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ROAD SAFTEY AND ACCIDENT PREVENTION SYSTEM

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Abstract: One of the prime reasons for vehicular accidents is due to undetected potholes and road humps.. Another reason for a huge number of accidents is drunk driving. Even a small amount of alcohol in blood can lead to mid-body imbalance. Also, even after an accident occurs timely medical is not given. Due to these reasons numerous lives are lost.

Through this project we will be trying to provide a solution to these problems so that there is better safety for people inside and outside the vehicle. We are trying to achieve this by using transmitter-receiver modules. The transmitter section will be placed near the obstacles on the road which will provide the alert signal. Receiver section on the car will receive this and alert the driver. Drunk driving shall be prevented by an engine-lock system. Also, new potholes can be identified using the ultrasonic sensor which will be placed on the car.

***Index Terms* –Accident Prevention, Alcohol Sensing, Engine lock, Ultrasonic Sensor, Pothole.**

I. INTRODUCTION

Road accidents, as the name itself suggests, are random events that are caused by the interplay of diverse factors relating to the road and its condition, the road users, the vehicles, and environmental conditions. Invariably, a combination of two or more of these factors may lead to accidents. With increase in population, the number of automobiles and modes of transportation have also increased. Heavy economic losses and human misery caused by accidents indicate the need for systematic accident studies.

To begin with, carelessness is one of the major causes of road accidents all over the world. Using the mobile phone while driving, breaking the traffic rules and entering from the wrong side driving are some examples of carelessness. Furthermore, inexperienced and untrained drivers and those with poor eyesight who drive at night are one of the major causes of escalating accident rate. In addition, most of the people drive after drinking alcohol, which may lead to dangerous road accidents.

In this project we are trying to deal with two such scenarios, i.e., Potholes/Humps on the road and drunk driving.

A transmitter-receiver section will be used to alert the driver about upcoming potholes/humps. When the vehicle comes near any potholes/humps, the receiver placed on the vehicle will receive a signal from the transmitter and an alert will be given indicating about the obstacle on the road. Ultrasonic sensor will be used to identify new potholes/humps.

To prevent drinking and driving, a breath analyser will be placed near the driver seat so that if the person has consumed alcohol, the system will detect its presence and lock the engine so that the vehicle will fail to start.

Accident notification system will be done using an accelerometer which will detect the rollover or crash of the vehicle and send the signal to the microcontroller which will activate the send an SOS message to the emergency number via android device.

II. PROBLEM STATEMENT

In India the poor quality of roads and driver carelessness causes hundreds of peoples to lose their lives. In order to prevent and to decrease the number of lives lost in roads due to accidents an advanced and automatic system is to be implemented in every vehicle.

III. EXPECTED OUTCOME

1. The driver will get notified about humps and potholes within a particular range while driving..
2. Ultrasonic sensor will identify new potholes and humps. And location of these are stored in the database to take further steps.
3. The Accelerometer will detect the crashing or roll-over of vehicle during an accident and will send an SOS message including location.
4. The engine-lock system will prevent a drunk person from driving by detecting the presence of alcohol.

IV. METHODOLOGY

Embedded system is any electronic equipment with built in intelligence and dedicated software. All embedded systems use either a microprocessor or a microcontroller. The application of these controllers makes user friendly cheaper solutions and enables to add features otherwise impossible to add features otherwise impossible to provide by other means.

An embedded system is a combination of computer hardware and software designed for a specific function. Embedded systems may also function within a larger system. The systems can be programmable or have a fixed functionality. The software for the embedded system is called firmware. The firmware is written in assembly language for time or resource critical operation or using higher-level languages like C or Embedded C.

In this project we are using **PIC16F877A** Microcontroller. The PIC microcontroller **PIC16F877A** is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses **FLASH memory technology**. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many PIC microcontroller projects. PIC16F877A also have much application in digital electronics circuits**.** It is used in remote sensors, security and safety devices, home automation and many industrial instruments. An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. It is flexible and can be used in areas where microcontrollers have never been used before as in microprocessor applications and timer functions etc.

