Accident prevention smart helmet and bike tracking system

Dr.J.Lakshmi Narayana[1], U.Siva Sai Krishna[2], O.Anusha[3], B.Supriya[4], B.L.V.Rushwik[5]
[1] Professor , [2345]Undergraduate. Department Of ECE,
PSCMR College Of Engineering And Technology, Vijayawada, Andhra Pradesh, India
principal@pscmr.ac.in@gmail.com[1], sivasaiuppaluru@gmail.com[2], anushahoney1910@gmail.com[3], supriyabinde04@gmail.com[4], rushwikbattenapati@gmail.com[5]

Abstract—: India, which is approaching its peak population and is the most populous country globally, is currently facing a significant increase in two-wheeler accidents. This surge can be primarily attributed to young individuals neglecting safety protocols, such as the use of helmets. In response, a smart headgear powered by the Internet of Things and featuring enhanced security features has been developed. By incorporating a camera module and Raspberry Pi technology, the cycle can be operated exclusively by authorized individuals. Helmet-based ignition guarantees that the bicycle will only commence when the designated user dons the helmet. When unauthorized attempts or incidents occur, the system expeditiously notifies registered contacts via a Telegram bot, furnishing them with real-time GPS coordinates to facilitate an immediate response. Additionally, anti-theft capabilities for locating stolen bicycles and helmets are incorporated into the solution. By integrating cutting-edge technologies, such as facial recognition facilitated by Raspberry Pi, this system effectively promotes road safety in India. It mitigates the loss of life and property caused by two-wheeler collisions, as well as prevents unauthorized access and larceny

Index Terms—Internet of thing, Raspberry pi, Telegram Bot, GPS.

I. Introduction

In contemporary India, a staggering 57helmets, leading to a proliferation of road accidents and fatalities. Despite well-established regulations, noncompliance remains perva-sive, highlighting the urgent need for technological interven-tions to enforce road safety measures effectively. Citing a World Health Organization (WHO) survey, helmet non-usage emerges as a significant risk factor in road safety, with fatal accidents often attributed to this negligence. Studies, including the 2013 WHO Global Status Report, underscore the pivotal role of helmets in mitigating accident severity, reducing fatality risks by 40and serious injuries by 70dire situation, with over 37,000 motorcycle-related fatalities and 1,300 serious injuries reported in 2014 alone. Alarming trends persist, exacerbated by the absence of smart helmet adoption among India's middle class, contrasting starkly with safety advancements in four-wheelers. Data from the All-India Institute of Med-ical Sciences (AIIMS) further elucidate the repercussions of helmet nonusage, with a substantial proportion of motorcy-cle fatalities attributed to inadequate protective gear. Despite legislative mandates, non-standard helmet use persists, posing grave risks to riders and pillion passengers alike. Beyond safety concerns, rampant motorcycle theft adds to the nation's woes, with low detection rates compounding the burden on law enforcement agencies and exacerbating financial losses for affected families. To address these pressing challenges, this paper proposes a technologically advanced smart helmet solution. Leveraging sensors and IoT technology, the smart helmet not only detects helmet usage but also integrates features to prevent drunk driving and monitor speed violations. Additionally, it incorporates bike tracking systems to facilitate swift recovery in case of theft or loss. This innovative approach holds promise in revolutionizing road safety enforcement and reducing motorcycle-related fatalities and injuries in India.

II. Literature Survey

A recent literature review examines an assortment of re-search papers pertaining to smart helmet technology. The 2019 article ”SMART HELMET: A Review Paper” lacks comprehensive component explanations and instead focuses on the utilization of wireless transmitters and RF receiver circuits to guarantee helmet usage during bicycle journeys. ”Smart for safe driving” (2019) neglects other accident factors in favor of alcohol detection and accident alerts to police stations. In a similar vein, the 2017 version of ”Smart Helmet” places greater emphasis on alcohol detection and accident alerts than on comprehensive safety features. Although the ”Smart-tec Helmet” employs a cooling mechanism and ac-cident detection to improve the likelihood of survival, it is devoid of comprehensive operational insights. In conclusion, the ”Internet of Things (IoT)-based Smart Helmet for Accident Detection and Notification” system offers alcohol and helmet detection in addition to accident notification capabilities for hospitals and law enforcement. However, it raises concerns regarding the dependability of a button-based helmet detection system. As a whole, these studies highlight progress in helmet safety technology; however, they also highlight deficiencies in comprehensively addressing road safety issues and offering detailed technical explanations.

