SMART HELMET SAFETY SYSTEM

A MINI-PROJECT REPORT

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LIST OF ABBREVIATION

ABBREVIATION	ACCRONYM
MQ-3 Sensor	Metal Oxide Semiconductor Gas Sensor Model 3
BAC	Blood Alcohol Concentration
MOS	Metal Oxide Semiconductor
RFID	Radio Frequency Identification

ABSTRACT

The increase in two-wheel motor vehicle accidents, which are often caused by riders failing to wear helmets or driving under the influence of alcohol, needs stronger safety measures. This research demonstrates an innovative helmet system that incorporates a breath-analyzer sensor (MQ3) and helmet usage detection technologies to improve rider safety. The MQ3 sensor measures the alcohol level of the rider's breath, and if it exceeds the legal limit, a buzzer sounds an alert, and the motorcycle's engine is instantly turned off, suspending functioning. Furthermore, the helmet is equipped with a sensor to verify proper usage; if the helmet is not properly worn, the motorcycle will not start, so ensuring helmet compliance. This novel solution is intended to be affordable, simple to use, and compatible with existing helmets. It also collects data over time to help improve accident prevention measures. This smart helmet system seeks to drastically reduce accident rates by tackling crucial issues such as drinking and driving and improper helmet usage, resulting in safer roads and safeguarding the lives of two-wheeler riders through increased safety standards and responsible riding behaviors.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The "SMART HELMET SAFETY SYSTEM" project tackles the rising number of two-wheel motor vehicle accidents caused by riders who do not wear helmets or are driving under the influence of alcohol. This system, which includes a breath-analyzer sensor (MQ3) and helmet usage detection, prevents drunk driving and assures helmet compliance, with the goal of improving rider safety, reducing accidents, and saving lives.

1.2 SCOPE OF THE WORK

The "SMART HELMET SAFETY SYSTEM" project involves designing and integrating an MQ3 breath-analyzer sensor and helmet usage detection mechanism. It includes hardware integration, software development, thorough testing, and user-friendly interface design. The system will log data, undergo pilot testing, and ensure regulatory compliance, aiming to enhance rider safety by preventing drunk driving and ensuring helmet use.

1.3 PROBLEM STATEMENT

The increasing incidence of two-wheel motor vehicle accidents, exacerbated by riders not wearing helmets and driving under the influence of alcohol, highlights a critical safety issue. Current measures to enforce helmet use and prevent drunk driving have proven insufficient. This project addresses these challenges by developing an intelligent helmet system equipped with a breath-analyzer sensor (MQ3) and helmet usage detection mechanisms. The system aims to reliably detect alcohol levels, prevent vehicle operation if the rider is intoxicated, and ensure helmet compliance, thereby reducing accidents and promoting safer road conditions for all stakeholders.

1.4 AIM AND OBJECTIVES OF THE PROJECT

This project aims to enhance two-wheel motor vehicle rider safety with an intelligent helmet system integrating an MQ3 breath-analyzer sensor for alcohol detection and a mechanism to verify helmet usage pre-operation. By preventing motorcycle start-up if alcohol exceeds legal limits and promoting helmet use through integrated verification, it aims to reduce drunk-driving accidents. Featuring a user-friendly interface for alerts and data collection for optimization, the system undergoes pilot testing for reliability and regulatory compliance. Impact evaluation includes user feedback and metrics to assess effectiveness in accident reduction and safety promotion.

CHAPTER 2

LITERATURE SURVEY

In[1] “Alcohol Detection Using Smart Helmet System,” Sudharsana Vijayan, Vineed T. Govind, Merin Mathews, Simna Surendran, and Muhammed Sabah present a smart helmet designed to enhance road safety by detecting the presence of alcohol in a rider's breath. Published in the International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE) in April 2014, the study outlines a system that integrates an alcohol sensor within the helmet, which can prevent the vehicle from starting if the rider's breath alcohol concentration exceeds a predefined limit. This innovation aims to reduce accidents caused by drunk driving, thereby promoting safer road practices.