4.1 Transmitter Section Block Diagram

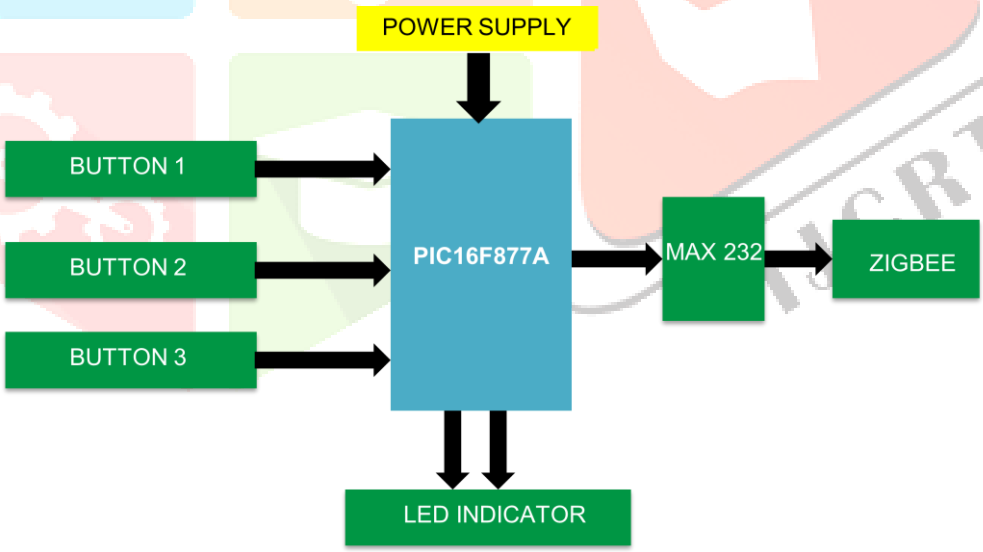

Fig. 1

In the transmitter section we are using a PIC16F877A microcontroller, MAX 232, ZIGBEE, 3 buttons, LED indicators and power supply. The microcontroller is used to control the entire transmitter section and MAX 232 is used for the TTL to RS232 logic conversion. Here we use ZIGBEE for the wireless communication. When the power supply starts to power the system, the PIC microcontroller starts to send signals to the IC MAX 232. The signals are generated according to the mode that we selected using the buttons. When the signals arrived to the MAX 232 it converts the TTL logic signals to RS232 logic and transfer it to ZIGBEE. Then ZIGBEE transmit the signal wirelessly. Here we have 3 modes for this device, the buttons help to select each mode. The modes are Humps, Potholes and Accident-prone area. The 3 LED indicators are used for indicating power supply, whether the program running correctly and transferring of data etc.

