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SAFETY HELMET FOR BIKE AUTHENTICATION AND ALCOHOL SENSING FOR RIDERS

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ABSTRACT

The aim of this project is to design a system that ensures bike authentication and rider safety by integrating helmet detection and alcohol sensing technology. The main objective is to develop a safety mechanism where the motorcycle engine will start only if the rider is wearing a helmet and is not under the influence of alcohol. This enhances road safety and prevents accidents caused by drunk driving or riding without a helmet.

The helmet-based system acts as a user-friendly interface that verifies the rider's compliance with safety protocols before allowing the bike to start. This project is particularly beneficial for reducing road accidents, enforcing traffic rules, and enhancing overall rider safety.

The key components used in this project include the Arduino Uno microcontroller, RF module, alcohol sensor (MQ-3), relay module, and buzzer. These components work together to facilitate seamless authentication and safety enforcement. The RF module ensures communication between the helmet and the bike ignition system, while the alcohol sensor detects the presence of alcohol in the rider's breath. If the rider is not wearing a helmet or if alcohol is detected, the system prevents the engine from starting. Additionally, the buzzer provides an alert in case of any safety violations.

In various applications, rider safety is a crucial concern, and implementing an intelligent authentication system helps in minimizing risks. This project provides a cost-effective and efficient solution to enforce helmet compliance and prevent drunk driving without requiring manual monitoring. The RF-based communication ensures reliable authentication within a reasonable range, making it suitable for personal and commercial bike safety applications. The system is designed for easy integration with existing two-wheeler ignition systems, allowing for enhanced security and rider protection.

INTRODUCTION

In various transportation and road safety applications, ensuring rider compliance with safety measures is essential for accident prevention and law enforcement. Traditional methods of monitoring helmet usage and alcohol influence rely on manual checks, which may not be efficient or feasible in real-time scenarios.

This project "Safety Helmet for Bike Authentication & Alcohol Sensing for Riders" introduces a smart and automated solution to enforce helmet usage and prevent drunk driving. The system is designed using an Arduino Uno microcontroller, which communicates with an RF module to authenticate helmet usage. Additionally, an MQ-3 alcohol sensor detects the presence of alcohol in the rider's breath. If the rider is not wearing a helmet or if

alcohol is detected, the system prevents the bike from starting by controlling the ignition system via a relay module.

The integration of RF communication and alcohol sensing technology enhances rider safety by ensuring that only sober and helmet-wearing riders can start the bike. A buzzer provides real-time alerts in case of violations, making the system proactive in accident prevention.

This project utilizes Arduino IDE for programming and Proteus for schematic design, ensuring seamless integration of hardware and software components. The proposed system can be applied in various scenarios, such as road safety enforcement, personal and commercial vehicle security, and automated traffic rule compliance, making it a versatile and practical solution for modern transportation safety.

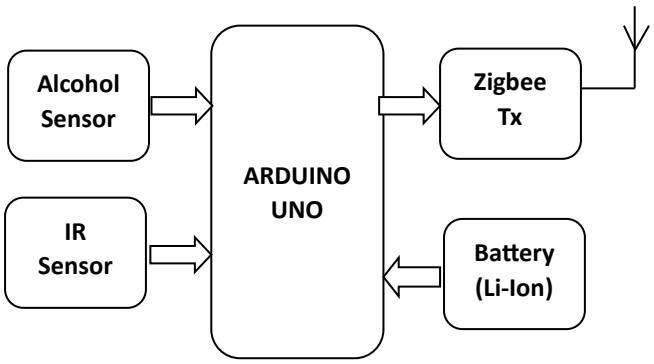

Figure.1 Block Diagram of Helmet

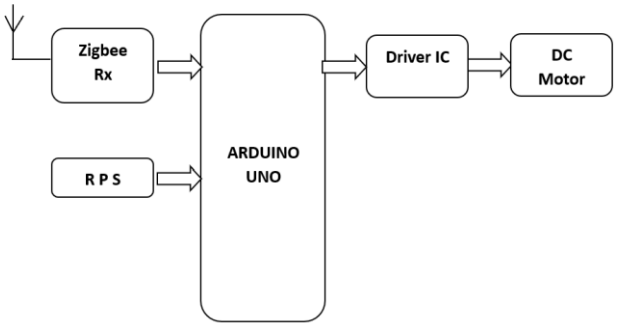

Figure.2 Block Diagram of Bike

Literature Survey

1. Wireless Communication Technologies for AC Load Control

Several studies have focused on the wireless technologies used for remote AC load control. Kumar et al. (2020) discussed the use of Bluetooth technology for short-range control, enabling users to operate appliances via a smartphone app. However, Bluetooth has range limitations, which led Singh and Kumar (2020) to explore Wi-Fi-based AC load control, offering wider coverage and internet connectivity. Meanwhile, Ali and Khan (2019)

compared Bluetooth, Wi-Fi, and GSM, concluding that Wi-Fi is more efficient for real-time control, while GSM-based control is better suited for long-range operation.

