ASHESI UNIVERSITY

AN ALCOHOL DETECTION SYSTEM FOR VEHICLES

CAPSTONE PROJECT

B.Sc. Electrical and Electronic Engineering

Edna Yelipoie

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AN ALCOHOL DETECTION SYSTEM FOR VEHICLES

CAPSTONE PROJECT

Capstone Project submitted to the Department of Engineering, Ashesi University in partial fulfilment of the requirements for the award of Bachelor of Science degree in Electrical and Electronic Engineering.

Edna Yelipoie

2020

DECLARATION

I hereby declare that this capstone is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

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Candidate's Name:

………………………Edna..Yelipoie………………………………………………………………

Date…May.29,2020………………………………………………………………………………

I hereby declare that preparation and presentation of this capstone were supervised in accordance with the guidelines on supervision of capstone laid down by Ashesi University College.

Supervisor's Signature:

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ABSTRACT

Drunk driving is a contributing factor to road accidents in several parts of the world. Road accidents caused by drunk driving are usually fatal and have an adverse on the victims and the government, in the long run. Government policies have been implemented to deter individuals from indulging in drunk driving. Positioning police officers with alcohol breath analysers at vantage points on the road has also employed to curb the menace of drunk driving. However, these strategies have barely been able to reduce the rate at which road accidents caused by drunk driving occur. In this project, alcohol breath analysers have been integrated with the ignition system of vehicles to prevent drunk drivers from moving their vehicles.

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Chapter 1: Introduction

1.1 Background

According to the National Road Safety Commission [1], “statistics show that about four people die daily on the roads in Ghana as a result of road accidents. Estimates show that every year Ghana loses 230 million dollars because of road accidents with more than 1600 deaths. The major causes of road accidents in the country are over speeding and drunk driving which account for 60% of the total road accidents that occur [2]. Out of this 60%, 50% of road accidents are as a result of over speeding and the remaining 10% are road accidents that occur as a result of drunk driving [2]. The World Health Organization [3] also claims that “injury from road accidents is one of the leading health problems, especially in low- and middle-income countries, including Ghana. Road traffic injuries account for 30% to 86% of trauma admissions to hospitals in low-income and middle-income countries”.

1.2 Problem Definition

One of the major causes of road accidents in the world can be attributed to drunk driving [2]. Drunk driving is when a person chooses to drive under the influence of alcohol thus, the person is not able to fully concentrate, see properly, make good judgments or decisions, and quickly react to situations when driving [4]. This is considered as a criminal offense and accidents that result from drunk driving are usually fatal and are not only a danger to the drunk driver but other drivers or individuals on the road [5]. Most of the time, people deny the fact that they are drunk and therefore still get behind the steering wheel to move their vehicles. They are mostly rescued if they are surrounded by individuals concerned about their safety.

1.3 Project Objectives

The objectives of this project include the following.

1. Design a low-cost alcohol detection system for vehicles.

2. Reduce the rate of road accidents caused by drunk driving

3. Integrate the use of alcohol breathalyzers in vehicles.

1.4 Expected Outcomes of the Project Work

The following are some of the expected outcomes of the alcohol detection system.

1. A minimum cost will be incurred in designing the system

2. The rate of road accidents as a result of drunk will reduce.

3. Vehicles can work efficiently with alcohol breathalysers.

1.5 Motivation for Project Topic

The problem of road accidents caused by drunk driving is worth investigating because the lives of people are at risk. Also, road accidents, in the long run, cause a stir in the Gross Domestic Product (GDP) of a country. Essentially, road accidents that result in the loss of lives or severe injury reduce the scarce labor force in the country hence, reducing human resources needed to carry out various activities that will lead to economic growth in the country[3]. Therefore, developing an engineered solution to accidents caused by drunk driving will not be saving only the lives of individuals directly affected by such accidents but also looking out for the welfare of the country.

1.6 Research Methodology Used

The main research approach employed in this project is literature reviews from engineering-based academic databases. Also, iterative testing and data analysis on the final product will be conducted.

1.7 Facilities used for the research

The facilities used in undertaking this project include online academic databases, library, and lab facilities.

1.8 Scope of Work

This project was undertaken to reduce the occurrence of road accidents caused by drunk driving. Therefore, the proposed solution is limited to integrating alcohol breathalyzers with the ignition system of vehicles to determine if it is safe to allow a driver to move a vehicle or not. This will be based on the blood alcohol concentration (BAC) of the driver. Also, location identification modules such as a Global Positioning System (GPS) and communication modules such as LoRa, GSM or Bluetooth will be used to provide information on the state of the driver based on his or her blood alcohol concentration.

Chapter 2: Literature Review

2.1 Introduction and Background to the Research

A literature review was conducted in order to gather information from already existing projects on road accidents caused by drunk driving. A search by keyword was performed to acquire already existing information from engineering-based academic databased such as IEEE. Several articles were selected and later filtered to obtain the most relevant articles to this project. This exercise helped in identifying some of the flaws that need to be addressed in the already existing engineering solutions provided to solve road accidents caused by drunk driving.

2.2 Review of Related Works

Nirosha, Priyanka, and Kishore [6] embarked on a project which was focused on developing an alcohol detection in vehicles. In their project, they made use of alcohol sensors, a microcontroller, LCD, relay, GSM module and some programming software tools. Basically, their system detects the alcohol level of the driver and then sends a message to the nearest police station if the blood alcohol concentration of the driver is above a set threshold. Their paper was very easy to read and understand. Also, they gave clear descriptions of the components they used and why they used them.

However, this project did not include integrating the alcohol sensors with the ignition system of vehicles by locking the car engine in the case where the driver's blood alcohol concentration is above the set threshold. They also did not consider the idea of contacting concerned individuals who will be available to come to the rescue of the drunk driver other than contacting the police directly. More so, no consideration was made to have an alternative form of detecting the alcohol content of the driver in the case where the driver decides to mask the smell of alcohol from his or her breath by maybe consuming a minty substance.