4.2 Receiver Section Block Diagram

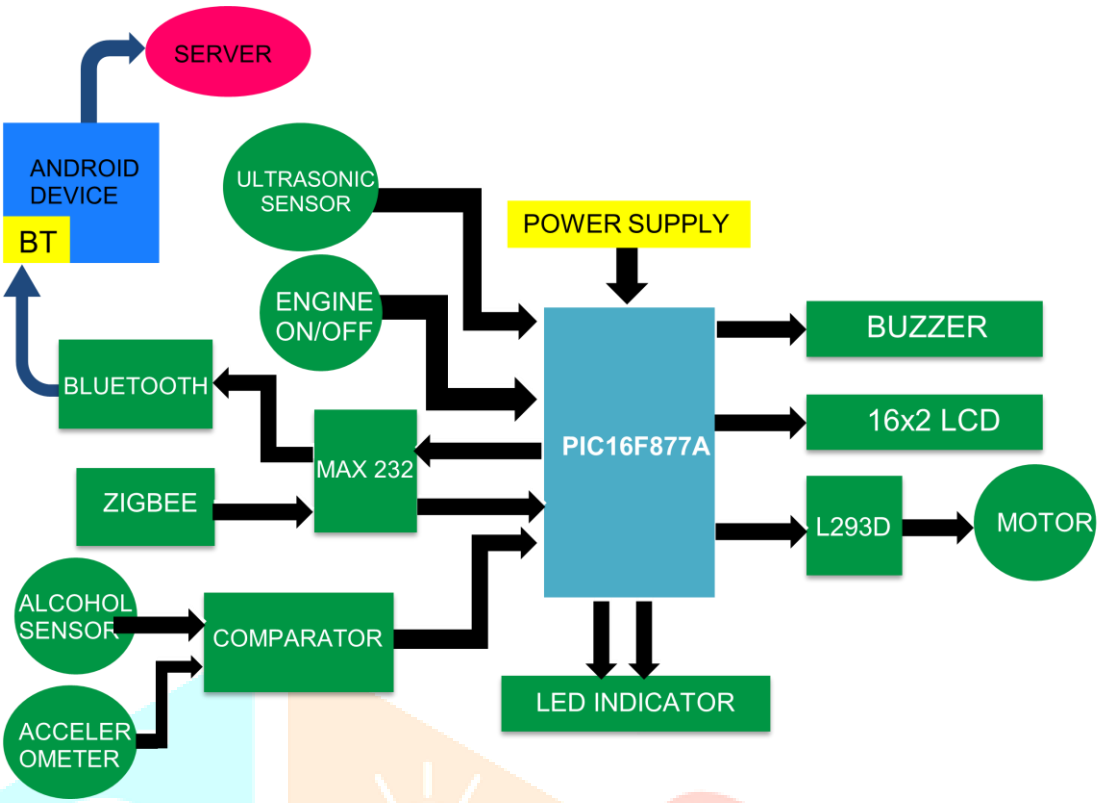

Fig. 2

The receiver section is used to receive the signals that are transmitted through the transmitter. Here in this section, we use PIC16F877A, buzzer, 16*2 LCD display, L293D motor driver IC, a gear motor to represent the vehicle's engine, ultrasonic sensor, MAX 232 IC, ZIGBEE, BLUETOOTH module, alcohol sensor, accelerometer, Lm324 Comparator IC, LED indicators and power supply. We power up the system using power supply then the ZIGBEE receive the signals that are transmitted from the transmitter, and converts it from RS232 logic to TTL logic through the IC MAX232 and transfer it to the PIC microcontroller. The controller process the signal and alert the driver using the buzzer and LCD display. Simultaneously it gives an order to the L293D motor driver IC and controls the motor. The other specification of the system is that it won't allow a driver to start his engine when he was drunk. For that it has an alcohol sensor that senses the presence of alcohol if it detects any content, it passes the information to the microcontroller and the controller turn offs the engine. And another specification of the system is accident prevention. For that we use the accelerometer. The accelerometer detects if any unusual movement happened to the vehicle and send the message to the controller so that it can control the motor using the motor driver IC. There is an ultrasonic sensor in this device to detect the presence of new potholes or humps where we don't put our transmitter on. After detecting it sends the information about potholes to an android device using a Bluetooth module. The android system sends the information to the respected servers for solving the problems like fixing the potholes or putting the transmitter on that area. The LED indicators are used for indicating power supply, whether the program running correctly etc.

V. IMPLEMENTATION

5.1 Circuit Diagram

5.1.1 Transmitter Section Circuit Diagram

The transmitter section module is placed beside a hump or pothole for transmitting signal in 360° direction. When any vehicle comes near to this area, the receiver module placed on the vehicle will automatically receive the signal and message will display on screen. And the alarm will glow. The above circuit diagram consists of Power supply, PIC16F877A microcontroller, MAX232 IC, DB-M connector, Buttons and LED indicators.

The power supply consists of a step-down transformer to reduce the 230V to 12V AC. Then 4 diodes are arranged as a bridge to form a Bridge Rectifier to convert 12V AC into 12V DC. We use an electrolytic capacitor to filter the dc output voltage coming from the rectifier circuit. A 7805 voltage regulator IC produces 5V DC for further applications. Hence the power supply can provide two both 12V and 5V as output. An LED indicator is also there to indicate power ON.

