# CHAPTER 1

# Introduction

## Motivation

In our community, there was a tragic incident that shook us to our core. It involved a young woman named Saretha, who, like many of us, attended a family gathering one evening. Unbeknownst to her family and friends, Saretha had consumed alcohol during the event, believing she was still under the legal limit to drive.

As Saretha headed home that night, her vehicle encountered a sharp turn on a winding road. Unfortunately, the alcohol in her system impaired her judgment, and she lost control of the car, resulting in a devastating accident. Saretha sustained life-threatening injuries, and her vehicle was severely damaged. Our tight-knit community was left in shock and disbelief.

This experience had a profound impact on me, and I realized that we needed a solution to prevent such tragedies from happening again. We recognized the need for a technology-driven system that could detect alcohol in a driver's breath and take immediate action to immobilize the vehicle if necessary. Our goal was to ensure that no one else in our community or any other community would have to endure the same pain and suffering.

Motivated by this life-altering event, I became deeply committed to the "Alcohol Detection with Engine Locking System for Road Safety" project. It symbolized our urgent mission to reduce accidents caused by alcohol-impaired driving, protect the lives of our loved ones, and create a safer and more responsible driving environment. Our determination was rooted in our shared experience and the unwavering commitment to making our community and the roads safer for everyone.

## Problem statement

The prevalent problem of alcohol-impaired driving remains a pressing concern, posing a substantial threat to public safety. Despite extensive awareness campaigns and stringent legal regulations, the persistently high incidence of accidents caused by alcohol-impaired drivers continues to result in tragic consequences. The core issues demanding attention encompass the frequency of alcohol-related accidents, often exacerbated by drivers' inaccurate self-assessment of their sobriety. Current preventative measures exhibit limitations in effectively curbing this issue, thereby impacting the broader community. The absence of robust technological interventions further compounds the challenge, necessitating innovative solutions to mitigate the grave risks associated with alcohol-impaired driving.

## Project objectives

* Develop a Robust Alcohol Detection System: Create a reliable and accurate system for detecting alcohol consumption in the breath of drivers.
* Real-time Monitoring: Enable real-time monitoring of alcohol levels to provide immediate feedback and response.
* Integrated Arduino Control: Implement Arduino-based control mechanisms to interact with the vehicle's engine and other systems.
* Establish Threshold Limits: Set specific alcohol concentration thresholds to trigger the system's response for engine control.
* Engine Autolocking: Develop a mechanism that sends a command to stop the engine if the alcohol levels detected exceed the defined threshold.
* Enhance Road Safety: Prioritize the prevention of accidents and the promotion of responsible driving behavior to reduce the number of alcohol-related accidents.

## Project overview

Alcohol Detection and Motor Locking System. Accident prevention detection based on Arduino is discussed. Here Arduino UNO is employed as Microcontroller Unit that acts because the heart for the system. The system performs 2 tasks one is police investigation and also the alternative is dominant. the method starts once the drivers takes the position the alcohol levels are going to be detected because the position sensing element gets activated. If detects quite the alcohol allowed makes the vehicle cannot work if driver ignores the command and tries to begin the automobile straightaway breaks can activate and makes the wheels to not rotate.

The ignition can begin only if the key touches positive and negative terminals with low o/p at the key terminal, the key fails to finish the circuit wherever it leads to fuel offer cut-off to the engine. Therefore, the engine close up or does not begin betting on the position of the automobile.

In cases where the engine is already running, but the vehicle remains stationary with the wheels not in motion, the power supply to the engine is immediately interrupted. In situations where the vehicle is in motion, the system gradually reduces the vehicle's speed, eventually coming to a complete stop, and then it cuts off power to the engine. This intervention ensures that the vehicle is brought to a halt in a controlled and safe manner when alcohol impairment is detected.

The main hardware components of our proposed system in the design are MQ-3 Alcohol sensor, ATmega328 Microcontroller, a DC motor and a motor controller. The software code is written in Arduino IDE sketch and was burnt into the Arduino. So, our proposed system reduces large number of accidents and fatalities due to alcohol consumption, in the upcoming days to a greater extent.

Main advantage of the system is that it is small in size and has good reliability. Future vision of our system is that it can control accidents and it can also give useful details about the vehicles and can minimize the number of accidents taking place due to drunk and drive. By employing our systems in the vehicle, it will be new innovation to the technology in automobiles by adding a safety feature, thereby bringing a new development in the automobile industry.

**Introduction to embedded systems**

Embedded systems are a fascinating and integral part of modern technology. They combine both hardware and software components meticulously designed and programmed to perform specific tasks. These systems are dedicated to a particular application, ensuring efficient and reliable operation.

At the core of every embedded system lies a processor or controller, which serves as the brain of the system. These processors/controllers can be broadly categorized into two types: general purpose and special purpose. General-purpose processors are versatile and handle various tasks, such as user commands, memory management, and display control. In contrast, special-purpose processors are designed for specific functions, such as digital signal processing (DSP) for voice communication or display controllers for generating vibrant images on screens.

Embedded systems can vary in complexity. They can be as simple as a digital watch or an MP3 player, where a single microcontroller chip performs all the necessary functions. On the other end of the spectrum, embedded systems can be highly intricate, featuring multiple units, peripherals, and networks enclosed within a substantial chassis or enclosure. Examples of these complex systems include traffic light control systems, factory automation controllers, and the sophisticated control systems found in nuclear power plants.

One defining characteristic of embedded systems is that they are entirely encapsulated within or dedicated to the device or system they control. This encapsulation ensures that the embedded computer operates seamlessly and reliably, fulfilling its intended purpose without the need for constant human intervention. Whether they are found in portable gadgets or massive industrial installations, embedded systems play a pivotal role in enhancing the functionality and efficiency of a wide array of devices and systems in our daily lives.