Sridhar et al [7] worked on a project that was concentrated on detecting the alcohol level of the driver and checking whether the driver is wearing a seat belt before the car starts. They also used an automatic high beam and low beam of upfront vehicles. In their project they made use of, alcohol detector, seat belt detector, headlamp relay, switch relay, spark plug relay, IR transmitter, and receiver and an Arduino Uno microcontroller. Their paper and project were also read and understood and provided details of each aspect or subsystem of the main system. Conversely, they did not consider incorporating any GPS or GSM module to prevent the person from being stuck at his or her current location. They also did not consider the fact that the driver can use something minty to mask the effect of alcohol in order to pass the alcohol test.

Al-Youif, Ali, and Mohammed [8] undertook a project that revolved around using an alcohol sensor to determine whether a driver can start a vehicle based on his or her blood alcohol concentration level. Electrical components such as Arduino microcontroller, DC motor shield, and an MQ-3 gas sensor were used in achieving the aim of this project. This project made use of software simulations to monitor what was going on in hardware components. Nevertheless, they did not deliberate on the fact that the driver can try to use something minty to mask the smell of the alcohol. No consideration was made to prevent the drunk driver from being stacked at his or her current location in the case where his or her blood alcohol concentration is above the set threshold.

Shao et al [9] solution to drunk driving was to build and design a system that remotely detects concentration in a vehicle based on Tuneable Diode Laser Absorption Spectroscopy (TDLAS). Basically, instead of using the most widely used MQ-3 alcohol sensor or alcohol breathalyzers, they adopted the TDLAS technology. TDLAS is a robust and reliable technology accepted for trace gas sensing and analysis. It makes use of laser diode and detector which is being controlled by a lock-in amplifier. The authors of this paper did a good thing by looking for or adopting an alternative way of detecting the alcohol level content of a drunk driver. However, no considerations were made on incorporating this system with the ignition system of vehicles.

Chapter 3: Design Methodology

3.1 Introduction

The alcohol detection system for vehicles is an embedded system. Thus, it comprises of both a software design and a hardware design. The hardware design aspect of the project involves the use of a microcontroller, alcohol sensor, Liquid crystal display (LCD), relays, GPS, and communication modules. The software aspect involves using an embedded system-based software such as C to program the microcontroller. In order to select the right choice of hardware components, a Pugh chart would be used to make these choices.

3.2 Project Requirements and Specifications.

The requirements and specifications for the alcohol detection system for vehicles are as follows.

- The alcohol sensor should generate values with a high degree of accuracy.
- Alcohol sensors should function accurately at the driver's seat only.
- Message to be sent to the driver's rescue team should be done in about 5 minutes after the alcohol detection test.
- Drunk drivers should be able to move the vehicle at a regulated speed about 1 to 2 hours after a message has been sent out without any response.
- The system should be very responsive to relevant inputs.
- The system must be able to generate a message automatically if the driver is drunk.
- The system should be cheap.
- The system should be energy efficient.
- The system should be able to get an accurate location of the drunk driver.
- Data generated in the system should be secured.

3.3 Pugh Chart for Hardware Design

A Pugh chart is a quantitative technique used to evaluate and compare design ideas against design criteria in order to make the best design choice or decision during the design process [10]. Thus, the Pugh chart was used to determine and select suitable components for each subsystem.

3.3.1 Wireless Communication Technologies

The table below shows the Pugh charts that will help determine the choice of communication technology to use.

Table 3. 1: Pugh chart for wireless communication technologies

		Baseline	Weight	GSM	LoRa	Bluetooth
Criteria						
1	Speed	0	3	+1	-1	+1
2	Cost	0	1	-1	+1	+1
3	Power consumption	0	2	-1	+1	+1
4	Sensitivity	0	4	+1	+1	-1
5	Range	0	5	+1	+1	-1
				+9	**+9**	**-3**

3.3.2 Alcohol Sensors

The Pugh chart used in selecting the appropriate alcohol sensor for this project is shown in the table below.

Table 3. 2: Pugh chart for the different alcohol sensors

		Baseline	Weight	MQ-3 gas sensor	TDLAS
Criteria					
1	Accuracy	0	4	+1	+1
2	Cost	0	2	+1	+1
3	Power consumption	0	3	+1	+1
4	Sensitivity	0	5	+1	+1
5	Range	0	1	+1	-1
				+15	**+14**

3.4 Functional Block Diagram

The summary of how the system operates is shown in the functional block and schematic diagram below.

