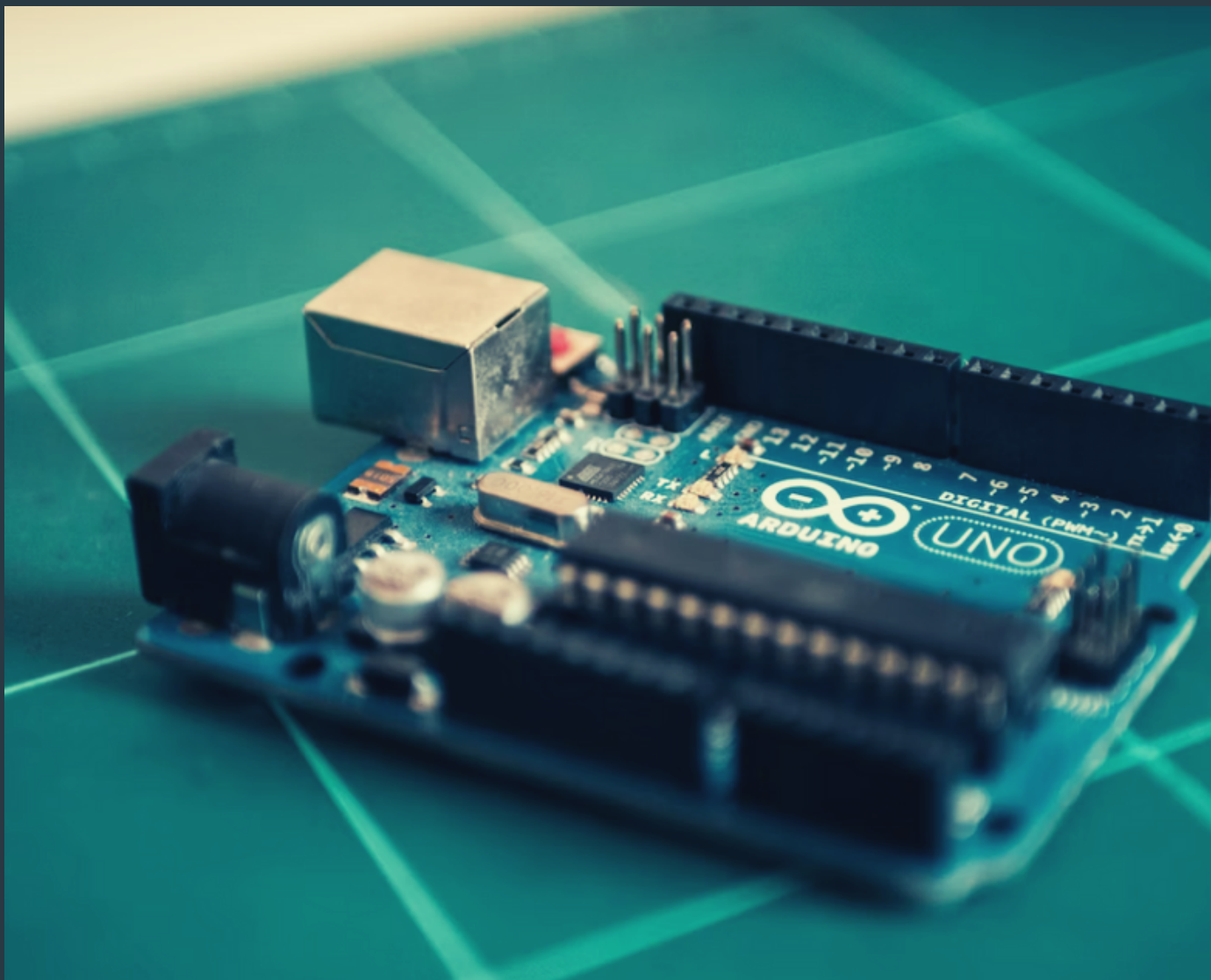


# Undergraduate Project

Alcohol Detection Using Arduino



Submitted by: Joseph Raju,  
B.Sc Physics (Voc: Computer Applications)



# BHARATA MATA COLLEGE THRIKKAKARA

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## DEPARTMENT OF PHYSICS

AFFILIATED TO  
MAHATMA GANDHI UNIVERSITY  
(2020-2023)

### A PROJECT REPORT ON “ALCOHOL DETECTION USING ARDUINO ”

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# BHARATA MATA COLLEGE, THRIKKAKARA

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## CERTIFICATE

This is to certify that the project report entitled “Alcohol Detection Using Arduino” is an authentic work carried out by Joseph Raju, Reg. No.200021039176, for the partial implementation of the requirement for the award of a degree BACHELOR OF SCIENCE IN PHYSICS through the Post Graduate Department of Physics, Bharata Mata College, Thrikkakara, affiliated to Mahatma Gandhi University, Kottayam, Kerala.