III. Methodology

A. MQ3 SENSOR

Specialized in the detection of alcohol breath, the MQ3 sensor has a detection range of 0.04 mg/L to 4 mg/L. Alcohol content analysis of the rider's breath is possible through direct integration into the headgear, operating within the temperature range of -10°C to 50°C. Strategically positioned within the helmet, it facilitates immediate detection and support, thereby ensuring the protection of the rider.It shows in Fig.1

Fig.1 MQ-3 Sensor

B. . FSR Sensors

A force-sensitive resistor (FSR) detects the presence of a helmet by operating on contact principles. The FSR detects human contact when the helmet is worn by a motorcyclist and initiates an ignition signal to start the motorbike. The sensor demonstrates prompt resistance alterations in response to applied force, enabling it to promptly detect helmet usage.It shows in Fig.2

Fig.2 FSR Sensors

C. Piezoelectric Sensors

For the purpose of accident detection, a piezoelectric vi-bration sensor module is equipped with a high DC output impedance. By utilizing a filter network and functioning as a voltage source, the piezoelectric transducer generates a voltage (V) that correlates directly with the applied force, pressure, or strain.

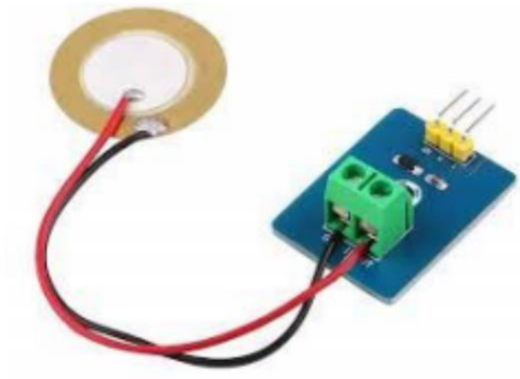


Fig.3 Piezoelectric Sensors

The sensor activates and transmits signals to the Arduino Nano for processing when an accident is detected. By effi-ciently capturing and converting mechanical vibrations into electrical signals, this module facilitates the implementation of prompt accident detection and response mechanisms.It shows in Fig.3

D. RF Transmitter and Receiver

Through the use of an RF transmitter-receiver, wireless data exchange is enabled between the helmet and bike modules. The transmitter receives serial data exclusively and transmits it to the receiver via the RF antenna. The components of this system engage in uninterrupted communication through the utilization of radio frequency technology for the transmission of data packets.It shows in Fig.4

Fig.4 RF Transmitter and Receiver

E. Camera module

A camera module is a diminutive imaging apparatus that is seamlessly incorporated into electronic systems; it accurately captures visual data. A typical configuration includes a pro-cessing device, lens, and image sensor. By employing a range of technologies such as CMOS or CCD sensors, it is capable of capturing still images or video footage with exceptional clarity and resolution. Camera modules are utilized in a wide range of disciplines, including machine vision, surveillance, photography, and videography. For enhanced performance, they provide autofocus, image stabilization, and sophisticated image processing algorithms. Camera modules find application in a wide variety of devices, including surveillance cameras,

Fig.5 Camera module

drones, and smartphones, owing to their adaptable nature and diminutive dimensions.It shows in Fig.5