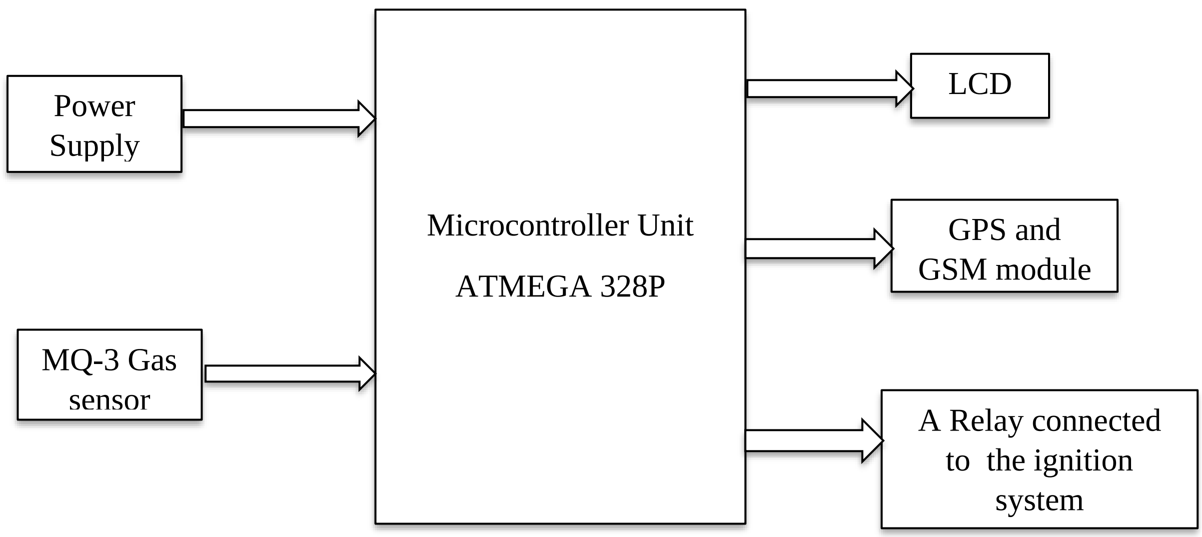

Figure 3. 1: Functional Block diagram

3.4.1 MQ-3 Gas Sensor

The MQ-3 gas sensor is made up of a low-cost semiconductor whose sensitive material is SnO_2. This sensor's conductivity is lower in clean air and increases as the concentration of alcohol gases increases. It is resistive to interferences caused by smoke, gasoline, and vapor. It can detect the presence of alcohol within a concentration range of 0.05mg/L to 10mg/L and within a distance of about 2m. It is suitable for detecting blood alcohol concentration through the breath of a person. The MQ-3 gas sensor consists of both analog and digital output pins and two other pins for VCC and GND. It has an operating voltage of 5V, highly sensitive, gives a fast response, and can be easily interfaced with any microcontroller unit [11]. In this project the MQ-3 gas sensor will be used to detect the BAC level through the breath of the driver.

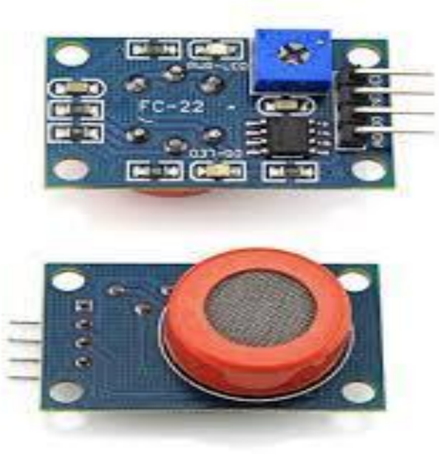

Figure 3. 2: MQ-3 Gas Sensor

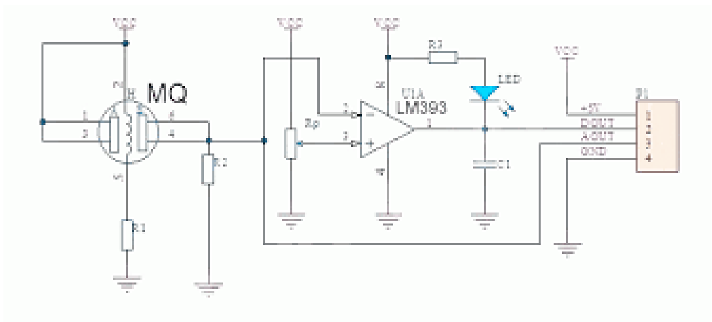

Figure 3. 3: Circuit diagram of the MQ-3 Gas Sensor

3.4.2 16x2 LCD

The 16x2 Liquid Crystal Display (LCD) is a small screen which displays characters in 16 columns and two rows. It has an operating voltage of 4.7V to 5.3V, can display both alphabets and numbers, less costly, can be easily programmed and interfaced with any microcontroller unit [12]. The LCD is being used in this project in order to know the status of the various components in the hardware systems. It has about 16 pins which need to be connected to a microcontroller unit. However, in order to reduce the number of pins, it will occupy on the microcontroller, the 16x2 LCD will be interfaced with the I2C communication interface to reduce the number of pins it needs to 4.

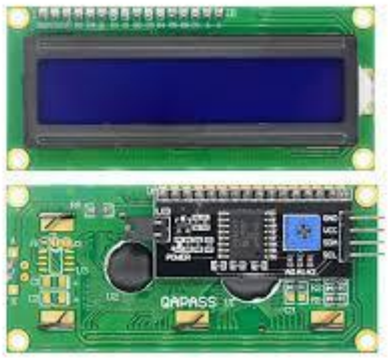

Figure 3. 4: 16x2 LCD

3.4.3 NEO-6M GPS Module

The NEO-6M Global Positioning System (GPS) module consists of a ceramic patch antenna, an on-board memory chip, and a backup which makes it to be easily interfaced with a wide range of microcontroller units. It is very cost effective and has a high performance in tracking the location of items [13]. The position or location of people on the earth is determined by taking measurements and making computations based on the information provided by satellites and ground stations [14]. The output of this module comprises of NMEA sentence which has to be decoded in order to get the actual location. In this project, the NEO-6M GPS module will be used to determine the location of a drunk driver in order to rescue him or her.

