Alcohol Detection System to Reduce Drunk Driving

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***Abstract*— Due to the rapid increase of vehicles on roads, the probability of road accidents is rising steeply. Drunk driving is considered to be a major cause of road accidents throughout the world. The main aim of this project is to develop a system that would detect the amount of alcohol that is consumed by the driver of the vehicle. The proposed system aims at preventing the user from driving when drunk and thereby intends to reduce the number of accidents occurring due to drunk driving. The proposed model is developed using Arduino Uno and alcohol detection sensor (MQ-3) as its major components. As a safety measure, when the level of alcohol crosses a permissible limit, the vehicle ignition system (DC Motor) will be turned off and the concerned authority will be alerted using the GSM module.**

Keywords—Arduino-UNO,MQ-3,LED,GSM,Button,DC motor

I. INTRODUCTION

The report by the Government of India[1] (Ministry of road transport and highways) in the year of 2017 states that, the total number of accidents occurring on the Indian roads were 4,64,910. Out of these, 14,071 accidents occurred due to drunk driving, which is becoming a major cause of accidents on Indian roads. India has thus earned the dubious distinction of having a huge number of accidents due to drunk driving. Many mishaps are occurring because of the alcohol consumption of the driver. Due to drunk driving many lives and properties have been endangered. This is because the person driving the car is not in a stable position to take control of the car. In such a situation, the driver must not be permitted to operate his vehicle. Fig 1.[2] depicts the alarming number of accidents and deaths occurring between the years 2008-2017.

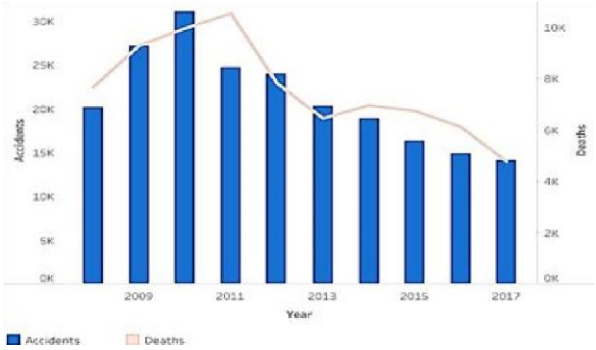

Fig 1. Road accidents and deaths due to driving under influence of alcohol

A. Present Scenario

Currently, the police inspect roads to detect alcohol consumption by using breathalyzers. The breathalyzer requires the driver to blow into the device and indicates the blood alcohol level. A person can be punished if alcohol exceeding 30 milligram per 100 millilitre of blood is detected in the breath analyser test, according to Section 185 of The Motor Vehicles Act,1988. It also states that, drunk driving is a punishable offence, charging a fine of up to Rs 2,000 and/or imprisonment for up to six months on first offence.[3]

B. Proposed Solution

The use of breathalyser is however manual and unlikely to detect most cases of drunk driving as the mishaps have already occurred and detection of alcohol happens postliminary. Also,

this method is not considered to be accurate due to the physiological differences such as an individual's weight, external temperature, breathing patterns, etc. In this paper, Arduino Uno is used which is an open source microcontroller and is easily operable. The system senses the presence of alcohol consumed by the driver using the MQ-3 sensor. The nifty property of this sensor is that the range can be set up to 5-10 cm to sense the alcohol consumption of the driver alone and will thus be placed on the steering of the car. If the level of alcohol crosses the threshold value, the engine of the vehicle (DC Motor) is stopped and a short message is sent as an alert via GSM to the concerned authorities. The proposed system is designed for the safety of the people seated inside the car as well as people out in the surrounding.

II. SYSTEM BLOCK

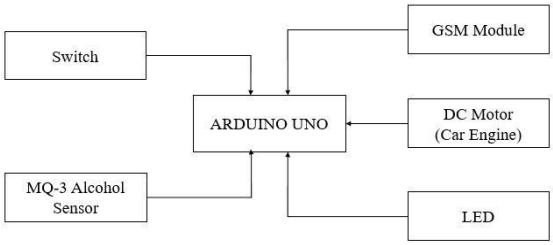

Fig 2. Block Diagram for alcohol detection

The block diagram of the proposed system is shown in Fig 2. It consists of a switch which is used to start the system. It is analogous to starting the car engine. The MQ-3 alcohol sensor is used to detect the presence of alcohol that crosses the specified threshold value. The value is then sent to the Arduino and if the specified value is surpassed, then it forwards an input to GSM module to send a SMS to the concerned authority. The DC motor is used in order to signify the car ignition system which is cut off in case of alcohol consumption.

