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Druken alcohol intelligent detection system IoT based Arduino controller

Siti Aminah Nordin[1,2], Zakiah Mohd Yusoff[1], Nurul Nadia Mohammad[1]
[1]School of Electrical Engineering, College of Engineering Universiti Teknologi MARA, Segamat, Malaysia
[2]Microwave Research Institute, Universiti Teknologi MARA, Shah Alam, Malaysia

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ABSTRACT

An intelligent alcohol detection system has been created to recognize the location of drunken drivers to prevent such road incidents. The project is being enhanced to use the internet of things (IoT) to make it easier for users to track their location and receive messages through their smartphones. The alcohol breath analyzer sensor detects the amount of alcohol in the driver's breath and the liquid crystal display (LCD) will display "Alcohol Detected" and the blood alcohol concentration (BAC) value if the level exceeds the threshold. İn addition, the global system for mobile (GSM) will send short message service (SMS) or make phone calls and telegram will sends BAC value, while the GPS will broadcast the discovered alcohol's location. This project implicitly provides more benefits for current efforts in the development of accident prevention systems in the hopes of putting them into practice in the real world to improve road safety.

Corresponding Author:

Zakiah Mohd Yusoff
School of Electrical Engineering, College of Engineering Universiti Teknologi MARA
Pasir Gudang Campus, 81750 Masai, Segamat, Johor, Malaysia
Email: zakiah9018@uitm.edu.my

1. INTRODUCTION

According to a study published by the World Health Organization in 2008, drunk driving is responsible for about 50-60% of traffic accidents [1], [2]. Despite the fact that drinking, and driving is strictly forbidden, most people disobey the law and drive after drinking alcohol, resulting in road accidents. This is dangerous for pedestrians and small cars, but the lush manages to flee the accident area without being caught [3], [4]. The aim of this project is to establish a method of preventing car accidents using an alcohol detector in order to minimise traffic accidents caused by drunk driving. The alcohol sensor is integrated with the NodeMCU ESP32 board as microcontroller in this project. The MQ-3 alcohol gas sensor was used in this project to detect the presence of alcohol in human breath. As a prototype, an ignition device that produces spark plugs is designed to serve as the ignition starter for the vehicle's engine. The ignition system will be regulated by the amount of blood alcohol content (BAC) measured by an alcohol sensor in human breath. The primary goal of this project is to detect drunk driving. The internet of things (IoT) was added since technology in the world continues to advance and succeed [5]-[8]. As a result, the IoT is used in this project to make it simple for people to detect their location and receive messages through their smartphones [9].

There are three main objectives which is to design and improve a project of an Intelligent Alcohol Detection System that has been done by people in order to measure the road incidence. Other than that, to implement IoT in this project to make it simple for people to detect, monitor and track their location. Lastly, to develop software in order to measure blood alcohol content in the drunk driver’s breaths whether the BAC levels cross the threshold. This project has been done by many people but the information about the drunk drivers is not enough to be identified [10]. Therefore, in this case we redesigned and improved a project of an intelligent alcohol detection system using IoT in order to control, detect, monitor and track drunk driving as much as possible. Otherwise, in case the drunk drivers are not in possession of their phone, the liquid crystal display (LCD) display could be useful for them. So, by adding an LCD display in this project, it will show all the sensed values towards the drunk driver's breath.

2. BACKGROUND STUDY

2.1. Internet of things

The internet of things (IoT) used in this project is global positioning system (GPS) module which is GPS is invaluable to an IoT system since it measures and records location, speed, time, and direction, global system for mobile (GSM) that is based on enhanced data rates for GSM evolution (e-GPRS) and is intended as a high capacity, long range, low energy, and simple cellular system for IoT communications, ESP32 that have the Wi-Fi antenna and dual-core of the module allow embedded devices to connect to networks and transmit data, Blynk app and Telegram [11], [12]. Blynk is the most widely used IoT platform for connecting devices to the cloud. It is well-known for enabling users to create apps to control IoT devices, analyze telemetry data, and manage deployed products at scale [13]-[17]. Telegram and the Blynk app are the two applications used in this project. Aside from that, the GSM will make calls and send messages using the subscriber identity module (SIM) card provided.