2. IoT-Based Load Control for Smart Homes

With the emergence of the Internet of Things (IoT), several researchers have integrated IoT platforms with AC load control systems. Patel et al. (2021) implemented an Arduino and ESP8266-based Wi-Fi system that allowed users to turn appliances ON/OFF using an Android application. Gupta and Mishra (2021) proposed an Android-controlled home automation system using Raspberry Pi, which supports cloud-based monitoring. Additionally, Raj and Das (2021) introduced the MQTT protocol for IoT-based load control, improving real-time responsiveness and data security.

3. GSM and Voice-Controlled Load Management

Remote AC load control has also been extended to GSM-based systems. Sharma et al. (2018) developed a GSM-based home automation system that enables users to send SMS commands for appliance control. However, GSM-based solutions face delays due to network dependencies. To enhance user interaction, Rahman et al. (2021) implemented voice-controlled AC load switching using Google Assistant and NodeMCU, providing hands-free operation.

PROPOSED SYSTEM

The proposed methodology for the Safety Helmet for Bike Authentication & Alcohol Sensing for Riders focuses on developing an intelligent system that ensures motorcycle operation only when the rider is wearing a helmet and is sober. This system is divided into two primary components: the helmet unit and the bike unit.

The system architecture is meticulously designed to enhance rider safety by integrating authentication mechanisms and alcohol sensing before allowing bike ignition. At its core, the Arduino Nano serves as the central processing unit, coordinating interactions between various components to prevent unauthorized and drunk driving. The system continuously monitors two key parameters: helmet authentication and alcohol detection. A dedicated helmet switch sensor ensures that the rider is wearing the helmet; if not, the ignition remains disabled. Simultaneously, an MQ-3 alcohol sensor detects the rider's breath alcohol concentration (BAC), and if it exceeds a predefined threshold, the bike is prevented from starting. This dual-layer verification system significantly reduces the risks associated with unsafe riding conditions.

Upon successful authentication—where the helmet is worn and no alcohol is detected—the Arduino Nano processes the inputs and activates the HC-12 wireless communication module to transmit an authorization signal to the bike’s control unit. This unit, interfaced with a relay module, enables or disables the bike ignition accordingly. Additionally, the system integrates a 16x2 LCD display to provide real-time feedback on helmet authentication and alcohol detection, enhancing user awareness and usability. The seamless wireless communication between the helmet and bike control system ensures a robust and efficient safety mechanism, effectively minimizing the risks of accidents due to drunk or unauthorized riding.

