SMART CONSTRUCTION HELMET (SMET)

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ABSTRACT:

The smart construction helmet is a headgear equipped with high-tech electronics, sensors and several cameras which began development in 2014. Although the smart helmet developed by DAQRI has set a new standard for industrial and professional-grade wearables with advanced technology and augmented reality features, the durability of the conventional hardhat remains the same and is not strong enough to withstand significant risk of accidents in the construction industry. Therefore, an innovation to the conventional headgear is essential to overcome these problems. The Smart Construction Helmet (SMET) will be made of composite materials which will be able to withstand the accidents while still protecting the sensitive technological equipment built inside such as a GoPro camera, GPS system and Bluetooth which can connect to a smartphone. Nowadays composite material which is usually used for the body of aircraft is known to have been used in replacing clay bricks for houses. It is lightweight, renewable, and flexible in design and has high durability. Therefore, the application of composite material for the SMET will emerge as an opportunity to improve safety for workers in Malaysia.

***Keywords*:** Smart Construction Helmet, DAQRI, Augmented Reality, Composite Material, GPS System.

***Novelty*:** The smart construction helmet (SMET) with smart features to detect and alarm workers on the expected risk of accidents shall increase the protection level to the construction workers. The composite material used in SMET is expected to give better protection to workers and the devices installed.

INTRODUCTION

The Fatal Four in construction related accidents which are falls, struck by objects, electrocutions and caught in or between objects, garners the most focus when it comes to construction safety (Occupational Safety & Health Administration, 2009). Over the years, several safety related incidents are also caused by non-helmet use behavior influenced among workers. Hence, proper use and adoption of Personal Protective Equipment (PPE) especially the construction helmet is deemed as a necessity on construction sites. (Heng Li, 2017)

The conventional construction helmet requires high maintenance to sustain its strength and protective capabilities. It is also uncomfortable to be worn for a long period of time. Workers are prone to risk of accidents as they are unaware of potentially dangerous conditions and locations. From the identifications of these problems, the proposal of new concept for a smart construction helmet is introduced with the integration of devices that will alert workers of potential danger, give comfort as of the interior while increasing the strength of the exterior by using a robust material.
The objectives of this paper is to identify the issues and problems with the conventional safety construction helmet, to evaluate new features needed by workers and also to propose a new concept with smart features for a smart construction helmet. Thus, proposed new concept of a smart construction helmet would provide higher protection for the workers, increase ergonomics with low maintenance.

METHODS

A critical review was made on readily available construction helmet in the market. Then, identification on the problems of the conventional construction helmet that leads to safety issues on construction sites. By the identification of the safety related problems, the proposal of new features and concept for a smart construction helmet is introduced. With the new features and concept, it will reduce the number of accidents on construction sites and provide a better protection for workers.

RESULTS AND DISCUSSIONS

The comparison between the features of conventional construction helmet and SMET is shown in Table 1 below.

Table 1: Comparison of features for conventional construction helmet and SMET

Features	Conventional Construction Helmet	SMET
Interior	i) Harness fixing ii) Sweatband iii) Headband	i) Harness fixing ii) Sweatband iii) Headband iv) Cushions v) Extra Lining
Exterior (material)	High Density Polyethylene (HDPE) or ABS Materials	Robust Composite Materials
Shell Thickness	1.7 mm	3.5 mm
Camera	-	Depth-sensing Camera
Alarm	-	i) Audible Alarm ii) Visual Alarm
Service life	6 months – 2 years	5 years

CONCLUSION

To sum it up, the new technology which are the audible and visual alarm along with a depth-sensing camera that are integrated into the proposed new concept of construction helmet is what makes it 'smart'. With the installation of devices and a stronger shell for the SMET, it will feature a modern and improved technology that will contribute to more benefits in the construction industry. Furthermore, workers will favor of wearing a high-technology SMET that does not only provide comfort and efficiency, but also save lives.

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