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Smart Ambulance Movement and Monitoring System Using GSM and RFID Technology

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Abstract - *A steady increase in metro-city population, the number of automobiles and cars increases rapidly and metro traffic is growing crowded which leads to the traffic jam problem. Controlling the traffic becomes major issue when it comes to large time delays between traffic lights/signals. Due to this, ambulance service one of the crucial services gets delayed very often. To overcome this situation, this paper describes a solution that is "Smart ambulance movement and monitoring system" which includes 'traffic controlling/movement' as well as a 'monitoring system' using GSM and RFID technology.*

In traffic controlling/movement system, a density based system is used which aims at reducing traffic congestion and unwanted long time delay during the traffic light switch over especially when the traffic is very low by analyzing the counting and controlling system using IR technology and 89C52 microcontroller. Also, an RF transmitter on the ambulance will communicate with the RF receiver mounted on the signal post. An algorithm is used to control the traffic signals automatically based on the RF switch/key pressed by the driver in the ambulance when in range. In monitoring system, every patient is provided with RFID TAG/smart card which includes all the details of patient i.e. name, age, sex, major diseases suffered, medical history etc. when swiped upon RFID reader (installed in ambulance), will get transferred to hospital department with the help of GSM technology. This monitoring system will help the doctors to give patients the necessary treatment for the time being.

Key Words: Traffic; Ambulance, IR, GSM, RFID, RF, technologies

1. INTRODUCTION

These days with the increase in the population and due to luxurious living there is an increase in the traffic on roads. The problem with the traffic system is that for every minute the vehicles at the 2-way road will be heavy and the traffic lights shall be changed to each side for some fixed time even if there are no vehicles at particular side, the traffic lights will glow for given fixed time. Due to this, other side vehicles have to wait for the time to complete the process. Also on roads, due to high traffic people are unable to provide the free way to the emergency unit which also becomes one of the factors of late first aid to the patient due to which one can die on the way to hospital.

This paper aims at reducing traffic congestion and unwanted long time delay during the traffic light switch over ; also proposes that how ambulance can easily pass through traffic signals by making use of RF Module and lastly, how monitoring of the patient will help the doctors to give them necessary treatment with the help of RFID and GSM technologies [4]. The paper is organized as follows. Section-I introduces the problem formulation and objective of the paper. Section-II discusses about the proposed system. Section-III discusses about the design methodology. Section-IV discusses about the choice of components/major technical listings. Section-V proposes the design architecture/pin diagram. Section-VI discusses about observations/testing and finally section-VII concludes the paper.

2. PROPOSED SYSTEM

Traffic congestion is major problem in cities of developing countries like India. The poor infrastructure and the irrational distribution of the development are core reasons for increasing traffic congestion. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage. Due to this, there is a problem of delay in first aid service.

This project is proposed into two categories i.e. movement system and monitoring system. In monitoring system, this project an automated way of controlling signals in accordance to the density of traffic in the roads. IR modules (photodiode and IR sensor) are placed in the entire intersecting road at fixed distances (say 5cm) from the signal placed in the junction [6]. The time delay at the traffic light is set based on the density of automobiles/vehicles on the roads.

The IR modules are used to sense the number of vehicles/density of vehicles on the road. According to the IR count, microcontroller takes

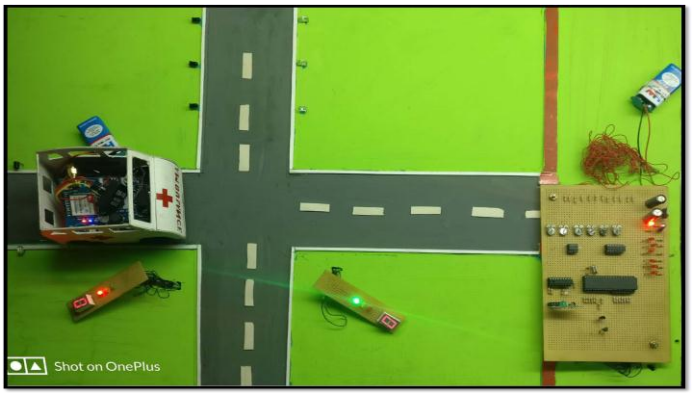

Fig -1: Overview of Proposed Design

appropriate decisions as to which road is to be given the highest priority and the longest time delay for the corresponding traffic light. In normal condition i.e. in the simple traffic light with, the count is stored in microcontroller and 1st LED is on. Similarly, if the traffic density is more than normal traffic, then 2nd or 2 LEDs are on. Similarly, for the third one. If the traffic is high on any side, then sensors are activated and microcontroller gets a signal from OP-AMP and it immediately changes the position of counter.