A crystal oscillator is connected to OC1 (13) and OC2 (14) of the PIC Microcontroller to provide a clock to the microcontroller. Here 20MHz of clock frequency is needed to operate PIC16F877A microcontroller. Pin 1 of the PIC microcontroller is called MCLR (Master Clear) and it is connected to +5V DC through a resistor. MCLR acts as a reset pin and is active low, meaning when 0V is given the Microcontroller will reset.

We are using Zigbee for transmitting signals to the receiver. Zigbee works on RS232 logic. So we are using MAX232 IC to convert TTL logic to RS232 logic and vice versa. A MAX232 IC is connected to the TX (25) and RX (26) pins of microcontroller by T1-IN (11) pin and R1-OUT (12) pin of the IC. Zigbee has a DB-F connector that can be connected to a DB-M connector. So a DB-M connector is connected to pin 13 & 14 of MAX232.

Three buttons are connected to I/O pins of PIC Microcontroller for changing the modes of the Transmitter Unit. The modes we intend to implement are Hump, Potholes and Accident-prone area. The buttons are given +5V Dc through 3 resistors each and they are connected to 15, 16, 17 pins of Microcontroller. 2 LEDs are connected to 19th and 20th pins of Microcontroller. These LEDs indicate the running of the program and flowing of data.

