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Title: Tracking dynamic construction objects — A key nodes modeling approach using color-depth cameras
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A construction site presents a dynamic scenario. Locations of multiple objects are continuously changing and a lot of objects enter and exit the site in high frequencies. Meanwhile a construction activity consists of a large amount of stochastic operations, many uncertainties occur when making decisions. Lack of real time spatial information for construction objects, safety and efficiency are always two big issues. This paper presents a key nodes modeling approach to facilitate the detecting, locating and tracking process. A supervised training process is designed based on key nodes model which can lead to a standard templates library for typical construction objects. The key nodes model represents the distinguished characteristics of object's geometry and shape, meanwhile incorporates the kinematic constraints for adjacent parts of objects. Feature matching is realized by comparing the real object components and segmented contour templates in a traversal order of the tree structure of the key nodes. Since color-depth cameras capture not only images, but also the distance between detected objects and the camera itself in a format of three-dimensional (3D) point clouds, the 3D spatial location of the detected key node is obtained by linking its image pixel value with corresponding 3D point coordinate. The key nodes modeling approach is proved to be efficient for detecting, locating and tracking key nodes of objects, which also has great potential for interactive analysis and behavioral prediction in construction monitoring and safety management.