IV. PROPOSEDMETHODOLOGY

The initiative is organized around three fundamental components: the tracking unit, the helmet unit, and the bike unit. MQ3 and FSR sensors are incorporated into the helmet unit in addition to RF transmitters. FSR sensors detect the use of a helmet, whereas MQ3 sensors monitor the exhalation alcohol concentration of the rider. After both criteria have been validated, the RF transmitter establishes a wireless connection with the cycle unit. In lieu of an Arduino Nano, the bicycle component is powered by a Raspberry Pi and is equipped with RF receivers, GPS, an accelerometer, and a vibration sensor. The Raspberry Pi activates and monitors for incidents in response to signals received from the helmet unit. Following a two-minute interval without a detected safety button press, a Telegram assistant notifies the rider's family by providing them with the exact GPS location. In order to detect theft, the tracking device enables bicycle owners to pinpoint the location of their vehicles through the use of GPS technology on their mobile phones. The streamlined processes made possible by the system's efficient design bolster safety and security protocols. The integration of Telegram bots and the robust capabilities of Raspberry Pi enable the project to monitor and respond promptly to potential safety hazards and larceny incidents in real time, thereby demonstrating a comprehensive solution tailored to the needs of motorcyclists.It shows in Fig.6

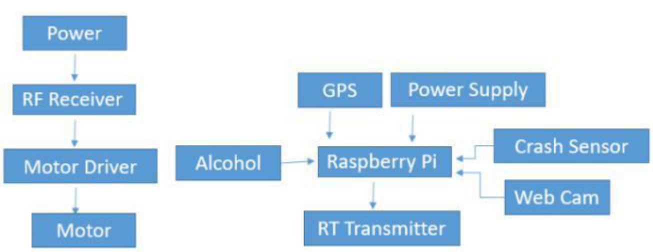


Fig.6 Circuit at bike and helmet

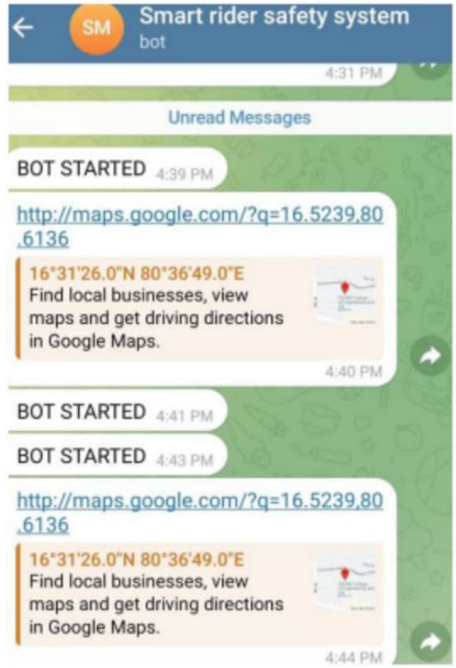
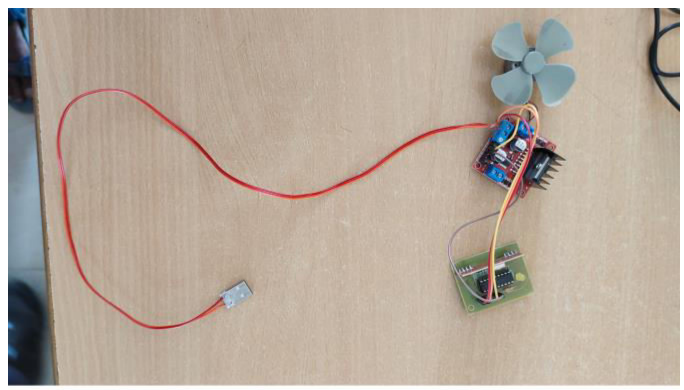