Embedded systems find application in a wide range of fields and industries due to their versatility and ability to perform dedicated tasks efficiently. Here are some key application areas and examples of embedded systems.

**Application Areas:**

1. Consumer Appliances: Embedded systems are commonly found in household devices such as microwave ovens, washing machines, and smart thermostats. They control the operation and provide user interfaces for these appliances.

2. Office Automation: Printers, scanners, and photocopiers often incorporate embedded systems to manage document processing and user interactions.

3. Industrial Automation: In manufacturing and industrial settings, embedded systems are essential for controlling machinery, robots, and processes to optimize production and ensure safety.

4. Medical Electronics: Embedded systems play a crucial role in medical devices like infusion pumps, heart monitors, and MRI machines, helping with diagnostics, treatment, and patient care.

5. Telecommunications: Embedded systems are integral to the operation of network switches, routers, and base stations, facilitating communication across various devices and networks.

6. Wireless Technologies: Devices like Wi-Fi routers and Bluetooth speakers rely on embedded systems to handle wireless communication protocols.

7. Security and Finance: Alarm systems, access control systems, and point-of-sale (POS) terminals use embedded systems to ensure security and perform financial transactions.

**Examples of Embedded Systems:**

1. Calculators: Basic calculators have embedded microcontrollers to perform arithmetic operations and display results.

2. Laser Printers: Laser printers use embedded systems to manage print jobs, control toner levels, and handle paper feeds.

3. Security Systems: Home security systems incorporate embedded controllers for monitoring sensors, cameras, and alarms.

4. Musical Instruments: Digital pianos, synthesizers, and electronic drum kits utilize embedded systems to produce and control sound.

5. Medical Equipment: Devices like insulin pumps and ECG monitors rely on embedded systems for precise control and data acquisition.

6. Automatic Teller Machines (ATMs): ATMs use embedded systems to handle cash dispensing, card processing, and security functions.

7. Cellular Telephones and Telephone Switches: Mobile phones and the equipment in telephone exchanges use embedded systems for call management and data processing.

8. Inertial Guidance Systems: These systems, used in aircraft and missiles, employ embedded controllers for navigation and guidance.

9. Computer Peripherals: Devices like routers and printers incorporate embedded systems to manage data transfer and network communication.

10. Automotive Systems: Engine controllers and anti-lock brake controllers in automobiles are embedded systems that optimize engine performance and ensure safety.

**Microcontroller:**

A microcontroller is a compact computing device specifically designed for embedded systems and control applications. It features a tightly integrated combination of essential components on a single silicon chip. Here's an in-depth look at the key elements of a microcontroller:

1. Central Processing Unit (CPU): The CPU is the core processing unit of the microcontroller. It executes instructions and performs calculations as directed by the program stored in memory.

2. Memory:

ROM (Read-Only Memory): Microcontrollers have a built-in ROM that stores the firmware or fixed programs essential for the device's operation. This firmware typically remains unchanged throughout the system's lifetime.

RAM (Random-Access Memory): RAM is used for temporary data storage and variable manipulation during program execution.

EPROM (Erasable Programmable Read-Only Memory): Some microcontrollers use EPROM for firmware storage, allowing for limited reprogramming capability.

3. I/O Features:

Serial Ports: These ports facilitate serial communication with external devices or other microcontrollers.

Parallel Ports: Parallel ports are used for interfacing with external devices or providing parallel data transfer.

3.Timer/Counters: Timer and counter units are essential for generating time delays, measuring time intervals, and controlling timing-related aspects of the system.

4.Interrupt Controller: This component handles interrupts, allowing the microcontroller to respond to external events promptly.

5. Data Acquisition Interfaces:

Analog to Digital Converter (ADC): ADCs convert analog signals (e.g., sensor readings) into digital values for processing. Digital to Analog Converter (DAC): DACs are used when the microcontroller needs to produce analog output signals.

6. Other Peripherals: Depending on the specific application, microcontrollers can include additional peripherals like PWM (Pulse Width Modulation) controllers, GPIO (General-Purpose Input/Output) pins, communication interfaces (e.g., SPI, I2C), and more.

7. Internal Bus: An internal data bus connects the various components of the microcontroller, allowing them to communicate efficiently.

Microcontrollers are well-suited for control applications due to their integrated nature, which minimizes the need for external components. They excel at managing tasks where precise timing, real-time control, and bit-level manipulation are crucial, such as in embedded systems and robotics. In contrast, microprocessors are more generalized computing devices found in personal computers and servers. They typically rely on external components for memory and peripherals and are better suited for tasks that require extensive data processing and computation. In summary, microcontrollers are specialized for control and embedded applications, offering a compact and integrated solution with the necessary components for dedicated tasks, while microprocessors provide more general-purpose computing capabilities.

**Components Description**

## Arduino Uno

## Dr. Monk's DIY Electronics Blog: Arduino Leonardo vs. Arduino Uno

Fig 1.6.1: Arduino Uno

The Arduino Uno is a remarkable open-source microcontroller board that has revolutionized the world of electronics, making it accessible to people of all backgrounds, from beginners to experienced engineers. Developed by Arduino.cc and first released in 2010, the Arduino Uno has since become an iconic platform for creative exploration, learning, and prototyping in the fields of electronics, robotics, automation, and beyond. Fig 4.2.2 depicts Arduino Uno. This comprehensive description will delve into the various aspects and features of the Arduino Uno, showcasing its versatility, capabilities, and impact on the maker and DIY communities.

