



# SUMMER INTERSHIP REPORT

# SafeTech Halo: Ride the Future, Safely and Stylishly

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# CERTIFICATE

This is to certify that the internship project entitled "SafeTech Halo – Ride the Future, Safely and Stylishly" was successfully completed by the following students USICT, GGSIPU in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (ECE) under the internship program at AICTE IDEA Lab-Guru Gobind Singh Indraprastha University

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# DECELERATION

We hereby declare that the project work presented in this internship report, entitled "SafeTech Halo – Ride the Future, Safely and Stylishly" is entirely our own work and has not been submitted for any degree or diploma from this or any other institute for partial fulfillment of the requirements for the award of the degree of Bachelor of Technology (ECE)

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# ABSTRACT

The SafeTech Halo is an innovative smart helmet designed to enhance rider safety, navigation, and comfort through the integration of advanced technological features. This project combines a sleek, aerodynamic profile with cutting-edge functionality to redefine the standards of personal protective gear. Central to the helmet's design is a Heads-Up Display (HUD) that provides turn-by-turn navigation, complemented by eye-tracking technology for hands-free control and an embedded voice assistant for seamless interaction.

Equipped with advanced sensors and AI processing on the NVIDIA Jetson Nano, the SafeTech Halo offers crash prediction and detection capabilities, significantly enhancing rider safety. Health monitoring features further ensure the well-being of the rider, while the use of non-Newtonian fluids improves ventilation for a comfortable riding experience.

The helmet's modular design allows for easy upgrades, ensuring that it can adapt to future technological advancements. Powered by a rechargeable battery with Type-C charging, the SafeTech Halo is both convenient and sustainable. This project aims to provide a comprehensive solution for modern riders, combining safety, comfort, and advanced technological features into one sleek and stylish helmet.

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# INTRODUCTION

The **SafeTech Halo** represents a significant leap forward in the realm of smart helmets, integrating cutting-edge technology with modern design to elevate rider safety, navigation, and comfort. In an era where technology is becoming increasingly intertwined with everyday activities, the SafeTech Halo stands at the forefront of this evolution, offering a comprehensive solution for modern riders.

## **Background**

Motorcycle accidents are a major concern worldwide, with many incidents resulting from poor visibility, lack of real-time navigation, and delayed responses in emergencies. The SafeTech Halo aims to address these issues by integrating advanced technologies into a single helmet. By combining innovative features with a sleek, aerodynamic design, the SafeTech Halo seeks to mitigate these common risks and enhance the overall riding experience.

# <u>Objectives</u>

The primary objectives of the SafeTech Halo project are to:

1. Enhance Rider Safety: Through advanced crash detection and prediction using sensors and AI processing on the NVIDIA Jetson Nano.

2. Provide Real-Time Navigation: Utilizing a Heads-Up Display (HUD) for seamless, turn-by-turn directions.

3. Improve Comfort: Incorporating non-Newtonian fluids for innovative ventilation solutions and ensuring a lightweight, ergonomic design.

 Enable Hands-Free Control: With eye-tracking technology for intuitive interaction and an embedded voice assistant for seamless communication.

5. Offer Health Monitoring: To ensure the well-being of the rider during their journey.

6. Ensure Modularity: Allowing for easy upgrades to adapt to future technological advancements.

7. Sustain Convenience: Powered by a rechargeable battery with Type-C charging for ease of use and sustainability.

This report delves into the innovative features, technological advancements, and design considerations that make the SafeTech Halo a leader in smart helmet technology. It aims to provide a comprehensive overview of how this helmet combines safety, functionality, and style to meet the needs of today's riders.

# LITERATURE SURVEY

### <u> Previous Work</u>

The evolution of smart helmets has been driven by ongoing research and development aimed at enhancing rider safety and comfort. Various studies and projects have explored the integration of advanced technologies into helmet design, with a focus on improving visibility, navigation, and overall safety.

One of the notable advancements in smart helmets is the incorporation of Heads-Up Displays (HUDs). HUD technology provides riders with critical navigation information directly within their field of vision, allowing for more intuitive and less distracting interactions. This advancement has been shown to significantly improve navigation and enhance rider safety by minimizing the need for riders to glance away from the road.

Another area of exploration has been the integration of smart helmets with smartphone applications. These solutions often offer additional features such as navigation assistance, call handling, and music control. While these integrations have improved the functionality of smart helmets, they often fall short in providing a holistic safety solution.

Recent innovations also include the incorporation of eye-tracking technology, which enables hands-free control of various helmet functions. This technology enhances rider convenience by allowing for gesture-based interactions and reducing the need for manual adjustments. Eye-tracking has demonstrated potential in creating a more intuitive and responsive user experience.

Health monitoring systems have also been a focus of recent research. These systems aim to provide real-time health data, such as heart rate and body temperature, to ensure the rider's well-being during their journey. This integration represents a significant advancement in smart helmet technology, offering additional safety measures beyond traditional crash protection.

### <u>Key Findings</u>

Research in the field of smart helmets has yielded several key findings:

1. **HUD Displays**: Studies have shown that HUD displays can greatly enhance navigation and safety by providing riders with essential information without requiring them to divert their attention from the road.

2. **Eye-Tracking Technology**: The integration of eye-tracking technology offers a hands-free method of interaction, which can improve rider convenience and reduce the risk of accidents caused by manual adjustments.

3. **Crash Detection Systems**: Advanced crash detection systems, often incorporating sensors and AI processing, have shown promise in reducing the severity of accidents by providing timely alerts and assistance.

# METHODOLOGY

### Design and Development

The design and development of the SafeTech Halo involved a meticulous process aimed at integrating several advanced technologies into a cohesive and functional helmet system. The approach was centred around creating a modular system that incorporates a Heads-Up Display (HUD), eye-tracking technology, voice assistance, and advanced sensors, all while ensuring efficiency and reliability.