Fig.7 Alert Message in Teligram Bot



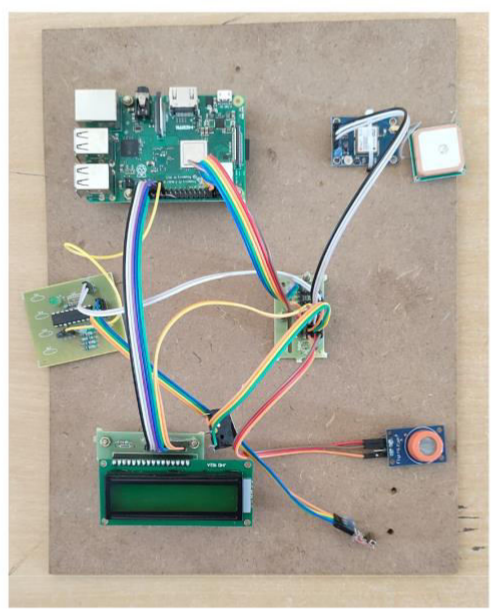


Fig.8 Circuit of RF Transmitter and receiver

V. RESULTS AND DISCUSSION

A vibration sensor is utilized by the accident detection system to distinguish between major and minor incidents. The sensor establishes a connection with the Raspberry Pi upon encountering substantial pressure fluctuations that signify an accident. The Raspberry Pi provides the passenger with a one-minute window in which to activate consciousness by pressing a switch. When not in use, the GPS module is activated on the Raspberry Pi to determine the exact location of the 1 8 passenger. Subsequently, an SMS is transmitted to regis-tered family members through a TelegramIt shows in Fig.7 automaton, containing the accident's specifics and location so that they may promptly seek assistance. The prompt response system plays a critical role in ensuring the timely provision of medical assistance to accident victims and preserving lives. In situations where the passenger is conscious and does not necessitate medical intervention, the alert system may also be deactivated manually. During situations involving bicycle larceny, the proprietor may utilize the GPS module integrated into the bicycle unit on their smartphone to ascertain the pre-cise whereabouts of the bicycle. A specialized application for smartphones facilitates uninterrupted monitoring of the bicycle and helmet, providing instantaneous notifications regarding their location. By activating the "GO" button, the proprietor is granted entry to the longitude and latitude coordinates of the helmet and vehicle, thereby augmenting the efficacy of larceny prevention protocols for two-wheelers.

VI. CONCLUSION

This paper argues in favor of the implementation of intelli-gent helmets and tracking systems as a response to concerning statistics that reveal a significant prevalence of helmet non-utilization among cyclists (57safety, the intelligent helmet suggested in this endeavor provides all-encompassing protec-tion for two-wheeler commuters. By substituting Raspberry Pi for Arduino Nano and incorporating a Telegram assistant for communication rather than GSM, the system guarantees streamlined functionality and communication protocols. Fur-thermore, security measures are augmented with the incor-poration of a camera module, which restricts bike operation exclusively to authorized individuals. By employing Raspberry Pi technology, this function verifies the identity of the user prior to enabling bicycle ignition; thus, it ensures safety by discouraging unauthorized usage. Additionally, the integra-tion of a theft detection system not only enhances security measures but also provides economically viable alternatives for middle-income households, enabling them to promptly recover pilfered bicycles. In its entirety, this undertaking offers a comprehensive strategy for ensuring road safety and pre-venting vehicle larceny by utilizing cutting-edge technologies to effectively protect passengers and their belongings amidst widespread safety issues.

VII. FUTURE SCOPE

The future scope of this initiative could involve further advancements in intelligent helmet technology, such as in-tegrating real-time health monitoring systems for cyclists, enhancing the communication capabilities of the helmet as-sistant for emergency response situations, and incorporating artificial intelligence for predictive accident detection and prevention. Additionally, expanding the theft detection system to include GPS tracking and remote locking mechanisms could provide even greater security for cyclists' belongings. More-over, exploring partnerships with urban planning authorities and transportation agencies could facilitate the integration of these smart helmet systems into broader urban mobility initiatives aimed at promoting safer and more sustainable transportation options.

REFERENCES

[1] 1] Tiwari, V., Srivastava, R., Sharma, M. S. (2023, February). Smart Helmet and Bike Tracking System. In 2023 International Conference on Power, Instrumentation, Energy and Control (PIECON) (pp. 1-6). IEEE.

[2] [2] Sonwane, N., Vairagade, A., Wasnik, A., Panhekar, S., Bhat, S., Wadibhasme, V. SMART HELMET.

[3] [3] Nataraja, N., Mamatha, K. S. (2018, May). Smart helmet. In 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information Communication Technology (RTEICT) (pp. 2338-2341). IEEE.