2.2. Automatic toll payment, alcohol detection, load and vehicle information using internet of things and mailing system

The technology detects the vehicle's details using infrared sensors. Radio frequency identification (RFID) tags connected to things are automatically identified and tracked using electromagnetic fields [18]-[20]. Existing approaches rely on ultrasonic sensors, vision sensors, and other technologies that are unworkable, non-commercial, and incomparable to RFID technology. When it comes to actual implementation and utilization, we eliminate the limitations by implementing an RFID-based localization system that determines the locations of various products unequivocally and instantly [21], [22]. Because the current method cannot be changed in the future, RFID is the only solution for object identification. RFID tags that store information on a specific vehicle can be used to take money from a user's prepaid account, saving time and effort.

3. METHOD

3.1. Block diagram

The intelligent alcohol detection system for car using IoT is depicted in the diagram in Figure 1. NodeMCU ESP32 Microcontroller: the ESP32 is a powerful 32-bit microcontroller with built-in Wi-Fi, a full TCP/IP stack for connecting to the internet, and Bluetooth 4.2. The ESP32 microcontroller is highly suited for IOT projects due to its inexpensive cost combined with high power and the ability to connect it to a wide range of other electronic devices.

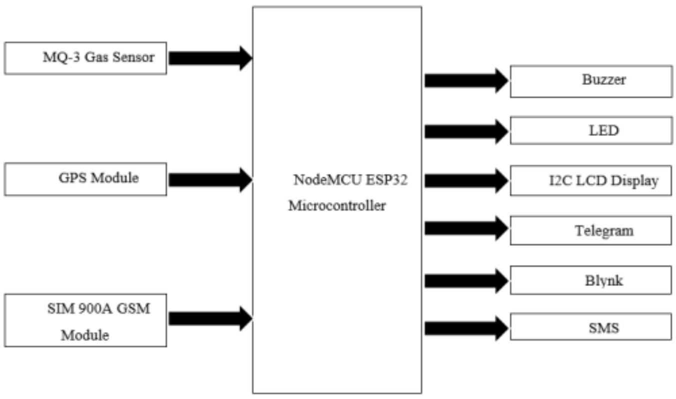


Figure 1. Block diagram of the system

MQ3 gas sensor: the MQ3 simple gas sensor is suitable for detecting liquor, and it can be used as part of a breathalyzer. It has a high sensitivity to alcohol and a low sensitivity to benzene. The potentiometer can be used to balance affectability [23]-[25]. Tin oxide (SnO2) is a mineral. The MQ-3 gas sensor's sensitive material has a lower conductivity in clean air.

GPS module: the Neo-6M GPS Module is a standalone GPS receiver with a positioning motor from the elite u-box 6. They offer a compact design, as well as power and memory options. The GPS is a space-based satellite route system that provides area and time data in every climate condition, anywhere on or near the Earth with an unobstructed viewable path to at least four GPS satellites.

SIM 900A module: global system for mobile communications is the most widely used wireless standard for mobile phones in the human race (GSM). Short message service (SMS) broadcasts are supported in both TEXT and PDU modes. To communicate with the arrangement, it requires a SIM (Subscriber Identity Module) card, similar to that used by mobile phones.

Blynk app: Blynk was created with the IoT in mind. It can control hardware remotely, display sensor data, save and visualize data, and perform a variety of other tasks. The platform is made up of three primary components blynk app, blynk server and blynk libraries. Blynk App helps to create stunning user interfaces for our projects by combining multiple widgets. Blynk Server is in charge of all data transfers between the Smartphone and the hardware.

As depicted in block diagram in Figure 1, a buzzer, often known as a beeper, is a type of auditory signaling device which act as an audio indicator where it is produces sound with a frequency range of 1 to 7 kHz. While I2C LCD displays screens are electronic screens that can be used for a variety of purposes. The commonly used 16×2 LCD screen is a basic module that is utilized in a variety of circuits and devices. A PCF8574 chip (for I2C connection) and a potentiometer for adjusting the LED lighting are included in I2C LCD display. Therefore, LED is a semiconductor device that, will charged with an electric current to generates infrared or visible light.

3.2. Simulation part

The working principle of the system is depicted in Figure 2. The internet of things drunk driving monitoring system is a groundbreaking system with a wide range of applications in smart cities and smart transportation. The system begins when the micro cable is linked to the Arduino through the laptop. The device will begin to operate.

