Kinematic 3D laser scanning of building interior using SLAM technique

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ABSTRACT: Monitoring as-built condition of existing building interior is required for efficient building operation and maintenance. To acquire the as-built data, terrestrial laser scanner has been widely used due to its fast speed and accuracy. However, conventional static laser scanning method has some restrictions of its operability for complex building interior because of blockage areas. To fully scan the target area without loss of information, surveyors need to change scanner locations several times, and additional job is created during the post processing to register each scanned point cloud at different locations into a single point cloud data with same coordinate system. As an alternative, this study proposes a kinematic laser scanning method which continuously scans and registers the point cloud data using Simultaneous localization and mapping (SLAM) technique. It was originally developed to locate current position of mobile robot. Typically, 2D laser scanner is installed on the mobile robot and used to build a 2D map of surrounding environment, and the robot use the map to navigate its way. If more than two laser scanners are available, 3D can be obtained and used for as-built modeling of the surrounding environment, e.g., building interiors. SLAM consists of several steps including landmark extraction, data association, state estimation, and state and map update. We will be showing example of extended Kalman filter (EKF) with multiple sensors (2D laser scanner and odometry), and discussing its limitations for the application of as-built modeling of indoor environment.

Keyword : SLAM, Laser scanner, Point cloud, Extended Kalman filter