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AUTOMATIC AMBULANCE RESCUE SYSTEM

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Abstract - *Traffic congestion and tidal flow management were recognized as major problems in modern urban areas, moreover road accidents in the city have been incessant and to bar the loss of life due to the accidents is even more crucial. To implement this we introduce a scheme called AARS (Automatic Ambulance Rescue System). The main theme behind this scheme is to provide a smooth flow for the ambulance to reach the hospitals in time and thus minifying the expiration. The idea behind this scheme is to implement AAR, which would control mechanically the traffic lights in the path of the ambulance and controls the traffic light according to the ambulance location and thus reaching the hospital safely.*

The existing systems are post accident detection systems which has lack of intelligence. It fails to track the rear end collision and pre-damage status. It depends on the way of monitoring people to be manual. It requires manual work to save human life which results in time delay and because of that first aid cannot be provided to the patient on time. This leads to loss of human life.

Key Words: Automatic Ambulance Rescue System, the accident detection, locating the position, sending signals to traffic unit, traffic signal controlling.

1.INTRODUCTION

There is loss of life due to the delay in the arrival of ambulance to the hospital in the golden hour. This delay is mainly caused by the waiting of the ambulance in the traffic signals. It would be of great use to the ambulance if the traffic signals in the path of the hospital are ON. Thus we propose a new design for automatically controlling the traffic signals and achieving the above mentioned task so that the ambulance would be able to cross all the traffic junctions without waiting.

Every traffic junction will have a controller controlling the traffic flow. The traffic junctions are referred to as nodes and each node will have a GSM modem connected to the controller. The nodes are controlled by a main server by sending the control messages to their GSM modems. When a node is controlled and its traffic signal is made to be green for the ambulance to pass through without waiting, it is said to be in ON STATE.

2.WORKING-MECHANISM-PRINCIPLE

This project proposes an efficient system which consists of two parts, the vehicle unit and the ambulance unit. It comprises of GPS module, GSM module, Mini LPC2148 board, PIC16F877A microcontroller, RF transmitter and receiver and LCD display.

2.1 Working

When an accident is occured the pressure sensor, which senses the pressure above a particular value provided in the vehicle unit detects the accident and through GPS the location of the accident is identified. Through GSM module the message is passed to the authority regarding the location.

To reach the destination immediately the ambulance unit controls the traffic signals to avoid delay in traffic junctions. That is the RFID transmitter in the ambulance unit and receiver in the traffic signals used for wireless communication communicates each other and the signal is to be controlled in accordance with the ambulance unit

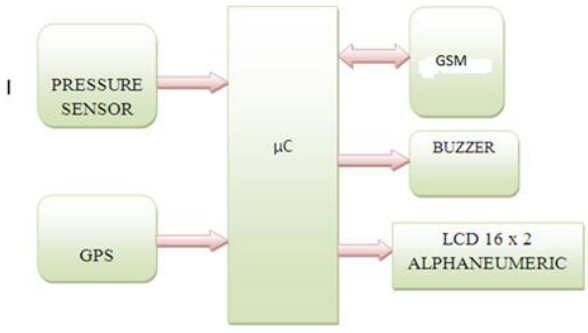

Figure 1- Vehicle Unit

In Vehicle Section, all the equipments are connected to microcontroller. The Piezoelectric sensor is used as vibration sensor to measure flex, touch, vibration and shock.

Piezoelectric sensor is a device that uses piezoelectric effect to measure changes in acceleration, pressure, temperature, strain or force by converting them to an electric charge. This piezoelectric sensor measures dynamic pressure which includes blast, ballistics and engine combustion under varying condition. An electronic amplifier is an electronic device that increases power of a signal and converts alternating current into direct current.

Here we have used Microcontroller ARM7 for this vehicle section. ARM7 is a group of older 32-bit ARM processor. ARM is a family of instruction set architecture for computer processor based on a reduced instruction set computing. A RISC-based computer design approach means ARM processor requires significantly fewer transistors. LPC2148 is the widely used IC from ARM7 family which we have used in vehicle section. It is pre-loaded with many inbuilt peripherals making it more efficient. Power supply, crystal oscillator, reset circuit, UART are the minimum listed hardware needed for LPC2148. It works on 3.3V power supply, transformer is used to step down 230V AC to 9V AC supply and provide isolation between power grid and circuit. Rectifier in LPC2148 is used to convert AC supply into DC and regulator is used to regulate DC supply output, reset button is essential to avoid programming pitfalls and provide clock for RTC operation. LPC2148 has inbuilt ISP which means we can program it within the system using serial communication on COM0.

