

Activity-level Construction Progress Monitoring Using Visual Data and Schedules



Aritra Pal, Ph.D.

Assistant Professor, IIT Madras

Dr. Aritra Pal is an assistant professor in the Department of Civil Engineering at the Indian Institute of Technology Madras. He holds a Ph.D. in Civil Engineering, specializing in Construction Automation, from National Taiwan University, where he was honored with the Dean's Award for exceptional academic achievement. Before joining IIT Madras, Dr. Pal worked as a postdoctoral research fellow at the University of Cambridge and National Taiwan University. His research focuses on harnessing advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML), digital twin, and building information management to address complex challenges in construction engineering. Through his work, he strives to enhance the efficiency of construction projects and promote sustainability in the built environment.

Dr. Pal also brings valuable industry experience, having managed large-scale construction projects across India and the Middle East. In addition, he actively contributes to his field by publishing his research in prestigious journals and conferences and serving as a reviewer for renowned publications.

Abstract: Accurate monitoring of construction progress is essential for ensuring timely and successful project delivery, yet traditional vision-based methods typically focus on individual building elements, such as columns, beams, or walls, and provide only binary built/not-built information. This limits their ability to capture nuanced progress at the level of schedule activities, such as formwork, reinforcement, or concrete placement. To address these challenges, this research introduces two complementary methodologies. The Activity Level Progress Monitoring System (ALPMS) leverages construction site images together with a four-dimensional BIM to generate as-built point clouds, compare them with planned models, and apply deep learning-based semantic segmentation to estimate activity-wise completion percentages, enabling detailed 3D visualization of progress. The second methodology focuses on automatically aligning project schedules with reality models by registering point clouds to a common coordinate system, segmenting elements, extracting task and location information using natural language processing, and matching it to schedule activities, effectively linking observed progress to planned work. Both methodologies have been applied to

* DigiTRACKER Stands for “Digital Twin & Robotic Automation Center for Knowledge Sharing, Entrepreneurship, and Research” and aims to be at the forefront of exploring, developing, and implementing Digital Twin and Robotics technologies. By fostering interdisciplinary collaboration among researchers, industry partners, and government agencies, the DigiTRACKER Center will drive innovations and practical solutions to address challenges facing the industries.

construction projects, demonstrating their effectiveness: ALPMS achieves less than 6% mean absolute error in reporting activity-level progress, while the alignment method successfully updates schedule-level information. Together, these approaches provide accurate, detailed, and actionable insights, supporting efficient schedule management, informed decision-making, and ultimately facilitating successful project delivery.

April 8th | 4:30 PM

Only 20 Seats Based on Application and Selection, Location Will be Announced to Selected Participants. Apply to Attend [HERE](#) by Apr. 6th. Light refreshment will be provided.



* DigiTRACKER Stands for “Digital Twin & Robotic Automation Center for Knowledge Sharing, Entrepreneurship, and Research” and aims to be at the forefront of exploring, developing, and implementing Digital Twin and Robotics technologies. By fostering interdisciplinary collaboration among researchers, industry partners, and government agencies, the DigiTRACKER Center will drive innovations and practical solutions to address challenges facing the industries.