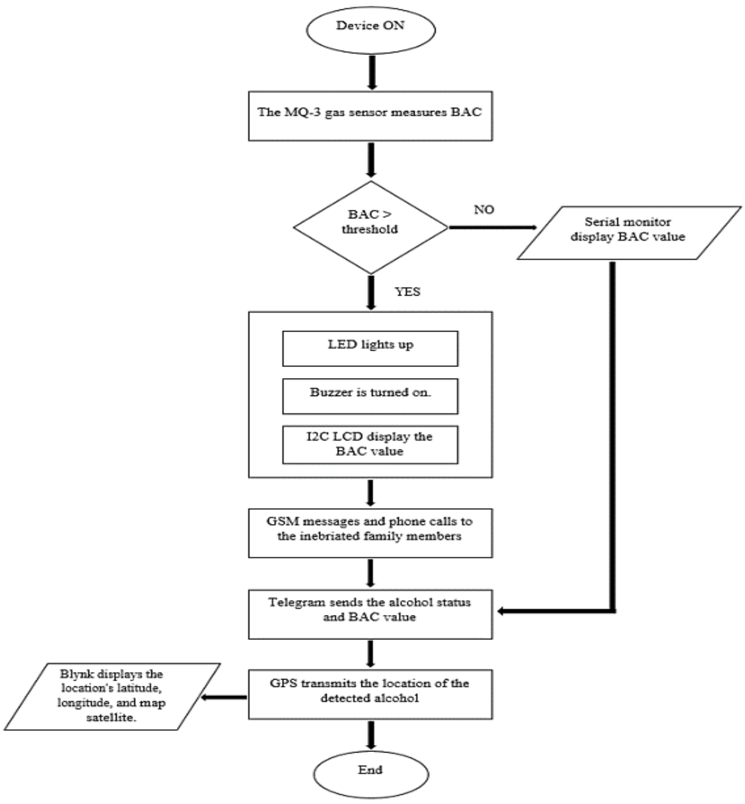


Figure 2. Working principle of the system

The alcohol is directed to the MQ-3 gas sensor. If alcohol is detected, the blood alcohol concentration exceeds the 0.90 mg/L threshold limit. As an alert, the buzzer will sound, the LED will light up, and the I2C LCD will display 'alcohol detected' and the BAC value. If no alcohol is detected, that is, if the blood alcohol concentration of the human's breath is less than 0.90 mg/L, the BAC value will be displayed on the serial monitor, the LED does not light up and the buzzer does not sound. Based on the instructions given on the serial monitor, the GSM will send texts or make phone calls to the drunken family members. The GSM can call, send messages, receive calls, redial calls, and hang up calls. The GSM will dial the number specified in the Arduino code. The GSM requires a sim card to function even when there is no internet connection. The telegram will determine whether or not the alcoholic driver has over the alcohol limit. If the drunk driver reaches the threshold value, the telegram bot will spam 'alcohol detected' together with the BAC value of the breath. If the inebriated driver's BAC does not exceed the threshold, the telegram bot will just send the BAC value of the breath.

The location of the detected alcohol also will be transmitted through GPS. The latitude, longitude, and map satellite of the place will be displayed by the Blynk. As a result, determining the location of the incident will be easier. The developed system offers various advantages in terms of convenience, efficiency, and passenger safety from accidents. The detection of the presence of alcohol within the car is extremely accurate. This arrangement enhances human care, thereby offering actual growth in the sector in terms of reducing alcohol-related accidents.

4. RESULT AND ANALYSIS

Figure 3 shows the breadboard view of intelligent alcohol detection system for car using IoT. The components used are breadboard, MQ-3 gas sensor, light-emitting diode (LED), buzzer, I2C LCD display, jumper wires, ESP32, sim card, GSM, and GPS module. The ESP32 chip has 48 pins that can be used for a wide range of purposes. The ESP32 acts as the most important components because the other components connected to the ESP32. Most of the components are powered 54 with 5V voltage and none are powered by a 3.3V supply. Once the MQ-3 gas sensor detects alcohol, the buzzer rings, the LED lights up, and the I2C LCD display indicates the 'alcohol detected' sign and the BAC value of the human's breath. The ESP32 will serve as a microcontroller as well as a Wi-Fi network, allowing the GPS to relay the location to the Blynk app. If the Internet is unavailable at the time of the occurrence, GSM is used as a backup. The GSM will call or text the drunken family members.

