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Enhancing Workplace Safety through Smartwatch and Bluetooth-based PPE Tracking

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Abstract

Workplace safety remains a global concern, with approximately 2 million fatalities and 270 million occupational accidents reported annually. Many incidents are linked to the improper use or neglect of personal protective equipment (PPE), particularly helmets in construction and industrial environments. To address this challenge, this study proposes a smart system integrating a T-Watch S3 smartwatch with a Bluetooth Low Energy (BLE) module embedded in a helmet. The smartwatch functions as a control hub, issuing alerts whenever the helmet moves beyond a predefined safe distance of 70 cm. A laboratory experiment was conducted with ten participants to test system functionality, tracking PPE use in real time. Results show that the system successfully detects PPE violations and notifies supervisors through the Blynk application. This integration of wearable devices and wireless communication enhances safety compliance, reduces risks of accidents, and improves productivity. The research highlights how Industry 4.0 technologies can create safer workplaces and support the vision of smart and sustainable cities such as NEOM.

Keywords
Workplace safety, Smartwatch, Bluetooth BLE, Personal protective equipment, IoT.

Biographies
Ahmed Aljohani is a graduate of Industrial Engineering at the University of Tabuk, specializing in workplace safety and smart technology integration. His research interests include IoT applications, occupational health, and Industry 4.0 innovations.

Ammar Albalawi is an Industrial Engineering student at the University of Tabuk. His work focuses on safety systems, ergonomics, and human factors in industrial applications.

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