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Dr. Shibi Thomas  
(Project guide)  
Assistant Professor  
Bharata Mata College  
Thrikkakara



## DECLARATION

I Joseph Raju, hereby declare that this project report entitled “Alcohol Detection Using Arduino” is an authentic work carried out during my course of study under the guidance of Dr. Shibi Thomas, Assistant Professor, Post Graduate Department of Physics, Bharata Mata College, Thrikkakara.

Joseph Raju



## ACKNOWLEDGEMENT

First and foremost, I would like to thank God for making me able to complete this project successfully.

I wish to convey my gratitude to all those who gave me the possibility to round off this project.

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I also acknowledge with a deep sense of reverence, my gratitude towards my family, who always supported me morally as well as economically.



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# Introduction

Drunken driving, or driving under the influence (DUI), is a significant threat to our lives and the lives of others. Drunken driving significantly increases the risk of accidents. Studies have shown that a driver's ability to react and make decisions is impaired when they are under the influence of alcohol. This can lead to slower reaction times, poor decision-making, and an increased risk of collisions. It can result in serious injuries or death to the driver and others on the road. Even at low blood alcohol levels, a driver's reaction time and judgment can be impaired, increasing the risk of accidents. Drunken driving is illegal in most countries, and conviction can result in fines, imprisonment, and a criminal record. It will also have other economic and social consequences. It is essential to recognize that the consequences of drunken driving go beyond the immediate aftermath of a collision. A DUI conviction can result in long-term effects on a person's life, such as increased insurance premiums, difficulties in finding employment, and limitations on travel and other activities. These effects can significantly impact a person's quality of life, making it essential to avoid drinking and driving whenever possible.

Even though we cannot stop people from drinking, we can lessen the likelihood of accidents by asking them if they have consumed any alcohol, even in small amounts, as alcohol can impair your driving skills.

Drunken driving incidents can have devastating consequences and we must take measures to prevent them from happening. One way to do this is by installing alcohol detection devices in cars, which can detect when a driver is under the influence and prevent them from driving.

Breath analyzers, also known as alcohol sensors, are commonly used to detect the amount of alcohol in a person's breath. These devices work by analyzing the alcohol content of the air around them and detecting changes in the amount of alcoholic gas. If the device detects alcohol, it will trigger an alarm, alerting the driver to the fact that they may be too intoxicated to drive. In addition to cars, breath analyzers can also be used in factories and homes to detect leaks. For example, they can be used to monitor the air quality in a factory and detect any leaks of hazardous gases.

In this project, we are going to create a basic alcohol indicator that can be used in a variety of applications. Although there are many high-tech alcohol sensors on the market, we will be using some simple materials, such as an Arduino, an LED, and alcohol sensors, to construct our device. By using these materials, we can create a low-cost and easy-to-use alcohol indicator that can be used in a variety of settings.



# Principle

## Alcohol Detector Using Arduino

In our project, we will employ an Arduino microcontroller board along with various sensors, including the MQ-3 alcohol sensor, to detect the presence of alcohol in the air. The MQ-3 sensor is an extremely accurate and trustworthy sensor that can detect a wide range of alcohol, making it a perfect choice for our project.

We will use an LED and buzzer as the alarm system to notify when alcohol is present. The LED will illuminate to indicate the level of alcohol detected, while the buzzer will sound an alarm to alert the user.

The circuit for this project will be straightforward, comprising the Arduino board, the MQ-3 sensor, the LED, and the buzzer. The MQ-3 sensor will transmit its readings to the Arduino board, which will then process the information and forward it to the LED and buzzer to notify of the presence of alcohol. Overall, the combination of an Arduino board, MQ-3 sensor, LED, and buzzer will enable us to create a highly reliable and precise alcohol detection system that can be utilized in a variety of applications.

