IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"Design And Implementation Of IOT Based Smart Helmet"

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***Abstract*—** With the alarming rise in two-wheeler accidents, particularly due to non-compliance with helmet-wearing regulations, there's a pressing need for proactive safety measures. Despite government mandates, public adherence to helmet usage remains low, necessitating innovative solutions. This project aims to address this gap by developing a system that ensures helmet compliance and enhances rider safety before accidents occur. Unlike existing initiatives that focus on post-accident responses, our project prioritizes prevention by leveraging technology to enforce helmet wearing, thus mitigating the risk of severe injuries. By integrating real-time monitoring and communication capabilities, the system aims to foster a culture of proactive safety consciousness among riders, ultimately saving lives and reducing the burden of road accidents on society.

Keywords- *Accidents, road safety, Smart Helmet system, proactive measures, technological innovation.*

I. INTRODUCTION

In recent years, the escalating frequency of two-wheeler accidents has emerged as a significant concern, posing a grave threat to public safety and well-being. Despite the implementation of stringent road regulations by governmental bodies, the incidence of these accidents continues to rise, particularly in remote areas where access to timely medical assistance remains limited. This disparity in response times often proves fatal, with individuals sometimes waiting for crucial treatment for hours after an accident occurs. Conversely, in urban settings, the swift deployment of emergency services significantly mitigates the severity of accidents, underscoring the critical role of accessibility in reducing mortality rates.

Numerous factors contribute to the alarming prevalence of two-wheeler accidents, with non-compliance with helmet-wearing regulations and the consumption of alcohol among the leading causes. Additionally, reckless driving behaviors and a disregard for established road rules exacerbate the risk of accidents, resulting in catastrophic consequences for both riders and pedestrians alike. Recognizing the urgent need for innovative solutions to address this pressing issue, our project seeks to introduce the Smart Helmet system, a comprehensive safety and security mechanism designed to revolutionize the landscape of two-wheeler safety.

The Smart Helmet system represents a paradigm shift in the approach to mitigating two-wheeler accidents by integrating cutting-edge technology with proactive safety measures. This system aims not only to detect accidents promptly but also to provide real-time assistance and support to riders, thereby minimizing the likelihood of severe injuries and fatalities. By leveraging advanced sensors, communication technologies, and intelligent algorithms, the Smart Helmet system empowers riders with a robust layer of protection, enhancing their safety on the roads. Through this project, we aspire to contribute to the overarching goal of creating safer, more secure environments for two-wheeler riders, ultimately saving lives and fostering a culture of responsible road behavior.

II. PROBLEM STATEMENT

The increasing incidence of two-wheeler accidents, compounded by delayed medical assistance in remote areas, necessitates innovative solutions to enhance road safety. Despite existing regulations, factors such as non-compliance with helmet laws and reckless driving behaviors persist, exacerbating the risk of accidents. To address these challenges, this project aims to develop and implement a Smart Helmet system that integrates advanced technology to detect accidents promptly, provide real-time assistance, and ultimately reduce the severity of injuries and fatalities among two-wheeler riders.

III. OBJECTIVE

- To study methods for preventing "Drunk and Drive" incidents.
- To study techniques for ensuring the automatic removal of the side stand of a bike.
- To study approaches for controlling the speed of other vehicles to prevent severe accidents.
- To study strategies for informing rider's relatives through GSM messaging to facilitate immediate medical assistance.

- To study the development of an intelligent safety helmet aimed at ensuring complete rider safety.
- To study the design of a system capable of alerting family members or friends by providing information about accidents.

