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Smart Solutions for Enhancing Road Safety by using Micro-Controller base Smart Helmet

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Abstract- *This paper's goal is to offer a solution that will ensure road safety for both drivers and pillion drivers. The bike will not start unless the rider is wearing a helmet in order to ensure that they do so. Additionally, the paper suggests that the driver wear a helmet and breathe cleanly. This system involves attaching the transmitter to the helmet and installing the appropriate receiver in the car. A helmet-mounted alcohol sensor is positioned near the driver's mouth to detect alcohol consumption, and a sensor verifies that the driver has correctly put on the helmet. Through a relay interface circuit, a microcontroller unit (MCU) regulates the ignition and the relay's operation. To increase road safety, this system ensures that the engine is turned off if the driver is not wearing a helmet or if the alcohol sensor picks up alcohol.*

Key Words: **Accident, Drunken Driving, Smart Helmet, Micro-Controller.**

1. INTRODUCTION

Road accidents remain a significant global concern, with a substantial number of incidents attributed to factors such as drunk driving and non-compliance with safety regulations. India, in particular, grapples with a disturbingly high number of road accidents each year, a substantial proportion of which are caused by drivers operating under the influence of alcohol. Despite efforts by traffic authorities to enforce safety regulations, many individuals continue to disregard these rules, putting their lives and the lives of others at risk. In response to this pressing issue, we present an innovative solution: the "Smart Helmet." This intelligent system is designed to automatically verify whether a motorcyclist is wearing a helmet and if they are sober before allowing the vehicle's engine to start. By addressing these critical safety concerns, we aim to contribute to a reduction in road accidents, injuries, and fatalities caused by drunk driving and non- compliance with safety regulations.

1.1 The issues addressed or faced along with our solutions are as follows:

- Drunk driving Epidemic: The prevalence of drunk driving on Indian roads is one of the main causes for concern. To detect alcohol use, the Smart Helmet has an alcohol sensor built in close to the driver's mouth. The engine is not allowed to start if alcohol is found, lowering the risk of accidents brought on by drunk driving.

- Helmet Non-Compliance: Despite widespread use-required helmet laws, compliance is still difficult to achieve. To address this problem, we built a sensor into the helmet that checks to see if the rider is wearing the helmet. The engine won't start if the helmet isn't worn, which encourages riders to put their safety first.

- Enforcement of Safety Regulations: Traditional enforcement strategies frequently fail to ensure that safety regulations are followed. The Smart Helmet eases the burden on law enforcement agencies by offering an automated and proactive method of enforcing safety regulations.

- Technology Integration: To transmit data between the helmet and the bike in a seamless and secure manner, the system uses radio frequency (RF) encoding and decoding. The ignition is controlled by an embedded microcontroller unit (MCU) via a relay, which gives the vehicle's startup procedure an extra layer of intelligence.

- Enhancing Road Safety: In the end, the Smart Helmet contributes to an ecosystem that improves road safety by preventing accidents caused by drunk driving and encouraging motorcycle riders to wear helmets. The likelihood of accidents brought on by negligence or human error is significantly decreased by the integration of technology and automation.

1.2 Working procedure

The "Helmet Unit" and the "Bike Unit" are the two separate sections of the entire project. As a result, each unit's functionality is governed by two distinct circuits, each of which is managed by an individual Arduino microcontroller. The use of RF (Radio Frequency) modules, which enable wireless data transmission and reception between the two units, facilitates communication between these two Arduinos. Powering the Units: The "Bike Unit" is powered by the bike's battery through a direct connection. As a result, the "Bike Unit" turns on automatically when the rider turns on the ignition key of the bike. The "Helmet Unit", in contrast, relies on an external battery as its power source. The rider must wear the helmet and fasten the strap tightly in order to turn on the "Helmet Unit" because these actions act as a switch. Initiating Communication or Data Transfer: When both units are turned on, a process of Serial Communication or Data Transfer between the two Arduino microcontrollers starts through RF modules. Using an RF encoder, the Arduino inside the "Helmet Unit" continuously transmits data, a specific frequency of signal is sent whether the rider has worn the helmet appropriately and has a breath that is free of alcohol. The RF decoder within the RF module then allows the Arduino inside the "Bike Unit" to receive this data and work accordingly.