In case of monitoring system, the ambulance heading towards its destination may get stuck in traffic. In this case, RF module helps in getting rid of the traffic, as the RF transmitter is attached to the ambulance itself and receiver at traffic signal. The range is defined (say 50cm) from signal. When the ambulance comes in the range, one of the people sitting in ambulance can turn on the RF switch and steadily, signals changes to green and it stops the counter of other signals and in this way, ambulance can easily pass through the signal. As soon as the ambulance reaches its destination, the patient RFID TAG is shown /swiped to/upon the RFID reader, the reader reads the value and is saved in the database from which it is retrieved by the server and the details are displayed. The reader reads the tag and patient's details like unique ID number, name, age, blood group, disease, etc and the same is transferred to medical team/department through GSM technology.

3. DESIGN METHODOLOGY/WORKING

Initially the signals are started by giving the power supply. The first step is to make sure that the signals are all in ON condition. During this, all the traffic signals will blink in yellow light. This indicates that they are all in the working condition.

The next step is to check the traffic density on the roads . By density what we are trying to mean in that the number of vehicles available in a particular at a certain period of time. The density is calculated over here by means of using an IR and photodiode circuit. Depending on the number of vehicles passing through IR the light/ray travelling from the receiver (photodiode to transmitter (IR) of the IR circuit, the count of the vehicles is registered in the microcontroller. This is followed by the next step in which the microcontroller decides as to which road should be given the highest priority. This is based on the density of traffic on each road and also it depends on the speed at which an IR circuit registers the count [1].

The very next step is to assign time delays for each road. The time delays have already been set for certain specific counts in the microcontroller. As soon as the microcontroller receives the counts from the IR circuit it will immediately detect the density of each road and accordingly allot the time delays for which each signal will show the green light. The higher the traffic density, the longer will be the time delay allotted.

Now turning to the last part, in the 'monitoring' case (fig 4), we use RF Module i.e. RF transmitter, RF receiver and RF switch. RF transmitter is connected to Port 3 of 89C2051 controller and RF receiver to Port 2 of 89C52 controller. A HT12 encoder and decoder are used to convert data into BCD code. When data is sent, 1 bit is chosen from D0, D1, D2, D3 (encoder), code is generated and is encoded at RF transmitter and decoded at RF receiver [3]. RF switch is fixed in the ambulance, when turned on, it will stop the counter. RF transmitter, GSM module and RFID reader are fixed in ambulance itself as shown in Fig 3.