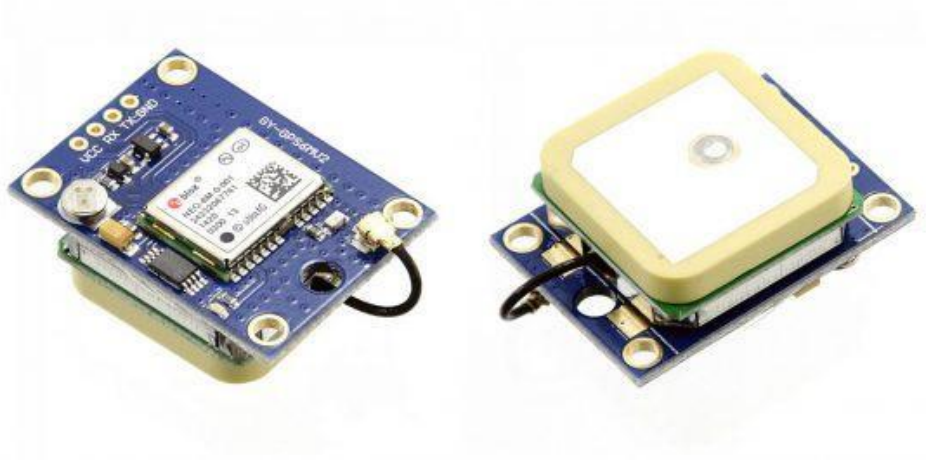

Figure 3. 5: NEO-6M GPS Module

3.4.6 ATMEGA 328P MCU

The ATmega328P microcontroller unit is an 8-bit low power high-performance microcontroller. It has 28 pins in total of which 23 are programmable GPIO pins [15]. It also has two-wire Master/Serial Interface, Master/Slave SPI Serial Interface, two 8-bit counter with separate prescalers, 6 Pulse Width Modulation channels, external and internal oscillators [15]. The ATmega328P MCU possesses a 32Kbytes flash memory, 2Kbytes internal SRAM, and a 1Kbytes EEPROM [15]. It can be programmed using Arduino programming or embedded c programming. In order for it to be programmed directly with Arduino software it was boot loaded. It requires a power supply of 5V and a clock source to operate. This component is the brain of the alcohol detection system for vehicles. It will be programmed to make all the decisions for the system.

Figure 3. 6: ATmega328P chip

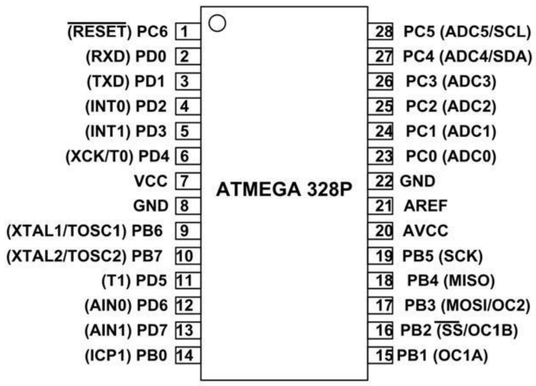

Figure 3. 7: ATmega328P pinout

3.4.7 SIM800L GSM Module

This is a mini Global System for Mobile Communication (GSM) modem that uses a SIM800L GSM cellular chip from SimCom. It requires an external antenna to connect to a network and has a SIM socket for any 2G micro-SIM. This makes it possible to send and receive SMS messages. This GSM module’s operating voltage is from 3.4V to 4.4V its baud rate ranges from 1200bps to 115200bps. It also has pins that allow it to communicate with a microcontroller over UART [16]. In order to get the required operating voltage, an LM317 voltage regulator, DC–DC buck convertor or a 1N4007 diode with a capacitor can be used. This component will be used to send the location of a drank driver via SMS to the driver’s rescue team.

Figure 3. 8: SIM800L GSM Module.

3.4.8 Power Supply Unit

The power supply unit used in this project comprises of a YWROBOT power supply module which derives power via a standard DC power jack [17]. It also has a USB connector that can be used to either power it or power other devices that have USB connectors [17]. It is used to supply either 5V or 3.3V which are the various power requirements for the components used in this project. This module controls power with the aid of a push on/off button It this project, it will be used as the power source for all the components chosen above.

Figure 3. 9: YWROBOT power supply unit.

3.4.9 Schematic Diagram

The diagram below shows the various electrical connections of the hardware components used in this project;

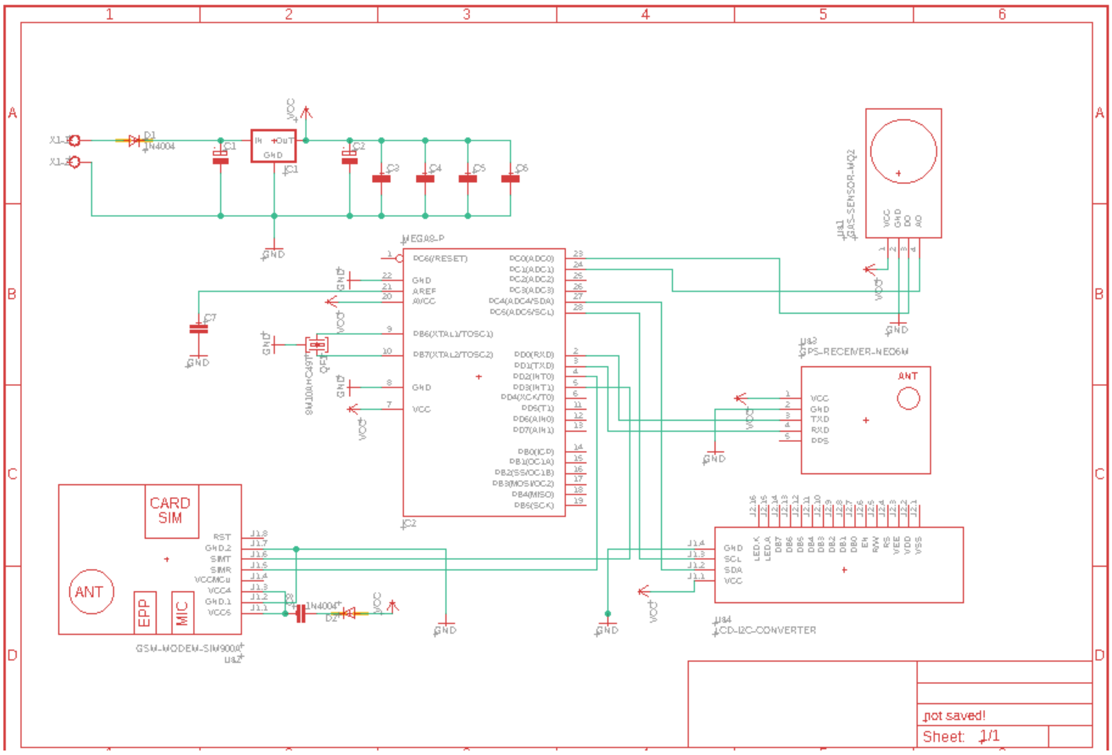

Figure 3. 10: Schematic diagram.