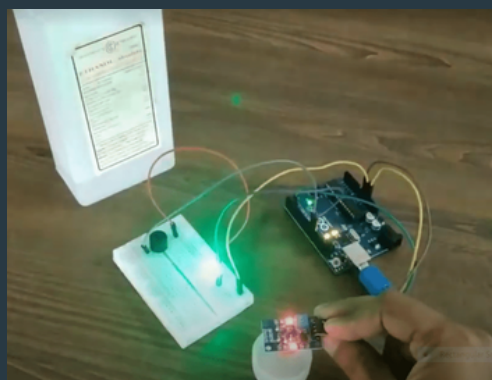


Figure 1 - Experimental Set Up

## Arduino Board

The Arduino platform is an accessible electronic system that combines hardware and software components. Arduino boards can receive input signals and convert them into output actions. To control the board, you can send a set of instructions to its microcontroller through the Arduino programming language, which is based on Wiring, and the Arduino Integrated Development Environment (IDE), which is based on Processing. The IDE is a software tool that allows users to write, compile, and upload code to the board. Programming codes in IDE are written using a variant of C++ programming language. It has some additional methods and functions compared to the normal C++ language. The codes written in this language are called sketches.

The Arduino board is a versatile and powerful tool for building electronic projects. It is based on the Microchip ATmega328P microprocessor and consists of a microcontroller unit (MCU) and a set of input/output (I/O) pins. The MCU is based on the AVR microcontroller and is programmed using the Arduino Integrated Development Environment (IDE).

One of the key features of the Arduino board is its ability to interface with a wide range of sensors and actuators. The board has a variety of digital and analog input/output (I/O) pins that can be used to read or write data from sensors or control the output of actuators. The board features 6 analog input pins, which can be used to read voltage or current values from sensors that produce an analog signal. The board also has 6 digital input pins, which can be used to detect changes in the state of a circuit, and 14 digital output pins, which can be used to control the state of an external circuit. Six of these digital output pins can be used for pulse-width modulation (PWM) output, which is useful for controlling the speed of motors or the brightness of LEDs.

In addition to its standard I/O pins, the Arduino board also features a variety of additional components, such as the USB connection, which allows the board to communicate with a computer, and the SD card socket, which allows the board to store and retrieve data. The board also has a number of built-in functions, such as the ability to read and write to the board's memory, and a number of libraries that make it easier to work with common sensors and actuators.

Overall, the Arduino board is a powerful and versatile tool for building electronic projects. Its ability to interface with a wide range of sensors and actuators, coupled with its user-friendly software and extensive library of built-in functions, makes it a popular choice for hobbyists and professionals alike.

