Wearable Technology for Personalized Safety Monitoring in Construction

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The construction process is considered a precarious endeavor because of the high frequency of work-related injuries, illnesses, and fatalities. Among industry sectors, workers in construction face the highest risk of occupational injuries and illnesses. The collection and analysis of safety data is an important element in measurement and improvement strategy development. Existing studies indicate that the adoption of wearable technology has the potential to improve worker safety through a result-oriented data collection and analysis approach for providing real-time information about safety and health risks to construction personnel. The objective of this paper is to evaluate the applications of wearable technology for personalized construction safety monitoring. The characteristics of wearable devices and safety metrics thought to be capable of predicting safety performance, and management practices are identified and analyzed. The study provides an evaluation of the features of wearable devices, the safety data that can be obtained, and the potential benefits of using wearable technology to mitigate injuries and illnesses on construction sites.

This research was conducted by first reviewing the present state of knowledge of wearable technologies across industries, codifying literature and specifications related to each technology systems and sensors as well as describing the human factors implications of the technologies in accordance with prevailing theory. The safety and health hazards associated with construction works were reviewed to identify the metrics that can be captured and processed by the wearable technologies to measure and monitor safety performance. Additionally, wearable technology systems and sensors were critiqued based on the performance characteristics required of functional personalized wearable devices.

The findings of this study indicate that the existing wearable technology systems and sensors applied in other industrial sectors can be used to monitor and measure a wide variety of safety performance metrics within the construction industry. The evaluation led to the discovery of four divisions of measurable safety performance metrics: a) physiological monitoring; b) environmental sensing; c) proximity detection; and d) location tracking. The findings of the study also revealed that the benefits of individual wearable sensors or systems can be integrated based on their attributes for multi-parameter monitoring of safety performance. Infrared, magnetometer, radar, RFID, sonar, Bluetooth, and GPS rank high as wearable sensors or system with multi-parameter applications (i.e., can be used to measure and monitor a wide variety of safety performance metrics). The outcomes of this study have opened up further research studies to enhance the application of wearable sensing devices (WSDs) and the Internet of Things (IoT) for active and proactive construction safety management. The evaluation of the adoption, adaptation, and infusion of WSDs in construction; selection and application of commercially available WSDs in construction; and development of prototypes of construction specific WSDs, are subjects of further research currently being undertaken by the researchers involved in this study.

Keywords: Construction safety monitoring, Safety and Health Hazards, Safety performance, Sensor, Wearable technology