3.5 Software Design

The main software used in the Arduino software (IDE). This software is open-source and makes it easy to code and upload this code onto the microcontroller unit [18]. Thus, this was used to program the ATMEGA 328P (MCU). Basically, the MQ-3 gas sensor which detects the presence of alcohol through the breath of the driver. The data obtained from the MQ-3 gas sensor sent to the MCU where it is processed to obtain BAC values. If the BAC value is above the set threshold, the relay connected to the car ignition remains open and thus, ignition is disabled. Once this happens the location of the driver is obtained from the GPS module and sent an SMS to the rescue team. A summary of this operation is shown in the figure below.

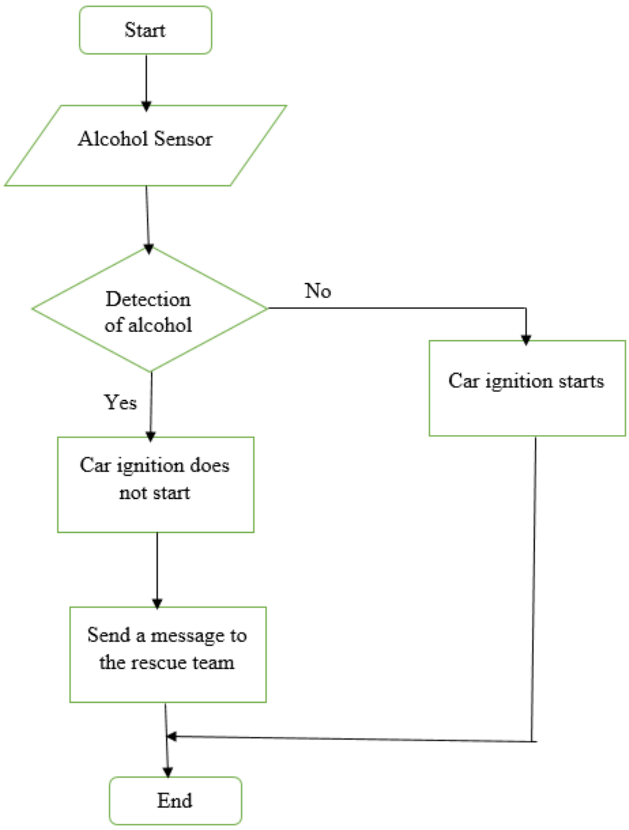

Figure 3. 11: Flowchart of the Alcohol Detection System for vehicles

In addition, data from the MQ-3 gas sensor will be stored in the database to keep track of BAC level of drivers. This database will also contain information on the current location of each driver and contact details of individuals who can rescue a drunk driver. A login page was also created to allow drivers to provide their contact details. The database and login page were created using PHP, MYSQL, HTML, and CSS. The relationship of how this different information will be stored in the database is shown in the figure below.

Sensor_data		
Key	**Field**	**Data type**
Primary Key (PK)	Sensor_id	integer
	BAC	varchar
	GPS_data	varchar
Foreign Key (FK)	Driver_id	int

Drivers		
Key	**Field**	**Data type**
Primary Key	Driver_id	int
	FullName	char
	PhoneNumber	int
	Location	varchar

Rescue_team		
Key	**Field**	**Data type**
Primary Key	Team_id	int
Foreign Key	Driver_id	int
	FullName	char
	PhoneNumber	int
	Location	varchar

Figure 3. 12: Entity Relationship Diagram

Chapter 4: Results and Discussions

4.1 Introduction

The alcohol detection project for vehicles is an embedded system project and thus consists of a software program embedded on hardware components. Therefore, the results obtained from this project comprises of the results obtained from connecting the various hardware components and the software design or program that runs on the hardware.

4.2 Results from Hardware Design

In the hardware design, the MQ-3 gas sensor detects the presence of alcohol from the breath of the driver and then feeds that information into the microcontroller The MQ-3 gas sensor does not generate BAC levels directly, so its output had to be converted using an equation provided from the datasheet[19]. Below is the equation

$$sensorVolt = \frac{sensorValue}{1024 \times 5} \tag{4.1}$$

$$R_s = \left(\left(\frac{5 \times 2000}{sensorVolt}\right) - 2000\right) \tag{4.2}$$

$$R_o = \frac{R_s}{60} \tag{4.3}$$

$$BAC\ (in\ gdL) = 0.0001 \times (0.4 \times \frac{R_s}{R_o})^{-1.431} \tag{4.4}$$

R_s and R_o are built-in resistors in the MQ-3 gas sensor.

This formula was used in programming the microcontroller. The set threshold for the BAC level for a driver is 0.08mg/l. Therefore, in the case where the BAC of the driver is above the set threshold, the relay remains open and thus, the ignition system of the vehicle will not come on. A message containing the BAC and current state of the driver is displayed on the LCD.