## Microcontroller and Origins:

## At the heart of the Arduino Uno lies the Microchip ATmega328P microcontroller (MCU). This MCU serves as the computational brain of the board and is responsible for executing user-defined programs and interfacing with various sensors, actuators, and external components. The Arduino project, born out of a desire to simplify microcontroller programming and hardware interfacing, led to the creation of the Arduino Uno as a user-friendly, open-source platform.

## Physical Attributes:

## The Arduino Uno boasts a compact and user-friendly physical design. Its form factor is well-suited for embedding into projects, experimenting on breadboards, and fitting into various enclosures. The board features a mix of digital and analog input/output (I/O) pins, each serving a specific purpose in facilitating connections with external devices.

## Digital and Analog I/O Pins:

## One of the standout features of the Arduino Uno is its extensive I/O capabilities. The board is equipped with 14 digital I/O pins, six of which are capable of Pulse Width Modulation (PWM) output. These pins enable users to control a wide range of digital devices, including LEDs, relays, and motors, with precision.

## Complementing the digital pins are six analog I/O pins. These analog pins are crucial for interfacing with sensors that generate analog signals, such as light sensors, temperature sensors, and potentiometers. They allow for the acquisition of continuous, real-world data, making the Arduino Uno suitable for a wide array of applications.

## Programming with Arduino IDE:

## The Arduino Uno's ease of use is further amplified by the Arduino Integrated Development Environment (IDE), a software platform specifically tailored for creating and uploading code to Arduino boards. The Arduino IDE simplifies programming tasks by providing a user-friendly interface for writing, compiling, and uploading sketches (the term used for Arduino programs). This streamlined workflow makes the board accessible to newcomers while offering advanced users the flexibility to develop complex projects.

## USB Connectivity:

## Connecting the Arduino Uno to a computer for programming and data exchange is a straightforward process. The board features a Type B USB connector, allowing it to be easily linked to a desktop or laptop computer. This USB connection serves a dual purpose, as it facilitates both the transfer of code to the Arduino Uno and the exchange of data between the board and the host computer. This capability is particularly useful for applications involving data logging, monitoring, or control.

## Powering the Arduino Uno:

## The Arduino Uno can be powered through multiple means, providing users with flexibility in selecting the most suitable power source for their projects. One option is to use a USB cable connected to a computer, which not only powers the board but also allows for code uploads and data exchange. Alternatively, the board can be powered through a barrel connector that accepts voltages in the range of 7 to 20 volts, making it compatible with a variety of power sources, including external adapters, batteries, and solar panels

## Microcontroller Compatibility:

## It's worth noting that the Arduino Uno employs the same ATmega328P microcontroller found in the Arduino Nano board. Additionally, the Arduino Uno's pinout and header configuration are akin to those of the Arduino Leonardo board. This compatibility fosters a high degree of interoperability between different Arduino models and shields (expansion boards), allowing users to mix and match components to meet specific project requirements.

## Open Design Philosophy:

## The Arduino project has always embraced an open design philosophy. In line with this ethos, layout and production files for certain versions of the Arduino Uno hardware are made available to the community. This open-access approach empowers users to modify and adapt the board to suit their unique needs, promoting innovation and customization.

## Community and Ecosystem:

## Perhaps one of the most compelling aspects of the Arduino Uno is the vibrant and supportive community that has formed around it. This community includes makers, educators, hobbyists, and professionals who share a passion for electronics and programming. Countless online resources, tutorials, forums, and projects are available, making it easy for users to find guidance, inspiration, and solutions to their technical challenges. The global reach of the Arduino community has contributed to the widespread adoption and enduring popularity of the Arduino Uno.

## Applications:

## The versatility of the Arduino Uno opens the door to a multitude of applications across various domains. Some common use cases include:

## 1. Prototyping: The Arduino Uno is an ideal platform for quickly prototyping electronic systems and proof-of-concept projects. Its ease of use allows users to iterate and experiment rapidly.

## 2. Education: The board is widely used in educational settings to teach electronics, programming, and robotics. Its simplicity and extensive documentation make it an excellent tool for learners of all ages.

## 3. Home Automation: Arduino Uno can be the cornerstone of DIY home automation systems, controlling lights, thermostats, and security systems.

## 4. Robotics: As a central controller, the Arduino Uno is often used in robotics projects, where it coordinates the actions of motors, sensors, and other components.

## 5. IoT (Internet of Things): With the addition of networking shields or modules, the Arduino Uno can be integrated into IoT applications for data collection, remote control, and more.

## 6. Data Logging: The board can log data from various sensors, making it suitable for applications such as weather stations, environmental monitoring, and scientific experiments.

## 7. Art Projects: Arduino Uno's ability to interact with the physical world makes it a valuable tool for artists and creators working on interactive installations and kinetic sculptures.

## 8. Automation: The board can be used to automate tasks such as controlling garden irrigation systems, pet feeders, and smart mirrors.

## 9. Gaming: Arduino Uno is used in creating custom game controllers, interactive gaming installations, and even homemade arcade machines.

## The Arduino Uno is a true embodiment of the democratization of technology. Its combination of accessible hardware, a user-friendly development environment, and a thriving community has paved the way for countless innovations and creative projects. Aspiring makers, educators, engineers, and hobbyists have all found in the Arduino Uno a powerful tool for bringing their ideas to life. Its impact on the world of electronics and embedded systems continues to be profound, making it an enduring symbol of open-source innovation and collaboration. Whether you're a novice eager to embark on your first electronic adventure or a seasoned engineer pushing the boundaries of what's possible, the Arduino Uno remains an indispensable tool for turning imagination into reality.