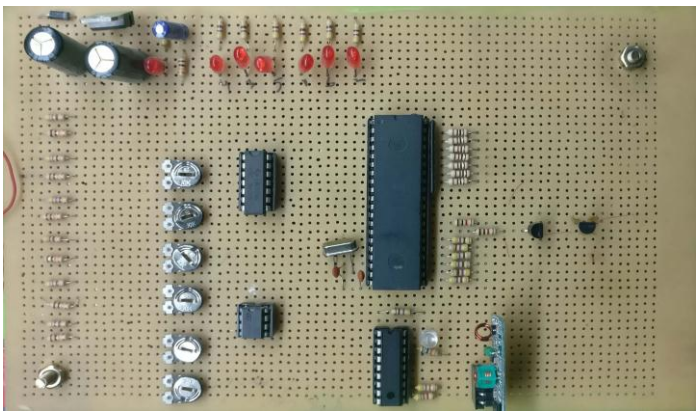

Fig -2: Movement System/Traffic Density

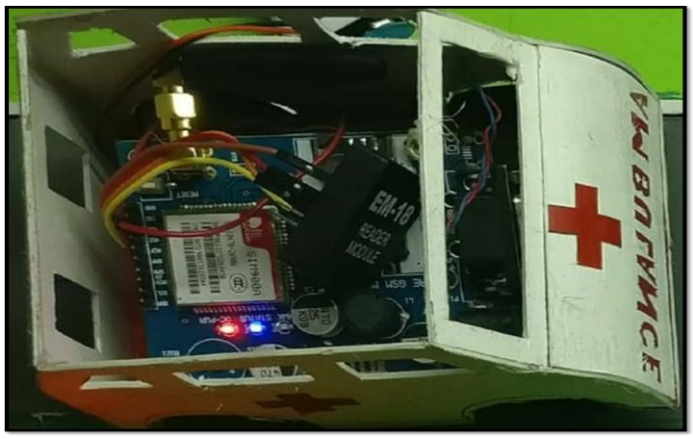

Fig -3: Smart Ambulance

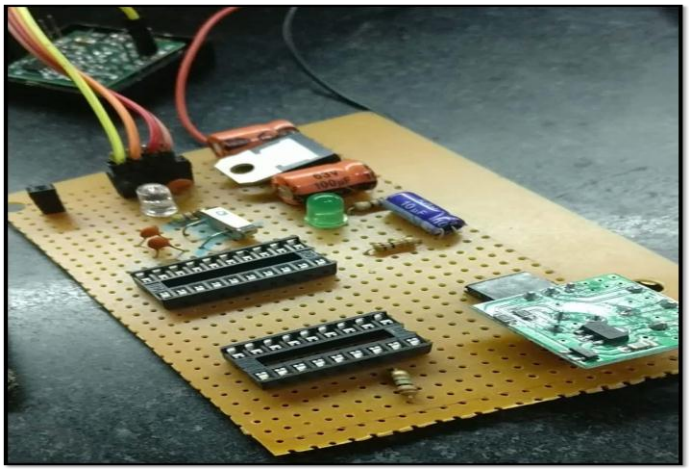

Fig -4: Monitoring System

RFID (EM-18) are interfaced at pin no 1 and 2 at R'X and RST pin whereas, GSM is interfaced at T'X pin i.e. port 3.1 as shown in fig 6. When the ambulance is in the range, the RF switch is turned ON and it can easily pass through the signal and can turn OFF when it crosses the signal. RF technology is used for transmit the data to receiver for switching the traffic light in emergency cases [2].

In the transmitter circuit, we use RFID Reader, Tag and GSM technology first of all we connect RFID reader and then GSM for sending message [5]. In the final step, when the ambulance reaches its destination, the patient RFID TAG can be swiped upon reader which send the details of patient i.e. name, age, disease, etc to the hospital department with the help of GSM technology.

4. CHOICE OF COMPONENTS/MAJOR TECHNICAL LISTINGS

Table -1: Major Components

Components	Model	Feature/Use
Microcontroller(2)	Atmel-89C52/89C2051	Interface sensors and SSDs.
Electrolytic capacitor	1000µF	Power supply
Crystal Oscillator	11/12 MHz	External clock
Voltage regulator with filter capacitor	7805(5V)	To provide ripple free regulated voltage.
Transistor(2)	PNP	For seven segment display
IR Module (IR, PD)	10-15 cm in range	Transmit and Receive
Seven Segment Display(SSD)	___	Display road Light counter value (common anode)
Dot Board/PCB	___	Ckt designing
Resistors(6)	470&10K	Load resistance
Battery	12V	Power supply
Op-Amps(2)	LM-339 & LM-358	As a comparator
Variable resistor(6)	___	Reference voltage
LEDs(6)	___	Traffic light
RF Module (Transmit, Receive, Encoder, Decoder)	433 Mhz, HT12 encoder and decoder IC	RF data transmission/ ambulance data receiving system
RF Switch	433MHz	In ambulance
GSM Modem	SIM 900	Messaging
RFID (TAG, Reader)	EM 18	Patient details/card detection
Ceramic capacitor	___	To maintain constant frequency