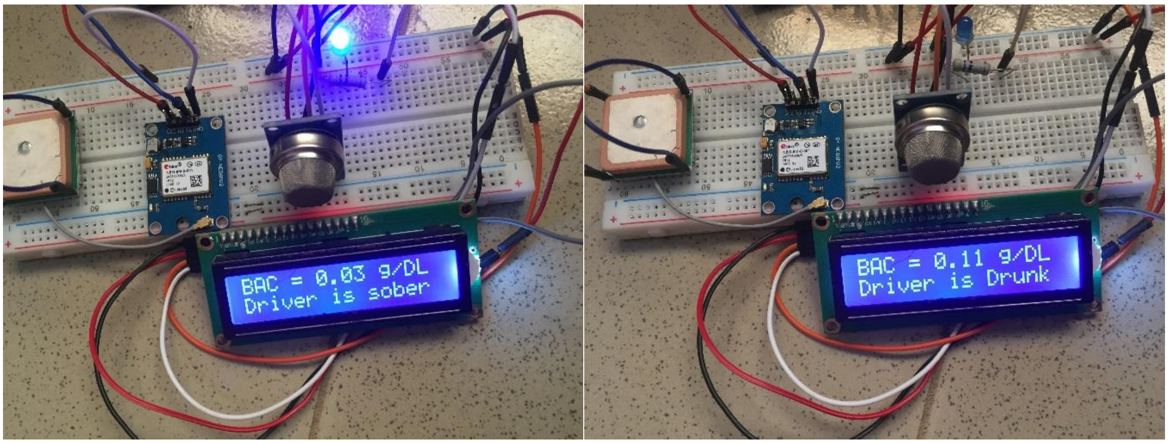

Figure 4. 1: Results from implementing the hardware design

4.3 Results from Software design

The software design for this project involved the use of Arduino programming to program the Microcontroller unit which in turn controls how the other hardware components function. In addition, a database was created using PHP and MySQL to record BAC readings from the MQ-3 gas sensor. The login page which allows the driver to continuously check up on his contact details and update these details was also created. Data from the hardware components especially the sensor and GPS module were then linked to the corresponding drivers and their respective contact details in the case were they too drunk to drive. The results from the various software design are shown in the figures below.

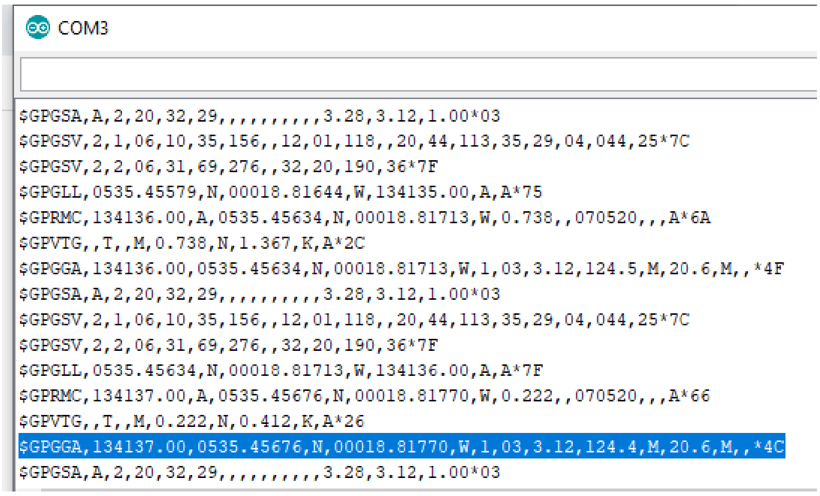

Figure 4. 2: NMEA sentences from GPS used to locate a drunk driver

Figure 4. 3: Results from getting the location of a drunk driver on the map

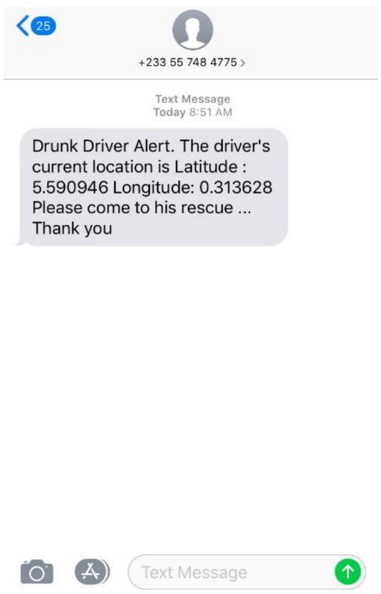

Figure 4. 4: Results from sending SMS via the GSM module

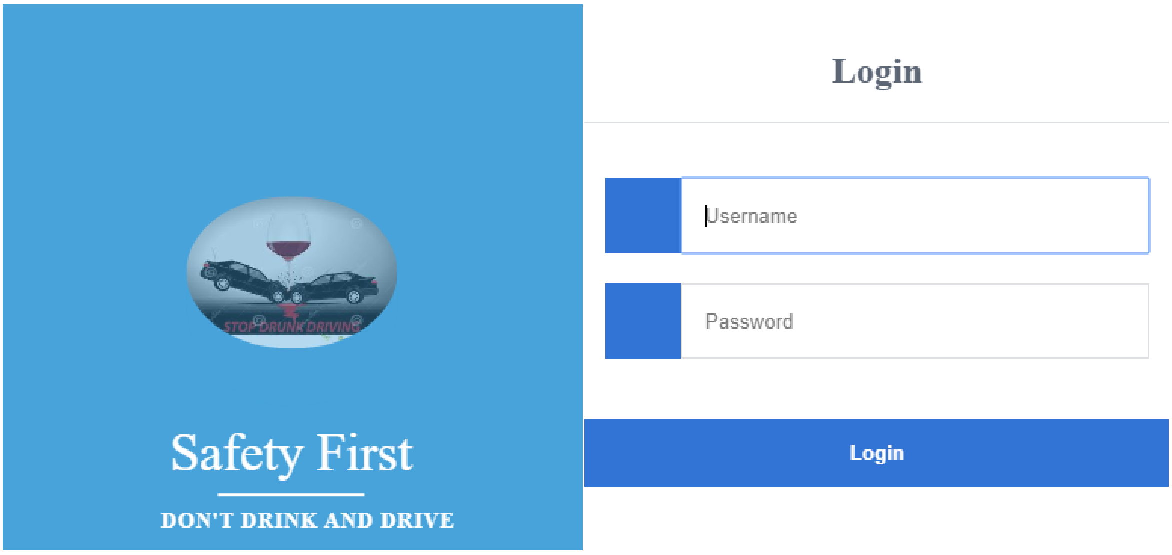

Figure 4. 5: Login Page.