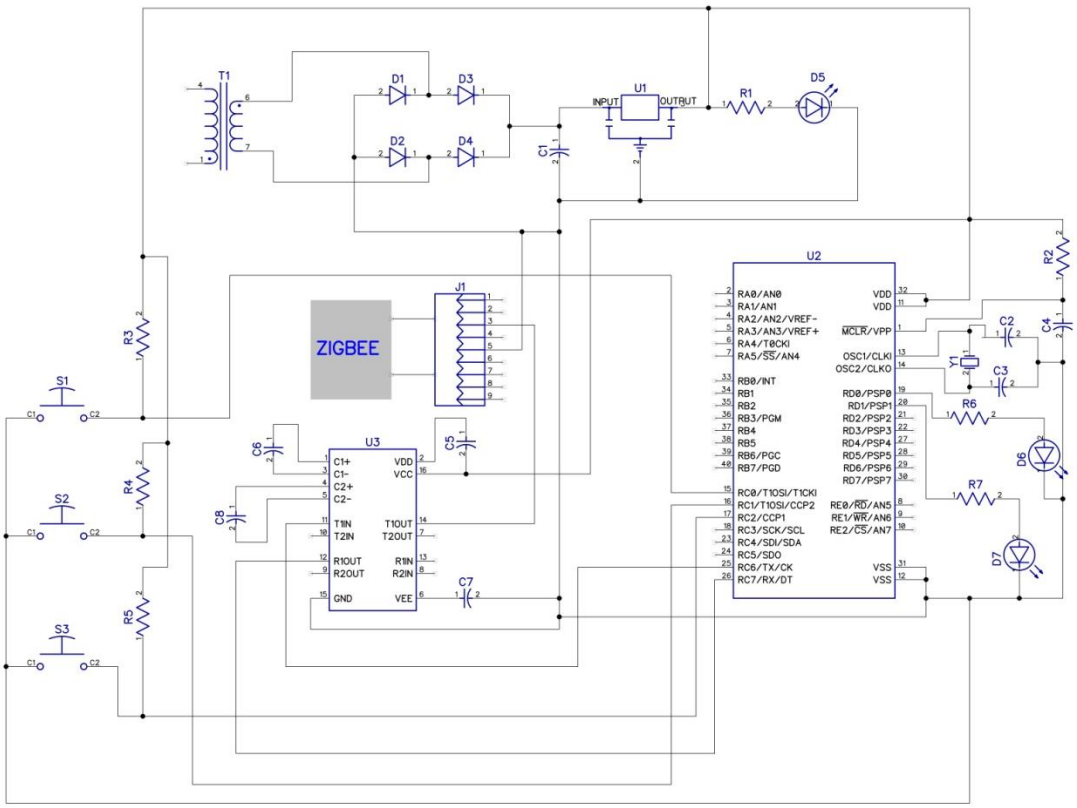

Fig. 3

5.1.2 Receiver Section Circuit Diagram

This receiver section module is placed in the vehicle for receiving the signal transmitted by the transmitter. The above circuit diagram consists of Power supply, PIC16F877A microcontroller, MAX232 IC, DB-M connector, LM324 Comparator IC, L293D Motor Driver IC, Zigbee, Bluetooth, Ultrasonic sensor , Alcohol sensor, Accelerometer, buzzer and LCD display. The power supply consists of a step-down transformer to reduce the 230V to 12V AC. Then 4 diode Bridge Rectifier converts 12V AC into 12V DC. We use an electrolytic capacitor to filter the dc output voltage coming from the rectifier circuit. A 7805 voltage regulator IC produces 5V DC for further applications. Hence the power supply can provide both 12V and 5V as output. An LED indicator is also there to indicate power ON.

A crystal oscillator is connected to OC1 (13) and OC2 (14) of the PIC Microcontroller to provide a clock to the microcontroller. Here 20MHz of clock frequency is needed to operate PIC16F877A microcontroller. Pin 1 of PIC microcontroller is called MCLR (Master Clear). It is connected with a capacitor and resistor and acts as a program reset pin. The 32nd and 11th pin of the microcontroller is connected with 5V supply.

The L293D IC is connected with the motor to control the forward and reverse movement of the motor by the microcontroller. For that we connected 3 I/O pins with 1,2,7 of the L293D for enabling and controlling the forward and reverse movement. The 4th and 5th pin of the L293D is grounded. The motor is connected with 3rd and 6th pin of L293D and 8th & 16th pin is connected with a 12V supply as an operating voltage for both the IC and the motor. Here we are using a 16*2 LCD display. The display has 16 pins on it. The 16th and 15th are for the back light and 1 and 2 for the Ground and VCC respectively. So we short 1 and 16 pin with ground and 15 and 2 with 5V supply. 7 to 14 pins of the display are data bus, and are connected serially with the 8 I/O pins of the PIC microcontroller for sending and receiving data. And the 6th pin (Enable pin) is connected with the microcontroller for enabling the display. The 5th pin is a R/W pin, here we only need the write operation so we ground the pin. The 4th pin is a register select (RS) pin to determine whether we are sending command or data to LCD. The 3rd pin (CONTR) is for adjusting the contrast of the display so we connect that pin with a variable resistor. For making the alert system more effective we place a buzzer in the circuit. The one end of the buzzer is connected with the 5V supply and the other end is connected with the collector side of the transistor. The emitter side is connected with ground. The base is connected with an I/O pin of the microcontroller when the microcontroller emits a 1 the transistor gets a connection between emitter and collector so that the circuit of the buzzer gets completed and it makes beep sound.

Here we use an accelerometer for finding whether the vehicle met with an accident or not. The accelerometer generates a 1.6V while it is in normal condition. Here we use a LM324 for amplifying and comparing the output. For the non-inverting side of the first OP-AMP is set to a 2.2V with a pot and inverting pin of 2nd OP-AMP is set to a 0.8V with a pot and the inverting of first and non-inverting of second OP-AMP is connected with the output of the accelerometer. When the vehicle met with any kind of accidents the accelerometer produces a voltage greater than 2.2V or less than 0.8V, so either the OP-AMP gives an output as one. The both output of OP-AMP is connected with two ADC I/O pins of microcontroller. When the OP-AMP outputs a one it means

the vehicle met with an accident. After that the program that we inserted in the PIC microcontroller inform the emergency number by SMS through an Android Device about the accident. The other OP-AMP in the LM324 is connected with the alcohol sensor to sense whether the driver is drunk or not. The circuit contains a switch used to start the rotation of the motor, if the alcohol sensor gives an output by sensing the presence of alcohol, then the OP-AMP sends an output to the microcontroller so that it can stop the rotation of the motor by commanding the driver IC to do so.

We connected the ultrasonic sensor with the ADC I/O pin of the microcontroller to detect the new potholes in the road. After detecting deeper holes in the road greater than threshold value set in the program the ultrasonic sensor will output a data to PIC microcontroller. The microcontroller sends these data into the database by the help of an Android Device via Bluetooth. The data about new potholes is shared with authorities for taking suitable actions.