## Table 1.6.1: Technical Specification of Arduino Uno

|  |  |
| --- | --- |
| Microcontroller | ATmega328P |
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limit) | 6-20V |
| Digital I/O Pins | 14 (of which 6 provide PWM output) |
| Analog Input Pins | 6 |
| DC Current per I/O Pin | 20 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 32 KB (ATmega328P) of which 0.5 KB used by bootloader |
| SRAM | 2 KB (ATmega328P) |
| EEPROM | 1 KB (ATmega328P) |
| Clock Speed | 16 MHz |
| LED\_BUILTIN | 13 |
| Length | 68.6 mm |
| Width | 53.4 mm |
| Weight | 25 g |

## Pin Description

* **Vin: -** The input voltage to the Arduino board when it’s using an external power source you can supply voltage through this pin. If the supplying voltage via USB connection or the power jack, you can access it through this pin.
* **5V: –** This pin gives the output of 5V. You can use this pin to give a 5V supply to the sensor.
* **3V3: -** This pin gives the output of 3.3V. The maximum current drawn is 50 mA.
* **GND: -** These pins use as Ground Pins.
* **IOREF: -** On the Arduino board, this pin provides voltage references, with which the microcontroller operates. A properly configured gradient can read the IOREF pin voltage and can work with 5V or 3.3V to select a suitable power source on the output or enable the voltage translator on the output.

**ATmega328 with Arduino (Uno)**

The ATmega328 in a DIP (Dual Inline Package) configuration comes pre-loaded with the Arduino Optiboot (Uno 16MHz) Bootloader. This pre-programmed chip enables you to utilize Arduino code seamlessly within your custom embedded projects, eliminating the need for a physical Arduino board.

To effectively use this chip with the Arduino IDE, you'll require an external 16MHz crystal or resonator, a 5V power supply, and a serial connection. If you're not experienced in setting up these components, it's advisable to consider purchasing an Arduino Uno board, which integrates all these necessary elements.

The ATmega328 is Atmel's 8-bit processor, and in this DIP package, it offers double the flash memory compared to the ATmega168, providing 32K of program space. It boasts 23 I/O lines, including 6 channels for the 10-bit ADC (Analog-to-Digital Converter). This microcontroller is capable of running at speeds of up to 20MHz when an external crystal is used. Additionally, it supports an operating voltage range of 1.8V to 5V and allows for in-circuit programming.

**ATmega328**

The ATmega328, part of Atmel's megaAVR family, is a versatile single-chip microcontroller. This 8-bit AVR RISC-based microcontroller packs an impressive array of features, including 32 kB of in-system programmable (ISP) flash memory with read-while-write capabilities, 1 kB of EEPROM, 2 kB of SRAM, 23 general-purpose I/O lines, and 32 general-purpose working registers. It also boasts three flexible timer/counters with compare modes, support for internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire serial interface, SPI (Serial Peripheral Interface) serial port, and a 6-channel 10-bit A/D (Analog-to-Digital) converter (with 8 channels available in TQFP and QFN/MLF packages). Additionally, it features a programmable watchdog timer with an internal oscillator and offers five software-selectable power-saving modes. Operating within a voltage range of 1.8 to 5.5 volts, this microcontroller achieves a processing throughput approaching 1 million instructions per second (MIPS) per MHz.

Since 2013, the ATmega328 has found widespread use in numerous projects and autonomous systems where a straightforward, low-power, and cost-effective microcontroller is required. Its most prominent application is within the popular Arduino development platform, specifically in models like the Arduino Uno and Arduino Nano. These microcontrollers have empowered countless makers and developers to create a wide range of innovative projects and applications, contributing to their enduring popularity in the embedded systems community.

## Relay Module (5V)

## Relay Module with Arduino | How to Set up 5V Relay

## Fig 1.6.2: Relay Module

A relay is an essential electrical component used in various applications to control the flow of electrical current through a circuit shown in fig 4.2.3 Here's an in-depth explanation of relays and their operation.

## Relay Operation:

## A relay is essentially an electromagnetic switch that is controlled by a separate electrical circuit. It consists of four main parts: an electromagnet coil, a movable armature, a set of contacts, and a frame to house these components.

## When a voltage is applied to the coil terminals, an electrical current flows through the coil, creating a magnetic field. This magnetic field attracts the metal armature towards the coil, causing the armature to move and close the contacts. This closed contact allows electrical current to flow through the relay's main circuit.

## When the voltage is removed from the coil, a spring attached to the armature returns it to its original position, opening the contacts. This interruption of the magnetic field prevents current flow through the main circuit.

## Types of Contacts:

## Relays can have different types of contacts: Normally Open (NO), Normally Closed (NC), or change-over contacts (also known as Form C contacts).

## Normally Open (NO): These contacts are open when the relay is not energized but close when the coil is energized.

## Normally Closed (NC): These contacts are closed when the relay is not energized but open when the coil is energized.

## Change-Over Contacts (Form C): These contacts have both normally open and normally closed positions and switch between them when the coil is energized or de-energized.

## Relay Applications:

## Relays are used to control circuits with higher power requirements than the controlling circuit can handle directly. This allows a weaker control signal to operate a more substantial load.

## Relays provide electrical isolation between the controlling circuit and the controlled circuit, enhancing safety and preventing interference.

## They are commonly used in various applications, including industrial automation, automotive systems, home automation, and telecommunications.

## Historical Background:

## The concept of the relay dates back to the early 19th century, with Samuel Morse's invention of the "Telegraph Amplifying Electromagnetic Device" in 1836. This device enabled a small electrical current in one circuit to control a larger current in another, helping relay telegraph signals. Over time, relays evolved into more sophisticated and versatile components, becoming a fundamental part of electrical engineering.