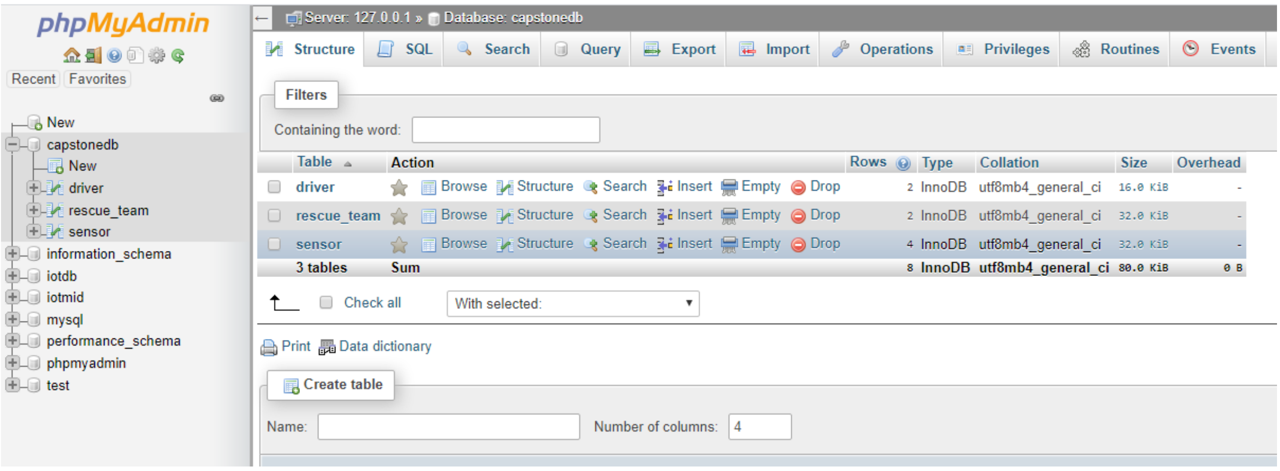

Figure 4. 6: Database containing driver's details

4.4 Discussion.

- The alcohol detection system that was designed and built in this project was a prototype.
- The system was able to detect the presence of alcohol by diffusing the smell of alcohol about 2m to 3m from the alcohol sensor
- The ATmega328P microcontroller unit was able to read the output of the alcohol sensor and perform computations to produce Blood Alcohol Concentration (BAC) readings. This result of this is shown in Figure 4.1 above

- The NEO-6M GPS module was able to accurately get the location. It worked effectively to produce accurate data when it was used outdoors. Information about the location obtained from the module comes in the form of NMEA sentences which have to be decoded in other to get a human-readable location. Results from this show in figures 4.2 and 4.3 above.
- The creation of a login page shown in Figure 4.4 makes it easy for drivers to easily have access to their contact details and also serves as an avenue where they can change and update their contact details.
- The SIM800L GSM module was able to send the location of drunk drivers to their contact details. However, a few challenges were encountered in achieving this.
- Also, a dc motor together with an LED was used to represent the ignition system of a vehicle.
- Since the project was built as a prototype, the objective of testing the system to determine whether the rate of drunk driving will reduce when this system used was not fully achieved. However, the results show that a minimum cost alcohol detection system for vehicles can be produced on a large scale and integrated into the functionality of new and existing vehicles.
- At the end of this project, it can be said that about 85% of the expected outcomes were achieved.

Chapter 5: Conclusion, Limitations and Future Works

5.1 Conclusion

There is no doubt that, alcohol breath analyzers can be integrated with the ignition system of vehicles to help reduce the rate of road accidents caused by drunk driving. This can be achieved by making use of sensors that detect the presence of alcohol from a driver and devices that can track the location of drunk drivers. Also, communication modules can be used to relay information such as the BAC level and location of drunk drivers to people who can come to the rescue of the driver. Results obtained from the prototype of the proposed system in this project show that, this technique of curbing road accidents cause by drunk driving is ideal and can be considered in the manufacturing of new vehicles.

5.2 Limitations

Although this project was able to prove to an extent that road accidents as a result of drunk driving can be prevented by integrating alcohol breath analyzers with the ignition system of vehicles, certain factors that hindered the progress of certain aspects of this project. These factors include;

- Some hardware components were not available due to the COVID-19 pandemic. Hence, some components had to be improvised. This resulted in some delays and not achieving all the expected outcomes in this project.
- This project requires a drunk person and a car to test the system in other to get very accurate results. However, it was hard to come by a drunk driver and a car to test the proposed system.

5.3 Future Work

The results from this project show that they are opportunities that can be further explored in this area in future research. These opportunities include

- Making use of a fingerprint or touch-based system to detect the blood alcohol concentration of a driver beneath the skin. This will help ensure that drivers are tested for the presence of alcohol even if they try to bypass the system by consuming something minty in order to mask the smell of alcohol through their breath.
- Since, too much intake of alcohol can cause sleepiness, a face monitoring system can also be included to detect sleepy drivers.
- Drunkenness leads to dizziness and unconsciousness. This can make some drivers drive out of their lanes. Therefore, cameras can be used to determine if a driver has drifted from their lane or not
- A way of securing the data on the drunk driver's location can be investigated in future works. Also, regular reminders can be sent to drivers on the dangers of drunk drivers

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Appendix

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>

#include <SoftwareSerial.h>



// Set the LCD address to 0x27 for a 16 chars and 2 line display

 LiquidCrystal_I2C lcd(0x27, 16, 2);



// sensor setup

const int ledPin = 13;

const int AOUTpin=0;

float sensor_volt;

float RS_gas;

float R0;

float ratio;

float val;

float BAC;

int R2 = 2000;

float conv = 0.1;



// GPS INITIALIZATION

SoftwareSerial gps(0,1); // RX, TX
```

```
//String str="";

String nmea="";

char *test="$GPGGA";

String latitude="No Range      ";

String longitude="No Range     ";

int temp=0,i;

boolean gps_status=0;


void gsm_init();

void get_gps();

void serialEvent();

void tracking();




void setup()

{

    Serial.begin(9600);

    gps.begin(9600);


