

Mandeep Guleria¹, Manisha², Madhu Saini³, Sukriti Shah⁴, Anjali Bijalwan⁵

Abstract

The main aim of this project is to develop a system that can detect the alcohol content in the breath of the driver and automatically turn off the car, if alcohol percentage exceeds the limit. Moreover, the investigation done by the World Health Organization in 2008 shows that about 50%-60% of traffic accidents are related to drunk driving. The drunk driving has been listed as the main reason for the accident in most of the countries all over the world.

Keywords

Alcohol, Auto Ignition, Accidents, Breath

Received: 12 August 2017; **Revised:** 15 November 2017; **Accepted:** 21 December 2017;

Published: 31 December 2017;

¹Assistant Professor, Electrical Engineering Department, T.H.D.C Institute of Hydropower Engineering and Technology, Dehradun, Uttarakhand, India.

^{2,3,4,5}Student, Electrical Engineering Department, T.H.D.C Institute of Hydropower Engineering and Technology, Tehri, Uttarakhand, India.

Corresponding author:

Email: mandyguleria20318@gmail.com



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Introduction

The main idea of this work is to design a kind of system which can restrict the behavior of drunk driving^[1]. The major components used to design this project consists of following parts:

- Sensor Part used to detect the concentration of alcohol in the air and send the concentration in the form of voltage signals to the following part.
- Processing Part used to receive the voltage signals and process the signal to analog signals that can be standard for the concentration of alcohol.
- Display Part used to get the processed signal and show the data to users in the form of diagrams^[2].

The sensor will be fixed near the driver's seat. The driver should breath to the system before he (she) starting the car. If the concentration of alcohol detected is below the allowable standard, the car can be started normally. If the concentration of alcohol is above the allowable standard, the system will send alarm to the driver. The concentration of the alcohol will be showed in diagrams which can be seen on the driver's cellphone^[3].

The system should be safe, sensitive, accurate, convenient and cheap. This kind of system can be fixed on every car to ensure the driver's driving safety and can protect the passengers' walking safety^[4].

Design Approach

The following block diagram shows the sketch how we design the system^[5].

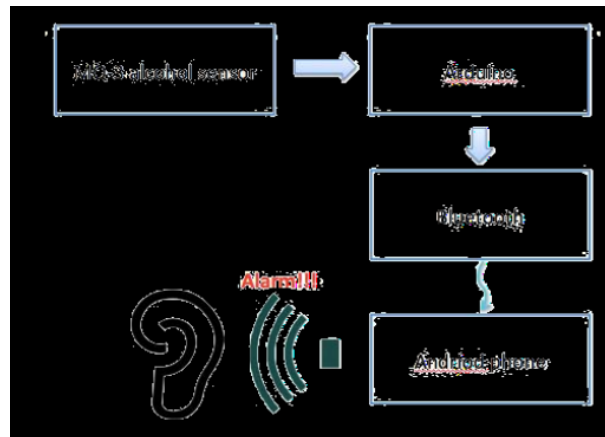


Figure 1. Flow chart of Alcohol detecting system

The flow chart above shows the main structure of the alcohol detecting system. From this chart we can briefly know the components we have used and how to connect them. Here is the introduction of the usage of each component:

2.a MQ-3 alcohol sensor: This sensor can detect the value of the alcohol concentration in the air and transform this value to voltage signals^[6]. The sensor should be powered and the pin on the sensor which is used to send out the voltage signals should be connected with the analog-in pin on the Arduino board.

2.b Arduino board: We choose the Arduino Mega ADK as the developing board for it has more pins and has more advanced chip with more flash memory which can reach almost all of our requirements in the research period. With the help of Arduino board, we can transform the uncountable voltage signals to countable analog signals which range from 0 to 1023^[7]. The operating voltage is 5V. So the real voltage of the input voltage is: $(\text{Output analog value}/1024)*5V$. After the Arduino board has completed the data processing part, it would send the signals to the cellphone with the help of Bluetooth module.

2.c Bluetooth module: Bluetooth module can help the system reach wireless connection. This means we needn't take pains to try to connect the cellphone with Arduino board by cockamamie wires. This design can let the system become more humanized.

Android phone: Smart phone is a wide platform for developers to design applications. We have designed an application that can let the value of alcohol concentration showed in visual diagrams instead of analog signals. And because the cellphone is a good medium that can contact with others by messages or the Internet, the statistics can be shared easily^[8].