The sensor installed in the vehicle unit senses the accident and GPS tracks the location of the accident. Through GSM, it sends the location of the accident to the ambulance. The buzzer produces sound when accident occurs. The ambulance crosses all the traffic junctions by automatically controlling the traffic signals and reaches the nearest hospital. Here, wireless technologies are used to transfer information.

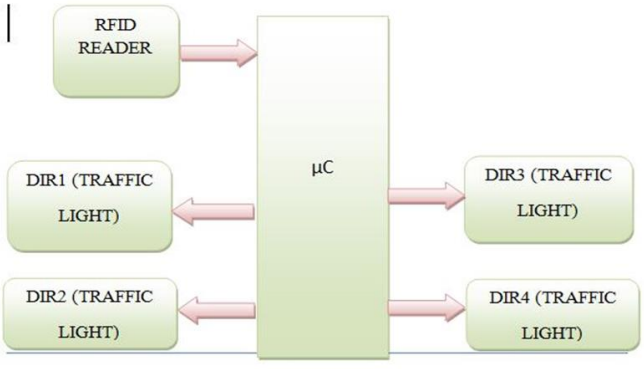

Figure 2-Ambulance Unit

In Ambulance Section, we used PIC microcontroller. The serial number of the IC is 16F877A. This section consists of crystal oscillator, power circuit and serial communication. 9V input supply is given and the operating voltage is 5V. The crystal oscillator is used to work according to the frequency change. In a PIC microcontroller, there are totally 40 pins and 5 ports; port A to port E. PIC is a family of modified architecture microcontrollers. The name PIC initially referred to Peripheral Interface Controller. The MAX232 is an IC, which converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. Here it is used for the purpose of serial communication. It is a dual driver/receiver. The display unit is for the purpose of driver's reference. An encoder is a device, transducer, circuit, algorithm, software program, or person, which converts data from one format or code to another, for the purposes of speed, standardization, security, secrecy or compressions. Here, the encoder converts the serial data into parallel data because the controller performs only serial functions and wireless is parallel communication. The RF transmitter consists of switches, the signal changes according to it [3]. An RF module is an electronic device used to transmit or receive radio signals between two devices. It is often preferable to communicate with other device wirelessly in an embedded system. The wireless communication may be performed through optical communication or RF communication. The choice is RF for many applications as it does not require line of sight. RF communications use a transmitter or receiver.

Signal Section

In Signal Section, the functions of the microcontroller section are same as in the ambulance section. Here, we used reader device, decoder unit and signal indicator. The reader device receives the data which the RF transmitter sends from the ambulance section. Any device may act as a reader that can display text on a screen. A decoder is a device that performs the reverse operation of an encoder. To recover the original information, it undoes the encoding. Normally, the same method which is used to encode is reversed to decode. It is a combinational circuit that converts binary information. Here, the decoder unit converts the parallel data into serial data and sends it to the microcontroller section.

3.SYSTEM DESIGN AND COMPONENTS

Constructional details

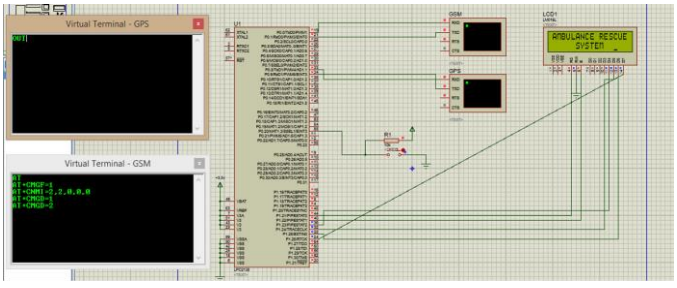

Figure 3: Simulation Model 1

Initially the LCD display displays 'Automatic ambulance rescue system' under normal running condition of the vehicle. When a high pulse has came from the piezoelectric switch microcontroller activates GPS module, which ends the

exact location of the vehicle unit and sends it to the authority through GSM. LCD displays accident occurred location detected and location send when each process continues. That is show in the above simulation diagram.