In[2] “Online Driving Style Recognition using Fuzzy Logic,” Dominik Dörr, David Grabengiesser, and Frank Gauterin present a method for identifying driving styles in real-time using fuzzy logic. Presented at the IEEE 17th International Conference on Intelligent Transportation Systems (ITSC) in October 2014 in Qingdao, China, the study proposes a system that analyzes various driving parameters to classify driving behavior dynamically. This approach aims to improve traffic safety and efficiency by providing adaptive feedback based on the recognized driving style, ultimately contributing to smarter and safer transportation systems.

In[3] “Vehicular Ad Hoc Networks (VANETs): Current State, Challenges, Potentials and Way Forward,” Elias C. Eze, Sijing Zhang, and Enjie Liu review the status and future prospects of VANETs. Published in 2014 by the Centre for Wireless Research at the University of Bedfordshire, the study discusses the technological advancements, current challenges, and potential applications of VANETs in improving traffic management and safety. The authors highlight the need for addressing issues such as security, scalability, and standardization to fully realize the benefits of VANETs in creating efficient and intelligent transportation systems.

In[4] “Smart Helmet using GSM & GPS Technology for Accident detection and reporting system” by Manjesh N and Prof. Sudarshan Raj present a smart helmet designed to detect accidents and report them using GSM and GPS technologies. Published in the International Journal of Electrical and Electronics Research in the October-December 2014 issue, the study outlines a system where the helmet detects collisions and automatically sends the location and accident alert to predefined contacts. This innovation aims to enhance rider safety by ensuring timely emergency responses and reducing the consequences of accidents.

In[5] “A Low Power Intelligent Helmet System,” Albert Daimary, Meghna Goswami, and Ratul Kumar Baruah present a helmet designed to enhance safety while conserving power. Published in 2017 by the Department of Electronics & Communication Engineering at Tezpur University, Assam, India, the study details a system that integrates various sensors to monitor environmental conditions and the wearer's status. This low-power intelligent helmet aims to provide real-time safety alerts and data transmission while optimizing energy consumption, making it practical for prolonged use in diverse conditions.

In[6] “Biometric Automobile Ignition Locking System,” R. M. Vithlani, Sagar Shingala, and Dr. H. N. Pandya present a secure vehicle ignition system that utilizes biometric authentication. Published in the International Journal of Electronics and Communication Engineering and Technology (IJECET) in 2016, the study details a system that requires biometric data, such as fingerprints, to start the vehicle, thereby enhancing security by ensuring that only authorized users can operate the vehicle. This biometric approach aims to prevent theft and unauthorized access, significantly improving the safety and security of automobiles.

In[7] “Two-Factor Authentication Based Automobile Keyless Entry System,” O. Akinsanmi, A. D. Usman, A. Abdulraheem, G. D. Obikoya, and B. G. Bajoga present a secure keyless entry system for vehicles that employs two-factor authentication. Published in the International Journal of Engineering and Applied Sciences (IJEAS) in 2015, the study describes a system that combines something the user knows (a PIN or password) with something the user possesses (a key fob or mobile device) to enhance security. This approach aims to provide a robust defense against unauthorized access, improving the overall safety of automotive keyless entry systems.

In[8] “Smart Protection of Vehicle using Multi Factor Authentication (MFA) Technique,” S. Aliyu, Umar Abdullahi, Majeedat Pomam, Mustapha Hafiz, Adeiza Sanusi, and Sodiq Akanmu explore the implementation of a multi-factor authentication system to enhance vehicle security. Presented at the 3rd International Engineering Conference (IEC) in 2019, the study outlines a security system that combines multiple authentication factors, such as passwords, biometric data, and smart cards, to ensure only authorized users can access and operate the vehicle. This approach significantly strengthens vehicle protection against unauthorized access and theft by adding multiple layers of security.

In[9] “Predictive Prevention of Loss of Vehicle Control for Roadway Departure Avoidance,” Mohammad Ali, Paolo Falcone, Claes Olsson, and Jonas Sjoberg propose a predictive system aimed at preventing loss of vehicle control and roadway departure accidents. Published in 2013, the study focuses on developing algorithms that anticipate potential loss of control events based on vehicle dynamics and driver behavior. By providing real-time warnings or interventions, this system aims to mitigate the risk of accidents and enhance road safety, particularly on highways and winding roads where loss of vehicle control is more prevalent.