Hardware

MQ3-sensor

In this sensor, there is a small white tube in the middle of sensor. Basically, this tube is a heating system that is made up of aluminium oxide and tin dioxide and inside it there are heater coils, which produce heat. And you can also find 6 pins. 2 pins that we called Pin H are connected to the heater coils and the other pins are connected to the tube.

The core system is the cube. As we can see in this cross-sectional view in figure below, basically, it is an Alumina tube cover by SnO₂, which is tin dioxide. And between them there is an Aurum electrode, the black one. we can also see how the wires are connected. Basically, the alumina tube and the coils are the heating system, the yellow, brown parts and the coils below.



Figure 2. MQ-3 sensor

The MQ-3 is an alcohol gas sensor that is available for about \$5 from sparkfun. It is easy to use and has sparked the imagination of anyone who has thought of building their own Breathalyzer device for measuring the amount of alcohol in the human body. We got five MQ-3 sensors a couple of months ago and have spent a lot of time trying to figure out how to do this. After collecting lots of data, we found that this task is not as easy as it sounds.

Circuit of sensor connection of MQ3

As shown in Figure 3.2, The other part of the circuit is essentially a variable resistor inside the sensor. The resistance across an A pin and a B pin varies depending on how much alcohol is in the air in the sensor. The higher the amount of alcohol, the lower will be the resistance. We measure alcohol in the breath by measuring this resistance. In place of measuring the resistance directly, we measure the level of voltage at the point between the sensor and a load resistor.

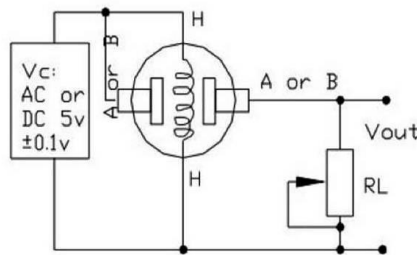


Figure 3. Sensor Connection

First, we use 5v. And as you can see one of H pins goes to the power and the other one is connected to the ground. And the pin A is connected between the power and the pin H and the pin B is go to the microcontroller. Also between the ground and the Arduino, you need the resistor. Before you connect the resistor if you use the pot, you can tune the resistor for getting more exact values. In the datasheet they say you can used 100k ohm to 470k ohm. So we use 220k ohm in our circuit.

It's response is depending on the environment, it gives us little bit of different values. But in our experiment, it gives me 200 as the lowest value and 700 as the highest value. And when it detects the alcohol in the air, actually it is pretty sensitive, the value gets higher very quickly but you have to wait for about 10 seconds to reset it. So that means getting values is fast. And the sensitivity of this sensor is affected by time span. When I used three different sensors, the range of value was a little smaller than the new one's. But it doesn't affect the whole experiment.

Detail of Sensor Connection

As the figure 4 shown, we put the H (left) connect the 5.0V and H (right) to the ground (GND). We can choose either A or B as one of the analogin pin to connect the Arduino board. And use another one, B or A, just opposite to the former one, we can only use 4 of 6 pins in the project.

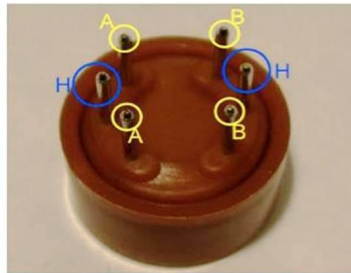


Figure 4. Sensor Pins

Arduino Board

Arduino Mega2560 microcontroller board is user friendly or simple to use development board based on the Atmel ATmega2560 MCU. The ATmega2560 has 256 KB of flash memory for keeping code (of which 8 KB is used for the bootloader), 8 KB of SRAM, and 4 KB of EEPROM. The Arduino Mega2560 microcontroller board has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. The Arduino Mega2560 contains everything needed to support the MCU. Simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to start. This Arduino development board is compatible with most shields designed for the Arduino Duemilanove or Diecimila. The Arduino Mega2560 is different from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. In place of, it features the Atmega8U2 programmed as a USB-to-serial converter. The Arduino MCU board includes a number of facilities for communicating with a computer, another Arduino, or other MCUs.

Sampling rate in the Design

Delay () is a key function to arrange the frequency of reading in the while loop. Once the loop starts, the analog Read () function will sample the data from sensor and by delay (100) function, delay 100ms, then next sample data comes in.

