



AN EMBEDDED BASED SYSTEM FOR PREVENTING ACCIDENTS DUE OF DRUNK AND DRIVE

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ABSTRACT

Drunk and drive is one of the basic reasons for vehicle accident. Many lives could have been saved if emergency service could get accident information and reach in time. Nowadays, GSM and sensors has become an integral part of a vehicle system. This paper analyses the capability of a GSM Transmitter to send the message to detect accident basing on monitored speed and send accident location to an Alert Service Center. The Alcohol sensor will monitor a vehicle owner whether consumed alcohol in every second through a Microcontroller Unit. Whenever the alcohol and cell phone signal is detected, it will assume that an accident can be occurred. The system will then send the accident location acquired from the GPS along with the time and the speed by utilizing the GSM network. This will help to reach the rescue service in time and save the valuable human life.

1.1 INTRODUCTION

Mobile phones may have brought instant communication within the reach of all, but they are also fast turning into a global killer, accounting for 20 percent of fatal road accidents worldwide annually, half of which are on Indian highways alone. Every year nearly 1.4 million people have been killed because of they are wireless customers and their over-bearing cell phones. Majority of accidents, which occur, are due to drunk driving and using mobile phones while driving. So far, there is no effective mechanism to prevent this. While in India, an estimated 1.35 lakhs person died due to road accident in 2010, which is approximately 10% of road accident fatalities worldwide and these

figures are the highest in the world. But still no research has been carried out to find the number of drivers using cell phone involved in road accident and very limited efforts has been carried out to prevent accident due to cell phone usage while comparing to drunk and drive. With India reporting as many as 1.34 lakh fatalities in road accidents every year, a vast 70 per cent of them being due to drunken driving. With the aim of preventing such accidents, it is proposed to develop a highly efficient automatic system for early detection of incoming and outgoing call and alcohol consumed drivers. Here an integrated system was designed for the same purpose. This is specially designed to safeguard the students, who are travelling in school or college vehicles. The system is foolproof and the driver cannot tamper with it easily.

1.2 OBJECTIVES

- i. The main objective of the proposed system is to prevent accidents because of drunk driving and mobile phone using while driving.
- ii. To implement a system with embedded controller to provide safety in vehicles especially on colleges and schools vehicle.
- iii. To design and utilize active precise control system on vehicle unit to maintain secure driving using sensors and controller.

3. SYSTEM DESCRIPTION

3.1 SYSTEM BLOCK DIAGRAM

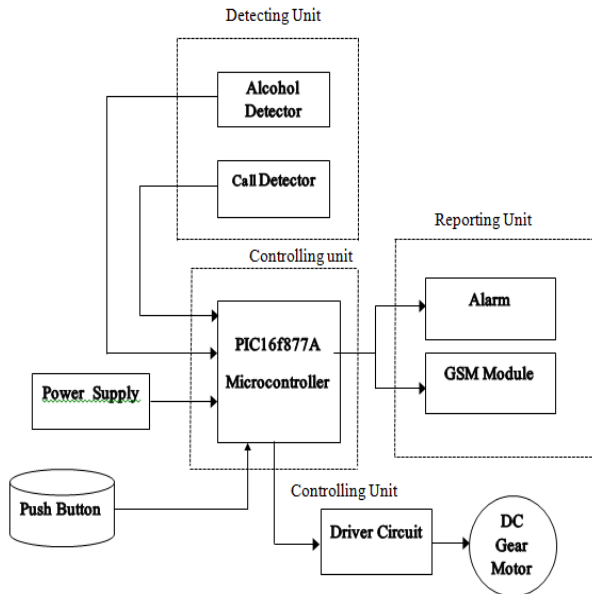


Figure 3.1 Block Diagram of Accident Prevention System

3.2 BLOCK DIAGRAM DESCRIPTION

The system consists of five units:

1. DETECTION UNIT
2. CONTROL UNIT
3. REPORT UNIT
4. POWER SUPPLY
5. DC GEAR MOTOR

3.2.1. DETECTION UNIT

The project includes parallel detection of driver's status whether he is consuming alcohol or using mobile phone. BAC (Blood Alcohol Concentration) level in the driver's body is detected by means of alcohol sensor. Thus the alcohol level of the driver is continuously monitored and calibrated on a scale. When it exceeds a particular limit the fuel supply is cutoff.

