

Design and Implementation of Alcohol Detector and Accident Detection System using GSM Modem

Daw Khaing Zar Win

Lecturer, Faculty of Precision Engineering, University of Technology,
Yatanarpon Cyber City, Pyin Oo Lwin, Myanmar

How to cite this paper: Daw Khaing Zar Win "Design and Implementation of Alcohol Detector and Accident Detection System using GSM Modem" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-5, August 2019, pp.1086-1090, <https://doi.org/10.31142/ijtsrd26595>



Copyright © 2019 by author(s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



The high demand for automobiles has also increased traffic hazards and road accidents. The numbers of accidents are also getting increased even though many accidents are minor but due to lack of first aid and the reach of the ambulance to the spot is late and there is a large number of people are losing a life every day. To reduce the number of people losing a life, in the proposed system, the information is sent automatically to the ambulance and the ambulance will reach the spot fast. And can save human life and reduce the number of people dying every day.

This design is a system which can detect accidents in significantly less time and sends the basic information within a few seconds covering geographical coordinates, in which a vehicle accident occurs. This alert message is sent to the rescue team in a short time which will help in saving the valuable life.

The proposed system is mainly composed of PIC microcontroller, MQ3-Alcohol gas sensor, vibration sensor, GSM modem and GPS module. Other necessary components are 16x2 Line LCD, Buzzer, DC Motor, Relay, Voltage regulator and battery. The overall block diagram of the system is shown in Figure 1. The inputs of the microcontroller are alcohol sensor, vibration sensor, GPS module and switch. The outputs of the microcontroller are buzzer, relay and GSM modem.

ABSTRACT

Nowadays, the number of vehicles is increasing significantly every year. Many accidents are occurring because of the alcohol consumption of the driver. After drinking alcohol, driving is the most reason for accidents in almost all countries all over the world. Therefore, alcohol detection system and automatic finding car accident place using GSM modem and GPS are presented in this paper. The combination purpose of alcohol detection and car accident detection systems is to save human life. If the car driver drinks alcohol, the alcohol sensor will sense alcohol concentration, will display it on the LCD and will turn off the car engine. In the accident detection system, the vibration sensor senses vibration when an accident occurs. If the sensor senses the car accident, the vibration sensor will give the digital output to the microcontroller. By using the GPS module, the latitude and longitude of the place where the accident happened are sent by message to the assigned phone number through the SIM900 GSM Modem. By implementation of this system, human beings can be protected from harm and other non-desirable outcomes on road accidents.

KEYWORDS: microcontroller; sensor; GPS; GSM modem; road accident

I. INTRODUCTION

Nowadays, numbers of vehicles are a significant increase every year and many accidents are occurring because of the alcohol consumption of the driver. Alcohol Detector in-car system is designed for the safety of the people inside the car.

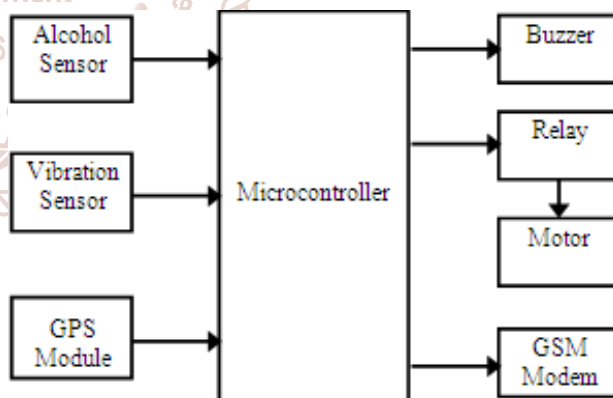


Figure1. Overall block diagram of the system

II. OPERATION OF THE SYSTEM

The proposed system has two portions for road safety and protection. The alcohol detection and accident detection. In alcohol detection portion, the system will check the driver was drinking alcohol or not. In the accident detection portion, the system will send a message to a mobile phone if the accident occurred.