2. Control of the Relay Switch:

The Arduino microcontroller is in charge of controlling the relay switch, which is a crucial part of the "Bike Unit". After receiving the data from the RF module, the Arduino in the "Bike Unit" keeps the relay switch in the OFF position, if it receives data indicating that the rider has not correctly fastened their helmets or is intoxicated. On the other hand, the Arduino activates the relay switch, placing it in the ON state, when it receives data confirming that the rider has securely fastened the helmet and is not under the influence of alcohol. Control of the ignition system: It is well known that two-wheeler engines are typically powered by internal combustion engines that make use of spark plugs. Uninterrupted electric current flow is essential to produce a spark inside the spark plug. In this situation, a relay switch that takes control of the engine's ignition system has been added to the spark plug circuit. Due to the spark plug's continued inactivity when the relay switch is in the OFF position, the engine is unable to start by cranking. In conclusion, the rider's smooth and safe journey is ensured by the relay switch activating and the engine performing flawlessly, only when the rider correctly puts on the helmet and no alcohol is detected.

Table: A. Hardware Components B. Software Components **Arduino IDE**

SL NO.	COMPONENTS	QUANTITY
1	Arduino UNO	1
2	RF Transmitter	1
3	RF Receiver	1
4	12V Battery	1
5	Relay	1
6	CDI	1
7	Stator Coil	1
8	HT Coil	1

Fig-1: Installation of Relay Switch

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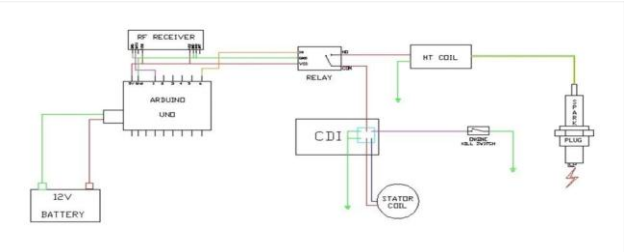

Fig-2: Circuit Diagram of "Bike Unit"

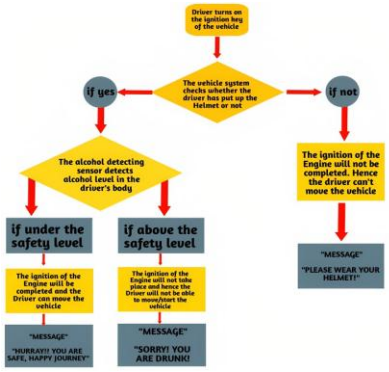

Fig-3: Flow chart of working principle of model

Result and Discussion:

The implementation of the Smart Helmet system, as described in the previous sections, represents a significant advancement in enhancing road safety and addressing the critical issues associated with helmet compliance and drunk driving. In this section, we will discuss the results obtained and the implications of this innovative system.

• Results:

• Enhanced Safety: The Smart Helmet system has demonstrated its ability to significantly enhance the safety of two-wheeler riders. By ensuring that the rider is wearing the helmet correctly and is free from the influence of alcohol, the system effectively mitigates the risk of accidents and injuries resulting from non-compliance with these crucial safety measures.

• Effective Communication: The RF modules employed in the system have proven to be reliable for wireless data transmission and reception between the Helmet Unit and Bike Unit Arduinos. This enables real-time communication, ensuring that the relay switch and ignition system respond promptly to rider actions.

• Reliable Data Transfer: The Serial Communication protocol makes it easier for the two Arduinos to exchange data. Thanks to the incorporation of sensors in the Helmet Unit circuit, the system can detect whether the rider is wearing their helmet properly and whether they are under the influence of alcohol.

• Controlling the ignition system is made possible by a reliable relay switch built into the Bike Unit circuit. The relay switch stays in the OFF position, stopping the engine from starting, protecting the rider when the system detects failure to wear a helmet or the presence of alcohol. • Discussion: SL. No. Components Quantity 1 Arduino UNO 1 2 RF Transmitter 1 3 RF Receiver 1 4 12V Battery 1 5 Relay 1 6 CDI 1 7 Stator Coil 1 8 HT Coil 1 Arduino IDE .

• Road Safety: Improving road safety is the Smart Helmet system's main objective. The system directly contributes to reducing accidents and fatalities, a critical concern, especially in areas with a high incidence of two-wheeler accidents, by enforcing the use of helmets and checking the sobriety of riders.