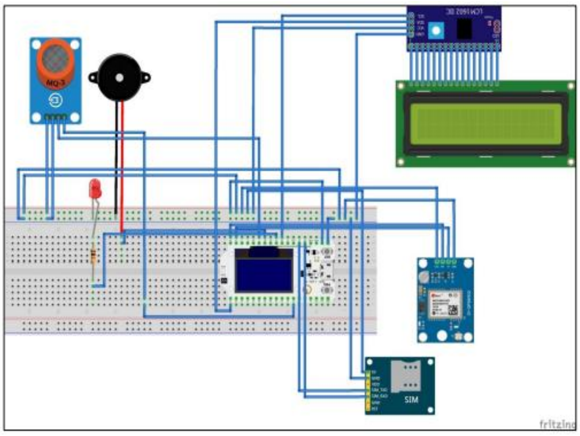
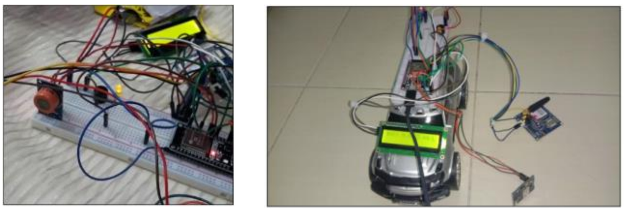


Figure 3. Simulation result

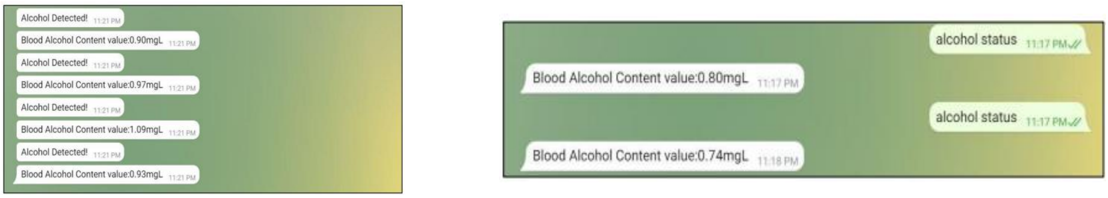
Figure 4 shows the connection for MQ-3 gas sensor to detect the presence of alcohol. As depicted in Figure 4(a) and Figure 4(b), all component for the system is connected on breadboard and shows the system when the MQ-3 gas sensor detects the presence of alcohol. The buzzer will then sound, and the LED will brighten up to show that alcohol is present. Moreover, Figure 5 show the Telegram message when the BAC value greater than 0.9. The system will send a telegram message with the word "alcohol detected" and the blood alcohol concentration value shown on the I2 C LCD. Alcohol has been found the BAC reading is greater than 0.9.

While, in Figure 5(a), shows the signal send the message 'system on' to test Telegram functioning, and the bot will answer with a message greeting the system and stating that it is currently online. If alcohol is discovered, the bot will repeatedly spam the word "alcohol detected" along with the BAC value. Referring to Figure 5(b), the BAC value can still be determined on the Telegram by sending alcohol status notifications when there is no alcohol detected. The system begins to operate when the alcohol sensor detected BAC level from the driver. The signal is then sent to the ESP32 for further processing, which includes the LCD display, buzzer, LED, GPS module, and GSM module. The BAC level recorded by an alcohol sensor is based on the concentration of gas or alcohol in parts per million (PPM). As an input to the experiment, Methylated Spirit skin disinfectant is used to test this system. The alcohol sensor can detect alcohol levels in human breath ranging from 25 to 500 ppm. The outcome is classified into four states of the driver with varying values (in mg/L) of BAC level, which include drunkenness, mildly drunk, and above limit drunk.