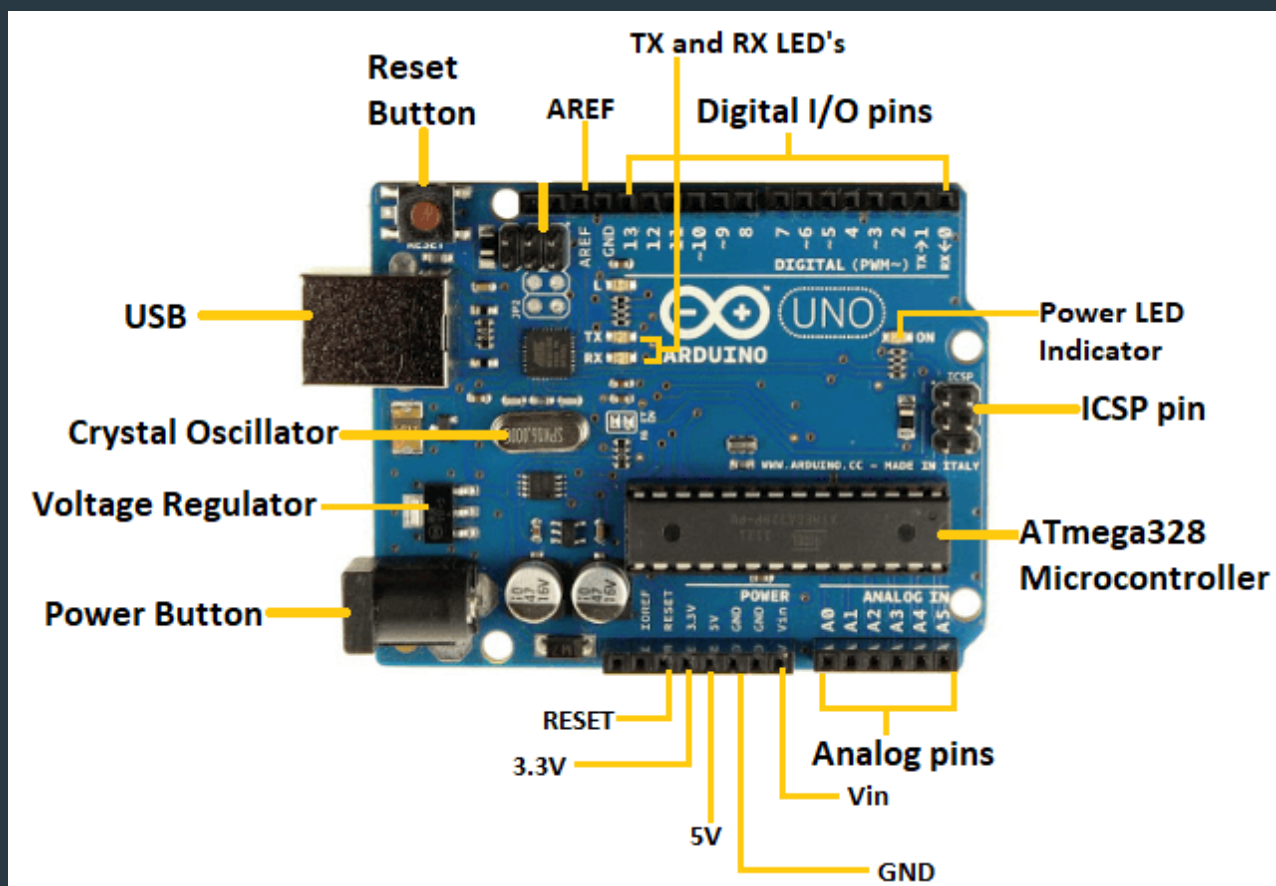


Figure 2 - Arduino Uno

There are several different Arduino boards available, each with its own set of features and capabilities. Some of the most popular Arduino boards include:

- Arduino Uno: This is the most basic and widely used Arduino board.
- Arduino Mega: This board has a larger microcontroller chip than the Arduino Uno, which makes it well-suited for projects that require a lot of processing power.
- Arduino Nano: This is a smaller and more compact version of the Arduino Uno.

There are many other Arduino boards available, each with its own set of features and capabilities. The best board for a particular project will depend on the specific requirements of the project. In this project we are using Arduino Uno.

## MQ-3 Alcohol sensor

The MQ-3 sensor is an exceptional gas sensor that is intended to be utilized with microcontrollers like Arduino. This sensor is designed to analyze the concentration of different gases present in the air and can be programmed to respond to any changes in gas concentration by generating an alarm or taking some other action.

The MQ-3 sensor is highly sensitive and has a rapid response time, allowing measurements to be taken almost immediately. It operates on the principle of electrochemical sensing, where a gas molecule interacts with a thin film of electrically conductive material, resulting in a change in the electrical properties of the material. This change can then be measured and used to determine the concentration of the gas.

The sensor is designed to detect a wide range of gases, including CO, CO<sub>2</sub>, CH<sub>4</sub>, LPG, H<sub>2</sub>, H<sub>2</sub>S, O<sub>2</sub>, and NO<sub>2</sub>. It is commonly used in industrial and commercial applications, such as monitoring indoor air quality or detecting leaks in industrial processes. The MQ-3 sensor is a valuable tool for detecting and measuring changes in gas concentration and can be employed in a variety of applications where gas sensing is crucial.

The MQ-3 gas sensor is equipped with an output that can be connected to any digital pin on the Arduino to read its digital component. If the Arduino detects a high pulse, it indicates the presence of alcohol, while a low pulse indicates the absence of alcohol. This sensor is designed to have excellent sensitivity to alcohol and can withstand interference from other gases such as smoke, petrol, and vapor. It is a cost-effective solution that can be utilized in a wide range of applications where detecting alcohol at various concentrations is required.