A call detector circuit is designed and used to capture the RF signal of the mobile phone used by the driver. Indicators are used to indicate the detection of call.

3.2.2. CONTROL UNIT

The controller used in this project is PIC16F877A microcontroller. The detection outputs were given to the microcontroller as inputs. When the input (detection unit) is high, the controller works according to the program, we had written in.

3.2.3. REPORT UNIT

A SMS which contains the situation of the driver either he is drunk and driving or using mobile while driving is sent via a GSM module to the first level of management (means bus authority of an organization) and next to police control room to report the police.

3.2.4. POWER SUPPLY

Each and every electronic circuit requires power supply to perform its function. Microcontroller PIC16F877A needs 5V power supply. DC gear motor works on 12V. So, Driver circuit is used between power supply and the gear motor.

3.2.5 DC GEAR MOTOR

For demo purpose DC gear motor is used. In real time, engine's fuel plug is cut off. To indicate vehicle start/stop dc gear motor is included in the system.

3.3 FLOW CHART OF ACCIDENT PREVENTION SYSTEM

The flow chart is the schematic sequence, with which the project works. When the push button is set (similar to the key start in vehicle), the whole set up will on. The motor starts rotating. The two sensing unit will start which are detecting the alcohol smell and the call detection

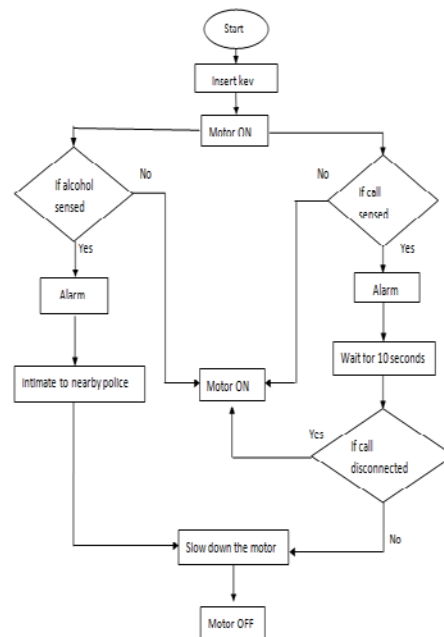


Figure 3.2 Flow Chart of Accident Prevention System

3.4 FLOW CHART DESCRIPTION

The alcohol sensing is done through the alcohol sensor MQ6. If some sort of alcohol is sensed means, then the alarm will indicate that, the driver should stop the vehicle in the safer side. If the driver is consuming alcohol and driving the vehicle, then the motor will stop and send message to the authority. This messaging will done with the help of GSM.

The next sensing process is the call detection. The call may be either incoming or outgoing call, even the mobile phone is switched off. The antenna is used to detect the RF signal. An amplifier is use to amplify the signal. The buzzer and LED is used to indicate that the call is activated. The set up will wait for 1 minute, to disconnect the phone. If the call does not disconnected then the motor will stop and the message will send to the corresponding authority.

4. HARDWARE AND SOFTWARE DESCRIPTION

4.1 HARDWARE DESCRIPTION

4.1.1 POWER SUPPLY

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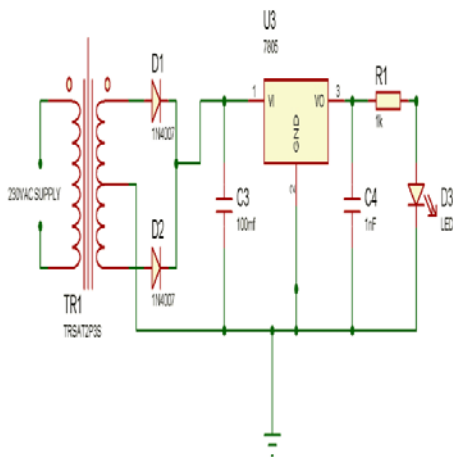


