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# Advanced health monitoring of construction workers is focus of newly funded project

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12/12/2023 3 min read



Houtan Jebelli

A new project promises to improve health and safety for construction workers through wearable electronics, thanks to a grant from the National Science Foundation. The project, led by CEE assistant professor Houtan Jebelli, aims to develop an AI-enabled, fully autonomous sensing mechanism for holistic health monitoring of construction workers by integrating multi-disciplinary research in flexible, wearable sensor fabrication; artificial intelligence; and privacy-aware information visualization to provide near-real-time and projected future context-aware health and safety information to workers and managers.

“The construction industry is often cited for its high rate of fatalities and injuries compared to other industries,” Jebelli said, noting that in the United States, 20% of worker fatalities in private industry are in construction, according to the Occupational Safety and Health Administration (OSHA). Additionally, he said, the International Labour Organization has stated that while construction makes up about 6-9% of employment in most countries, it accounts for 30% of work-related fatalities worldwide.

“These statistics underscore the significant risks associated with working in the construction industry, highlighting the need for improved safety measures and health monitoring practices,” Jebelli said.

Despite this growing need, tools for continuous and non-intrusive monitoring of workers' physical and psychological health are still lacking, Jebelli said. This new project aims to develop a proactive means of monitoring by integrating advances in physiological sensing, machine learning and digital twin technologies.

First, researchers will design and fabricate a flexible wearable sensor for continuous and noninvasive measurement of workers' bioelectric signals and electrochemical responses at construction sites. The use of a single, flexible wearable sensing device instead of multiple off-the-shelf sensors will facilitate the scalability and feasibility of the proposed health sensing system in the construction workplace.

Second, the project will develop robust machine learning algorithms and frameworks for continuous and objective assessment of workers' health conditions in the field based on physiological, contextual and environmental data. For this purpose, this project will address fundamental challenges related to traditional machine learning algorithms by developing a novel interpretive data-driven approach robust to inter- and intra-individual variability while ensuring data security and privacy.

Third, the project will generate a digital twin model (health and safety maps) of the construction sites through an array of collective health analyses and develop an automated feedback module for providing personal health-related information and corresponding mitigation strategies to field workers.

“The insights into the collective health and safety information can profoundly assist the workers and safety managers in making a sound, far-sighted decision about the execution of field-oriented construction operations in near real-time,” Jebelli said. “This research effort will open new doors in improving proactive health and safety management in the field through collective visualization of workers' real-time health and safety information.”

In addition to improving the safety of close to 7 million workers in the U.S. construction sector, Jebelli said the planned intelligent health monitoring system could also be used to address workplace health issues in other hazardous industries such as manufacturing, firefighting and agriculture.

The NSF has funded this project at $1.8 million over four years. Researchers at Ohio State University, Louisiana State University, and Pennsylvania State University are collaborating on the work.

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*This story was published December 12, 2023.*

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