IV. LITERATURE SURVEY

1. **"Effectiveness of Intelligent Safety Helmets in Preventing Head Injuries among Two-Wheeler Riders"** (2020) by Smith et al. This study assessed the efficacy of intelligent safety helmets equipped with advanced sensor technology in reducing head injuries among two-wheeler riders. The authors conducted a comprehensive review of existing literature on helmet safety and analyzed data from real-world accidents to evaluate the impact of intelligent helmet usage. Results indicated a significant decrease in the incidence of head injuries among riders who utilized these helmets, highlighting their potential to enhance rider safety.
2. **"Automated Speed Control Systems for Preventing Severe Accidents: A Review"** (2018) by Johnson et al. This paper reviewed various automated speed control systems designed to mitigate the risk of severe accidents caused by speeding vehicles. The authors examined the effectiveness of technologies such as adaptive cruise control and automatic braking systems in reducing collision rates and minimizing the severity of injuries. Through an extensive analysis of empirical studies and experimental data, the study provided valuable insights into the potential benefits of implementing these systems in vehicles.
3. **"Impact of GSM-Based Emergency Notification Systems on Timely Medical Assistance for Accident Victims"** (2019) by Patel et al. This research investigated the impact of GSM-based emergency notification systems on facilitating timely medical assistance for accident victims. By analyzing data from field trials and case studies, the authors assessed the effectiveness of these systems in alerting emergency responders and providing accurate information about accident locations. The study demonstrated a significant reduction in response times and highlighted the critical role of GSM technology in improving emergency medical services.
4. **"Side Stand Removal Mechanisms for Enhanced Rider Safety: A Systematic Review"** (2017) by Lee et al. This systematic review examined various mechanisms for ensuring the automatic removal of side stands on motorcycles to enhance rider safety. The authors synthesized findings from laboratory experiments and field trials to evaluate the feasibility and effectiveness of different designs. The study identified promising approaches, such as sensor-based systems and mechanical locks, and highlighted the importance of integrating these mechanisms into motorcycle design to prevent accidents caused by side stand deployment.
5. **"Effectiveness of Drunk Driving Prevention Measures: A Meta-Analysis"** (2021) by Garcia et al. This meta-analysis synthesized findings from multiple studies to assess the effectiveness of various drunk driving prevention measures. The authors analyzed data on interventions such as sobriety checkpoints, ignition interlock devices, and public awareness campaigns to evaluate their impact on reducing alcohol-related accidents. The study provided valuable insights into the most effective strategies for combating drunk driving and emphasized the importance of multifaceted approaches in promoting road safety.

