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DYNAMIC TRAFFIC FLOW MANAGEMENT SYSTEM

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Abstract: This paper presents an efficient priority control for ambulance clearance. Each ambulance is equipped with radio frequency transmitter (RF Tx). We use RF receiver, PIC16F877A, liquid crystal display (LCD), piezo electric buzzer were attached to the traffic signals. It detects ambulance while arriving at 100 meters before reaching the signal. In addition, when an ambulance is approaching the junction it will communicate to the traffic signal in the junction to turn ON the green light. This module uses radio frequency (RF) transmitter, receiver and PIC16F877A for wireless communication between the ambulance and traffic signal.

Keywords: RF Transmitter and Receiver, LCD, PIC16F877A, Piezoelectric buzzer, ambulance vehicle, traffic junction.

1. Introduction

INDIA is the second most populous Country in the World and is a fast-growing economy. Infrastructure growth is slow as compared to the growth in number of vehicles, due to space and cost constraints [1]. Intelligent management of traffic flows can reduce the negative impact of congestion. In recent years, wireless networks are widely used in the road transport as they provide more cost effective options [2]. Technologies like RF Transmitter and Receiver, LCD, PIC16F877A and Piezo electric buzzer can be used in traffic control to provide cost effective solutions. RF is a wireless technology that uses radio frequency electromagnetic energy to carry information between the RF Transmitter and RF Receiver. Some RF systems will only work within the range 100 meters or more. The range of RF is about 3 Hz and 300 GHz and RF Transmitter and Receiver are available for operation in the 868-870 MHZ band in Europe and 902-928 MHZ band in North America [3], [4]. It uses ASK, FSK, OOK, Direct sequence spread spectrum and Frequency-hopping spread spectrum [5].

Literature Survey

Traffic congestion is a major problem in cities of developing Countries like India. Growth in urban population and the middle-class segment contribute significantly to the rising number of vehicles in the cities [6]. 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. In [7], green wave system was discussed; this was used to provide clearance to any emergency vehicle by turning all the red lights to green on the path of the emergency vehicle, hence 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. 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 biggest disadvantage of green waves is that, when the wave is disturbed, the disturbance can cause traffic problems that can be exacerbated by the synchronization.

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Fig 1 Shows ambulance stuck in traffic

In [8], the use of RFID traffic control to avoid problems that usually arise with standard traffic control systems, especially those related to image processing and beam interruption techniques are discussed. This RFID technique deals with multivehicle, multilane, multi road junction areas. 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 of a traffic policeman on duty. The number of vehicles in each column and the routing are properties, upon which 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. In [9], it proposed a RFID and GPS based automatic lane clearance system for ambulance. The focus of this work is to reduce the delay in arrival of the ambulance to the hospital by automatically clearing the lane, in which, ambulance is travelling, before it reaches the traffic signal. This can be achieved by turning the traffic signal, in the path of the ambulance, to green when the ambulance is at a certain distance from the traffic junction. The use of RFID distinguishes between the emergency and non-emergency cases, thus preventing unnecessary traffic congestion. The communication between the ambulance and traffic signal post is done through the transceivers and GPS.

The system is fully automated and requires no human intervention at the traffic junctions. The disadvantage of this system is it needs all the information about the starting point, end point of the travel. It may not work, if the ambulance needs to take another route for some reasons or if the starting point is not known in advance.

Traffic is a critical issue of transportation system in most of all the cities of Countries. This is especially true for Countries like India and China, where the population is increasing at higher rate. In [10], some of the main challenges are management of more than 36,00,000 vehicles, annual growth of 7–10% in traffic, roads operating at higher capacity ranging from 1 to 4, travel speed less than 10 Km/h at some central areas in peak hours, insufficient or no parking space for vehicles, limited number of policemen. In, currently video traffic surveillance and monitoring system commissioned in Bangalore city. It involves a manual analysis of data by the traffic management team to determine the traffic light duration in each of the junction. It will communicate the same to the local police officers for the necessary actions.