Figure: 4.1Power supply circuit diagram

4.1.1.1OPERATION

The circuit employed in our project requires 5V. Hence we designed the power supply unit to produce 5V. The transformer is fed with 230V A.C which is step down

to 24V. This 24V is applied as input to Full wave Rectifier which converts A.C into D.C. In order to satisfy our requirement we use IC 7805 for regulating purpose. The capacitors are used to remove ripples in the circuit. Finally for indication purpose a Light Emitting Diode is used.

4.1.2 ALCOHOL DETECTOR

This model is suitable for alcohol detection such as portable breath alcohol checker or ignition locking system in automobiles. Gas sensitive semiconductor material is a mini bead type and a heater coil and electrode wire are embedded in the element. The sensing element is installed in the metal housing which uses double stainless steel mesh (100 mesh) in the path of gas flow. The mesh is an anti-explosion feature.

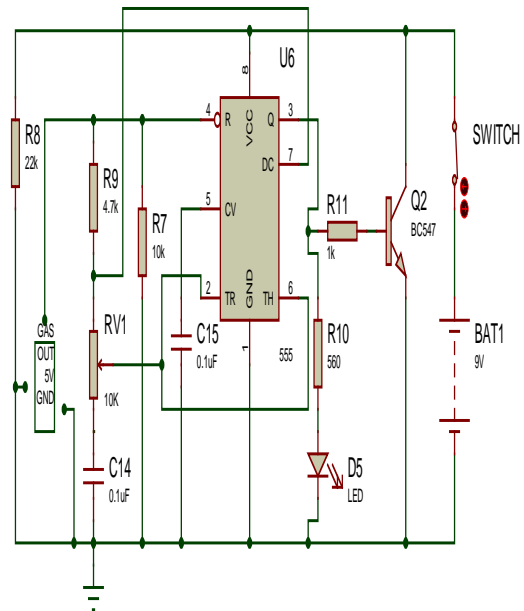


Figure:4.2 Alcohol detector circuit

4.1.2.1 MQ-6 ALCOHOL SENSOR

Sensitive material of MQ-6 gas sensor is SnO₂, which with lower conductivity in clean air. When the target combustible gas exist, The sensor's conductivity is more higher along with the gas concentration rising.

MQ-6 gas sensor has high sensitivity to Propane, Butane and LPG,also response to natural gas.



Figure 4.3 MQ-6 Alcohol Sensor

The sensor is used to detect effectively different combustible gas, especially Methane, it is with low cost and suitable for different application. It is a portable and has a simple driver circuit.

4.1.2.2 IC 555

The IC555 is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation the time is precisely controlled by one external capacitor and resistor. For a stable operation as an oscillator, the free running frequency or duty cycle are accurately controlled by two external resistors and one capacitor.

4.1.2.3 OPERATION

The IC555 operates in astable mode. In this mode if the input is low then the output is high and vice versa. The resistor 10 Kilo Ohm is fixed to the input pin 2 in order to maintain the input at high level. The input becomes low and hence the output is high and it is indicated by a Light Emitting Diode.

Output pin 3 of IC 555 is connected to LED1 and speaker-driver transistor SL100 through current-limiting resistors R_5 and R_4 , respectively. LED1 glows and the alarm sounds to alert the user of gas leakage. The pitch of the tone can be changed by varying preset VR_1 . Use a suitable heat-sink for transistor SL100.

Each time there is ALCOHOL concentration of 1000 ppm (parts per million) in the area, the OUTPUT pin of the sensor module goes high.