In this project, we have use the analog read () in the arduino, the Arduino board contains a 16 channel (8 channels on the Mini and Nano, 16 on the Mega), 10-bit analog to digital converter. It will map input voltages between 0 and 5 volts into integer values between 0 and 1023. It provides us readings of: 5 volts / 1024 units or, .0049 volts (4.9 mV) per unit. The input range and resolution can be changed using analog Reference(). It takes about 100 microseconds (0.0001 s) to read an analog input, so the maximum reading rate is about 10,000 times a second. It returns int (0 to 1023).

Bluetooth Silver Module

The baud rate is quite important to be set in Arduino code part. At the first, we use the blue tooth module to test, the baud rate we set is 9600, that is suitable for the connection. But when using Bluetooth silver module, the baud rate should be 115200. Here's the Connection the bluesmirf silver Bluetooth, as shown in the figure 6. There're 6 pins in the Bluetooth Silver Module, we use the middle of them, the sequence is

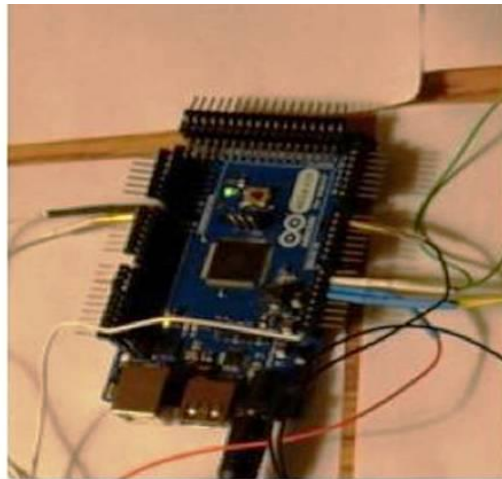


Figure 5. Arduino Mega Board

VCC, GND, TX and RX, TX and RX means the transmit port and receive port which should be connect to the receive port and transmit port in the arduino board.

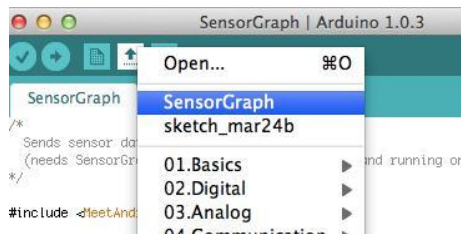


Figure 6. Blusmirf Bluetooth

As the following figure 4.3, BlueSmirf Bluetooth Module should have 115200 baud rate which we modify before we use it. When the BlueSmirf Bluetooth Module paired with your device, the green light is on. The picture shows the baud rate in the arduino code, shows the reading board in the computer.

Arduino Software

The software helps in inputting the code into the arduino board, which shows the corresponding alcohol reading result of MQ3 (sensor).

As shown below, after placing the folder into the libraries folder, we can access all the amarino files through the arduino programming environment and then open the code in arduino board.

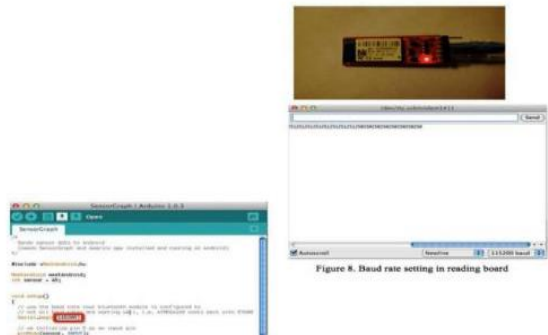


Figure 7. Sensor Graph code in Arduino

Installing Amarino 2.0

The Amarino 2.0 is installed on the phone for messaging and alerting family members.

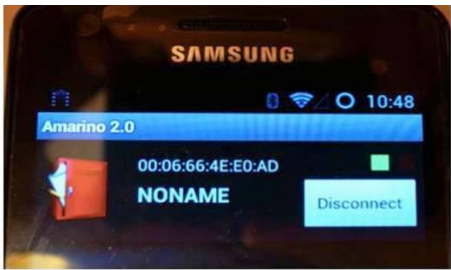


Figure 8. Amarino 2.0 App

Structure of Android programming

Android programming based on the Java SE platform, we design the project as seven parts, Alarm, Amarino, AmarinoIntent, Country, GraphView, SensorGraph and StartingPart.