## In summary, relays serve as automatic electromagnetic switches that control the flow of electrical current in a circuit. They are essential for various applications where electrical isolation, amplification of control signals, and the ability to switch high-power loads are required. Relays have a rich history and continue to play a crucial role in modern technology and automation.

## MQ3 Sensor

## The MQ3 sensor is one of the most widely used in the MQ sensor series. It is a MOS (Metal Oxide Semiconductor) sensor. Metal oxide sensors are also known as Chemiresistors because sensing is based on the change in resistance of the sensing material when exposed to alcohol.

## The MQ3 alcohol sensor operates on 5V DC and consumes approximately 800mW. It can detect alcohol concentrations ranging from 25 to 500 ppm.

## Internal structure of MQ3 Alcohol Sensor

## The MQ3 is a heater-driven sensor. It is therefore covered with two layers of fine stainless-steel mesh known as an “anti-explosion network”. It ensures that the heater element inside the sensor does not cause an explosion because we are sensing flammable gas (alcohol).

## MQ3 alcohol sensor parts hardware overview

## It also protects the sensor and filters out suspended particles, allowing only gaseous elements to pass through the chamber.

## The sensing element and six connecting legs that extend beyond the Bakelite base form the star-shaped structure. Two (H) of the six leads are in charge of heating the sensing element and are linked together by a Nickel-Chromium coil (a well-known conductive alloy).

## The remaining four signal-carrying leads (A and B) are connected with platinum wires. These wires are connected to the body of the sensing element and convey slight variations in the current flowing through the sensing element.

To summarize, the Heating System is composed of a Nickel-Chromium coil and

an Aluminum Oxide-based ceramic, while the Sensing System is composed

of Platinum wires and a Tin Dioxide coating.

## iii MQ3 sensor:

## 

## Fig 1.6.3: MQ3 Sensor

## When a SnO2 semiconductor layer is heated to a high temperature, oxygen is adsorbed on the surface. When the air is clean, electrons from the conduction band of tin dioxide are attracted to oxygen molecules. This creates an electron depletion layer just beneath the surface of the SnO2 particles, forming a potential barrier. As a result, the SnO2 film becomes highly resistive and prevents electric current flow.

## In the presence of alcohol, however, the surface density of adsorbed oxygen decreases as it reacts with the alcohol, lowering the potential barrier. As a result, electrons are released into the tin dioxide, allowing current to freely flow through the sensor.

## MQ3 Alcohol Sensor Module Hardware Overview

## The MQ3 alcohol sensor is simple to use and has two different outputs. It not only provides a binary indication of the presence of alcohol, but also an analog representation of its concentration in air.

## The sensor’s analog output voltage (at the A0 pin) varies in proportion to the alcohol concentration. The higher the concentration of alcohol in the air, the higher the output voltage; the lower the concentration, the lower the output voltage. The animation below shows the relationship between alcohol concentration and output voltage.

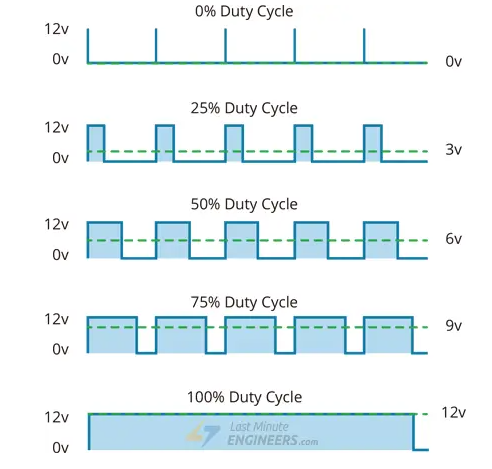
## This analog signal is digitized by an LM393 High Precision Comparator and made available at the Digital Output (D0) pin. The module includes a potentiometer for adjusting the sensitivity of the digital output (D0). You can use it to set a threshold so that when the alcohol concentration exceeds the threshold value, the module outputs LOW otherwise HIGH.

## Motor Controller L298N

## The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A. Let's take a closer look at the pinout of L298N module and explain how it works. L298N can control the speed and spinning direction of two DC motors. In addition, it can control a bipolar stepper motor, such as the NEMA 17.

## v. PWM – to control speed

The speed of a DC motor can be controlled by changing its input voltage. A widely used technique to accomplish this is Pulse Width Modulation (PWM). PWM is a technique in which the average value of the input voltage is adjusted by sending a series of ON-OFF pulses. This average voltage is proportional to the width of the pulses, which is referred to as the **Duty Cycle**. The higher the duty cycle, the higher the average voltage applied to the DC motor, resulting in an increase in motor speed. The shorter the duty cycle, the lower the average voltage applied to the DC motor, resulting in a decrease in motor speed.



## Fig 1.6.4: Duty cycles

PWM technique with various duty cycles and average voltages is shown in Fig 4.2.4

## 

## Fig 1.6.5: Motor Controller L298N.

### **Power Pins**

The L298N motor driver module receives power from a 3-pin, 3.5mm-pitch screw terminal.

The L298N motor driver has two input power pins: VS and VSS.

VS pin powers the IC’s internal H-Bridge, which drives the motors. This pin accepts input voltages ranging from 5 to 12V.

VSS is used to power the logic circuitry within the L298N IC, and can range between 5V and 7V.

GND is the common ground pin.

### **Output Pins**

The output channels of the L298N motor driver, OUT1 and OUT2 for motor A and OUT3 and OUT4 for motor B, are broken out to the edge of the module with two 3.5mm-pitch screw terminals. You can connect two 5-12V DC motors to these terminals.

Each channel on the module can supply up to 2A to the DC motor. The amount of current supplied to the motor, however, depends on the capacity of the motor power supply.