4.1.3 CALL DETECTOR CIRCUIT

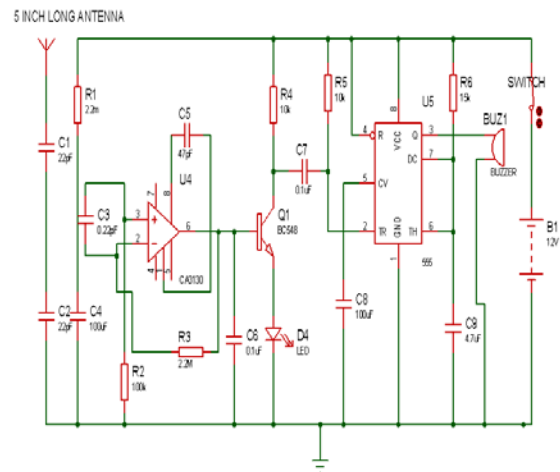


Figure: 4.4 Call detector circuit

One of the main aim of our project is to detect whether the driver is using mobile phones while driving. So we use this call detector circuit. The circuit can detect both incoming and outgoing calls even if the mobile phone is kept in the silent mode. The moment the bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases.

The circuit can detect both incoming and outgoing calls, SMS and video transmission even if the mobile phone is kept in the silent mode. The moment the bug detects RF transmission signal from an activated mobile phone, it starts sounding a beep alarm and the LED blinks. The alarm continues until the signal transmission ceases. An ordinary RF detector using tuned LC circuits is not suitable for detecting signals in the GHz frequency band used in mobile phones. The transmission frequency of mobile phones ranges from 0.9 to 3 GHz with a wavelength of 3.3 to 10 cm. So a circuit detecting gigahertz signals is required for a mobile detector.

4.1.3.1 IC CA3130

CA3130 are op amps that combine the advantage of both CMOS and bipolar transistors. Gate-protected P-Channel MOSFET (PMOS) transistors are used in the input circuit to provide very-high-input impedance, very-low-input current, and exceptional speed performance. The use of PMOS transistors in

the input stage results in common-mode input-voltage capability down to 0.5V below the negative-supply terminal, an important attribute in single-supply applications.

A CMOS transistor-pair, capable of swinging the output voltage to within 10mV of either supply-voltage terminal (at very high values of load impedance), is employed as the output circuit.

The CA3130 Series circuits operate at supply voltages ranging from 5V to 16V, ($\pm 2.5V$ to $\pm 8V$). They can be phase compensated with a single external capacitor, and have terminals for adjustment of offset voltage for applications requiring offset-null capability. Terminal provisions are also made to permit strobing of the output stage.

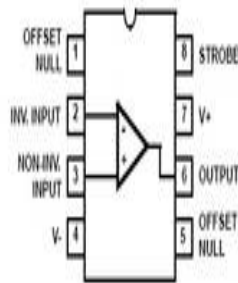


Figure: 4.5 Pin configuration of IC CA3130

4.1.3.2 OPERATION

Op-amp IC CA3130 (IC1) is used in the circuit as a current-to-voltage converter with capacitor C_3 connected between its inverting and non-inverting inputs. It is a CMOS version using gate-protected p-channel MOSFET transistors in the input to provide very high input impedance, very low input current and very high speed of performance. The output CMOS transistor is capable of swinging the output voltage to within 10 mV of either supply voltage terminal.

4.1.3.3 IC 555

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The IC555 operates in mono stable mode. In this mode if the input is low then the output is high and vice versa. The resistor 10 Kilo Ohm is fixed to the input pin 2 in order to maintain the input at high level. The input becomes low and hence the output is high and it is indicated by a Light Emitting Diode.

4.1.4 MICROCONTROLLER

The microcontroller is the heart of the project. Microcontroller PIC16F877A is one of the PIC Micro Family microcontroller which is popular at this moment, start from beginner until all professionals. Because very easy usage of PIC16F877A and use FLASH memory technology so that can be write-erase until thousand times. The superiority this RISC Microcontroller compared to with other microcontroller 8-bit especially at a speed of and its code compression. PIC16F877A have 40 pin by 33 path of I/O.