The Country.java and StartingPart.java, we set these activities to let the user choose the country they have to fit the different criteria the application has. As you can see in the following picture: When you want to arrange the sequences of your activities (it's the name of android interface), it should be set in the AndroidManifest.xml, that's the different between Java and Android.

And in order to let the country.java become the first, we should press the following code, let the `intent-filter` inside the first activity we want to show to the user. Finally, we set the criteria as 500 to alarm because it can show you the brief change in each time. Once the reading touches 500, it will alarm at once.

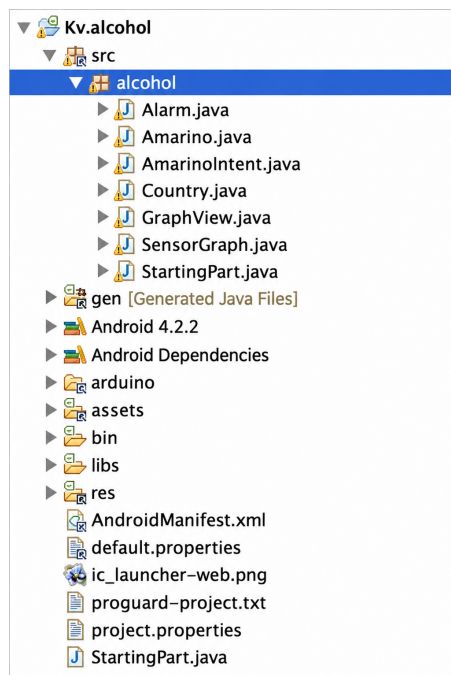


Figure 9. The brief structure in Android programming



Figure 10. App

Then open the apk file and install the application “alcohol detection” into smart phone. We use the Samsung S1 GT-I9100 android version is 4.2.2, processor is ARmv7 Processor rev 1(v71).

Choosing the place of its installation

The first option is that we can set it on the keychain, the system is as small as a key and the driver can blow it directly. So the drivers won’t take pains to refit the car.



Figure 11. Keychain

Another option is that we can put a cable near the driver’s seat and the cable is connected with the ignition of the car. This means the alcohol detection system can be another key to the car. The driver should blow to the system before he/she start the car. If the value of the alcohol concentration is above a certain value, the system will stop the car starting. So a drunk driver won’t be able to start the car which will prevent the behavior of drunk driving. It is not only safe to the driver, but can ensure the passengers won’t be hit because of the driver’s drunk driving.

We can also design it as a plug-in unit. It can be plugged with a cellphone or on the console of the car. This design can ensure a tiny size of the system. And the system can be used as an USB stick that means the data can be stored in it and we can plug it with relevant terminal to do more calculations.



Figure 12. Connect with car ignition



Figure 13. Plug the Iphone

Fixing the alcohol detection system on the driver's seat is also a wise choice. Because the sensor near the seat can detect the driver's breathe alcohol concentration easily and the driver won't take pains to blow to any system intentionally.



Figure 14. Fix on the back

Conclusion

In this paper, we have researched about a system which can detect all the conditions when driver has drunk already no matter how much they did. Secondly, connecting to the car ignition is a proper way to force driver do so every time they want to drive. Thirdly, user can get the data on their android phone in time when they do breathing test every time. We believe that alcohol detecting system can use in all cars to serve for the people who need and for the safety.

References

- [1] C. J. Abaoag, R. Alforque, J. B. Ordoño, and E. Quinto, “Non-invasive Detection of Human Body Liquor Intake Based on Optical Biosensor,” vol. 5005, pp. 1–6, 2018.
- [2] P. C. Gosal, A. C. P, A. B. R, M. K. K M, and M. T M, “Intelligent Automatic Vehicle Accident Detection and Prevention System,” *Int. J. Eng. Res. Appl.*, vol. 7, no. 7, pp. 37–41, 2017.
- [3] Firmansyah and A. R. A. Aziz, “Investigation of Auto-ignition of Several Single Fuels,” *MATEC Web Conf.*, vol. 13, p. 2013, 2014.
- [4] Sensor Report - MQ3 Gas sensor, April 27, 2008.
- [5] The Jacket That Tells “You are Drunk”, October 13th, 2011.
- [6] “Blood/Breath Alcohol Concentration (BAC) calculator”.
- [7] “Arduino Breathalyzer: Calibrating the MQ-3 Alcohol Sensor”.
- [8] “Building an Breathalyzer with MQ-3 and Arduino”, Mar 7, 2010.