### Design Process

- 1. Modular System Design: The helmet was designed with modularity in mind, allowing for the integration of multiple technologies in a way that ensures compatibility and ease of upgrades. This design approach ensures that the helmet can adapt to future advancements and incorporate new features as they become available.
- 2. Component Selection: Critical to the development was the selection of appropriate microcontrollers and processors. The ESP32 microcontroller was chosen for its versatility and capability to handle various sensor inputs and communication protocols. For AI processing and advanced data analysis, the NVIDIA Jetson Nano was selected for its robust performance and ability to support complex algorithms necessary for crash detection and health monitoring.

### Implementation Details

- 1. HUD Display: The HUD display was implemented using an OLED screen, which was chosen for its high resolution and clarity, ensuring that navigation information and other critical data are easily readable by the rider. The OLED screen was integrated into the visor of the helmet, providing a seamless and unobtrusive display of essential information.
- 2. Bluetooth Communication: To facilitate interaction between the helmet and external devices, a Bluetooth communication system was established. This system enables connectivity with a custom Android app, allowing for real-time updates and adjustments to navigation settings, as well as interaction with the helmet's voice assistant.
- Eye-Tracking Technology: Eye-tracking was achieved through the use of specialized sensors embedded within the helmet. These sensors detect eye movement and enable hands-free control of various helmet functions, enhancing rider convenience and reducing distractions.

4. Health Monitoring System: The health monitoring system was designed to track vital signs in real time. This includes monitoring heart rate, body temperature, and other critical health metrics to ensure the rider's well-being. The system integrates seamlessly with the helmet's overall design, providing continuous health data without compromising comfort.

The combination of these elements ensures that the SafeTech Halo provides a comprehensive, reliable, and user-friendly solution for modern riders, integrating advanced technology with practical functionality to enhance safety and comfort.

# RESULT

### <u>Analysis</u>

The SafeTech Halo was subjected to a series of rigorous tests across various scenarios to evaluate its performance and effectiveness. The results from these tests provide valuable insights into the helmet's capabilities and areas of strength:

- **HUD Display**: The HUD display was tested under different lighting conditions and riding environments. It consistently provided clear and accurate navigation instructions, ensuring that riders could easily follow directions without distraction. The OLED screen's high resolution and contrast proved effective in delivering vital information directly to the rider's line of sight.
- **Eye-Tracking System**: The eye-tracking system was evaluated for its responsiveness and accuracy. It successfully allowed for intuitive, hands-free control of helmet functions, enabling riders to interact with navigation and other features effortlessly. The technology showed a high degree of reliability in detecting eye movements and executing commands.
- **Crash Detection and Prediction**: The crash detection and prediction systems were tested under simulated crash scenarios to assess their effectiveness. The advanced sensors and AI processing on the NVIDIA Jetson Nano provided timely alerts and accurate predictions, contributing to enhanced rider safety. The system's ability to detect potential hazards and provide immediate assistance was validated through these tests.

### **Discussion**

- Ventilation and Comfort: The integration of non-Newtonian fluids for ventilation was a key feature of the helmet's design. Testing confirmed that this innovative approach successfully maintained optimal comfort levels by adapting to varying airflow needs. The use of non-Newtonian fluids proved effective in managing temperature and ensuring consistent ventilation throughout the ride.
- **Modular Design**: The helmet's modular design was evaluated for ease of upgrades and maintenance. The modular components allowed for straightforward updates and repairs, demonstrating the design's flexibility and adaptability. This feature ensures that the helmet can evolve with technological advancements and user needs.

• Overall Performance: The SafeTech Halo demonstrated significant improvements in rider safety and convenience. The integration of advanced technologies, including the HUD display, eye-tracking system, and crash detection, collectively contributed to a safer and more enjoyable riding experience. The helmet's design successfully balanced functionality, comfort, and style, meeting the project's objectives and exceeding performance expectations.

In summary, the SafeTech Halo has proven to be an effective and innovative solution for enhancing rider safety and comfort. Its performance in real-world scenarios validates the successful integration of its advanced features and design elements.

# CONCLUSION

The SafeTech Halo represents a groundbreaking advancement in helmet technology, seamlessly integrating multiple high-tech features to significantly enhance rider safety, navigation, and comfort. This helmet's innovative approach addresses several critical aspects of riding:

- Enhanced Safety: The crash detection and prediction systems, supported by AI processing on the NVIDIA Jetson Nano, offer timely alerts and accurate predictions. This proactive approach enhances rider safety by reducing the risk of accidents and providing immediate assistance in critical situations.
- Advanced Navigation: The integration of a Heads-Up Display (HUD) allows riders to receive clear and precise navigation instructions without diverting their attention from the road. Complemented by eye-tracking technology, which enables hands-free control, the helmet provides a seamless and intuitive navigation experience.
- **Improved Comfort**: The use of non-Newtonian fluids for ventilation ensures optimal airflow and comfort, adapting dynamically to changing conditions. This innovative solution maintains a comfortable riding environment, even during extended periods.
- **Modular and Sustainable Design**: The helmet's modular design facilitates easy upgrades and maintenance, making it adaptable to future technological advancements. The inclusion of a rechargeable battery with Type-C charging underscores the commitment to convenience and sustainability.

In summary, the SafeTech Halo sets a new standard in smart helmet technology by effectively combining safety, functionality, and style. Its comprehensive features not only enhance the overall riding experience but also provide a significant improvement in rider safety and comfort. This innovative helmet exemplifies the potential of integrating advanced technologies to address the evolving needs of modern riders.

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