When the driver opens the car key, LCD will be active and the engine will be stopped. If the driver drunk alcohol, the alcohol sensor senses alcohol molecules and displays it on the LCD and car engine will not be started. Otherwise, the engine will be started. In this system, the MQ3 sensor is used

for an alcohol detector. And the starter motor is used as a car engine. If some accident occurs while driving the car, the vibration sensor will sense vibration by measuring vibration wave. And the sensor will give the digital output to the microcontroller, PIC18f452. By using a GPS module, the latitude and longitudinal of the place where the car accident happens are sent by message to the assigned phone number through the GSM modem. The flow charts of alcohol detection and accident detection are shown in Figure 2 and Figure 3 respectively.

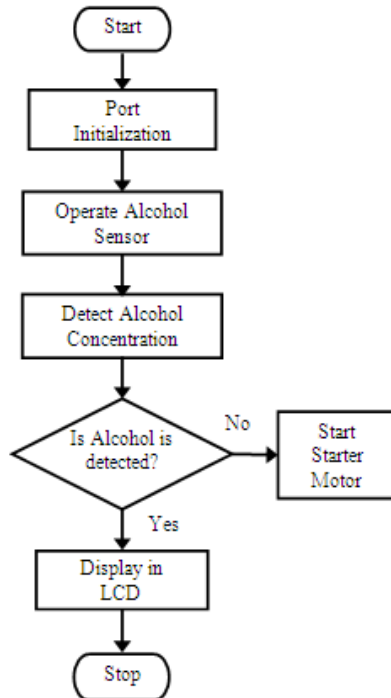


Figure2. Flow Chart of Alcohol Detection System

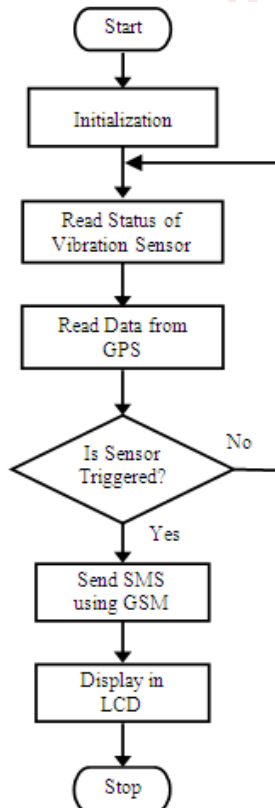


Figure3. Flow Chart of Accident Detection

III. HARDWARE COMPONENTS

A. PIC18F452 Microcontroller

A microcontroller is a microprocessor system which contains data and program memory, serial and parallels I/O, timers, and external and internal interrupts and all are integrated into a single chip. There are about 40 pins in PIC18F452 microcontroller. It consists of three independent timers/counters, two capture/compare/pulse width modulation (PWM) modules, two serial communication modules, eight (10bit A/D converter) channels and 256 bytes Electrically Erasable Programmable Read-Only Memory (EEPROM). The PIC18f452 has five parallel ports named PORTA (8 pins), PORTB (8 pins), PORTC (8 pins), PORTD (8 pins), and PORTE (4 pins). Most ports pins have multiple functions. For example, PORTA pins, PORTB pins and PORTE pins can be used as parallel inputs-outputs or analog inputs. PORTC pins can be used as parallel inputs-outputs or as Universal Synchronous/Asynchronous Receiver/ Transmitter (USART) function. The PIC18f452 microcontroller has 368 bytes of Random Access Memory (RAM). It also contains a 256 bytes EEPROM memory where each byte can be programmed and erased directly by applications software. Pin diagram of PIC PIC18f452 microcontroller is shown in Figure 4.