4.1.5 DRIVER

The ULN 2003 A is used as a driver IC in our project. It consists of seven Darlington pairs. The output voltage is 50 Volts and output current is 500 milliamps.

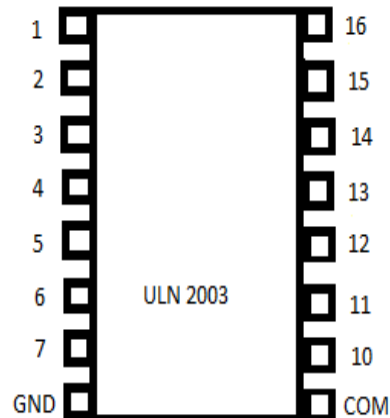


Figure: 4.8 Pin configuration of ULN2003A

It is a 16 pin plastic DIP packages with a copper lead frame to reduce thermal resistance. Pin 1 to 7 is input and pin 10 to 16 is output. They are versatile devices useful for driving a wide range of loads including solenoids, relays and DC motors.

4.1.6 DCGEAR MOTOR



Figure: 4.9 Diagram of DC Gear Motor

The DC motor works over a fair range of voltage. The higher the input voltage more is the RPM (rotations per minute) of the motor. For example, if the motor works in the range of 6-12V, it will have the least RPM at 6V and maximum at 12V. Geared DC motors can be defined as an extension of DC motor. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction.

4.1.7 GSM

GSM/GPRS RS232 Modem is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem.

The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serialport. The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface.

The modem needed only 3 wires (Tx, Rx, GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power

supply (4.2V -13V) with this modem be able to send & Read SMS, connect to internet via GPRS through simple AT commands.

This modem can operate at both TTL 3.3V and 5V Logic Level hence making it suitable for controllers at 5V logic level (PIC) and while interfacing depending upon the controller's logic level we should give appropriate voltage to the V-interface pin of the modem like 3.3V or 5V (should be in the range 2.5-6V) and power the modem with supply range (5V-12V).

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your M2M application, especially for slim and compact demand of design.

4.2 SOFTWARE DESCRIPTION

4.2.1 MPLAB IDE

MPLAB is a free integrated development environment for the development of embedded applications on PIC and dsPIC microcontrollers, and is developed by Microchip Technology.

MPLAB is designed to work with MPLAB-certified devices such as the MPLAB ICD 3 and MPLAB REAL ICE, for programming and debugging PIC microcontrollers using a personal computer. PICKit programmers are also supported by MPLAB.

4.2.2 PROTEUS SOFTWARE

Proteus is a best simulation software for various designs with microcontroller. It is mainly popular because of availability of almost all microcontrollers in it. So it is a handy tool to test programs and embedded designs. Simulation programming of microcontroller is carried out in Proteus Simulation Software.

5. CIRCUIT DIAGRAM

5.1 CIRCUIT DIAGRAM OF ACCIDENT PREVENTION SYSTEM

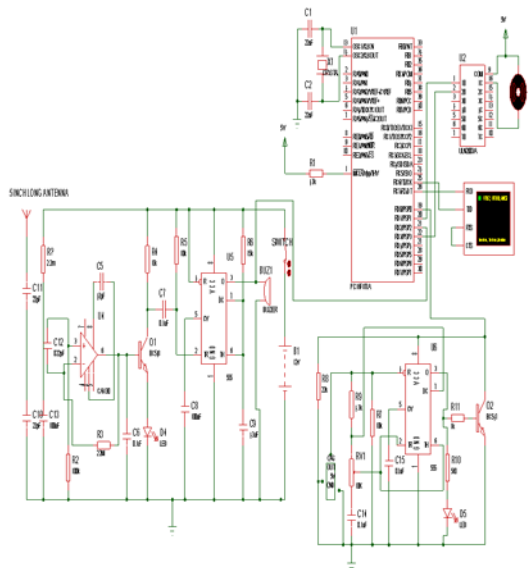


Figure: 5.1 Circuit Diagram

5.2 CIRCUIT DIAGRAM DESCRIPTION

In the project PORT-D and PORT-C are used. Totally, six pins are used for input and output purpose, in which two pins for input operation and 4 pins for output operation.