(a) (b)

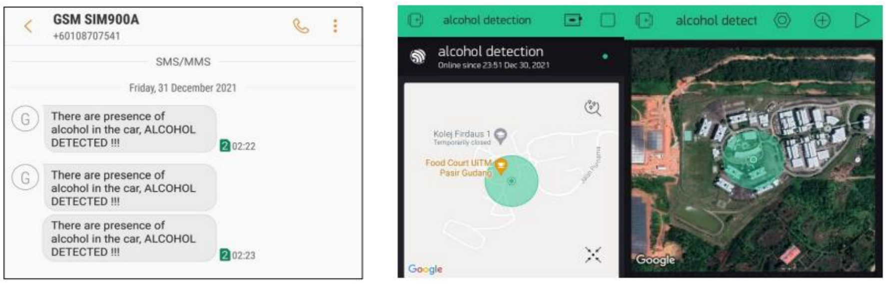
Figure 4. Connection of the system for MQ-3 gas sensor to detect the presence of alcohol, (a) when alcohol detected and (b) when no alcohol detected



(a) (b)

Figure 5. Reading system of the BAC value from telegram, (a) when alcohol detected and (b) when no alcohol detected

The output of the system will indicate through GSM and Blink Application as depicted in Figure 6. While Figure 6(a) shows the GSM will also convey messages through the drunken driver's family members, indicating the presence of alcohol in the vehicle. The people nearby must send the command to the GSM, which will phone or text the driver's family member. On the other hand, Figure 6(b) shows when alcohol is detected, the GPS will activate and transmit the location to the Blynk app. The GPS will send the latitude, longitude, and map satellite of the alcohol detected location. On the Arduino's serial monitor, there will be a command to GSM that either needs to message, make a call, receive a call, hang up, or redial. The messages will display “There are presence of alcohol in the car, ALCOHOL DETECTED!!!”.



(a) (b)

Figure 6. Output of the system through GSM and Blink App (a) GSM sends message when alcohol detected and (b) location of drunken drivers from Blynk App

The output result when no alcohol detected is depicted in Figure 4(b). The system operates when the MQ-3 gas sensor detects the presence of alcohol. The buzzer and LED are turned OFF that means the driver still in good condition. The system still sends a telegram message the blood alcohol concentration value shown on the I2C LCD. The reading is less than 0.9, which means 57 no alcohol is present. We will send the message 'system on' to test Telegram functioning, and the bot will answer with a message greeting the system and stating that it is currently online.

The acquired result is shown in Table 1. The first condition demonstrated that the driver was not under the influence of alcohol and that there was no alarm sound from the buzzer. While the system is turned on, the driver is aware and capable of driving the vehicle safely on the road. The next stage is slightly drunk, with a drunkenness level ranging from 0.26 to 0.50. This signifies that the driver has consumed a small amount of alcohol but requires assistance while driving on the road. The buzzer is deactivated. The third condition intoxication level ranges from 0.51 to 0.75. This signifies that the driver has consumed a small amount of alcohol but requires assistance while driving on the road. The buzzer is disabled since the threshold set is that if the BAC level reaches or above 0.90, the LED will light up and the 60 buzzers will sound.

Table 1. Conditions of the system with level of drunkenness (in mg/L)

Output	Level of Drunkenness (in mg/L)			
	0-0.25	0.26-0.50	0.51-0.75	0.76-1.00
LCD display	BAC value	BAC value	BAC value	BAC value
Buzzer indication	OFF	OFF	OFF	ON
LED	OFF	OFF	OFF	ON
Alcohol status by Telegram	BAC value	BAC value	BAC value	Alcohol detected and BAC value
Message send by GSM	No alcohol detected	No alcohol detected	No alcohol detected	Alcohol detected
Conclusion	Intoxicated	Slightly drunk	Drunkenness	Over limit drunk

In the last situation, the driver is completely unconscious and is not fit to drive. When the BAC level is too high, the buzzer and LED illuminate, and the LCD displays the BAC value of the human's breath. The telegram will transmit the alcohol status and BAC value the same as the LCD display. The GSM will call or send messages to the drunken family members to notify them that the driver is drunk and on the road. Ultimately, this system will serve to prohibit the driver from driving in dangerous situations and will help to avert road accidents.