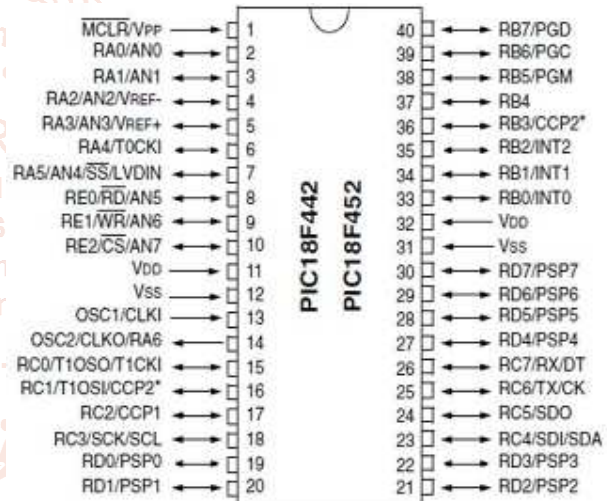


Figure4. Pin-diagram of PIC18F452

B. GSM Modem

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, it can be a mobile phone that provides GSM modem capabilities. A GSM modem exposes an interface that allows applications and now SMS to send and receive messages over the modem interface. In the proposed system, GSM SIM 900 module is used to send a message to the mobile phone when the accident occurred.

GSM SIM 900 module is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as a plug-in GSM Modem. The Modem is designed with 3V/5V TTL interfacing circuitry, which allows to directly interface to 5V microcontrollers (PIC, Arduino, AVR etc.) as well as 3V Microcontrollers (ARM, ARM Cortex XX, etc.). The baud rate can be configurable from 9600-115200 through AT command. Figure 5 shows the SIM900A V4 GSM/GPRS Wireless Extension Module.



Figure5. SIM900A V4 GSM/GPRS Wireless Extension Module

C. Alcohol sensor MQ-3

MQ-3 Gas sensor module uses the MQ-3 gas sensor which is sensitive to alcoholic vapors and thus can be used to detect the density of an alcoholic vapor. Its sensitive material is SnO₂. When the alcohol concentration in the air increases the sensor conductivity will increase accordingly and the module will convert the change of conductivity to analog signals. The sensitivity can be adjusted by the potentiometer. The output voltage of the module is nonlinear but close to linear to the concentration of alcoholic vapors. When the target alcohol gas exists, the sensor's conductivity is higher along with the gas concentration rising. MQ-3 Alcohol Gas Module is shown in Figure 6.

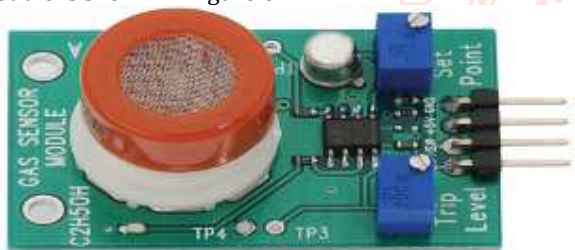


Figure6. MQ-3 Alcohol Gas Module

D. GPS Module

GPS devices may provide facilities such as Maps, including streets maps, displayed in human-readable format via text or in graphical format turn by turn navigation directions to a human in charge of a vehicle or vessel via text or speech, direction fed directly to an autonomous vehicle such as a robotic probe. Based on the type of computer and available connectors, connections can be made through a serial, USB cable or Bluetooth, Compact Flash, SD, PCMCIA, and the newer Express card. GPS module is perfect for applications involving navigation, tracking or surveying. GPS module requires 5V power and 40mA current. It also has -159dB sensitivity. In this system, the GPS module is used to locate the place of the accident occurred. Figure 7 shows the GPS module which is used in this system.



Figure7. GPS Module

E. Vibration Sensor

The vibration module based on the vibration sensor SW-420 and Comparator LM393 to detect if there is any vibration that beyond the threshold. The threshold can be adjusted by the on-board potentiometer. When there is no vibration, this module output logic LOW the signal indicates LED light, and vice versa. The SW-420 vibration sensor is shown in Figure8.