The MQ-3 gas sensor works on the principle of electrochemical sensing. It consists of an electrode with a sensing substance coated on top, which is heated to enhance its reactivity and sensitivity. Any unused energy from the heating process is captured by an infrared cell that emits infrared radiation through the sample. Alcohol molecules absorb this radiation, similar to how sunglasses block visible light, and the absorption increases with the concentration of alcohol. The MQ-3 sensor is made up of a stainless steel and plastic grid, an AL<sub>2</sub>O<sub>3</sub> micro-ceramic tube, a sensitive layer of tin dioxide (SnO<sub>2</sub>), a measuring electrode, and a heater.

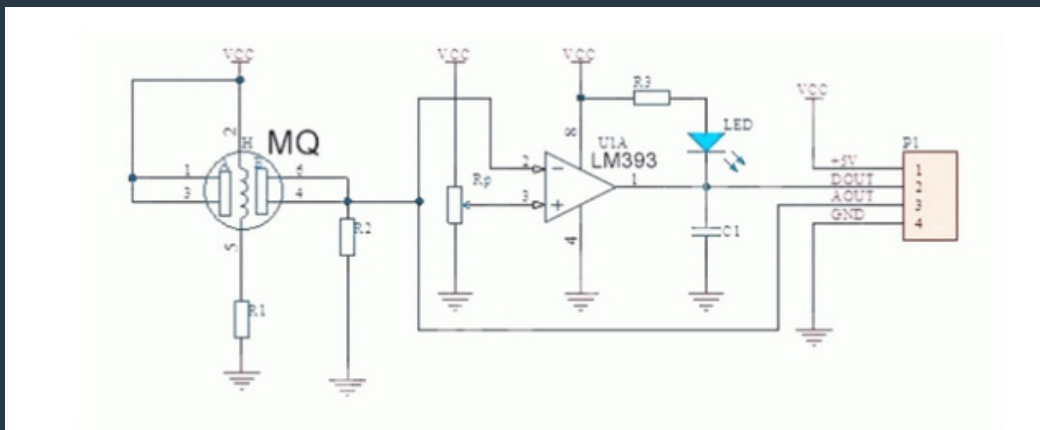


Figure 3 - MQ-3 Sensor Schematic Diagram

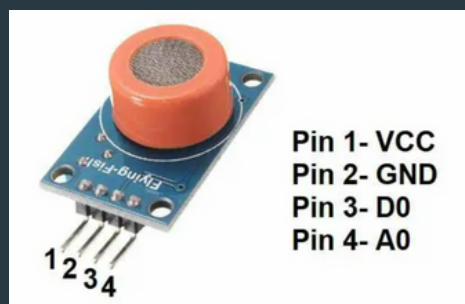


Figure 4 - MQ-3 Sensor Pinout Diagram

## Buzzer

A buzzer is a versatile electronic component that produces a sound when an electrical signal is applied to it. It is typically used as an audible indicator in a system, such as to indicate that a task has been completed or to provide feedback to a user. The buzzer works by vibrating and creating sound when an electrical current flows through it. The vibration is caused by the movement of a mechanical part, such as a coil, within the buzzer. The vibration is converted into sound by the buzzer's diaphragm, which is typically made of a flexible material such as plastic or metal.

Buzzer circuits are relatively simple and consist of a few basic components, such as a transistor or a dedicated buzzer chip. When a voltage is applied to the circuit, it causes the buzzer to vibrate, creating a sound. The frequency and volume of the sound can be controlled by adjusting the voltage and the properties of the components used in the circuit.

For example, the resistance of the coil can be adjusted to change the frequency of the buzz, and the power of the signal can be adjusted to change the volume of the sound.

Buzzer circuits can be powered by a variety of sources, such as a battery or a wall outlet. They are commonly used in a wide range of applications, from simple hobby projects to complex industrial systems. In hobby projects, buzzers may be used to create simple sound effects, such as a beep or a chirp. In industrial systems, buzzers may be used to provide feedback to operators, such as indicating that a machine is running or that a task has been completed successfully.

Overall, a buzzer is a versatile and easy-to-use electronic component that can be used to provide audible feedback in a wide range of systems. Its simple design and wide range of applications make it a popular choice for many projects.