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Proposed Model

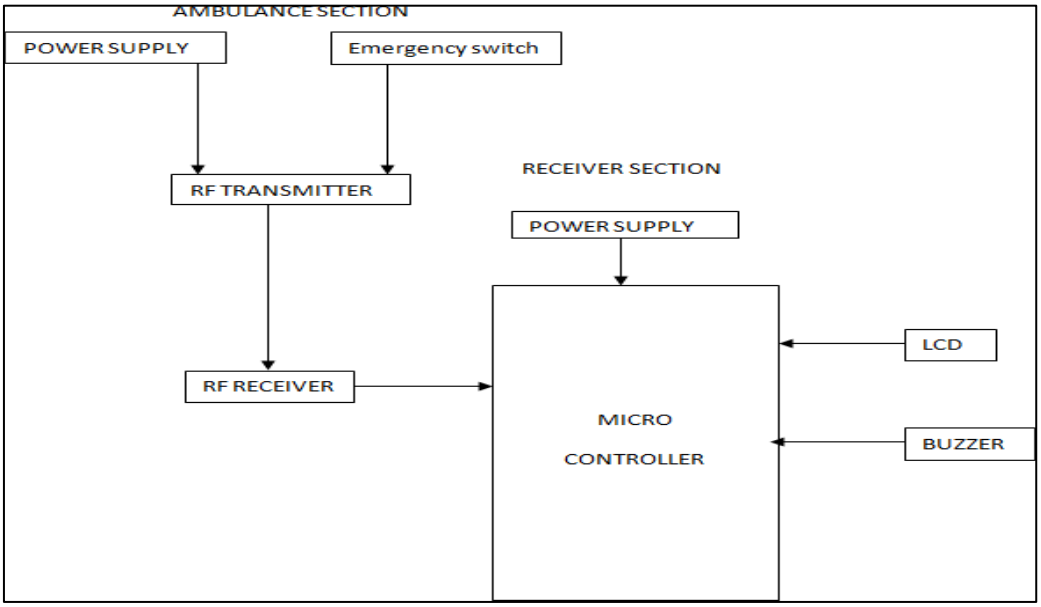

Fig.2. RF Transmitter and Receiver

From the current problem section, it can be seen that, existing technologies are insufficient to handle the problems of congestion control, emergency vehicle clearance, etc. To solve these problems, we propose to implement our Intelligent Traffic Control System. It mainly consists of three parts. First part contains automatic signal control system. The main scope of this project is to provide override facility for ambulance vehicles in peak hours in traffic signal. Traditionally traffic signal timings are changed automatically to reduce the traffic density at the junction. In the event of any emergency vehicles such as ambulance, fire brigades etc. requires top priority to cross signals. Therefore, this system is enhanced by an RF transmitter and receiver facility that helps to override the ambulance vehicle by flashing green signal in desired direction of such vehicles while blocking the other lanes by flashing the red signal for some time.

RF Transmitter and Receiver

The term RF stands for ―Radio Frequency‖. A RF transceiver module will always work in a pair that is it needs a Transmitter and Receiver to send and Send data. A transmitter can only send information and a Receiver can only receive it, so data can always be sent from one end to another and not the other way around. The speed at which it can transmit data is around 10Kbps. These are 18 pin IC‘s which can operate between 3V to 12V input power supply.

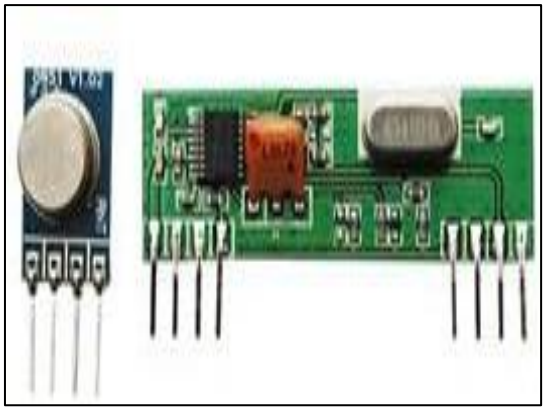

Fig 3 RF Tx

The Transmitter module consists of three pins namely Vcc, Din and ground. The Vcc pin has a wide range input voltage from 3V to 12V. The transmitter consumes a minimum current of 9mA and can go as

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high as 40mA during transmission. The center pin is the data pin with the signal to be transmitted is sent. This signal is then modulated using the ASK (Amplitude Shift Keying) and then sent on air at a frequency of 433MHz. The Receiver module has four 5.5mA. The pins D- out and Linear out is shorted together to receive the 433 MHz signal from air. This signal is then demodulated to get the data and is sent out through the data pin.

Microcontroller (PIC16F877A)

Peripheral Interface Control (PIC) 16F series has a lot of advantages as compared to other series. It executes each

Instruction in less than 200 nanoseconds. It has 40 pins and has 8K program memory and 368 byte data

pins namely Vcc, D-out, Linear out and Ground. The Vcc pin should be powered with a regulated 5V supply. The operating current of this module is less than

memory. It is easy to store and send UINs. At the junction, it is easy to store large number of emergency vehicles. Before switching to green, it should satisfy all the conditions. Simple interrupt option gives the advantage like jump from one loop to another loop. It is easy to switch any time. It consumes less power and operates by vehicle battery itself without any extra hardware.

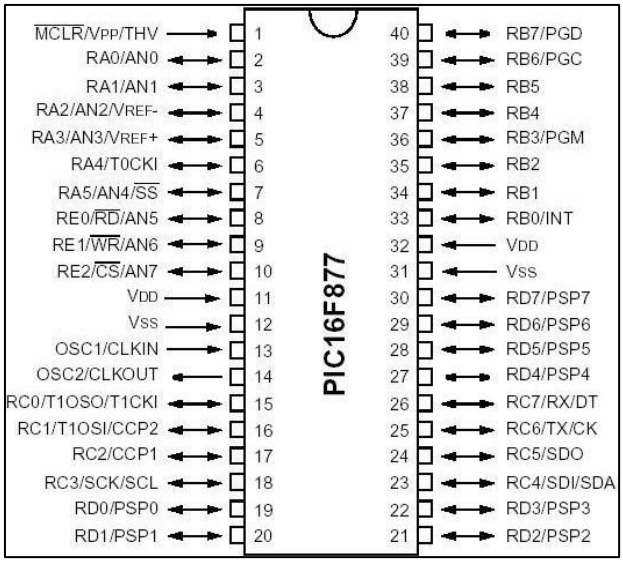

Fig 4 PIC controller

Liquid Crystal Display (LCD)

Fig 5 Liquid Crystal Display

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LCD screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters, animations and so on. A 16x2 LCD means it

the ASCII value of the character to be displayed on the LCD.