• User Compliance: The system promotes user compliance with safety regulations while also enhancing safety. A more responsible and safe riding culture results from motivating riders to wear helmets properly and avoid riding while drunk.

• Technology advancements: The combination of RF modules, sensors, and Arduino microcontrollers demonstrates how technology has the potential to address important safety concerns. It serves as an example of how well hardware and software components can work together to accomplish a shared safety objective.

• Future Development: Although the Smart Helmet system is a significant advancement, there is room for more advancement. Additional safety features, integration with smartphone apps, and the potential for data collection and analysis to improve traffic safety regulations are all examples of improvements.

• Advantages of Smart Helmet System:

• Enhanced Road Safety: By ensuring that riders are wearing helmets correctly and are not under the influence of alcohol, the Smart Helmet system significantly improves road safety and lowers the likelihood of accidents and injuries.

• Accident Prevention: The system assists in preventing accidents and fatalities brought on by non-compliance with these essential safety precautions by controlling the ignition system based on helmet compliance and sobriety.

• Deterrence of Drunk Driving: By preventing the engine from starting if alcohol is detected, the system discourages drunk driving and encourages sober riding.

• User Compliance: It promotes a more responsible and compliant riding culture by enticing drivers to follow safety regulations.

• Real-time data transfer between the Helmet Unit and Bike Unit is made possible by the RF modules and Serial Communication protocol, ensuring quick responses to rider actions.

• Ease of Use: Riders can easily ensure helmet compliance by activating the Helmet Unit by simply donning the helmet and fastening the strap.

• Data transfer between units is accurate thanks to the system's sensors, which are used to detect alcohol levels and helmet usage.

• Technology Integration: The integration of Arduino microcontrollers, RF modules, and sensors demonstrates how technology can be used to address important safety concerns. • Customization: The system is flexible and can be expanded to include more safety features, meeting a variety of needs and requirements.

• An overall improvement in riding culture and adherence to safety regulations is brought about by the system's promotion of responsible riding practices.

• Reduction in Fatalities: The system is essential in lowering fatalities and injuries from collisions caused by failure to wear a helmet and driving under the influence of alcohol.

• Future Development: The technology employed in the Smart Helmet system presents opportunities for additional development, which could eventually result in more cutting- edge safety innovations and solutions.

3. CONCLUSIONS

In conclusion, the Smart Helmet system represents a significant technological development that could potentially solve important road safety issues. By promoting the use of helmets and preventing drunk driving-related accidents, this revolutionary system is an essential instrument for improving road safety. The effectiveness and advantages of this system are underscored by the alarming statistics of accidents caused by drunk driving, particularly among two- wheeler riders.

Drunk driving on two-wheelers causes a shocking amount of accidents in India each year. These accidents have terrible results, including injuries, deaths, and significant financial burdens. The Smart Helmet system can play a pivotal role in reducing these statistics and improving road safety in the following ways:

• Reducing Drunken Driving Accidents: The system acts as a deterrent to drunk driving by preventing the engine from starting if alcohol is detected in the rider's breath. By doing so, it mitigates the risk of accidents caused by alcohol-impaired riders.

• Promoting Helmet Compliance: The system ensures that riders wear helmets correctly, thus reducing head injuries and fatalities that often result from noncompliance with helmet usage.

• Safety in Two-Wheeler Transportation: The Smart Helmet system caters specifically to the safety needs of two-wheeler riders, who are particularly vulnerable on the road.

• Potential for Government Initiatives: The Indian government can leverage this technology to enhance road safety and reduce the burden on healthcare and emergency services. Initiatives that promote the adoption of such systems can significantly impact road safety.

• Integration with Road Safety Schemes: The Smart Helmet system aligns with the government's ongoing efforts to enhance road safety through various schemes and initiatives. It complements programs that focus on creating safer roadways.

In light of the Smart Helmet system's potential, it is essential for the Indian government to consider its widespread adoption and promote its use through incentives and regulatory measures. This system aligns with existing schemes such as the "National Road Safety Policy" and "Pradhan Mantri Suraksha Bima Yojana," which are aimed at improving road safety and providing financial protection in the event of accidents.

By integrating the Smart Helmet system into the broader framework of road safety initiatives, India has the opportunity to reduce the number of accidents caused by drunk driving, save lives, reduce healthcare costs, and promote a safer and more responsible riding culture. This technology represents a significant step towards a safer and more secure future for two wheeler riders in the country.

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