The Zigbee wireless communication module helps to transmit and receive the data about humps/potholes/accident prone area in the road. MAX232 IC converts RS232 logic data from Zigbee to TTL logic.

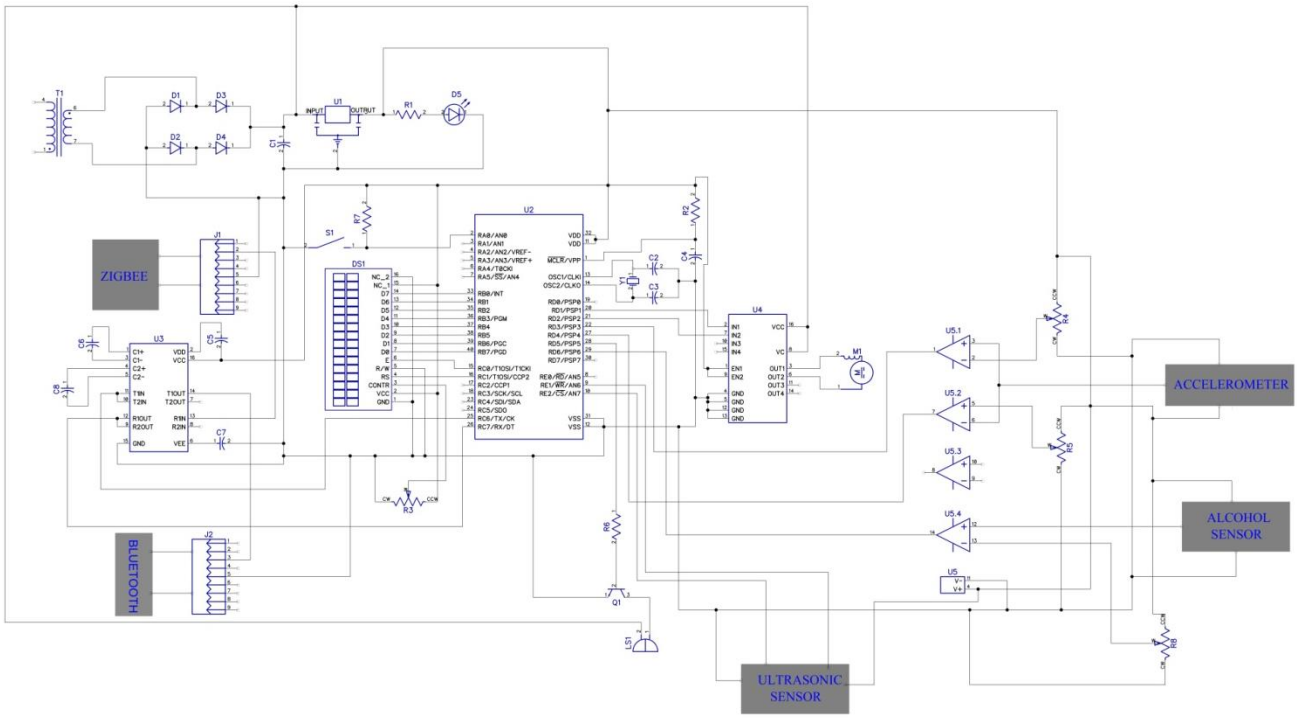

Fig 4

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VI. RESULT

1. The driver gets notified about the humps/potholes/accident prone area when the vehicle come in range (20m) with transmitter module placed on the road.

2. The Ultrasonic sensor identifies new potholes in roads and location of these potholes are send through PIC16F877A to be stored in the database.

3. The Accelerometer detects the crashing or roll-over of vehicle during an accident by the tilting of accelerometer in the prototype and sends an SOS message including location to the emergency number via Android application.

4. After detecting the presence of alcohol content by Alcohol sensor the driver cannot turn ON the vehicle.

VII. COCLUSION

- We have looked into various causes of road accidents and tried to come up with a solution for a few of them.
- Implementing a Road Safety and Accident Prevention system will be useful to reduce the number of such accidents at the very least even though there can't be a complete solution to this.
- Determination of different components for the hardware section has been done.

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