Figure8. Vibration Sensor

F. C Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. In this system, DC motor is used as a starter motor of the vehicle. Figure 9 shows a DC motor which is used in this system.



Figure9. DC Motor

G. LCD (16x2 Lines)

The Liquid Crystal Display (LCD) is used to display the data. (16x2) LCD that means that it can display the two lines containing 16 characters each. To control the operation of LCD, three control signals are used which are EN (Enable), R/W (Read/Write), RS (Register Select). The 2 bits LCD is used to show flame and gas sensors situation.



Figure10. LCD (16x2 Lines)

IV. IMPLEMENTATION AND TESTS

A. Circuit Design for Alcohol Detection

The MQ3 sensor is used to detect drinking alcohol and send data to the microcontroller. The buzzer is used to warn if a driver has drunk alcohol. The microcontroller is used to control the alcohol detection system. Alcohol sensor is connected to the port A0 pin of the microcontroller, the buzzer is connected with port D3 pin and motor is connected to the port D2. LCD is connected with port B pins of the microcontroller. RS, EN, D4, D5, D6, D7 pins of LCD is connected with port B7, B6, B5, B4, B3 and B2 pins of the

microcontroller. Alcohol sensor will give the analog output to the microcontroller and microcontroller will convert analog to digital. This design is firstly simulated in Proteus software. Figure 11 shows the circuit diagram of alcohol detection.

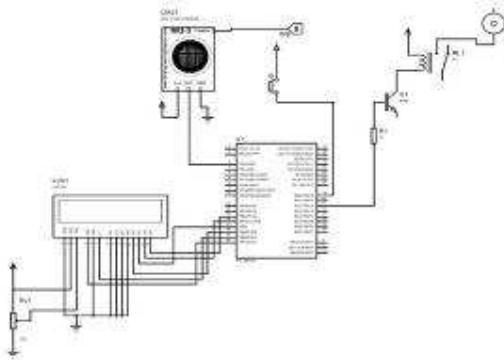


Figure11. Circuit Diagram of Alcohol Detection

B. Circuit Design for Alcohol Detection

The circuit diagram of the car accident detection system is shown in Figure 12.

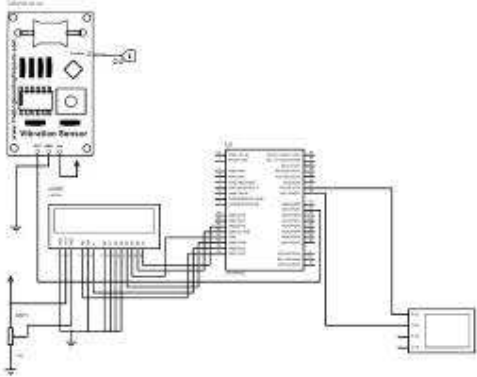


Figure12. Circuit Diagram of Accident Detection System

In Figure 12, the pin connections between modules and microcontroller are described in details. The GPS module is used by the PORTC of RC7 and the GSM module is connected to RC6 of the PIC 18F452 microcontroller. PORT D4, D5, D6, D7, E and RS pin of LCD are connected to the PORTB.

C. Overall Circuit Design

After completing testing of each design, those are combined as overall circuit design. The overall circuit design is shown in Figure 13. The implementation with real devices is doing after designing the circuit.

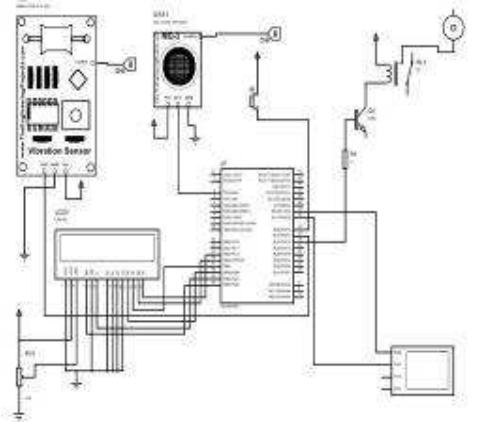


Figure13. Overall Circuit Design

D. Testing for Alcohol Detection

The system shows the welcome message as shown in Figure 14 and operate to detect alcohol as shown in Figure 15.