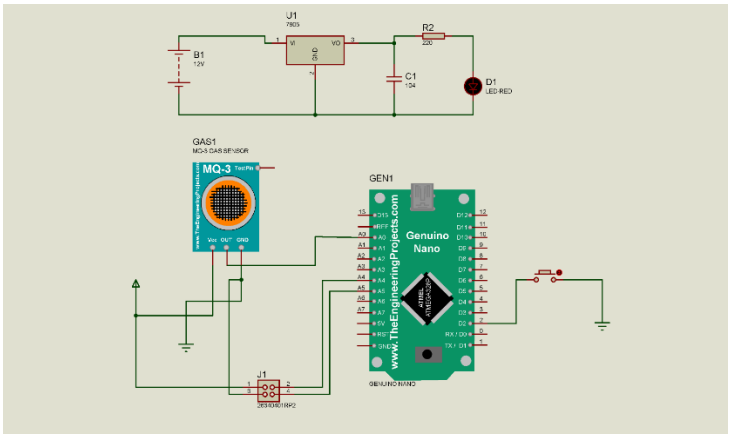

Figure.3 Schematic Diagram of Helmet

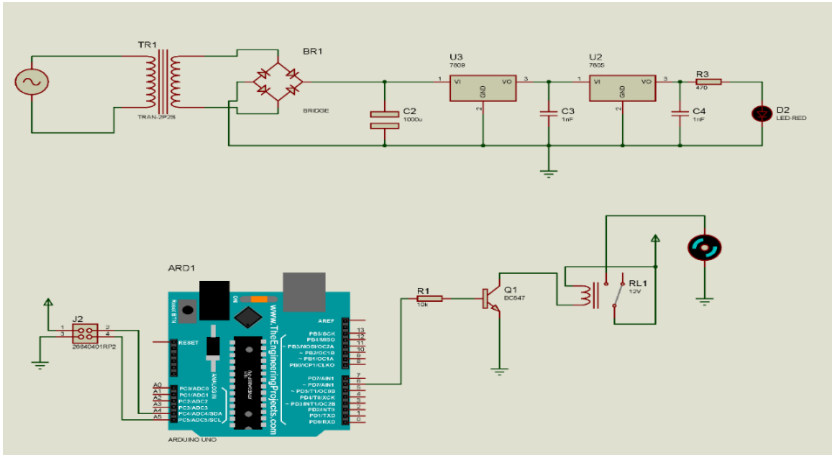

Figure.5 Schematic Diagram of Bike

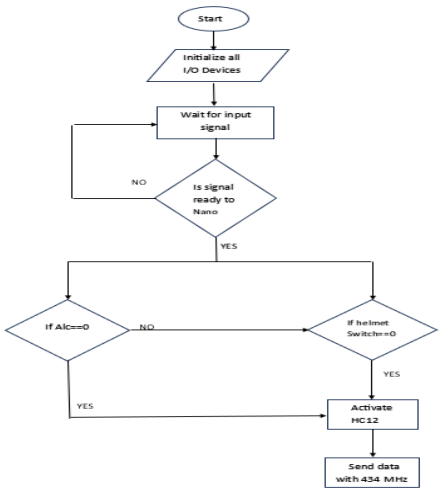

Figure. 5 Flow Chart of Helmet

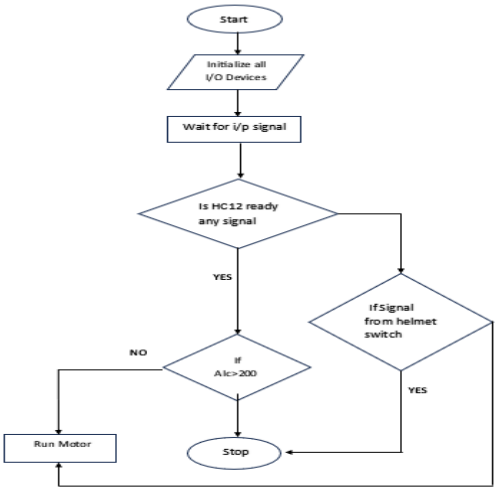

Figure.6 Flow Chart of Bike

RESULTS

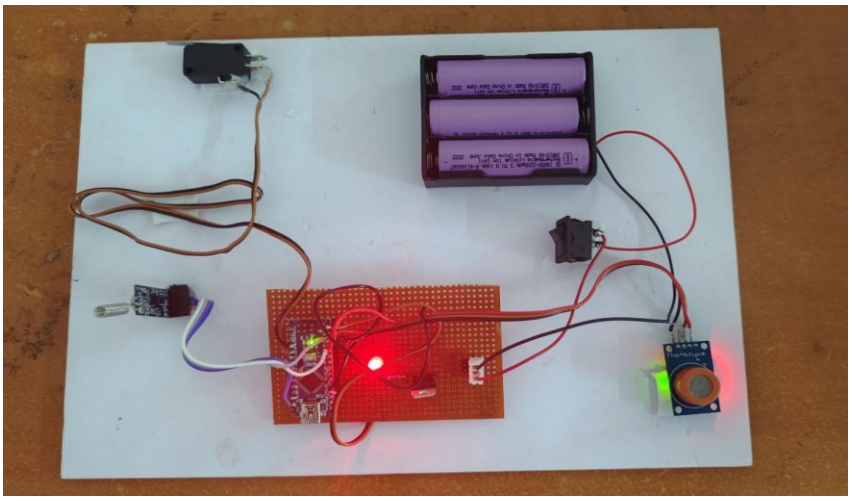

Figure.7 Helmet Part

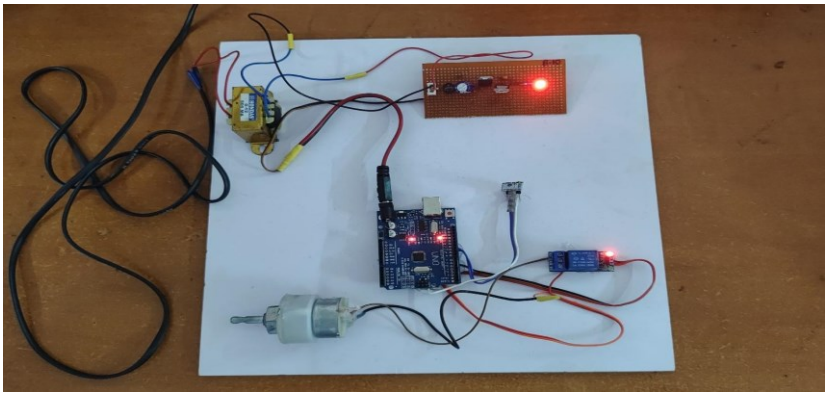

Figure.8 Bike Part

Condition 1:

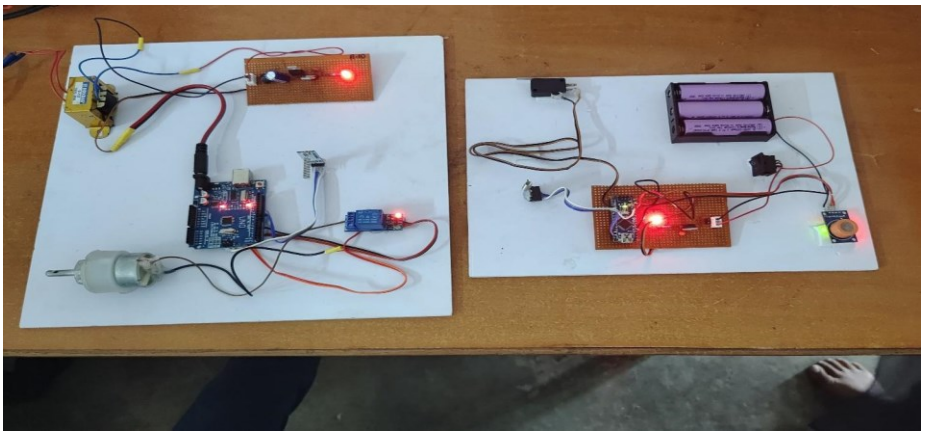

Figure.9 If the helmet is not placed and alcohol is not detected, the motor will not start.

If the helmet is not placed and alcohol is not detected, the system prevents the motor from starting. The helmet detection ensures safety compliance, while the alcohol sensor verifies the rider's condition. Only when both conditions are met, the motor remains off to enhance security.

Condition 2:

If the helmet is properly placed and alcohol is detected, the motor remains inactive. The system ensures safety by preventing operation under the influence. This mechanism helps reduce accidents and enhances rider security.

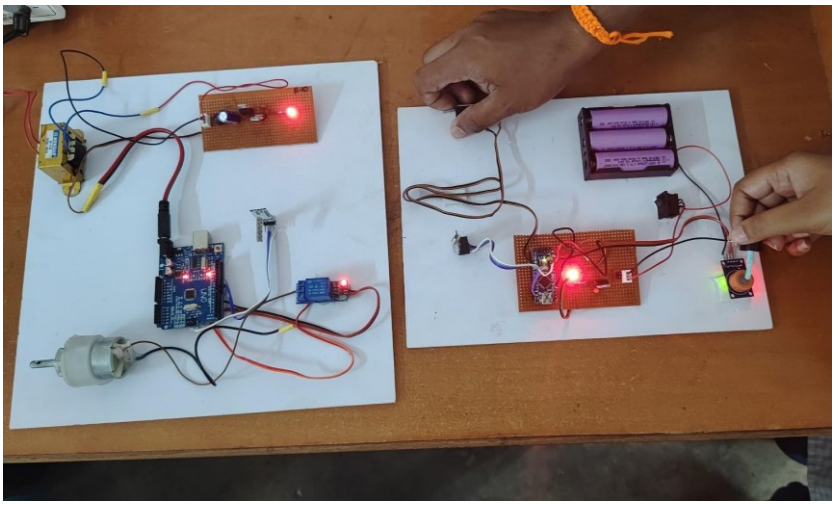

Figure.10 If the helmet is placed and alcohol is detected, the motor will not start.

Condition 3:

When the helmet is securely placed, the system checks for alcohol detection. If no alcohol is detected, the motor is allowed to start. This ensures the rider is both wearing the helmet and is sober. The system prioritizes safety by preventing operation under the influence. If alcohol is detected, the motor remains off. Similarly, if the helmet is not worn, the system restricts access. Only when both conditions are met does the motor function.