### **Direction Control Pins**

The direction control pins allow you to control whether the motor rotates forward or backward. These pins actually control the switches of the H-Bridge circuit within the L298N chip.

The module has two direction control pins. The IN1 and IN2 pins control the spinning direction of motor A; While IN3 and IN4 control the spinning direction of motor B.

The spinning direction of the motor can be controlled by applying logic HIGH (5V) or logic LOW (Ground) to these inputs. The chart below shows various combinations and their outcomes.

### **Speed Control Pins**

The speed control pins ENA and ENB are used to turn on/off the motors and control their speed.

Pulling these pins HIGH will cause the motors to spin, while pulling them LOW will stop them. However, with Pulse Width Modulation (PWM), the speed of the motors can be controlled.

The module usually comes with a jumper on these pins. When this jumper is in place, the motor spins at full speed. If you want to control the speed of the motors programmatically, remove the jumpers and connect them to the Arduino’s PWM-enabled pins.

# CHAPTER - 2

# Literature Survey

## Review of literature

## In 2016, 10,497 people died in alcohol impaired driving crashes, accounting for 28% of all traffic-related deaths in the United States. Of the 1,233 traffic deaths among children ages 0 to 14 years in 2016, 214 (17%) involved an alcohol impaired driver. In 2016, more than 1 million drivers were arrested for driving under the influence of alcohol or narcotics. That’s one percent of the 111 million self-reported episodes of alcohol-impaired driving among U.S. adults each year is shown in figure. Drugs other than alcohol (legal and illegal) are involved in about 16% of motor vehicle crashes. Marijuana use is increasing and 13% of nighttime, weekend drivers have marijuana in their system. Marijuana users were about 25% more likely to be involved in a crash than drivers with no evidence of marijuana use, however other factors–such as age and gender–may account for the increased crash risk among marijuana users. Annual Self-reported Alcohol-impaired Driving Episodes among U.S. Adults, 1993–2014

## Drivers with a BAC of 0.08% or higher involved in fatal crashes were 4.5 times more likely to have a prior conviction for DWI than were drivers with no alcohol in their system. (9% and 2%, respectively).1 Drivers are considered to be alcohol impaired when their blood alcohol concentrations (BACs) are .08 grams per deciliter (g/dL) or higher. Thus, any fatal crash involving a driver with a BAC of .08 g/dL or higher is considered to be an alcohol-impaired-driving crash, and fatalities occurring in those crashes are considered to be alcohol-impaired-driving fatalities.

## New Delhi: The per capita alcohol consumption in India increased two folds between 2005 and 2016, according to the Global status report on alcohol and health 2018 released by the World Health Organization (WHO) on Saturday. Indians consumed 2.4 liters of alcohol in 2005, which increased to 4.3 liters in 2010 and scaled up to 5.7 liters in 2016, the report said. According to the report, the highest increase in alcohol consumption is expected in South-East Asia, with an increase of 2.2 liters in India alone, from 2005 to 2016.

## More than 3 million people died as a result of harmful use of alcohol in 2016, the report said. More than three quarters of those reported dead were men. Overall, the harmful use of alcohol causes more than 5% of the global disease burden. The report highlighted that 51.1 men per 100,000 population and 27.1 women per 100,000 population suffered from liver cirrhosis. Cancers associated with alcohol abuse resulted in 181 men per 100,000 population and 126.4 women per 100,000 population. Of all deaths due to alcohol, 28% were from injuries, such as those from traffic crashes, self-harm and interpersonal violence; 21% due to digestive disorders; 19% due to cardiovascular diseases, and the remaining due to infectious diseases, cancers, mental disorders and other health conditions.―Far too many people, their families and communities suffer the consequences of the harmful use of alcohol through violence, injuries, mental health problems and diseases such as cancer and stroke," according to Tedros Adhanom Ghebreyesus, director-general, WHO. ―It’s time to step up action to prevent this serious threat to the development of healthy societies."

## According to the report, almost all (95%) of countries globally have alcohol excise taxes, but fewer than half of them use other price strategies such as ban on volume discounts. The majority of these countries have some type of restrictions on beer advertising, with bans most common for television and radio, but less common for the Internet and social me.

## Proposed solution:

The proposed solution for our project revolves around a cutting-edge alcohol detection and engine control system aimed at enhancing road safety by mitigating the risks associated with alcohol-impaired driving. This innovative system comprises various key components and functionalities designed to effectively sense alcohol consumption and take preventive action when needed.

**Alcohol Detection Mechanism:**

Our system incorporates advanced alcohol detection sensors, such as the highly sensitive MQ-3 sensor with a Tin Dioxide (SnO2) sensitive layer. These sensors are strategically installed near the driver's breathing zone, typically on the steering wheel, to focus on the breath of the person driving.

**Real-time Monitoring and Analysis:**

The alcohol detection system operates in real-time, continually monitoring the alcohol levels in the driver's breath. It utilizes sophisticated algorithms and data processing mechanisms to provide rapid and precise analysis.

**Threshold-Based Control:**

The system is configured with predefined alcohol concentration thresholds. If the analysis indicates that the driver's alcohol levels surpass these established limits, the system intervenes.

**Engine Autolocking:**

In cases where the driver's alcohol levels exceed the predefined limits, the system sends a command to immobilize the vehicle's engine. If the engine is already running but the vehicle is stationary, the system instantly cuts power to the engine. This intervention effectively prevents the vehicle from starting or gradually decreases its speed and brings it to a controlled stop in situations where the vehicle is already in motion.