In[10]“Comparing Car Drivers’ and Motorcyclists’ Opinions about Junction Crashes,” Chloe J. Robbins, Harriet A. Allen, and Peter Chapman analyze perspectives on junction crashes from both car drivers and motorcyclists. Published in Accident Analysis & Prevention, the study investigates the opinions, experiences, and perceived causes of junction-related accidents among these two road user groups. By comparing their viewpoints, the research aims to identify potential differences in understanding and awareness, with the ultimate goal of informing targeted interventions to reduce the incidence of junction crashes and improve road safety for all.

CHAPTER 3

SYSTEM SPECIFICATIONS

3.1 HARDWARE SPECIFICATIONS FOR APPLICATION

Processor	:	Pentium IV Or Higher
Memory Size	:	256 MB (Minimum)
HDD	:	40 GB (Minimum)

3.2 SOFTWARE SPECIFICATIONS

Operating System	:	WINDOWS 10 AND GREATER
Application	:	ARDUINO IDE

3.3 HARDWARE COMPONENTS FOR PROTOTYPE

Sensor	:	MQ-3 alcohol sensor module
Board	:	Arduino Uno
Actuator	:	Buzzer and DC Motor

CHAPTER 4

MODULES DESCRIPTION

Arduino Uno

It receives the analog signal from the MQ-3 sensor, converts it into a digital alcohol level reading using a calibration curve, and compares it to a pre-programmed threshold based on legal BAC limits.

Alcohol Sensor Module (MQ-3)

It measures the changes in electrical resistance caused by the interaction between alcohol molecules and the MOS surface. Higher alcohol concentration results in lower resistance.

Buzzer

A buzzer is a cost-effective option that provides a loud and clear warning. This makes it ideal for situations where the rider needs to be immediately aware of exceeding the alcohol limit, regardless of ambient noise.

Motor

A vibration motor offers a silent and subtle way to alert the rider. This is particularly useful in situations where a loud buzzer might be disruptive or draw unwanted attention, such as riding at night or in quiet areas.

CHAPTER 5

SYSTEM DESIGN

5.1 FLOW CHART

A flowchart is a type of diagram that represents an algorithm, workflow or process. The flowchart shows the steps as boxes of various kinds, and their order by connecting the boxes with arrows. This diagrammatic representation illustrates a solution model to a given problem.