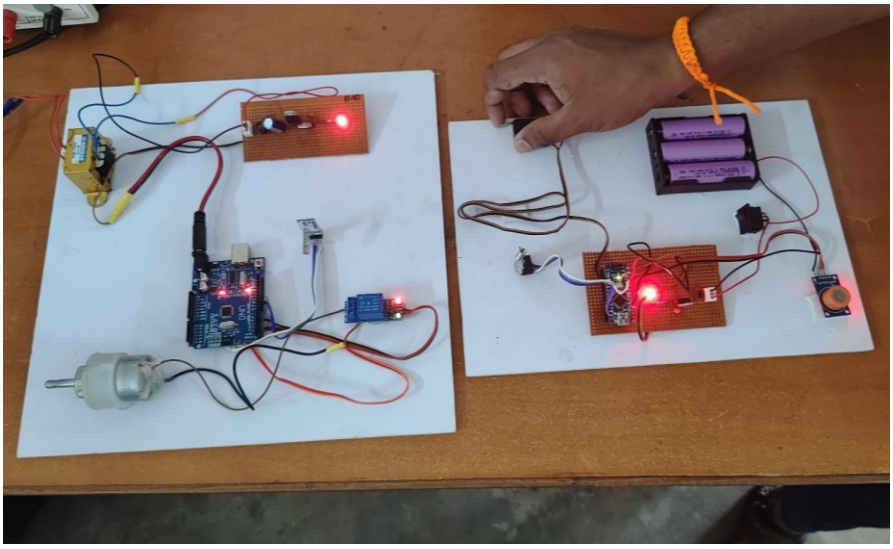

Figure.11 If the helmet is placed and no alcohol is detected, the motor will start.

ADVANTAGES

- **Enhanced Rider Safety:** Prevents drunk driving and ensures helmet usage, reducing accident risks.
- **Automated Authentication:** Eliminates manual checks by integrating automatic helmet detection and alcohol sensing.
- **Wireless Operation:** Uses the HC-12 module for seamless, real-time communication between the helmet and bike ignition system.
- **User-Friendly Interface:** A 16x2 LCD display provides clear status updates, improving ease of use.
- **Prevention of Unauthorized Use:** Ensures that only authorized riders can start the bike, reducing theft risks.
- **Low Power Consumption:** The system is energy-efficient, making it ideal for continuous use.

APPLICATIONS

- **Personal Vehicles**: Enhances individual safety by preventing riders from operating their bikes under the influence of alcohol.
- **Rental & Shared Mobility Services:** Ensures compliance with safety norms before allowing users to start rented bikes.
- **Corporate Fleets:** Companies can integrate this system into their vehicle fleets to ensure employee safety.
- **Traffic Law Enforcement:** Can assist traffic authorities in enforcing helmet and alcohol detection regulations.

CONCLUSION:

The successful implementation and simulation of the Safety Helmet for Bike Authentication & Alcohol Sensing for Riders in Proteus software mark a significant step forward in road safety and intelligent vehicle authentication. Through careful design, rigorous testing, and iterative refinement, the system has demonstrated reliable performance in ensuring that only authenticated and sober riders can start the bike.

By seamlessly integrating key components such as the Arduino Uno microcontroller, alcohol sensor (MQ-3), RF module for helmet authentication, relay-based engine control, and power supply unit, the system offers an efficient and user-friendly solution for enhancing rider safety.

The system's ability to detect alcohol consumption in real-time and authenticate helmet usage before allowing engine ignition highlights its effectiveness in preventing drunk driving and promoting helmet compliance. The relay-based control mechanism ensures that the bike starts only when all safety conditions are met, providing an intelligent and automated security solution.

In conclusion, the Safety Helmet for Bike Authentication & Alcohol Sensing System stands as an efficient, scalable, and practical solution for road safety, accident prevention, and intelligent vehicle control. Its successful simulation in Proteus signifies its readiness for real-world deployment, where it can contribute to saving lives, enforcing traffic regulations, and promoting responsible riding behavior.

Future Scope:

- **Integration with IoT Platforms –** Connecting the system to cloud-based services for remote monitoring and alert notifications in case of rule violations.
- **GPS-Based Tracking –** Incorporating a GPS module to track the rider's location and alert emergency contacts in case of accidents or intoxication detection.
- **Enhanced Authentication Mechanism –** Implementing biometric authentication (fingerprint or face recognition) for added security in bike ignition control.
- **Multiple Sensor Integration –** Adding heartbeat and drowsiness detection sensors to monitor the rider's physical condition and ensure road safety.
- **Wireless Helmet Authentication –** Upgrading to advanced wireless communication methods (RFID, NFC, or BLE) for seamless and secure helmet verification.

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