Working Model

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can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is

In this model, there are mainly 3 modules are follows:

Emergency Vehicle Clearance System

In this module, there are 2 parts; first part which is RF transmitter is placed in the emergency vehicle

Fig 7 Rf Receiver

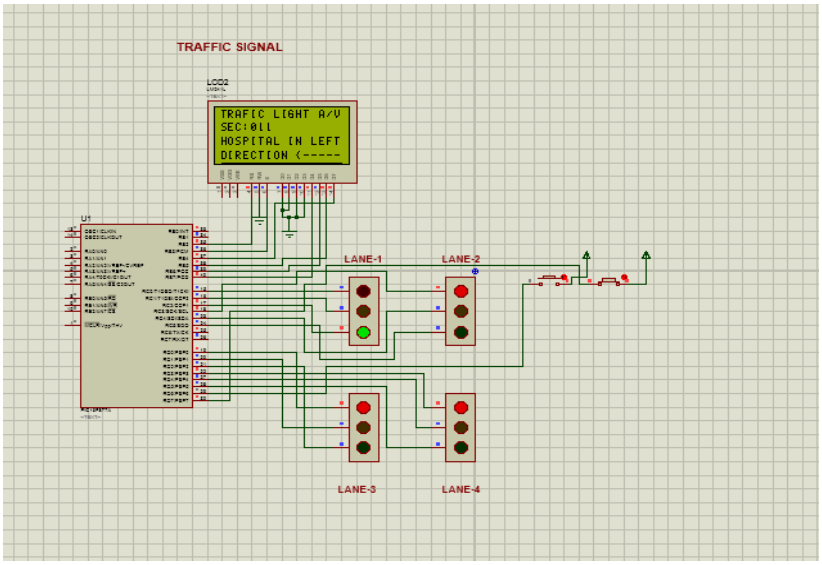

Fig 8 Complete circuit diagram

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When the switch is pressed, it will transmit the signal. The signal contains a Transmitter range of 3 Hz to 300 GHz. The transmitter contains PIC16F877A microcontroller and RF module. The microcontroller sends the commands and data to the RF via serial communication. Second part is the receiver, which is placed at traffic pole. It also contains PIC16F877A microcontroller and RF module. The range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. If the signal is received, then it will turn the green light on. For testing purpose, we used short range RF transmitter and receiver in our prototype. First, the transmitter part is turned on. The red and green signal will be on for 30 seconds duration and will be varied according to the traffic conditions and emergency vehicle. Figure shows the transmitter part is placed in the ambulance. It transmits RF signal continuously. Figure shows the LCD display status at different conditions (in that figure one is normal conjunction image (traffic signal running as per the default time period) and another one is LCD display status, when an ambulance coming near to junction. Figure 5.d shows the actual connections of different components like RF, LCD, Buzzer, interfacing different microcontrollers. Figure shows the status updated at the time of Ambulance vehicle. If ambulance vehicle is found, then it will immediately turn on green light in the signal. It sends immediately a message to LCD display. Figure shows the working model of the proposed work.

Conclusion and Enhancement

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. As the entire system is automated it requires very less human intervention. 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, a 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. Further enhancement can be done to the prototype by testing it with longer range RF Transmitters and Receivers. Currently, we have implemented system by considering four road of the traffic junction. It can be improved by extending to all the roads in the multi-road junction.

orange light will be on for 5 seconds duration one after the other. Then the signal will turn to red for duration of 30 seconds and a message is displayed in the LCD. Thirdly, we bring an Buzzer as intruder alarm into the range of traffic signal, and then the green light duration will change to 30 seconds. Fourthly, we bring an emergency vehicle carrying RF transmitter into the range of RF receiver, and then the traffic light will change to green till the receiver receives the RF signal as shown in Fig. Figure 5 shows the images of different components and highlighted features of the proposed work. The signal pole installed in junction. In the default condition, red and green light will set for 10 seconds. The time period

Automatic signal control system

In this module, for experiment purpose, we have used Passive RF transmitter and RF receiver with frequency of 3 Hz to 300 GHz. RF transmitter, when vehicle comes in the range of the receiver, it will transmit to the traffic signal. The microcontroller connected to the RF transmitter will produce the output in the form of audio and video communication. The green light duration is set to 30 seconds, if count is between 5 and 9, the green light duration is set to 20 seconds. If the count is less than 5, the green light duration is set to 10 seconds. The red-light duration will be for 10 seconds and orange light duration will be for 2 seconds.

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