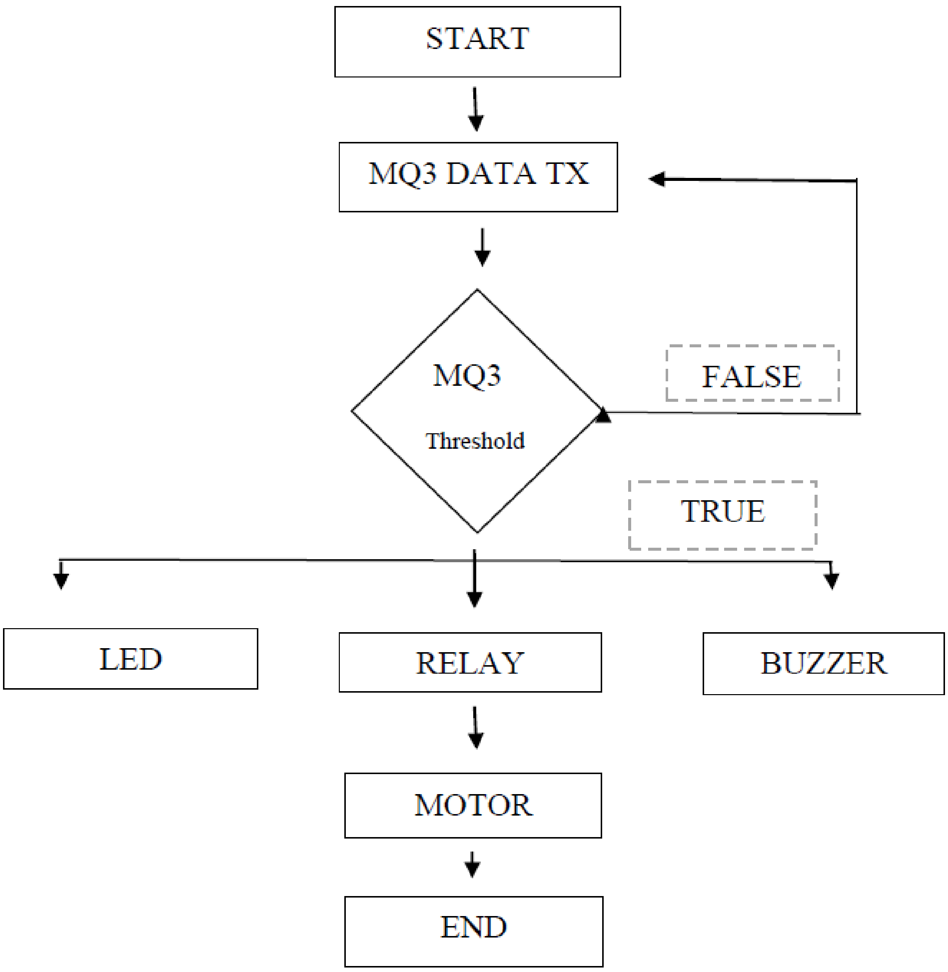

Figure 5.1 Flow Chart

5.2 CIRCUIT DIAGRAM

The device uses a MQ-3 alcohol sensor module to detect the presence of ethanol (alcohol) in the rider's breath. The electrical resistance of the sensor varies in inverse proportion to the alcohol concentration. This analog signal is sent into an Arduino Uno microcontroller, a popular choice because to its simplicity and versatility. The Arduino then translates the analog input into a digital alcohol level reading using a predetermined calibration curve. If this reading exceeds a predefined threshold based on regional Blood Alcohol Content (BAC) restrictions, the Arduino sounds an alarm. This alarm can be a buzzer for audible warning, an LED for visual indication, or a vibration motor for a subtle alert. This circuit provides an affordable and user-friendly method for incorporating alcohol detection into a smart helmet design.

