E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

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A-ST096: RENT AND SAFETY ENFORCEMENT HELMET WITH TELEGRAM BOT

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ABSTRACT

This project aims to develop a comprehensive smart helmet safety system combining advanced technologies to ensure secure usage and real-time monitoring. The system integrates a Hall effect sensor, magnetic coins, LEDs, Arduino Uno, GPS, ESP32, and a Telegram bot to detect whether the helmet is securely buckled and provide location tracking. The Hall effect sensor identifies the magnetic field from the buckle, triggering LEDs to indicate the status—green for securely fastened and red for unfastened. Additionally, the ESP32 interfaces with a GPS module to track the user's real-time location, sending updates and safety alerts via a Telegram bot. If the helmet is not properly buckled or an emergency occurs, the system notifies the user or concerned personnel. This cost- effective and user-friendly solution demonstrates the potential of IoT and embedded systems to enhance safety for applications in transportation, construction, and sports.

Keywords: Helmet Safety, Hall Effect Sensor, GPS, ESP32, Arduino Uno

1. Product Description

Helmets are essential for ensuring safety in activities like motorcycling, construction, and sports. Despite their critical role, improper use of helmets, such as failing to buckle them securely, often compromises their effectiveness. This project introduces a smart helmet safety system that combines a Hall effect sensor, magnetic coins, LEDs, Arduino Uno, GPS, ESP32, and a Telegram bot. The system not only detects whether the helmet is properly buckled but also provides location tracking and real-time alerts. By merging IoT and sensor-based technologies, this project addresses the need for innovative safety solutions in a user-friendly and cost-effective manner.

2. Flow Chart

The flowchart illustrates the operation of a smart helmet safety system designed to ensure proper helmet usage and enhance safety. The process begins with the initialization of components, including the Hall effect sensor, Arduino, GPS module, ESP32, and LEDs. The Hall effect sensor detects whether the helmet buckle is properly fastened by sensing the magnetic field generated by embedded magnetic coins. Based on the detection, the system updates the LED status, where a green LED indicates a securely buckled helmet and a red LED signals an unbuckled state. Simultaneously, the GPS module fetches the real-time

location of the helmet. This data, along with the buckle status, is transmitted to a pre-configured Telegram bot using the ESP32 microcontroller and Wi-Fi connectivity. The bot provides notifications and alerts, ensuring real-time monitoring and immediate feedback in case of improper usage or emergencies. The system continuously loops, maintaining seamless safety checks.