Figure 5 - Buzzer Pinout Diagram

It includes two pins namely positive and negative. The positive terminal of this is represented with the '+' symbol or a longer terminal. This terminal is powered through 6Volts whereas the negative terminal is represented with the '-' symbol or short terminal and it is connected to the GND terminal.

It is used in

- Communication Devices
- Electronics used in Automobiles
- Alarm Circuits
- Portable Devices
- Security Systems
- Timers



# Experimental Set-Up

## Apparatus

- Any microcontroller (Arduino UNO)
- A Red LED
- An MQ-3 Alcohol sensor
- A breadboard
- Jumper wires
- 220ohm resistor
- A buzzer
- Computer, laptop, or phone with IDE software installed

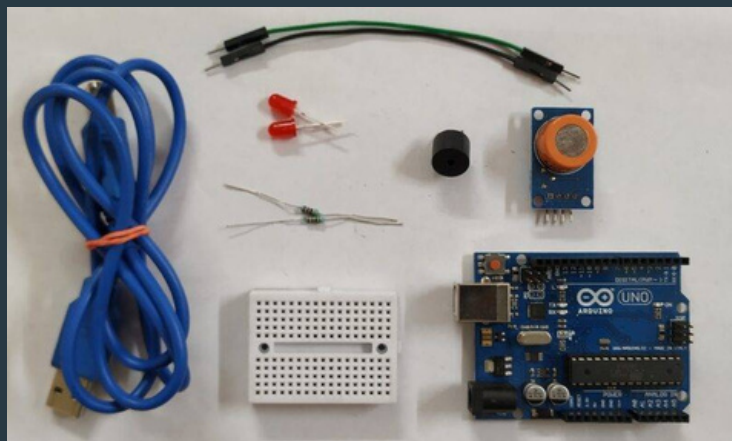


Figure 6 - Components

# Arduino MQ3 Circuit Diagram:

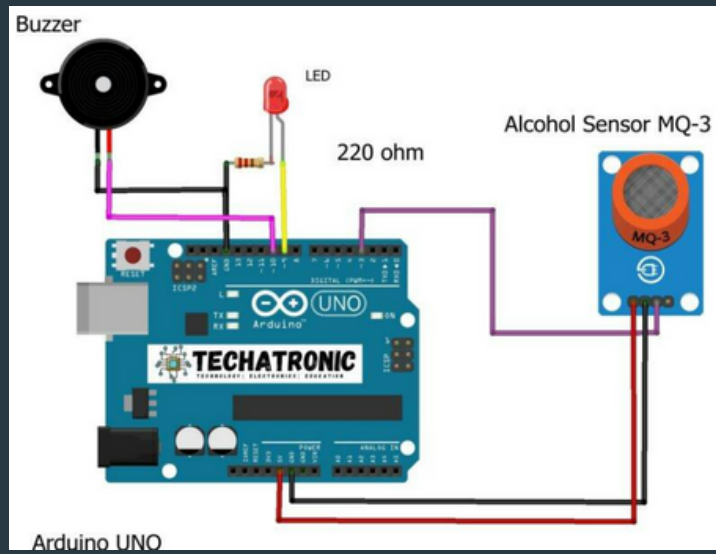


Figure 7 - Circuit Diagram

| <u>Arduino UNO</u> | <u>MQ-3 Alcohol Sensor</u> |                         |
|--------------------|----------------------------|-------------------------|
| (+5V)              | VCC                        |                         |
| GND                | GND                        |                         |
| D3 Pin             | OUT Pin                    |                         |
| <u>Arduino UNO</u> | <u>Buzzer</u>              |                         |
| D10 Pin            | Positive                   |                         |
| GND                | Negative                   |                         |
| <u>Arduino</u>     | <u>LED Red</u>             | <u>220 Ohm Resistor</u> |
| D9 Pin             | Anode Pin                  |                         |
| GND                |                            | Terminal 1              |
|                    | Cathode Pin                | Terminal 2              |

