Diverse Measurable Applications of Wearable Sensors

Isabella Chandi
Centre of Applied Research and Innovation in the Built Environment (CARINBE), Faculty of Engineering and the Built Environment, University of Johannesburg, South Africa

Innocent Musonda
Centre of Applied Research and Innovation in the Built Environment (CARINBE), Faculty of Engineering and the Built Environment, University of Johannesburg, South Africa

Rebecca Alowo
Department of Civil Engineering Sciences, Faculty of Built Environment, University of Johannesburg, South Africa

Abstract:

Construction environments remain among the most hazardous domains within the built environment, characterised by dynamic site conditions, physically demanding tasks, and persistent risks including falls from height, struck-by incidents, electrical exposure, ergonomic strain, and contact with hazardous substances. Conventional construction safety approaches—largely dependent on regulatory compliance, training, and personal protective equipment—are often reactive and episodic, limiting their ability to address real-time variations in worker behaviour, physiological stress, and environmental exposure. This paper examines the diverse measurable applications of wearable sensors in construction safety, positioning wearable sensing technologies as practical tools for continuous, data-driven risk management. Drawing on recent peer-reviewed literature, the study categorises wearable sensors into physiological, motion and proximity, environmental, and location-tracking systems, and maps these technologies to specific construction hazards, measurable variables, and safety applications. Embedded within a Wearable Internet of Things (WIoT) framework, wearable sensors enable real-time monitoring, automated alerts, and the aggregation of multi-dimensional data to support proactive decision-making across operational and organisational levels. The findings demonstrate that wearable sensors enhance situational awareness, enable early detection of safety and health risks, and support proactive injury prevention and emergency response. Beyond immediate site-level benefits, the integration of wearable sensor data contributes to data-driven and human-centred construction practices by reframing worker safety and wellbeing as measurable performance dimensions of the built environment. The paper also critically discusses implementation challenges, including data reliability, integration with existing workflows, worker acceptance, privacy, and scalability. Overall, the study concludes that wearable sensors represent a scalable and adaptable approach to improving construction safety by embedding continuous measurement, responsiveness, and learning into construction practice. Their application offers significant potential to support safer, more resilient, and socially sustainable built environments.

Keywords:

Wearable Sensors, Construction Safety, Wearable Internet of Things (WIoT), Occupational Health, Green Building, Real-Time Monitoring, Built Environment Performance.