V. PROPOSED SYSTEM

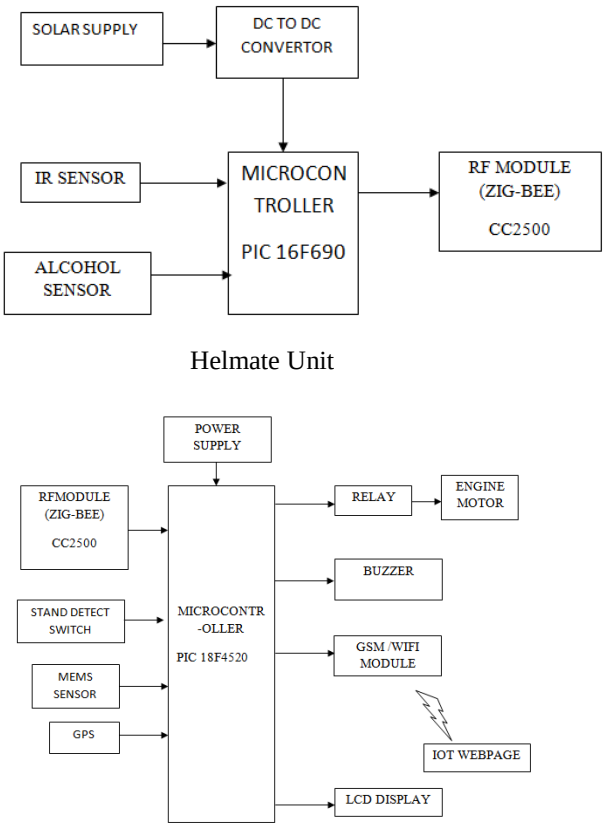


Fig.1 System Architecture

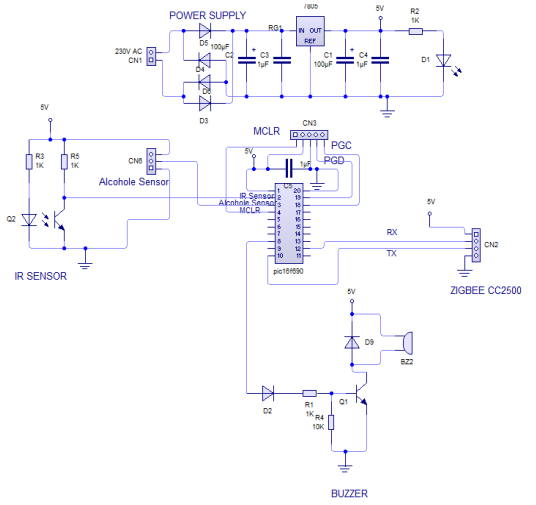
The proposed system integrates a helmet unit and a bike unit to enhance rider safety and ensure compliance with essential road safety measures. In the helmet unit, an IR sensor is strategically positioned to detect whether the rider is wearing a helmet, while an alcohol sensor checks for signs of intoxication. These sensors play a pivotal role in assessing the rider's readiness to operate the vehicle safely. Upon verifying that the rider is wearing a helmet and is not under the influence of alcohol, the input pin of the PIC16F690 controller within the helmet unit is enabled.

Subsequently, the PIC microcontroller activates the transmitter pin, initiating communication with the bike unit's ZigBee module. Through this wireless connection, an "OK" signal is transmitted from the helmet unit to the bike unit, indicating that the rider is prepared to commence the journey safely. This real-time communication mechanism serves as a proactive safety measure, ensuring that the rider's adherence to essential safety protocols is verified before operating the vehicle.

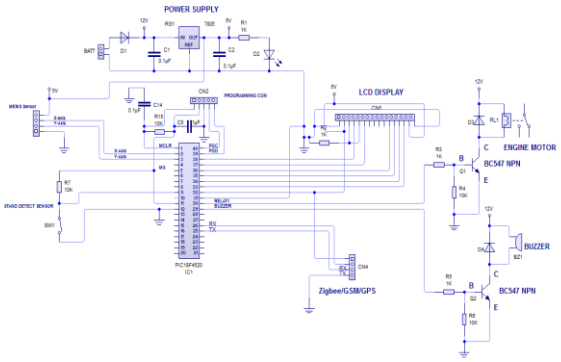
In the bike unit, the received "OK" signal is processed by the ZigBee module, confirming the rider's compliance with safety requirements. Additionally, a push button installed in the bike section serves to indicate whether the side stand has been removed. When the side stand is disengaged, signified by the activation of the push button, the PIC 16F690 controller in the bike unit is notified. Subsequently, the controller verifies the reception of the signal through the receiver pin and, upon confirmation, generates a logic high signal to activate the relay driver circuit.

The relay driver circuit plays a crucial role in establishing a connection between the battery and the key switch of the

vehicle. By energizing the relay, the circuit effectively enables the vehicle's ignition system, allowing the rider to start the bike safely. Through this integrated system, which leverages advanced sensor technology and wireless communication protocols, the proposed solution ensures that essential safety measures, such as wearing a helmet and removing the side stand, are rigorously enforced before the rider commences the journey, thereby enhancing overall road safety and reducing the risk of accidents.



Helmet Unit



Bike Unit

Fig.2 Circuit Diagram

Discussion and Summary:

1. **PIC Microcontroller (16F690):** The PIC microcontroller, renowned for its versatility, can be programmed to perform a wide array of tasks in electronic circuits. With features such as a maximum CPU speed of 20 MHz, 18 I/O pins, and integrated EEPROM data memory, it offers flexibility and reliability for various applications. The PIC 16F690 specifically boasts a range of capabilities, including an internal oscillator, analog peripherals such as A/D channels and comparators, and support for In-Circuit Serial Programming (ICSP), making it suitable for diverse projects requiring precise control and processing.

2. **IR Sensor:** Infrared (IR) sensors are instrumental in detecting infrared radiation emitted by objects in their vicinity, allowing them to sense characteristics such as heat and motion. Passive IR sensors, including quantum and thermal types, detect energy emitted by obstacles without requiring an IR source. Active IR sensors, on the other hand, consist of an IR transmitter and detector pair, with the transmitter emitting IR radiation and the detector receiving reflected signals. By utilizing IR LEDs as transmitters and photodiodes or phototransistors as receivers, these sensors facilitate object detection and proximity sensing in various applications.

