IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 3, March 2025

Smart Helmet - Intelligent Safety for Motorcyclist using Raspberry PI and OpenCV

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Abstract: *Smart Helmet - Intelligent Safety Helmet for Motorcyclist is a project undertaken to increase the rate of road safety among motorcyclists. The idea is obtained after knowing that there is increased number of fatal road accidents over the years. Through the study identified, it is analysed that the helmets used is not in safety features such as not wearing a helmet string and not use the appropriate size. Therefore, this project is designed to introduce safety systems for the motorcyclist to wear the helmet properly. With the use of Image processing unit using Raspberry Pi and Open Cv , the motorcycle can move if there is helmet pound wearing, in accordance with the project title Smart Helmet - Intelligent Safety for Motorcyclist using Raspberry Pi and Open Cv. Safety system applied in this project meet the characteristics of a perfect rider and the application should be highlighted. The project is expected to improve safety and reduce accidents, especially fatal to the motorcyclist.*

Keywords: Safety, Standard Detection, Motor Ignition, Raspberry Pi, Open CV

I. INTRODUCTION

Two-wheelers, the mode of transport most Indians use, continue to be the most vulnerable to accidents. Indian roads were at their deadliest in 2014 claiming more than 16 lives every hour on average. Over 1.41 lakh people died in crashes, 3% more than the number of fatalities in 2013. Accidents involving two-wheelers and accounted for nearly half of the lives lost in road crashes. While 13,787 two wheeler drivers were killed in crashes, 23,529 other people were killed in accidents involving these vehicles, while close to 1.4 lakh people were left injured in them. The top five states - Uttar Pradesh, Tamil Nadu, Maharashtra, Karnataka and Rajasthan - accounted for over 40% of the fatalities. Among 53 mega cities, Delhi registered the highest number of fatalities at 2,199 and Chennai recorded 1,046 such deaths. Bhopal and Jaipur ranked third and fourth with the city roads claiming 1,015 and 844 lives respectively [1, 2]. A motorcycle's helmet is a type of protective headgear used by the motorcyclist. The main purpose is for safety, which is to protect the rider's head from the impact during an accident. It protects the rider's head as the helmet provides ventilation system. Speeding and not wearing a helmet are the main reasons of fatalities and injuries. Here we are implementing a model which uses DC Motor, Relay and Raspberry Pi which in real time system is related to the ignition system of the Motorcycle

II. METHODOLOGY

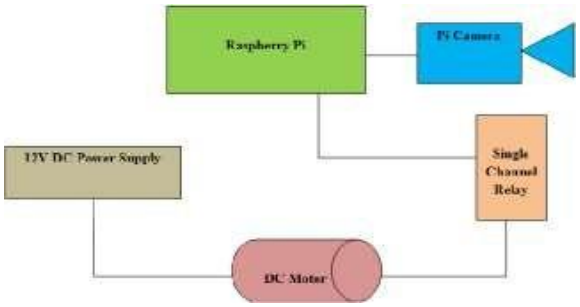

Fig 1: Block diagram of smart helmet

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The Smart Helmet - Intelligent Safety System for Motorcyclists is designed to enforce helmet usage and prevent the ignition of a motorcycle unless the rider is wearing the helmet properly. The system utilizes Raspberry Pi, OpenCV, a Pi Camera, a 12V DC power supply, a single-channel relay, and a DC motor to function effectively. The primary objective is to integrate image processing techniques to detect helmet usage and control the ignition system accordingly.

When the rider attempts to start the motorcycle, the Pi Camera captures an image of the rider's head. The image is then processed using OpenCV, a powerful image processing library, to detect whether the helmet is worn properly. If the system successfully identifies the helmet on the rider's head, the process moves forward. Otherwise, the motorcycle will not start, ensuring compliance with safety norms. This feature prevents riders from bypassing helmet laws and helps reduce fatalities in road accidents.

To further enhance safety, the system also includes chin strap detection. Many motorcyclists wear helmets loosely or without fastening the chin strap, making the helmet ineffective in an accident. The system verifies whether the chin strap is securely fastened before allowing ignition. If the helmet is worn but the strap is unfastened, a warning signal is activated, and the motorcycle remains locked. Only when the strap is securely fastened does the system proceed to the next stage.

Once the helmet and chin strap are correctly detected, the Raspberry Pi sends a signal to the relay module, which acts as a switch controlling the motorcycle ignition system. The single-channel relay is connected to the DC motor, simulating the ignition function in real-time. When the relay receives the activation signal, it completes the circuit and allows the motorcycle to start. If the helmet is removed while riding, the system can also trigger an alert or shut down the engine gradually to prevent abrupt stopping, which may cause accidents.

The entire system is powered by a 12V DC power supply, which ensures reliable operation and integration with the motorcycle's electrical system. The smart helmet system provides a robust solution to enforce helmet usage and reduce motorcycle-related fatalities. It is a step toward smart road safety solutions, ensuring that motorcyclists follow protective measures while riding. Additionally, the integration of machine learning algorithms in future versions could enhance helmet detection accuracy and incorporate additional safety features such as alcohol detection, accident detection, and GPS tracking.

By implementing this Smart Helmet System, the number of fatal accidents due to helmet negligence can be significantly reduced. The proposed system not only enforces safety regulations but also introduces an innovative intelligent transportation system that ensures responsible riding habits among motorcyclists.

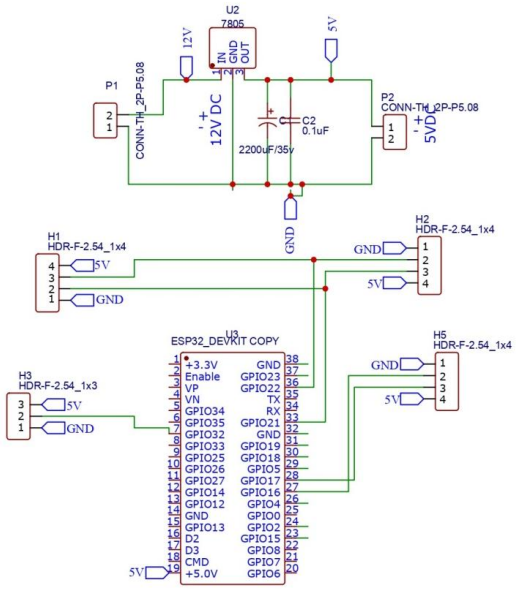

Fig 2: Circuit Diagram

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III. RESULT AND DISCUSSION

The smart helmet project using Arduino and GSM module technology is a significant step towards improving the safety of motorcycle riders. The system can detect accidents and send emergency alerts to a designated phone number, providing quick assistance to the victim in case of an emergency

IV. CONCLUSION

The scope of this project is a motorcycle rider that they care about their safety while riding. As we know, the motorcycle riders are now less concerned about their safety while riding, then the creation of this helmet safety rates can be increased and rate of road accidents can be reduced. The accident rates for motorcyclists are increasing from year to year, a Smart Helmet for Motorcyclist using Raspberry Pi and open CV which in future will inspire safety features for motorcyclists

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