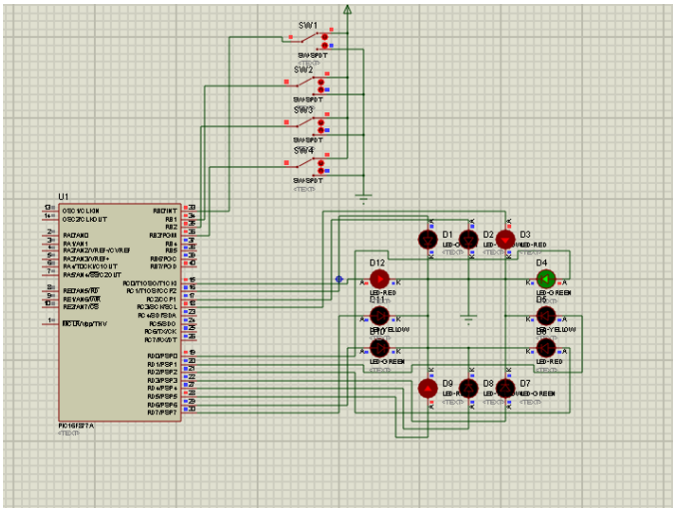

Figure 3: Simulation Model 2

In normal condition of the traffic signal one section will be in green light and other three will be in red for a particular time. And then yellow will glow for a short time in the transition between red and green or vice versa. Then the cycles repeats in a particular sequence. If the ambulance driver make his way green for an emergency by pressing the corresponding switch, and after the passage through the junction the switch is made open and the normal cycles repeats.

The traffic signals of a four junction road is shown with 12 LED's arranged in four sections of three light having red, green and yellow light. The RFID transmitter is along with four switches need separate voltage supply and receiver is with traffic section. RFID wireless transmitter and receiver communicates within 100 m range. The switches 1 is corresponding to right top signal and 2,3 and 4 are corresponding to right bottom, left bottom and left top.

In normal working condition of traffic junction green activates for signal 1 and red for other three. After a particular duration yellow activates for a short time in signal 1 and then green for signal 2 and remaining become red. This cycle repeat as 1,2,3,4,1,2,3,4.etc. The driver can make his path green signal in emergency situations when he reached within 100 m range by switching the corresponding switch other than the normal repeating cycle. When passed through the junction he can release the switch and the normal cycles execute.

3.1 MAIN COMPONENTS

3.1.1 GSM Module

This is a GSM/GPRS-compatible Quad-band cell phone, which works on a frequency of 850/900/1800/1900MHz and which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMSs. Externally, it looks like a big package with L-shaped contacts on four sides so that they can be soldered both on the side and at the bottom. Internally, the module is managed by an AMR926EJ-Sprocessor,which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself. The processor is also in charge of a SIM card (3 or 1,8 V) which needs to be attached to the outer wall of the module. In addition, the GSM900 device integrates an analog interface, an A/D converter, an RTC, an SPI bus, an IC, and a PWM module. The radio section is GSM phase 2/2+ compatible and is either class 4 (2 W) at 850/ 900 MHz or class 1 (1 W) at 1800/1900 Mhz. The TTL serial interface is in charge not only of communicating all the data relative to the SMS already received and those that come in during TCP/IP sessions in GPRS .

3.1.2 GPS Module

This GPS receiver utilizes the S1216 S, it supports NMEA 0183 V3.01 standard, and has integrated interfaces to facilitate the requirements of different communication methods like RS232 and TTL. This package also includes an 1.5ft external magnetic GPS antenna.

Features are:

- Low power consumption
- Powered with DC power supply 9-12 volts
- RF Receiver of Noise Figure is at 2.5 dB
- High Sensitivity -161 dB(indoor)
- Seamless Outdoor/Indoor Operation
- Support standard NMEA-0183 V 3.01
- Software for modifying baud rate is provided for free
- Interfaces:DB-9 RS232 serial port, TTL/3.3V serial breakout headers on PCB.