For input, 19th and 21st pins are assigned. Where 19th pin of pic microcontroller was connected to the alcohol sensing circuit and 21st pin of pic was connected with the call detector circuit.

The outputs were getting from 20, 22, 25, 26 numbered pins. The motor control was taken by the pins 20 and 22, which are of D ports family. GSM can be connected with pic via the pins 25 and 26 only. The RX and TX pins of the pic was connected with the RX and TX pins of the GSM module.

The power supply was connected to the 11th and 32nd pin of the pic microcontroller. 12th and 31st pin of the microcontroller was connected to the ground.

The power supply provides the 5V to the microcontroller PIC16F877A, with which the IC is activated. The call detector circuit is connected to the 21st pin of microcontroller, works on mono stable multi vibrator mode. The radio frequency signal is captured by the

antenna and amplified by the CA3130 amplifier. The amplified signal is given to the 2nd pin of IC555 timer. The output from the IC555 is taken from the 3rd pin. The buzzer and LED is connected in this pin along with there is a connection to the 21st pin of controller. If high voltage from the call detector circuit is detected, the motor will stop and the GSM is activated to send the reporting message to the corresponding authority

Similarly, the alcohol detection takes place by means of MQ-6 Alcohol detector. The output of the detector circuit is given to the 19th pin of the microcontroller PIC16F877A. If high voltage from the call detector circuit is detected, the motor will stop and the GSM is activated to send the reporting message to the corresponding authority

6. SYSTEM OPERATION

The alcohol detector circuit is used to determine presence of alcohol in driver's breathing. This circuit helps to prevent accidents due to drunk and drive and if such alcohol consumption is detected.

BAC (Blood Alcohol Concentration) level in the driver's body is detected by means of alcohol sensor. Thus the alcohol level of the driver is continuously monitored and calibrated on a scale. When it exceeds a particular limit the fuel supply is cutoff.

The setup automatically sends the message to the first level of authority, if it continues to 3 times, then, it sends message to the higher level of authority using GSM.

A call detector circuit is designed and used to capture the RF signal. Indicators such as LED and buzzer are used to indicate the detection of call. A SMS which contains the situation of the driver either he is drunk and driving or using mobile while driving is sent via a GSM module to the first level of management (means bus authority of an organization) and next to police control room to alert the police.

This project is implemented in the school and college buses. So that, we can get the status of the driver. If he is using the mobile phone frequently or driving while consuming alcohol, is detected. It is send to the bus authority of the organization, by means of the GSM. On further illegal driving, the set up will report to the higher authority.

7.FABRICATION & WORKING MODEL

7.1 RESULT

The project “PREVENTING ACCIDENTS DUE TO DRUNKEN AND CALL ATTENDEES” was designed such that to reduce the number of accidents which was caused by the drivers who consuming alcohol and using mobile phones while driving was controlled by the Microcontroller.

7.1.1PROJECT SETUP

The power supply provides the 5V to the microcontroller PIC16F877A, with which the IC is activated. The call detector circuit is connected to the 21st pin of microcontroller, works on mono stable multi vibrator mode. The radio frequency signal is captured by the antenna and amplified by the CA3130 amplifier. The amplified signal is given to the 2nd pin of IC555 timer. The output from the IC555 is taken from the 3rd pin. The buzzer and LED is connected in this pin along with there is a connection to the 21st pin of controller. If high voltage from the call detector circuit is detected, the motor will stop and the GSM is activated to send the reporting message to the corresponding authority