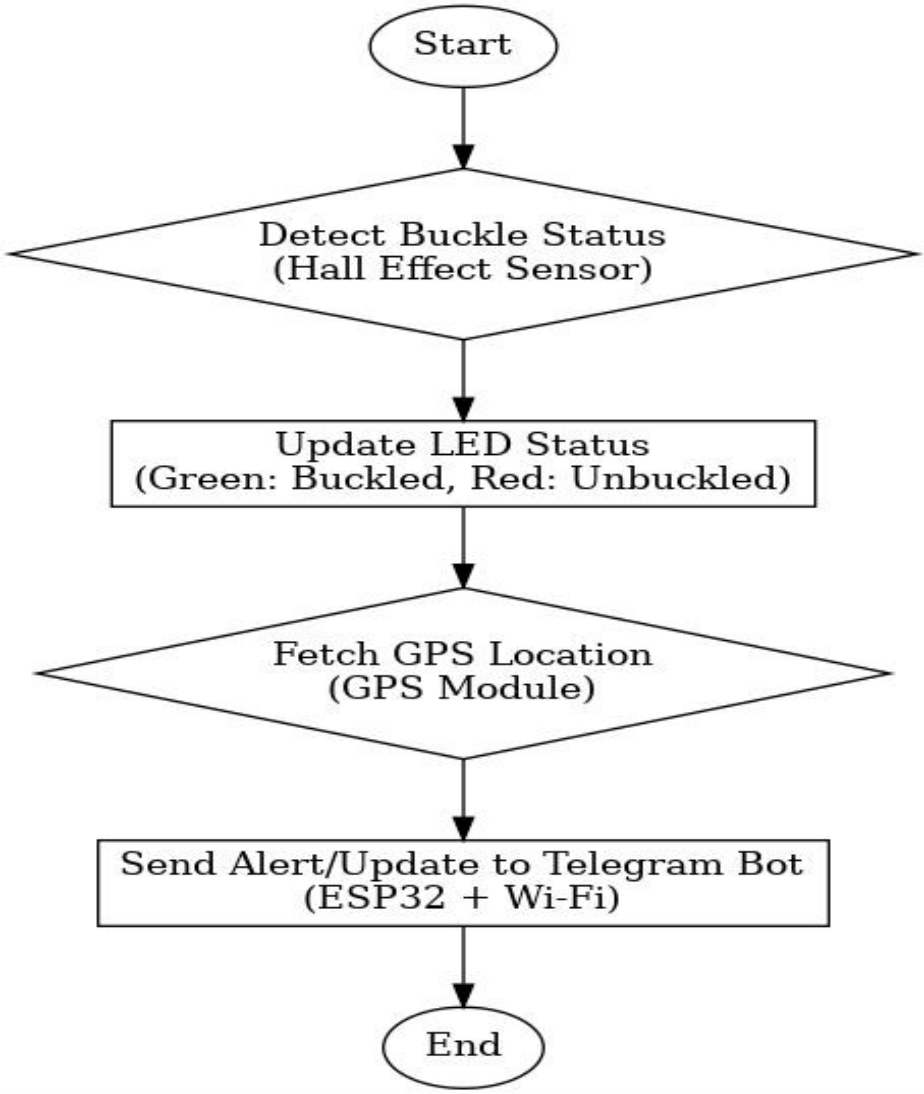

Figure 1. Flow Chart Model

3. Novelty and uniqueness

This project uniquely combines two critical safety aspects—buckle detection and real-time location monitoring—into a single, efficient system. The integration of a Hall effect sensor for buckle detection and GPS with an ESP32 for communication via Telegram bot enhances both safety and convenience. Unlike conventional helmet systems that focus solely on impact

detection, this system ensures proactive safety by verifying proper usage and providing location- based alerts, making it a novel approach in smart helmet technology.

4. Benefit to mankind

The smart helmet system addresses the global concern of safety in activities such as motorcycling, construction, and sports. By ensuring helmets are properly buckled and providing real-time alerts and location tracking, it reduces the risk of injuries caused by improper helmet usage. In emergency situations, the system's location-sharing capability can expedite response times, potentially saving lives. This project empowers users with technology that promotes safety and accountability.

5. Innovation and Entrepreneurial Impact

This project exemplifies innovation by leveraging IoT, embedded systems, and cloud communication to create an intelligent safety device. Its low-cost design and ease of integration make it accessible to a wide audience, opening opportunities for entrepreneurial ventures in personal safety equipment. The system's adaptability to various helmet types and its potential to include additional features like accident detection and voice alerts further enhance its market appeal.

6. Potential commercialization

The smart helmet safety system holds significant potential for commercialization due to its versatile applications across industries such as transportation, construction, and sports. Its ability to ensure proper helmet usage through buckle detection, real-time location tracking, and instant alerts makes it an attractive product for safety-conscious consumers and organizations. The system’s cost-effective design, ease of integration with existing helmet models, and user-friendly features ensure widespread adoption without the need for extensive modifications. In transportation, motorcyclists can benefit from enhanced safety compliance, while construction companies can leverage the system to ensure worker safety on-site, reducing liability and improving operational standards. Sports organizations can implement it to monitor athlete safety during training and events. By targeting markets with stringent safety regulations and promoting awareness about helmet compliance, this system has the potential to capture a broad market share. Additionally, its scalability and adaptability make it a promising entrepreneurial venture for long-term profitability.

7. Authors’ Biography

Hanis Munirah Haizal started her first education at Sekolah Kebangsaan Ayer Hitam at Kluang, Johor and continued her studies at SMK Seri Lalang, Kluang, Johor. Her academic journey laid at UITM Pasir Gudang, Johor Branch, Pasir Gudang Campus as a Diploma student in Electrical Engineering Studies. She has been joining many programmes to improvise soft skills in Matlab, Proteus and Arduino IDE.

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