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**INNOVATIVE MULTI-PURPOSE CLEANER: A CAPSTONE PROJECT  
FOR ENHANCING CLEANLINESS AND WELL-BEING AT  
BALAYAN SENIOR HIGH SCHOOL**

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**ABSTRACT**

This study presents the development and evaluation of a Smart Hard Hat System designed to enhance worker safety in high-risk environments such as construction and mining. The system integrates an emergency alarm for real-time hazard alerts and an intercom for seamless communication, improving workplace safety and response efficiency. The study employs an experimental research design conducted at Balayan Senior High School in Caloocan, Balayan, Batangas. Data was collected in both controlled classroom settings and real-world field conditions to assess the system's effectiveness. The Smart Hard Hat was developed using key materials such as a hard hat, intercom, emergency alarm, mic, and Velcro, following a structured design, assembly, and testing process. Results indicate that the Smart Hard Hat is lightweight (500g), ergonomically designed (28x22x15 cm), and equipped with a 300-meter intercom range and a 2000mAh battery with an 8-hour lifespan. Functionality tests confirmed that the emergency alarm activates within 1.8 seconds, ensuring a quick response, while the intercom maintains clear communication up to 300 meters. Durability tests

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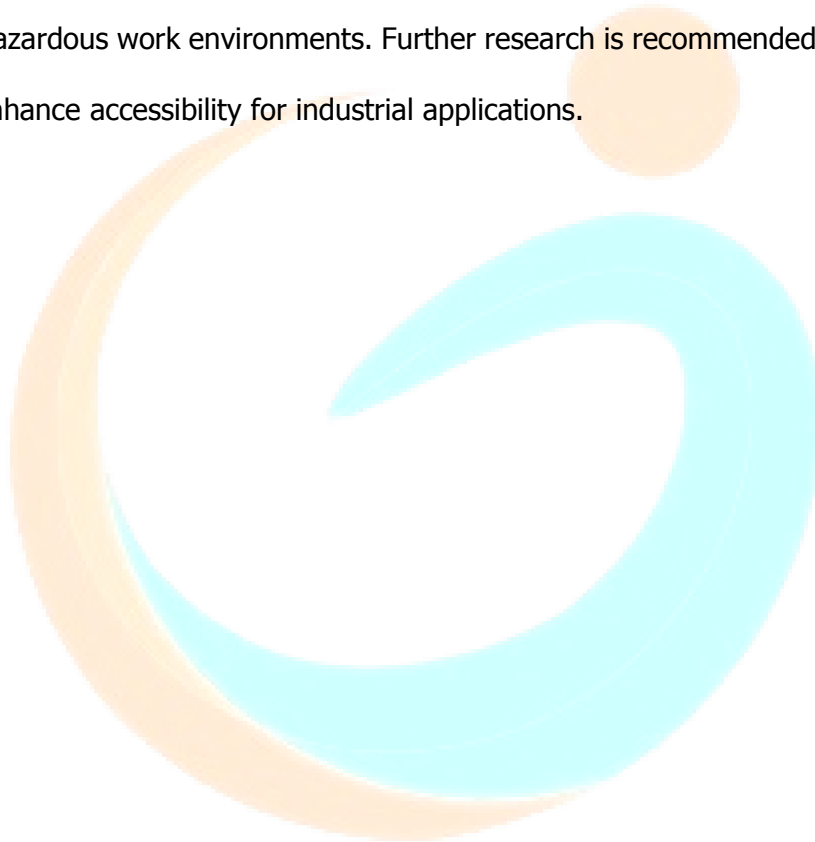
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showed that the system withstands impact without damage. The study highlights the practicality and efficiency of smart personal protective equipment (PPE) in reducing workplace hazards. However, challenges such as battery dependency, signal range limitations, and cost barriers were noted. The findings suggest that integrating smart technology into PPE significantly improves worker protection, emergency response times, and communication efficiency in hazardous work environments. Further research is recommended to optimize the system and enhance accessibility for industrial applications.



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