An Integrated Framework to Support Construction Monitoring Automation using Natural Language Processing and Sensing Technologies

Ran Ren, M.S., S.M.ASCE,[1] and Jiansong Zhang, Ph.D., A.M.ASCE[2] *

[1]Automation and Intelligent Construction (AutoIC) Lab, School of Construction Management Technology, Purdue University, West Lafayette, IN 47907; e-mail: ren153@purdue.edu
[2]Automation and Intelligent Construction (AutoIC) Lab, School of Construction Management Technology, Purdue University, West Lafayette, IN 47907; e-mail: zhan3062@purdue.edu

ABSTRACT

Traditional construction monitoring relies on specialized personnel to compare the prescribed steps in the construction procedural documents with executed procedure on the jobsites. This requires demanding manual efforts and may introduce human errors. To reduce manual efforts on collecting and integrating information for construction monitoring, the authors propose an integrated framework to process both workflow information from construction procedural documents and operation information from construction jobsites, in parallel and then comparatively. The proposed framework helps convert the traditional labor-intensive construction monitoring and checking process to an automated one, through: (1) integrating natural language processing (NLP) and sensing (i.e., computer vision) techniques to automatically extract, analyze and process information both in the procedural documents and on construction jobsite; and (2) automating the comparative analysis of these two types of information and the generation of a monitoring report for users regarding sequence correctness of execution steps. To evaluate the proposed framework, an experiment was conducted where execution steps from open-source specifications and the corresponding synthesized sensing data of a construction jobsite were automatically processed and comparatively analyzed. The results were compared with a manually developed gold standard and achieved 83.33% recall and 71.43% precision in the construction procedure compliance checking.