

Building the Future: How Can We Leverage Artificial Intelligence and Robots to Shape the Future Construction and Built Environment

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Abstract: Drones and related technologies such as high-resolution cameras, LiDAR sensors, and thermal imaging are revolutionizing the traditional built environment. Their diverse applications have contributed to energy audits, building and infrastructure inspection, and extreme event preparedness and response. However, drone applications in construction still meet challenges. First, when using drones to inspect building envelopes, the balance between accuracy and efficiency requires an optimized flight path design. Also, drone operators must have proficient flying experiences, multitasking skills, the ability to remember observation sequences, and the ability to optimize inspection paths based on their skill sets. The second challenge concerns aerial image processing. Researchers have been investigating efficient computer vision algorithms to detect defects (cracks, efflorescence, spalling, etc.) in RGB images and to assess building energy performance (heat loss, moisture, thermal bridges, etc.) in thermal images. Artificial intelligence (AI) has been playing a critical role in object detection and segmentation. Third, the concerns about whether automation and robotics will replace human labor, leading to job losses within the industry, and the socioeconomic consequences have attracted researchers' attention. Therefore, researchers not only discuss the power of AI but also investigate human factors.

This talk will discuss how AI and robotics allow researchers to understand the built environment. The speaker will introduce the applications of commonly used robots, such as drones and robot dogs, in the civil and construction fields. First, the speaker will discuss how computer vision has been used for building energy audits with thermal aerial images. Second, this talk will discuss how humans interact with drones and build partnerships with new technologies by using an Electroencephalogram (EEG) study on how human brain regions are connected. The participants performance of information processing and decision making was recorded in a virtual reality (VR) environment. Last, this talk will discuss how robot dogs are trained by using Reinforcement Learning (RL) for primary search for indoor firefighting.

Bio: Yu Hou earned his MS and PhD from the University of Southern California. He then worked as a Postdoctoral Research Associate at Carnegie Mellon before joining Western New England University in 2022 as an assistant professor in the Construction Engineering Department.

His research interests include Building Information Modeling, Digital Twins, Building energy performance and audits, Unmanned aircraft systems, Computer Vision in construction, and construction workforce training with eXtended Reality. He has published 11 peer-reviewed journal papers, 19 conference papers, and 3 open-source datasets. He is a member of IEEE, ASCE, and CMAA. He is currently serving the IEEE Digital Reality Technical Community as one of the Steering Committee Members. In 2020, he received the Outstanding Teaching Award from USC's Civil and Environmental Engineering Department. He serves as a reviewer for multiple peer-reviewed journals and conferences, such as Automation in Construction, the Journal of Computing in Civil Engineering, and Smart Infrastructure and Construction. He is also an advisor in a nonprofit educational organization, AI Academy Corp

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