3.1.3 MINI LPC 2148 Board

MINIARM7 KIT is very easy to use. It is manufactured by Philips. ARM(Advanced RISC Machine) is a family of reduced instruction set computing (RISC)architectures. All the boards are breakout boards - Main board and Daughter Board. Main Board Includes Power supply, two RS232 Ports, JTAG Connecter ,USB Connecter. Daughter Board Includes Crystal 12MHZ, ARM Chip and burg connecters connected to Ports with names. MINIARM -LPC 2148 includes USB Port with self Powered

- MCU: LPC2148 16/32 bit ARM7TDMI-S with 512K Bytes Program Flash, 42K Bytes RAM,USB 2.0,RTC,10 bit ADC 2.44 uS,2x UARTs,2x I2C,SPI, 2x32 bit TIMERS,6xPWM,8xCCR,1xDAC,WDT,5V tolerant I/O, up to 60MHz operation standard JTAG connector with ARM 2x10 pin layout programming/debugging with ARM-JTAG.
- USB connector.
- Two channel RS232 interface and drivers.
- Two buttons Reset and ISP.

- Two status LEDs.
- On board voltage regulator 3.3V with up to 800mA current.
- Single power supply: 12V AC or DC required.
- Power supply LED.
- Power supply
- Altering capacitor.
- RESET circuit with external control of Philips ISP utility via RS232.

3.1.4 RF Transmitter and Receiver

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz and 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter and receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources.

3.1.5 LPC 2148

The LPC2141/42/44/46/48 microcontrollers are based on a 16-bit/32-bit ARM7TDMIS CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed ash memory ranging from 32 KB to 512 KB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 KB up to 40 KB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power.

Key features

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 8 KB to 40 KB of on-chip static RAM and 32 KB to 512 KB of on-chip ash memory.
- Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus(400 Kbit/s), SPI and SSP with buffering and variable data length capabilities.
- Vectored Interrupt Controller (VIC) with configurable priorities and vector addresses.
- Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
- Up to 21 external interrupt pins available.
- 60 MHz maximum CPU clock available from programmable on-chip PLL with settling time of 100 s.
- On-chip integrated oscillator operates with an external crystal from 1 MHz to 25 Mhz.
- Power saving modes include Idle and Power down.
- Individual enable/disable of peripheral functions as well as peripheral clock.

3.1.6 PIC16F877A

This powerful,200 nanosecond instruction execution yet easy-to-program (only 35 single word instructions). CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC architecture into an 40 pin package and is upwards compatible with the PIC16C5X, PIC12CXXX and PIC16C7X devices. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, 2 Comparators,8 channels of 10-bit Analog-to-Digital (A/D) converter,2 capture/compare/PWM functions. The synchronous serial port can be configured as either 3-wire Serial Peripheral Interface or the 2-wire Inter-Integrated Circuit bus and a Universal Asynchronous Receiver Transmitter (USART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications.

3.1.7 LCD display

The LCD display is used to display various voltages and instructions to users. A liquid crystal is a material (normally organic for LCDs) that will own like a liquid but whose molecular structure has some properties normally associated with solids. A 16*2 LCD means it can display 16 characters per line and there are 2 such lines. LCD each character is displayed 5*7 pixel matrix. This LCD has two registers, namely Command and Data.

The Command register store the command instructions given to the LCD. The Data register stores the data to be displayed on the LCD. The Liquid Crystal Display (LCD) is a low power device. The power requirement is typically in order of microwatts for the LCD. However, an LCD requires an external or internal light source. It is limited to a temperature range of about 0K to 333K and lifetime is an area of concern, because LCDs can chemically degrade.

3. CONCLUSIONS

Here a novel idea is proposed for detecting the position of the vehicle in accident situations and controlling the traffic signals in favor of ambulances during the accidents. With this system the ambulance can be reached to the hospital without time lag. If two ambulance reaches the lane opposite to each other at the same time, priority is given based on FIFO. The probability of the ambulance reaches the lane opposite to each other at the same time is less.

This is effectual to control not only ambulance but also authoritative vehicles. Thus if this system

implemented in countries with large population like INDIA, it can produce better results. It is more accurate with no loss of time. This system can be used in Authoritative vehicle, Defense vehicles in emergency cases, Police vans in emergency cases and Fire extinguishing vehicles.

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