III. LITERATURE SURVEY

Several approaches have been proposed related to this issue in many papers. Of these, some specific papers have been analyzed in the following paragraphs.

Vijay Savania el al [4] proposed a system using an alcohol sensor placed in the vehicle along with the ultrasonic sensor used for car accident prevention. The resulting information is transmitted via SMS to the close by acquaintance through the GSM module.MS Malathi el al [5]proposed a software environment indicating the alcohol sensor placed on the steering wheel detects the alcohol level and also a seat-belt detector is introduced for the safety of the driver during accidents by locking the seat-belt slot due to which the ignition can never be started. Dada Emmanuel Gbenga el al [6] proposed a prototype to detect alcohol and an engine locking mechanism by using an Arduino-Uno microcontroller interfaced with an alcohol sensor along with an LCD screen and a DC motor. In case alcohol is detected the engine is stopped ,hence needs to be parked instantly .Aryan Mathur el al [7] proposed a system imbedded on the steering wheel of the four wheeler to detect the alcohol level of the driver, the respective output is sent via signal to piezoelectric shaft and key casting is locked/unlocked. RF receiver receives the signals from the transmitters placed on the accident prone sites and the driver is alerted regarding the respective zones. Prof. Dr. D.G.Jha, el al [8] proposed a model which aims at preventing the user from driving when drunk and reduces the number of accidents occurring due to drunken driving. In case ,if the driver is intoxicated before but consumes the alcohol in motion, the sensor continues measuring and when the level crosses the limit, the vehicle starts slowing down and is stationed.

IV. SYSTEM COMPONENTS

A. Arduino-UNO

Fig 3. Arduino Uno board

Arduino Uno is a microcontroller that is based on the ATmega328P. It can be connected to a computer with a USB connection or powered with the help of an AC-to-DC adapter or battery to get started. It is the first in the series of Arduino USB boards .It has a flash memory of 32KB with a clock speed of 16MHz. The Arduino board requires a voltage 5V for operating. It consists of 14 Digital I/O Pins and 6 Analog Input Pins.[9]

B. Alcohol Sensor

Fig 4. MQ-3 alcohol sensor

The alcohol sensor used here is MQ-3 which helps to detect whether the driver has consumed alcohol. Whenever alcohol is present in air, the sensor conductivity increases, generating the required output. The sensor is highly sensitive towards alcohol, while that towards benzene, gasoline, smoke and vapour is less The range of this sensor is up to 2 meters and it can be used for detecting alcohol with varying concentration levels.

Specifications:

- It requires 5V of power supply
- The range of concentration it can sense is between 0.4mg/L to 4mg/L
- It outputs its values in terms of voltage(Analog output)
- The sensitivity of the sensor is 200-1000ppm
- It is highly stable with fast response time[10]

C. Switch/Button

Fig 5. shows push button

The button acts as a prototype which is used to start the engine of a car. Push-Buttons are usually open tactile switches. Push buttons allow in order to make a particular connection when the button is pressed. It basically makes the circuit connected when pressed and breaks when it is released.

Specifications:

- The mode of operation of the button is through a tactile feedback
- Its power rating is MAX 50mA 24V DC
- The contact resistance is MAX 100mOhm
- Its operating temperature range is usually from -20 to +70 ℃
- Its storage temperature range is between -20 to +70 ℃ [11]

D. DC Motor

Fig 6. shows DC motor

The DC motor symbolizes the engine of the car. The motor comes to stand in the course of alcohol detected. The engine motor resumes to normality in case the level of alcohol is below the predefined threshold .The DC motor is connected to pin 9 on the microcontroller.

Specification:

- Standard 130 Type DC motor is operated
- Operating Voltage is ranging from 4.5V to 9V
- Recommended/Rated Voltage is 6V
- Current at No load is70mA (max)
- No-load Speed is 9000 rpm
- Loaded current is 250mA (approx) [12]

F. GSM Module :

Fig 7. shows GSM Module

A GSM modem consists of GSM Module along with some other components such as a communication interface (like Serial Communication: RS-232), power supply and some types of indicators. We can connect the GSM Module with an external computer or a microcontroller with the help of this communication interface. The GSM module used here is SIM900.

