The Engineering School of Sustainable Infrastructure & Environment (ESSIE) presents
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Mr. Daeho Kim is a Ph.D. candidate in Civil Engineering (majoring in construction engineering and management) at the University of Michigan, where he is also pursuing a graduate certificate in Computational Discovery and Engineering. He received his bachelor's and master's degree in Architectural Engineering at Yonsei University, Korea and earned another master's degree in Construction Engineering and Management at the University of Michigan as a recipient of John L. Tishman Master's Fellowship. His research interest lies in construction automation and robotics, particularly ensuring safe human-robot collaboration in unstructured and dynamic construction environments. While working toward his Ph.D., he has also conducted collaborative research with other disciplines—including computer science, robotics, ergonomics, and new and renewable energy systems—and had interned at the Idaho National Laboratory to propose emerging technologies for nuclear power plant construction management and Kinetica Labs, Inc. for the markerless motion capture technology for industrial ergonomics. In addition to these interdisciplinary and professional experiences, he has 11 peer-reviewed publications.

ROBOTIC HAZARD DETECTION TO ENSURE WORKERS' SAFETY IN CO-ROBOTIC CONSTRUCTION

Construction has remained the least automated and productive as well as the most hazardous industry. Moreover, it has been plagued by a significant lack of diversity in its workforce as well as aging laborers. To address these issues, co-robotic construction has emerged as a new paradigm of construction. The industry is gradually gearing up to embrace robotic solutions, and many construction robots with various degrees of autonomy are under development or in the early stage of deployment. Presenting a different horizon of construction—harmonious co-existence and co-work between workers and robots—co-robotic construction is expected to reform labor-intensive construction into the more productive, safer, and more inclusive industry. However, an in-depth understanding of the robots' situational intelligence is still lacking, particularly conclusive logic and technologies to ensure workers' safety nearby autonomous (or semi-) robots, which is fundamental in realizing the co-robotic construction. To fill the gap, this research established a comprehensive robotic hazard detection roadmap and developed core technologies to realize it (i.e., proximity monitoring and prediction, semantic relation detection, and pose and potential damage analysis), leveraging unmanned aerial vehicles, computer vision, and deep learning. In this talk, I will describe how the developed technologies with a conclusive logic can pro-actively detect the robotics hazards taking various forms and scenarios in an unstructured and dynamic construction environment. The successful implementation of the robotic hazard detection roadmap in co-robotic construction allows for timely interventions such as pro-active robot control and worker feedback, which contributes to reducing robotic accidents. Eventually, this will make human-robot co-existence and collaboration safer, while also helping to build workers' trust in robot co-workers. Finally, the ensured safety and trust between robots and workers would contribute to promoting construction enterprises to embrace robotic solutions, boosting construction reformation toward innovative co-robotic construction.