Figure14. Start Operation



Figure15. Alcohol Detection

E. Testing Vibration Detection

When the accident occurs, the vibration sensor will sense the vibration and send a digital signal to the PIC controller. Figure 16 shows the testing of vibration sensor.

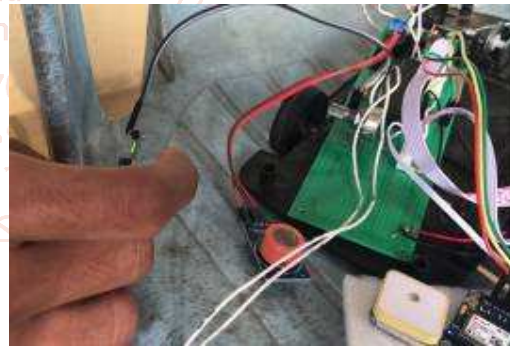


Figure16. Testing Vibration Sensor

If the PIC controller received triggered signal from vibration sensor, it read GPS data from the GPS module. And then send SMS to a preassigned phone number by using GSM modem and display Latitude and Longitude of accident location on LCD. Figure 17 show test result from the vibration sensor.



Figure17. Location of Accident Display on LCD

The following figure, Figure 18, shows the message which is arrived on a preassigned mobile phone if the accident occurred.

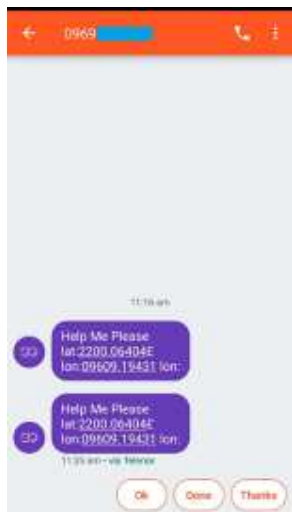


Figure18. Message arrives in Mobile Phone

V. CONCLUSION

By using this system, it will decrease car accidents more effectively because it has good conditions and reasons. It will examine the driver whether the alcohol is beyond the limit value or not. If the driver drinks alcohol beyond the limit, the car engine will stop automatically when the driver starts to

drive. If the car accident occurred, messages will be sent to the assigned phone number. These messages include the latitude and longitude of the place of the car accident. Therefore, the ambulance can find easily the place of accident and will save lives.

REFERENCES

- [1] A. Hjør and M. Holmberg, Measuring Mechanical vibration Using Arduino as a Slave I/O to an EPICS Control System [2015]
- [2] Crouse. Anglin, "Automotive Mechanics", 10th Edition, Glencoe Publishing C [1993]
- [3] Dogan Ibrahim, "PIC Basic Project, 30 Project Using PIC basic and PIC basic pro", [2006]
- [4] U Mg Mg Myat, "Electronic Circuits Manual"
- [5] Win Htet Win, "Pic Basic Pro Handbook"
- [6] Ian. Hickman, Analog Electronic, 2nd Edition, Newnes [1993]
- [7] Mike Tooley, "Electronic Circuits- Fundamentals and Application", 4th ed., Newnes, 2015
- [8] [http://sites.google.com/Datasheet of PIC18F452](http://sites.google.com/Datasheet%20of%20PIC18F452)
- [9] [http://sites.google.com/Liquid crystal display/ What Is An LCD \(Light-Emitting Diode\) - Build Electronic Circuits.htm](http://sites.google.com/Liquid%20crystal%20display/What%20Is%20An%20LCD%20(Light-Emitting%20Diode)%20-%20Build%20Electronic%20Circuits.htm)