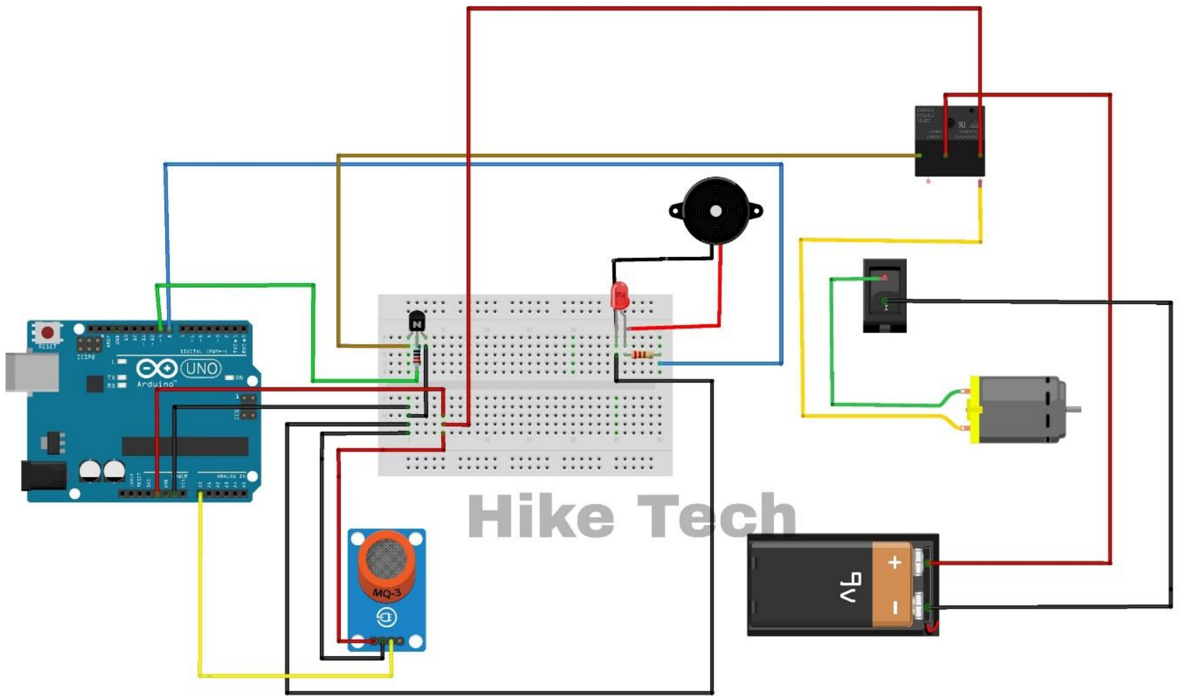

Figure 5.2 Circuit diagram

From the above figure 5.2, the connections are made

CHAPTER 6

CODING

1. Setup

```
#define sensorDigital A0
#define Motor 9
#define buzzer 8

void setup() {
  pinMode(sensorDigital, INPUT);
  pinMode(Motor, OUTPUT);
  pinMode(buzzer, OUTPUT);
  Serial.begin(9600);
}

void loop() {
  bool digital = digitalRead(sensorDigital);

  Serial.print("Digital value :");
  Serial.println(digital);

  if (digital == 0) {
    digitalWrite(Motor, LOW);
    digitalWrite(buzzer, HIGH);
  } else {
    digitalWrite(Motor, HIGH);
    digitalWrite(buzzer, LOW);
  }
}
```

2. Motor Code

```
#define sensorDigital A0
#define sensorAnalog A1
#define Motor 9
#define buzzer 8

void setup() {
  pinMode(sensorDigital, INPUT);
  pinMode(sensorAnalog, INPUT);
  pinMode(Motor, OUTPUT);
  pinMode(buzzer, OUTPUT);
  Serial.begin(9600);
}

void loop() {
  bool digital = digitalRead(sensorDigital);
  int analog = analogRead(sensorAnalog);

  Serial.print("Analog value : ");
  Serial.print(analog);
  Serial.print("\t");
  Serial.print("Digital value :");
  Serial.println(digital);

  if (digital == 0) {
    digitalWrite(Motor, HIGH);
    digitalWrite(buzzer, HIGH);
  } else {
    digitalWrite(Motor, LOW);
    digitalWrite(buzzer, LOW);
  }
}
```

CHAPTER 7

SCREEN SHOTS

CONNECTION

Figure 7.1 Connection Setup

Upon successful connection, a light will turn on in the Arduino Module, Relay and MQ3 Alcohol Sensor. The Alcohol Sensor senses the amount of alcohol present in the Driver’s breath and transmits the data to the Arduino Board. The Board compares if the driver is drunk or not and turns off the vehicle accordingly. There is a transmitter on the inside of the helmet that also contributes in the Driver’s safety measure while riding a bike. A motor is fixed with the receiver to receive the signal from the transmitter and the wheel rotates if all the predefined conditions are satisfied.

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, the Smart Helmet Alcohol Detection project aims to significantly enhance road safety by integrating an alcohol detection system into motorcycle helmets using Arduino technology. The system utilizes an MQ-3 alcohol sensor module and Arduino board to accurately measure alcohol levels in the rider's breath. It alerts the rider with an alarm if the detected alcohol concentration exceeds a predefined threshold, thereby preventing drunk driving incidents. While the proposed method offers a cost-effective solution suitable for DIY enthusiasts and hobbyists, it is crucial to acknowledge potential variations in accuracy and reliability due to factors like environmental conditions and sensor calibration.

Further testing and calibration efforts are essential to optimize system performance. Overall, this innovative project holds promise in reducing accidents caused by impaired riding, potentially saving lives and promoting responsible driving behavior on roads.

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