   //Initializing the lcd

    lcd.init();
```

```
  lcd.backlight();


// defining pin types

  pinMode(ledPin,OUTPUT);

  pinMode(AOUTpin,INPUT);


  //initializing the system

  lcd.setCursor(0,0);

  lcd.print("System getting");

  lcd.setCursor(0,1);

  lcd.print("ready....");

  delay(8000);


 gsm_init();

 Serial.println("AT+CNMI=2,2,0,0,0");

 Serial.println("GPS Initializing");

 Serial.println("  No GPS Range  ");

 get_gps();

 delay(2000);

 Serial.println("GPS Range Found");

 Serial.println("GPS is Ready");
```

```
   delay(2000);

   Serial.println("System Ready");

   temp=0;

}


void loop()

{

    // computing BAC from the sensor output

    int sensorValue = analogRead(AOUTpin);

    sensor_volt=(float)sensorValue/1024*5.0;

    RS_gas = ((5.0 * R2)/sensor_volt) - R2;

    R0 = 16000;

    ratio = RS_gas/R0;// ratio = RS/R0

    double x = 0.4*ratio;

    val = pow(x,-1.431);  //BAC in mg/L

    BAC = val*conv; //convert to g/dL



// when driver is drunk


 if(BAC >=0.08){
```

```
  digitalWrite(ledPin,LOW);

  Serial.print("BAC = ");

  Serial.print(BAC);

  Serial.println(" g/DL\n\n");

  Serial.println("Drunk Driver detected : ");



  lcd.clear();

  lcd.setCursor(0,0);

  lcd.print("BAC = ");

  lcd.print(BAC);

  lcd.print(" g/DL");

  lcd.setCursor(0,1);

  lcd.print("Driver is Drunk");



  // get gps location and sending sms

 serialEvent();



  if(temp)

{

 get_gps();

 tracking();
```

```
    }

   // when driver is not drunk
 else{
  digitalWrite(ledPin,HIGH);
  delay(3000);
  digitalWrite(ledPin,LOW);
  Serial.print("BAC = ");
  Serial.print(BAC);  //convert to g/dL
  Serial.print(" g/DL\n\n");
  Serial.print("Sober driver detected ");
  lcd.setCursor(0,0);
  lcd.print("BAC = ");
  lcd.print(BAC);
  lcd.print(" g/DL");
  lcd.setCursor(0,1);
  lcd.print("Driver is sober");
 }
 delay(1000);
}
```

```
void serialEvent()
{
  while(Serial.available())
  {
    if(Serial.find("Track Vehicle"))
    {
      temp=1;
      break;
    }
    else
    temp=0;
  }
}


/// storing data from the nmea sentence to get gps coordinates
void gpsEvent()
{
  nmea="";
  while(1)
```

```
{
 while (gps.available()>0)           //checking serial data from GPS
 {
  char inChar = (char)gps.read();
   nmea+= inChar;                          //store data from GPS into
   gpsString
   i++;
   if (i < 7)
   {
    if(nmea[i-1] != test[i-1])         //checking for $GPGGA sentence
    {
      i=0;
      nmea="";
    }
   }
  if(inChar=='\r')
  {
   if(i>65)
   {
     gps_status=1;
     break;
   }
```

```
      else
      {
        i=0;
      }
     }
   }
    if(gps_status)
     break;
   }
}



// setting up gsm module
void gsm_init()
{
  Serial.println("Finding Module..");
  boolean at_flag=1;
  while(at_flag)
  {
    Serial.println("AT");
    while(Serial.available()>0)
```

```
  {
    if(Serial.find("OK"))
    at_flag=0;
  }

  delay(1000);
}



Serial.println("Module Connected..");
delay(1000);

Serial.println("Disabling ECHO");
boolean echo_flag=1;
while(echo_flag)
{
  Serial.println("ATE0");
  while(Serial.available()>0)
  {
    if(Serial.find("OK"))
    echo_flag=0;
```

```
  }
  delay(1000);
}


Serial.println("Echo OFF");
delay(1000);

Serial.println("Finding Network..");
boolean net_flag=1;
while(net_flag)
{
  Serial.println("AT+CPIN?");
  while(Serial.available()>0)
  {
    if(Serial.find("+CPIN: READY"))
    net_flag=0;
  }
  delay(1000);
}
```

```
  Serial.println("Network Found..");

  delay(1000);

}




///// geting the latitude and longitude

void get_gps()

{

   gps_status=0;

   int x=0;

   while(gps_status==0)

   {

    gpsEvent();

    int str_lenth=i;

    latitude="";

    longitude="";

    int comma=0;

    while(x<str_lenth)

    {

       if(nmea[x]==',')

       comma++;
```

```
      if(comma==2)        //extract latitude from string
      latitude+=nmea[x+1];
      else if(comma==4)        //extract longitude from string
      longitude+=nmea[x+1];
      x++;
    }
    int l1=latitude.length();
    latitude[l1-1]=' ';
    l1=longitude.length();
    longitude[l1-1]=' ';

    Serial.println("Lat:");
    Serial.println(latitude);

    Serial.println("Long:");
    Serial.println(longitude);
    i=0;x=0;
    str_lenth=0;
    delay(2000);
   }
}
```

```
}



void init_sms()

{

  Serial.println("AT+CMGF=1");

  delay(400);

  Serial.println("AT+CMGS=\"+233555208161\"");    // use your 10 digit
      cell no. here

  delay(400);

}



void send_data(String message)

{

  Serial.println(message);

  delay(200);

}



void send_sms()

{

  Serial.write(26);

}
```

```
void tracking()

{

    init_sms();

    send_data("Drunk Driver Alert:");

    send_data("The driver's current Location is:");

    Serial.print("Latitude:");

    send_data(latitude);

    Serial.print("Longitude:");

    send_data(longitude);

    send_data("Please come to his rescue..\nThank you");

    send_sms();

    delay(2000);


}
```