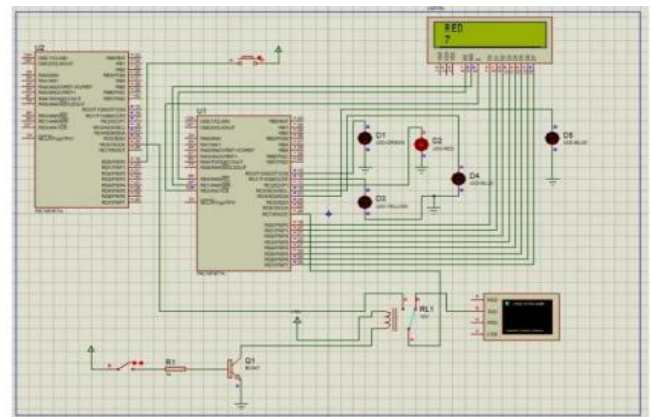Fig 5.Simulation results for Emergency Vehicle.

Fig 6. Results showing Red

5. Conclusion

The dynamic change of state using background referencing method is successful in solving the issue of fixed timing of controller in controlling

traffic and consequently will minimize the traffic congestion on the roads. The use of real time data obtained through RFID sensor technique that serves as input to traffic light will be an innovative way of controlling traffic volume in developing countries. Also the logs obtained are used to send traffic density to users so that congestion can be controlled. Licensing control module enforces discipline in users and thereby minimizing the breaking of traffic rules. With stolen vehicle detection, the signal automatically turns to red, so that the police officer can take appropriate action, if he/she is present at the junction. 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.

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