The graph depicts in Figure 7 shows the percentage of parts per million (PPM) in the alcohol against time in seconds. The higher the concentration of alcohol, the greater the volume of PPM. If the blood alcohol concentration (BAC) measurement is less than 0.25 mg/L, the drunken was not under the influence of alcohol, and the driver is safe to continue driving. If the BAC value ranges between 0.26 and 0.50 mg/L, alcohol was detected but not in a dangerous scenario. If the BAC is between 0.51 and 0.75 mg/L, the driver is intoxicated and must be assisted by the other person on their side. If the BAC value is between 0.76 and 0.90 mg/L, it signifies the driver has above the legal limit. The system will activate, and the output components will turn on automatically to alert the driver and their family members in the case of an accident.

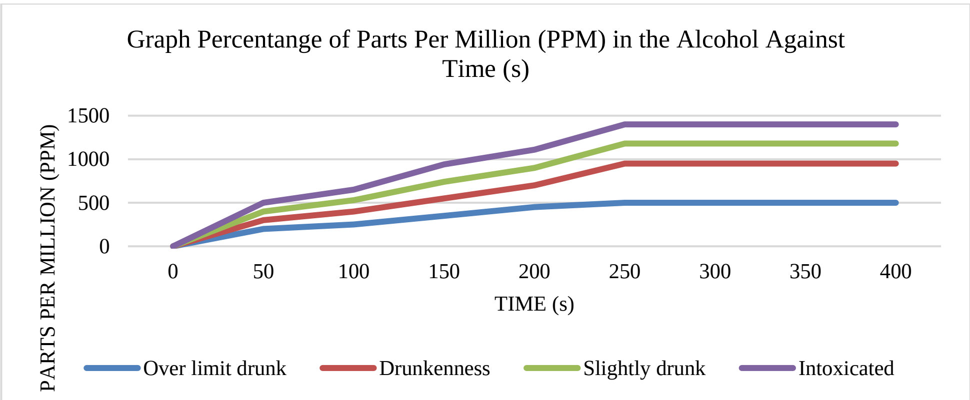


Figure 7. Graph percentage of parts per million (PPM) in the alcohol against time (s)

5. CONCLUSION

The proposed intelligent alcohol detection system has worked perfectly in tracking and identifying the locations of incidents involving intoxicated drivers on the road. The effectiveness of the proposed approach was evaluated using the drunkenness's BAC level. The amount of alcohol in the driver's breath is detected by the proposed alcohol breath analyzer sensor. When the level reaches the cutoff, a buzzer will immediately turn on and an LCD will indicate the alcohol status and BAC value. By enhancing the proposed design with the introduction of the IoT, it will be simpler for users to detect, monitor, and track their location and provide effective results by SMS, phone calls, and telegram while the GPS will broadcast the location of the identified alcohol. For future development is required to include a DC Motor for engine locking in the system. There are several incidents where intoxicated drivers smash their cars while also involving other drivers on the road. It endangers lives and property. When a drunk driver tries to start a car, the system recognizes alcohol on his or her breath and locks the engine, making it impossible for the car to move.

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BIOGRAPHIES OF AUTHORS

Siti Aminah Nordin is a lecturer who is currently working at UiTM Pasir Gudang. She received her B. Eng (Hons) of Electronic Engineering and Master's in electrical engineering from Universiti Teknologi MARA (UiTM) Shah Alam, in 2010 and 2014, respectively. In May 2014, she joined UiTM Pasir Gudang as a teaching staff. She is currently working towards the Ph.D. degree on microwave and radio frequency at Universiti Teknologi MARA Shah Alam, Malaysia. Her research interests include microwave filter, antenna, and electromagnetic wave. She can be contacted email: sitia181@uitm.edu.my.

Ts. Dr. Zakiah Mohd Yusoff is a senior lecturer who is currently working at UiTM Pasir Gudang. She received the B. ENG in Electrical Engineering and Ph.D. in Electrical Engineering from UiTM Shah Alam, in 2009 and 2014, respectively. In May 2014, she joined UiTM Pasir Gudang as a teaching staff. Her major interests include process control, system identification, and essential oil extraction system. She can be contacted at email: zakiah9018@uitm.edu.my.

Nurul Nadia Mohammad is currently a lecturer under School of Electrical Engineering, College of Engineering, UiTM, Cawangan Johor. She received her PhD in Electrical Engineering from Universiti Teknologi MARA (UiTM) in October 2019. Her research interest includes modelling and control system. She can be contacted at email: nurulnadia@uitm.edu.my.