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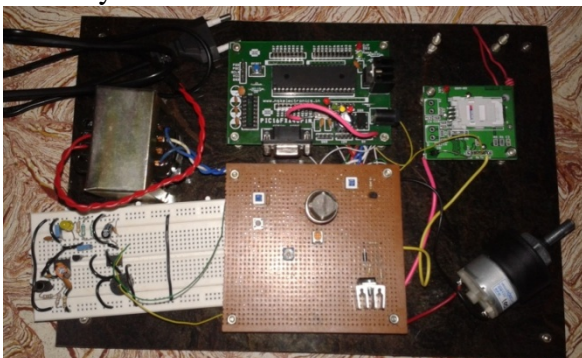


Figure 7.1 Project setup

7.1.2 CALL DETECTOR OUTPUT

The call detector circuit is connected to the 21st pin of microcontroller, works on mono stable multi vibrator mode. The radio frequency signal is captured by the antenna and amplified by the CA3130 amplifier. The amplified signal

is given to the 2nd pin of IC555 timer. The output from the IC555 is taken from the 3rd pin. The buzzer and LED is connected in this pin along with there is a connection to the 21st pin of controller. If high voltage from the call detector circuit is detected, the motor will stop and the GSM is activated to send the reporting message to the corresponding authority



Figure 7.2 Call detector output – Outgoing call

The above image shows the call detector output for Outgoing call . The LED is glowing as well as the Buzzer starts beeping. The antenna fetches the radio frequency signal of the mobile phone at the time of making call. Amplifications are made through the CA3130 IC, and thus the call was detected.

.The above image shows the call detector output for Incoming call . Indicators such as the LED is glowing as well as the Buzzer starts beeping. The antenna fetches the radio frequency signal of the mobile phone at the time of receiving call. Amplifications are made through the CA3130 IC, and thus the call was detected.



Figure 7.4 Call detector output – Reporting unit

Thus, Call detector circuit detects the incoming as well as outgoing calls and the reporting unit (GSM) works accordingly as shown in the image. The motor also stops, which indicating the vehicle stop condition.

7.1.3 GSM OUTPUT

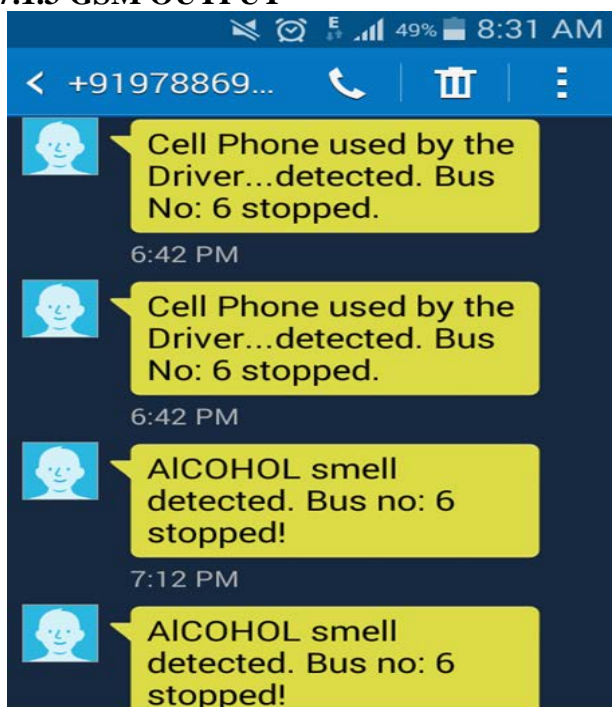


Figure 7.1.3 GSM output-Screenshot

The above image illustrates the output of GSM module in which both the alcohol detection and the call detection messages are reported to the corresponding authority.

8. ADVANTAGES AND APPLICATIONS

9.CONCLUSION AND FUTURE SCOPE

9.1 CONCLUSION

This project creates a new way for saving human life from the irresponsible drivers who does not know their responses.It also involves the reporting unit, in which the higher officials know about the status of their organization drivers. It will surely reduce the death rate to considerable extent.

9.2 FUTURE SCOPE

The project setup should be included in all types of vehicles, to reduce the accidents. The reporting unit can include the mobile number of the nearby police or respective authorities accordingly.

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