Specifications:

- It requires a supply voltage between 3.4V to 4.5V
- Frequency bands:SIM900A
- It also helps to provide GPRS connectivity with the help of GPRS multi-slot class 10 (default)

- It Supports UART interface
- It also Supports single SIM card[13]

F. LED :

Fig 8. LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. It is used to illustrate the presence or absence of alcohol detected by indicating the glow on LED respectively.

Specification:

- 5mm Round Standard Directivity
- UV Resistant Epoxy
- Forward Current (IF) is 30mA
- Forward Voltage (VF) is ranging between 1.8V to 2.4V
- Reverse Voltage is 5V
- Operating Temperature between -30℃ to +85℃
- Luminous Intensity is 20mcd [14]

V. FLOW CHART

A. Algorithm :

Step 1: Initialize the vehicle (DC motor)
Step 2: DC motor initiates to begin rotation
Step 3:Detection of the alcohol level through the MQ-3 sensor
Step 4: If the alcohol is above the predefined threshold, Then

Analog inputs sent to the Arduino-uno,
Arduino performs the conversion to digital outputs,
the LED turned off and
DC motor terminates the rotation.
Else,
motor resumes to rotate.

B. Flowchart :

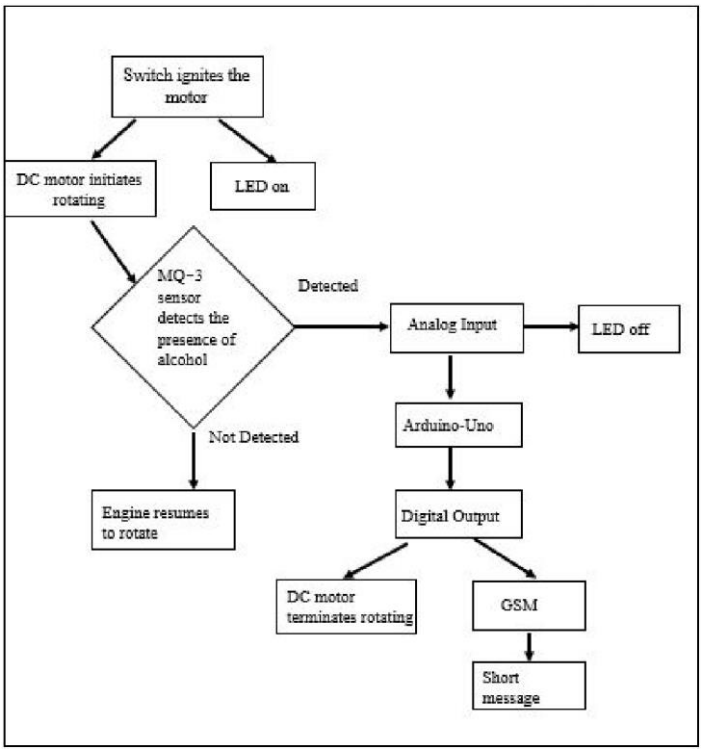

Fig 9. Flowchart of the system

The flowchart shown can be divided into three major parts: The first part includes the ignition process which is depicted using the button ,the DC motors begin to function and the led is turned on . The prime component is the alcohol sensor, which detects alcohol by breathing directly into the sensor. The second part is the controlling unit; it has the necessary functions to read alcohol sensor's output, the microcontroller will act accordingly in response to the detected alcohol percentage by controlling the DC motors (either stop or run) and LED visually indicating its status. The third part; the necessary output is displayed on the serial monitor and a short message is transmitted to the authority through the GSM module.

VI . RESULTS

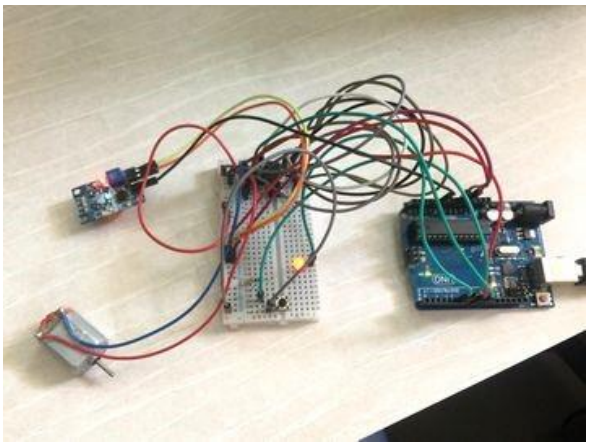

Fig 10 : System configuration

Indicating the absence of alcohol due to which the LED is turned on and the DC motor initiates spinning.