5. DESIGN ARCHITECTURE/PIN CONFIGURATION

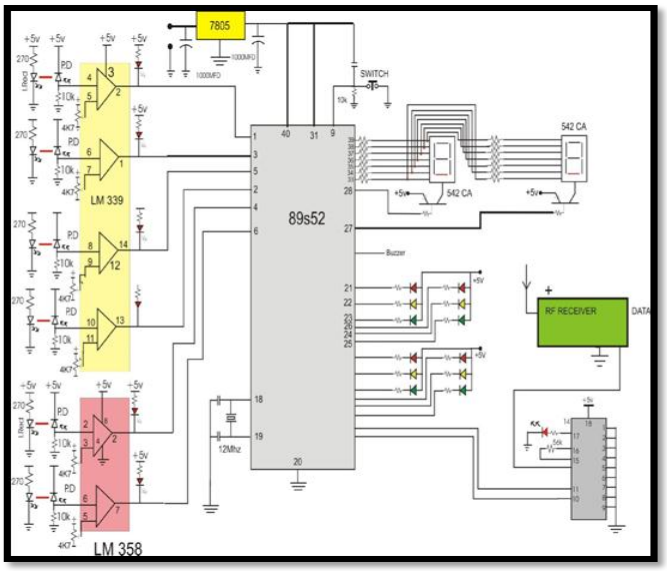

Fig -5: Movement System/Traffic Control

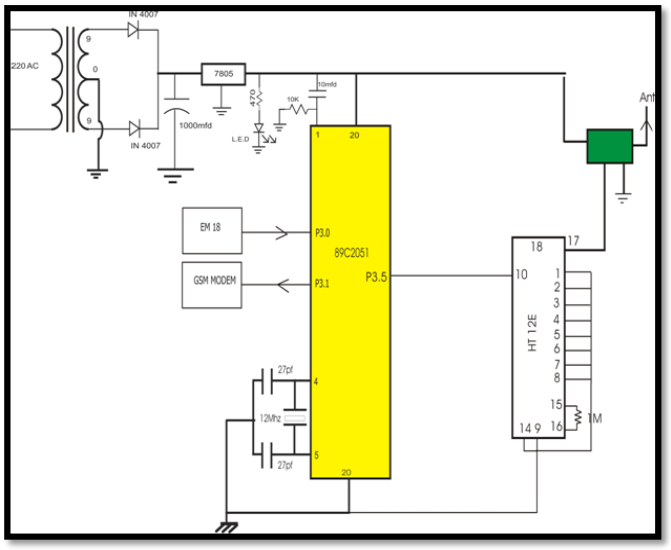

Fig -6: Monitoring System

Pin no 18 and 19 of the microcontroller is connected to external crystal oscillator to provide an external clock to microcontroller by which we set the machine cycle of the controller. For this project we use two circuits one is transmitter and second is receiver. In both the circuit we use microcontroller based circuit.

6. OBSERVATONS/TESTING

The observations are divided into two parts i.e. Movement and Monitoring system. The table for movement system /traffic density based system is shown below.

Table -2: Traffic Density Testing

INTERRUPTS	RED	GREEN	YELLOW
No Interrupt(Normal timings)	4	2	2
1st Interrupt	5	3	2
2nd Interrupt	7	5	2
3rd Interrupt	9	7	2
4th Interrupt	9	7	2
5th Interrupt	9	7	2
6th Interrupt	9	7	2

As per the above table we see that when we give an interrupt to the sensors the time of the traffic lights change automatically.

There are a total of six sensors in the project and these are divided into two parts with each 3 sensors on each of the two roads. The traffic density can be divided into 3 categories: 1) Low 2) Medium 3) High.

When the 1st Sensor is interrupted that means that that traffic density is low, when the 2nd Sensor is interrupted that means the traffic density is medium, when the 3rd Sensor is interrupted that means he traffic density is high. The traffic light times changes accordingly to the traffic density categories.

In the second part, we observe that how ambulance passes through the traffic light signal by pressing RF switch when stuck in traffic. Also, how message (patient details) is sent to hospital department with the help of GSM modem, when details are received by RFID TAG when swiped upon RFID reader.

7. CONCLUSION

In this paper, we show that how we manage to get rid of traffic congestion using smart movement system and to design a smart ambulance monitoring system for modern cities. If the road is very much busy with traffic and there is a heavy jam on the road. Then it's possible at that time ambulance use its RF signal to activate the traffic light from red to green. Also, how the monitoring of patient is done by RFID and GSM technology which will help the doctors to give him the necessary treatment for the time being.

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