# CHAPTER - 3

# Methodology

## Block Diagram

## 

Fig 3.1: Block Diagram

The Block Diagram of Alcohol Detection and Engine Auto Locking System is shown in Fig 3.1

## 1. MQ3 Sensor:

## Description: The MQ-3 sensor is a gas sensor that uses a Tin Dioxide (SnO2) sensitive layer to detect the presence of specific gases, including alcohol vapor. The sensor operates on the principle of changes in electrical resistance based on the concentration of the target gas in the surrounding environment. When exposed to alcohol vapor, the SnO2 layer undergoes changes in conductivity, leading to variations in electrical resistance. These resistance changes are used to measure the concentration of alcohol or other gases.

## Specifications: Consumes 150mA current. Digital output Do: 0 and 1 TTL digital (0.1V and 5V). Analog output Ao: 0.1V to 0.3V (relates to pollution), voltage concentration is maximum of 4V. Alcohol Concentration detection: 0.05 mg/L to 10 mg/L.

## Applications: MQ3 sensors are commonly used in Breathalyzers, Ignition Interlock Devices, Alcohol Detection Systems, Safety Alarms, Environmental Monitoring, Research and Experimentation

## 2. Arduino Microcontroller:

## Description: The Arduino Microcontroller is a versatile open-source microcontroller platform that serves as the brain of the system. It is responsible for processing data, making decisions, and controlling the various components of the charging system.

## Specifications: Arduino boards come in various models, but for this application, a compact and cost-effective board like the Arduino Uno or Arduino Nano may be used. They typically feature a microcontroller unit, input/output pins, and onboard programming capabilities.

## Applications: Arduino Microcontrollers are widely used in robotics, automation, IoT projects, and various electronic systems that require control and data processing capabilities.

## 3. Relay Module:

## Description: The Relay Module is an electromechanical device used to control high-power electrical circuits. It acts as a switch that can be electronically controlled to open or close a circuit, allowing or cutting off the power supply to other components.

## Specifications: Relay Modules come in different configurations, typically with multiple relay channels. They can handle various voltage and current levels, depending on the specific application requirements.

## Applications: Relay Modules are used in home automation, industrial control systems, and projects where electrical isolation or switching high-power loads is necessary.

## 4. Motor Controller L298N:

## Description: The L298N is a popular and versatile motor controller integrated circuit (IC) commonly used for driving and controlling DC motors and stepper motors. It is designed to provide precise and efficient motor control in various applications, making it a favored choice in robotics, automation, and DIY electronics projects.

## Specifications: Driver: L298N Dual H Bridge DC Motor Driver • Power Supply: DC 5 V - 35 V • Peak current: 2 Amp • Operating current range: 0 ~ 36mA • Control signal input voltage range : • Low: -0.3V ≤ Vin ≤ 1.5V.

## Applications: The L298N motor controller finds applications in various domains, including Robotics, Automation, CNC Machines, DIY Projects, Prototyping, Education

## Flow Chart

## 

Fig 3.2: Flow Chart

The Process of the Alcohol Detection and Engine Auto Locking System is shown in Fig 3.2

## Algorithm

## 1. Start

## 2.Initialize the system components

## 3. Create variables to track sensor input, speed of motor, and a temporary value for changing the speed of motor.

## 4. Enter the main loop:

## Continuously monitor the Sensor input

## If alcohol above threshold is detected Execute the following

## if vehicle is running.

## decrease the temporary variable of speed in a loop after every 10 seconds till it reaches 0.

## Stop the engine

## Else stop the engine.

## Circuit Diagram:

## 

## Fig 3.4.1: Circuit diagram.

# Arduino Code:

1. #include <LiquidCrystal.h>
2. #define gas A0
3. #define relay 6
4. int alc=0;
5. int motor1\_ena = 3;
6. int motor1\_in1 = 4;
7. int motor1\_in2 = 5;
8. int speed=255;
9. void setup()
10. {
11. pinMode( motor1\_ena , OUTPUT);
12. pinMode( motor1\_in1 , OUTPUT);
13. pinMode( motor1\_in2 , OUTPUT);
14. digitalWrite( motor1\_in1, LOW);
15. digitalWrite( motor1\_in2, HIGH );
16. pinMode(gas,INPUT);
17. pinMode(relay,OUTPUT);
18. digitalWrite(relay,HIGH);
19. }
20. void loop()
21. {
22. alc=digitalRead(gas);
24. if(alc==HIGH)
25. {
26. speed=255;
27. analogWrite( motor1\_ena , speed);
28. digitalWrite(relay,LOW);
29. }
30. else
31. {
32. for (; speed >70; speed--) {
33. analogWrite(motor1\_ena, speed);
34. delay(10);
35. }
36. digitalWrite(relay,HIGH);
38. }
39. }

# CHAPTER - 4

# SOFTWARE AND HARDWARE REQUIREMENTS

## Software Requirements

## Arduino IDE

## Windows 11

## Hardware Requirements

## Arduino UNO

## Relay Module

## Motor Controller

## DC Motor

## Battery

## MQ3 sensor

# CHAPTER – 5

# RESULTS AND DISCUSSION

The primary objective of the Alcohol Detection and Engine Locking System is to effectively prevent accidents resulting from drivers operating vehicles under the influence of alcohol. The successful implementation of this system holds the potential to lead to a significant reduction in alcohol-related accidents, thus enhancing road safety for all road users.

The cornerstone of the system's effectiveness lies in the accuracy of its alcohol detection sensor, exemplified by the MQ-3 sensor. The sensor's precision in measuring alcohol levels within a driver's breath is a pivotal factor determining the system's success. The ability to reliably and swiftly identify alcohol impairment is critical in taking timely preventive action.