[4] [4] SHILPA, K. A. ADVANCED SMART HELMET AND AUTOMATIC ACCIDENT ALERT SYSTEM. Penta, M., Jadhav, M., Girme, P. (2015). Bike rider's safety using helmet. Int. J. Electr. Electron. Eng. Telecommun, 4(2).

[5] [5] Jawalekar, M. D. A. U., Dabhade, A. A., Urkude, V. R., Kathole, A. M., Masne, G. G., Masne, T. S., Deshmukh, U. P. Making Smart Helmet for Smart City.

[6] [6] Sireesha, G., Jahnavi, K. B. S., Baburay, A. Smart Helmet using IoT.

[7] [7] Riya, J. F., Chowdhury, M. T. H., Usha, S. A., Howlader, S., Ahmad, S., Islam, M. Z. (2023, January). A Smart Helmet: Ensuring Safety of Bike Riders. In 2023 3rd International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST) (pp. 305- 310). IEEE

[8] [8] Mila, S. P., Roy, J. (2023, September). Design a Smart Helmet as a Quick Responder Safety Solution for the Bikers. In 2023 International Conference on Information and Communication Technology for Sustain-able Development (ICICT4SD) (pp. 163-168). IEEE.

[9] [9] KRISHNA, T. R., GANESH, C., KUMAR, K. L., KAVYA, K. S. N., NOKESH, M., PRIYA, M. G. K. (2021). GSM BASED SMART HELMET SYSTEM FOR BIKE RIDER SAFETY.

[10] [10] Anjum, M., Farhat, J., Tumane, S., Madavi, D., Azmi, S. (2017). Embedded Based Smart Helmet for Bike Rider's Safety. International Journal of Scientific Research in Science and Technology, 2(3), 129-134.

[11] [11] Paulchamy, D. B., Sundhararajan, C., Xavier, R., Ramkumar, A., Vigneshwar, D. (2018). Design of smart helmet and bike management system. Asian J Applied Sci Technol, 2(2), 207-211.

[12] [12]D'Souza, A., Maliyackal, S. S., RN, R. (2018, April). Helmet Integrated Bike Ignition Using Arduino. In Proceedings of International Conference on Energy Efficient Technologies for Sustainability, St. Xavier's Catholic College of Engineering, TamilNadu, India. 5th to 7th April.

[13] [13]Megala, B. (2021). IMPLEMENTATION OF SMART HELMET FOR ACCIDENT AVOIDANCE. INFORMATION TECHNOLOGY IN INDUSTRY, 9(3), 300-304.

[14] Ashwini, S. S., Udupa, N. G., Sweta, N., Alam, M. S. (2020). A Smart Helmet on IoT Technology for Safety and Accident Detection. Int. J, 99-102.

[15] [15] Parameshwari, P., Pujari, V., Gadgay, B. (2018). Smart helmet for accident prevention. Int. Res. J. Eng. Technol, 5, 368-370.

[16] [16] Dharani, P., Ganesh, T., Gopinath, V., Vali, Y. S. (2020). Smart Safety Helmet for Bike Riders using IoT. International Research Journal of Multidisciplinary Technovation, 2(4), 21-30.

[17] [[17]Yadav, N., Singh, S. K. (2021). Implementation of Smart Helmet for Bikers. International Research Journal on Advanced Science Hub, 3(Special Issue ICARD-2021 3S), 135-139

[18] [18]Rajendran, V. G., Jayalalitha, S., Kumar, M. V., Panneerselvam, K. T. (2017, September). Automatic protective headgear for safer ride. In 2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI) (pp. 1094-1099). IEEE.

[19] [19] Sumamah, M., Faiz, M., Tyagi, A. (2018). Smart helmet kit. Int. Res. J. Eng. Technol, 5, 3018-3020.

[20] [20]Parab, J., Kamat, S., Dhanjal, I. S., Kulkarni, S. (2021). Review on Smart Cycle with the Smart Helmet. Available at SSRN 3930658.
[21] [21] Patvi, T., Madre, T., Hodekar, I., Nimbalkar, V. V. Smart Helmet for Accident Detection and Prevention.