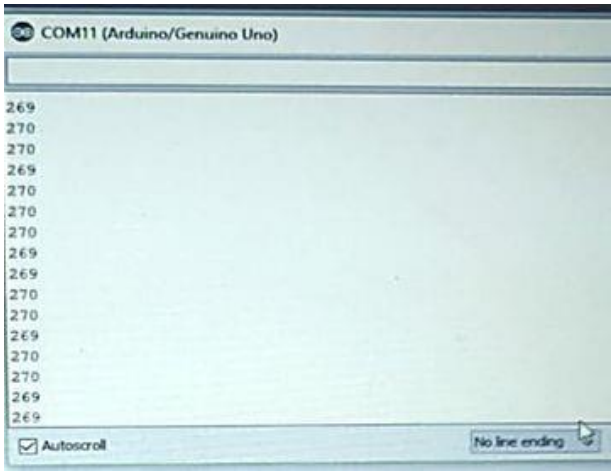

Fig 11 : COM port terminal output

The values observed in the COM terminal determine the absence of alcohol in part per million (ppm), as they are below the threshold value 400 parts per million(ppm).Hence the interpreted conclusion determines the absence of alcohol.

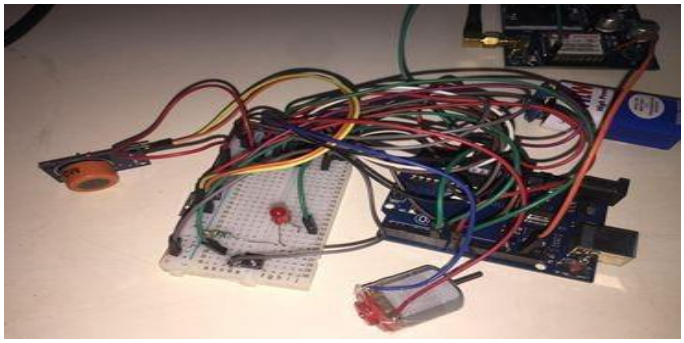

Fig12:Alcohol detected

Due to the presence of alcohol the resultant output leads to the termination of the DC motor and the led.

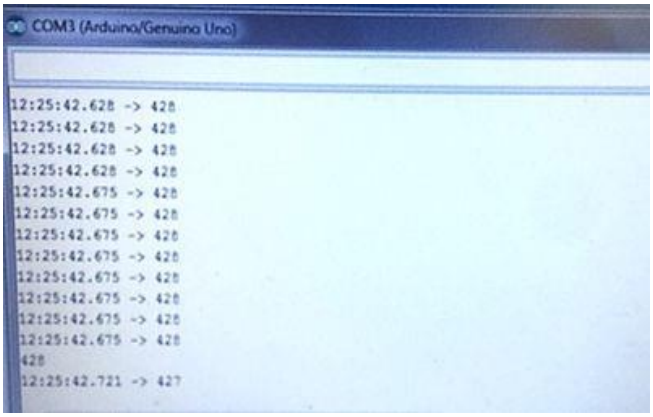

Fig 13 : COM port terminal output

The values obtained in the COM terminal conclude the presence of alcohol depicting the range above 400 ppm the predefined value

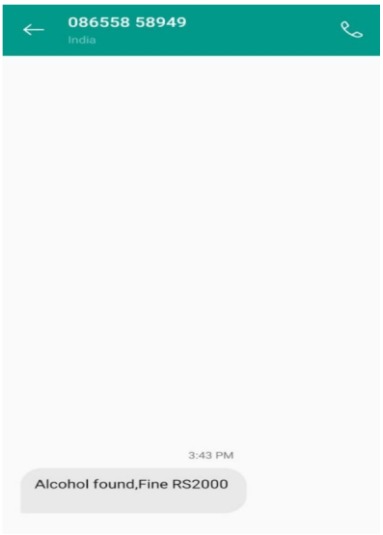

Fig 14 : GSM module

Transmitted short message to the respective authority

VIII .CONCLUSION

Thus the proposed system, ”Alcohol detection to reduce drunk driving” will thereby satisfy the criteria of a safety system if the driver has consumed a predefined amount of alcohol. Once the alcohol is detected the system will ensure a safety measure by turning the DC motor down and delivering an alert message to the respective authority.

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