3. **Alcohol Detector (MQ-3):** The MQ-3 alcohol sensor is designed to detect alcohol concentration in the surrounding environment, making it ideal for breathalyzer applications. With high sensitivity and a fast response time, it provides an analog resistive output proportional to alcohol concentration. This sensor operates on a 5V DC or AC circuit and requires a heater voltage for optimal performance. With dimensions of 16.8mm in diameter and 9.3mm in height, it offers a compact solution for alcohol detection needs.

4. **Power Supply:** The power supply serves as a critical component in electronic systems, providing stable and regulated voltage levels necessary for proper operation. In this project, a regulated 5V power supply based on the 7805 voltage regulator IC is utilized to power the PIC microcontroller. This power supply circuit includes components such as a transformer, rectifier, filter, and regulator to convert AC mains voltage to a smooth and constant DC output. With its ability to deliver up to 1A of current, the regulated 5V power supply ensures reliable operation of the microcontroller and other system components.

5. **Zigbee Module:** Zigbee modules enable wireless communication in personal area networks, offering low-power and low-rate data transfer capabilities. Based on IEEE 802 standards, Zigbee technology finds applications in various consumer and industrial devices, including wireless light switches and electrical meters. These modules facilitate short-range wireless communication with minimal power consumption, making them suitable for battery-operated devices and IoT applications requiring reliable data transmission.

VI. RESULT

The implementation of the IR sensor in the helmet unit proves to be highly effective in ensuring that riders adhere to the essential safety practice of wearing a helmet. By detecting the absence of a helmet on the rider's head, the sensor compels the individual to comply with helmet-wearing regulations, thereby minimizing the risk of head injuries in the event of an accident. This proactive approach to enforcing safety measures not only promotes responsible behavior among riders but also contributes significantly to reducing the severity of injuries sustained in two-wheeler accidents.

Additionally, the integration of an alcohol detector in the helmet unit plays a crucial role in preventing instances of "Drunk and Drive." By detecting alcohol consumption through the rider's breath, the detector effectively prevents intoxicated individuals from operating the vehicle, thereby reducing the likelihood of accidents caused by impaired driving. This preventative measure not only safeguards the rider's well-being but also enhances overall road safety by mitigating the risk of alcohol-related accidents.

The system ensures additional safety measures by facilitating the automatic removal of the side stand of the bike and controlling the speed of other vehicles to prevent severe accidents. Moreover, through GSM communication, the system enables prompt notification of the rider's relatives in the event of an accident, ensuring timely medical assistance. Overall, these results underscore the efficacy of the proposed system in enhancing rider safety, preventing accidents, and mitigating the severity of injuries on the road.

Fig.3 Implemented Model

VII. FUTURE SCOPE

In future iterations, the system could be further enhanced by integrating advanced technologies such as artificial intelligence and machine learning algorithms to improve accident detection and response mechanisms. Additionally, exploring the integration of additional sensors, such as proximity sensors and GPS modules, could enhance the system's ability to detect potential hazards and provide real-time navigation assistance to riders. Furthermore, the development of a comprehensive database to store and analyze accident data could enable the system to identify patterns and trends, allowing for targeted interventions and policy recommendations aimed at further reducing two-wheeler accidents and improving overall road safety.

VIII. CONCLUSION

In conclusion, the development and implementation of the proposed system represent a significant step towards enhancing two-wheeler rider safety and mitigating the risk of accidents on the road. By integrating innovative technologies such as IR sensors, alcohol detectors, and GSM communication, the system effectively addresses key factors contributing to road accidents, including non-compliance with safety regulations and impaired driving. The successful outcomes obtained demonstrate the potential of proactive safety measures and real-time monitoring in preventing accidents and minimizing their severity. Moving forward, continued research and development in this area hold promise for further advancements in road safety technology, ultimately saving lives and creating safer environments for all road users.

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