Table 1

## IDE Sketch

```
int LED = 9;
int BUZZER = 10;
int ALCOHOL_sensor = 3;// MQ-3 SENSOR
int ALCOHOL_detected;
void setup()
{
  Serial.begin(9600);
  pinMode(LED, OUTPUT);
  pinMode(BUZZER, OUTPUT);
  pinMode(ALCOHOL_sensor, INPUT);
}
void loop()
{
  ALCOHOL_detected = digitalRead(ALCOHOL_sensor);
  Serial.println(ALCOHOL_detected);
  if (ALCOHOL_detected == 1)
  {
    Serial.println(" NO ALCOHOL detected");
    digitalWrite(LED, LOW);
    digitalWrite(BUZZER, LOW);
  }
  else
  {
    Serial.println(" ALCOHOL detected");
    digitalWrite(LED, HIGH);
    digitalWrite(BUZZER, HIGH);
  }
}
```

## Working of IDE Sketch

The pin (ALCOHOL\_sensor) to which the sensor sends its data is initialized as soon as the code is run. Also, the pin (LED) to which the data is written is initialized. The type of function we want on the initialized pins, such as INPUT or OUTPUT, is then defined during setup. The data accessible on pin 3 is then read during the loop and stored into ALCOHOL\_detected, and the value is then printed on the monitor. Additionally, we determine if the sensor data is high or low (i.e. 0 or 1) and give corresponding signals to the LED to turn the LED on and off.

Additionally, we initialize pin 10 as the buzzer pin and set pin mode to OUTPUT in the setup part of the buzzer code. Along with the LED, the buzzer is also switched high and low in the loop part. By doing this we are alarmed by the presence of alcohol in the air.

## Procedure

- Test for the working of Arduino Board
- Connect the components as shown in the figure
- Write the sketch in IDE software and correct the errors
- Connect the Arduino board to the computer using a cable
- Select the corresponding Arduino board and port in the IDE software
- Upload the sketch
- Check various substances for alcohol content
- Tabulate the observation and output generated

# Observation

In this project, we check whether the vapors of these household products contain alcohol

| Product               | Yes/No |
|-----------------------|--------|
| Water                 | No     |
| Vinegar               | No     |
| Hairspray             | Yes    |
| Mouthwash             | Yes    |
| Cough Syrup           | Yes    |
| Oil                   | No     |
| Salt Solution         | No     |
| Cologne               | Yes    |
| Screen Cleaning Spray | Yes    |

Table 2

|                     |     |
|---------------------|-----|
| Honey               | No  |
| Astringents         | Yes |
| Bug Spray           | Yes |
| Fevicol             | No  |
| Ghee                | No  |
| Nail Polish Remover | Yes |
| Tomato Sauce        | No  |
| Vanilla extract     | Yes |
| Pril (dishwasher)   | Yes |
| Aftershave          | Yes |

Table 3

## The Following is Observed when the vapors of a Product with Alcohol are tested-

- LED lights up
- Buzzer beeps
- The following output is generated on IDE software-

```
0  
ALCOHOL detected
```

Figure 8 - Output(1)

## The Following is Observed when the vapors of a Product with No-Alcohol are tested-

- LED does not light-up
- Buzzer does not beep
- The following output is generated on IDE software-

```
1  
No ALCOHOL detected
```

Figure 9 - Output(2)

# Conclusion

In conclusion, the alcohol-detecting circuit using Arduino is a highly reliable tool for detecting the presence of alcohol and ethanol. The circuit described in this project is both easy to build and use, making it a suitable option for a wide range of applications. Its high sensitivity and low power consumption makes it an attractive option for individuals or organizations looking to implement alcohol detection technology.

The use of this circuit in vehicles could be particularly effective in reducing the number of accidents caused by drunken driving. By requiring every vehicle to be equipped with this system, and coupling it with regular compatibility checks, it would be possible to detect alcohol use before a driver gets behind the wheel. This would help to prevent accidents, reduce damage to life and infrastructure, and ultimately save lives.

The use of alcohol-detecting circuits is not limited to vehicles, however. The technology could also be used in a variety of other settings, such as airports, border crossings, and other areas where the presence of alcohol is a concern. In these settings, the circuits could be used to detect alcohol in a non-intrusive manner, without requiring individuals to submit to invasive tests or other forms of scrutiny.

Overall, the alcohol-detecting circuit using Arduino represents a significant step forward in the field of alcohol detection technology. By reducing the number of accidents caused by drunken driving and other alcohol-related incidents, this technology has the potential to save lives and improve public safety.



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Thank You