Moreover, the system's capacity to gradually and systematically reduce the speed of the vehicle, ultimately bringing it to a controlled stop upon detecting alcohol impairment, is essential for ensuring the safety of all involved. This feature is designed to minimize the risk of abrupt and potentially hazardous stops while effectively addressing the issue at hand.

In conjunction with gradual speed reduction, the ignition system's functionality plays a pivotal role. It allows the engine to start only when specific conditions are met, ensuring that individuals under the influence of alcohol are prevented from operating the vehicle. This dual mechanism of gradually reducing speed and controlling ignition provides a comprehensive approach to mitigating the risks associated with alcohol-impaired driving.

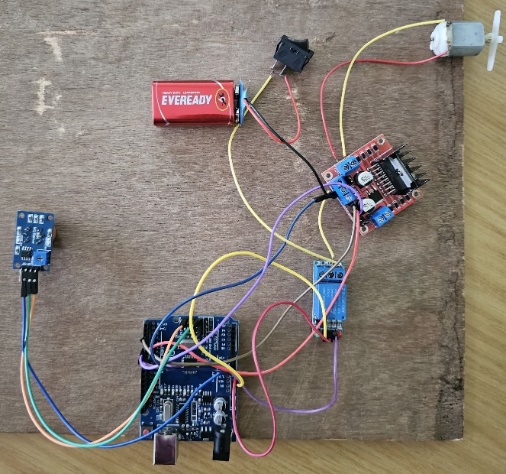


Fig 5.1 Circuit

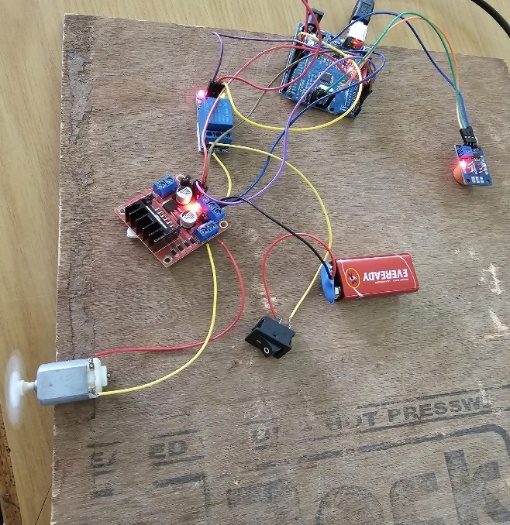


Fig 5.2 Running Motor

Motor running in when no methanol is sensed is shown in Fig 5.2

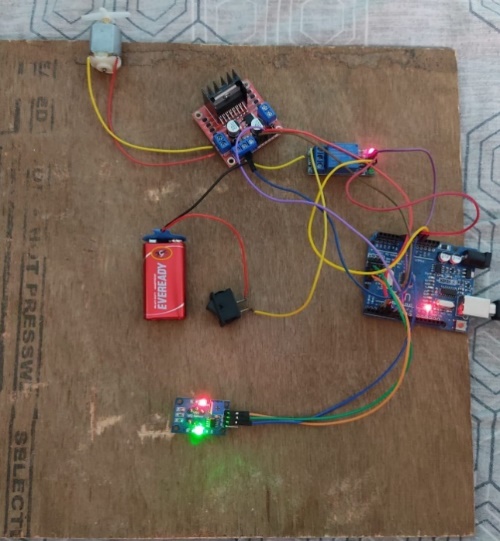


Fig 5.3 Power supply is halted

Power supply to motor is halted in when methanol is sensed is shown in Fig 5.3

# CHAPTER - 6

# CONCLUSION AND FUTURE SCOPE

**6.1 Conclusion**

The implementation of an alcohol detection and engine locking system carries a multifaceted set of objectives, all converging to bolster road safety and significantly diminish the occurrence of alcohol-related accidents. The core aim is the prevention of accidents stemming from drivers operating vehicles while under the influence of alcohol, which stands to bring about a substantial reduction in such incidents. By seamlessly integrating the alcohol detection and engine locking system, road safety is poised for a notable upswing, as the number of accidents resulting from alcohol impairment is anticipated to decrease. The success of the system, however, hinges on drivers' compliance with its directives, which necessitates effective user engagement and encouragement for responsible behavior, discouraging attempts to operate vehicles while impaired. Central to the system's efficacy is the precision and reliability of the alcohol detection sensor, exemplified by the critical role of the MQ-3 sensor in accurately gauging alcohol levels. To ensure safety, the system incorporates the ability to gradually reduce vehicle speed and execute a controlled stop upon detecting alcohol impairment, which is vital for mitigating risks. Furthermore, ignition control functions, predicated on specific conditions, prevent individuals impaired by alcohol from operating the vehicle. The system's overall performance relies on the reliability and durability of its hardware components, including sensors and microcontrollers. Successful implementation would translate into a tangible decrease in accidents linked to drunk driving, ushering in advancements in road safety, and potentially acting as a catalyst for further safety-related innovations in the automotive industry.

**6.2** **Future Vision and Innovation:**

The alcohol detection and engine locking system not only addresses the critical issue of alcohol-impaired driving but also holds the promise of pioneering a new era in vehicle safety. Its successful implementation has the potential to serve as a catalyst for broader innovations within the automotive industry. By effectively curbing alcohol-related accidents and enhancing road safety, this system sets the stage for the integration of advanced safety features in vehicles. Beyond its primary function, the technology can be extended to incorporate additional safety measures, such as detecting drowsy drivers and taking necessary actions. This expansion in functionality aligns with the broader industry trends of enhancing driver and passenger safety through smart technologies. By proactively responding to driver fatigue or impairment, the system contributes to a safer and more responsible driving environment. As a result, it may stimulate further research and development, fostering a wave of innovation aimed at reducing accidents and saving lives on the road.

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