Inspection of Port Facilities

Inspection of port facilities is critical for the safety and operations of effective ports, which in turn are vital for the national economy. Laser scanning, a novel health monitoring technique, is a new method for inspecting defected and damaged structures to enable effective remediation.

Terrestrial Laser Scanners, which are increasingly used in infrastructure assessment, industrial applications, and construction management, provide highly accurate 3D data sets that enable engineers to experience and work directly on real-time problems by viewing and manipulating collected point cloud data sets.

Laser scanners and associated images are capable of quickly recording data for an entire structure. For monitoring purposes, 3D laser point clouds coupled with mapped images may be recorded repeatedly over time to enable users to analyze scans to detect changes in the structure that highlight potential damage.

Determining Damage in Coastal Infrastructure

Damage assessment may be carried out with laser point cloud and image data that captures the current condition of the structure. In this research, new approaches are being developed for identifying damage in structures and infrastructure systems that are damaged due to age or accumulated effects of natural and manmade hazards.

In order to extract meaningful information from 3D laser point clouds and images, several data processing steps are needed. These steps include registration, feature detection, segmentation, surface fitting and object detection. Once the original object is detected, any deviation from the norm may be determined to highlight damage.

The type of the existing damage may be characterized by using a predefined taxonomy. This taxonomy is created by utilizing both 2D and 3D indicators of each damage type. Some of the damage types that can be detected from point clouds and texture mapped images include buckling, fractures, concrete spalling, erosion, and cavitation.

Post-Hazard Damage Assessment

It is critical to assess the extent of natural hazards rapidly for planning relief efforts after a major disaster. It is also important to collect useful data for further structural safety evaluations in order to determine whether a structure is damaged and if so, to establish the severity of this damage. Airborne Laser Scanners (ALSs), which are typically used in precise mapping of topography, are capable of capturing dense and accurate 3D data clouds from flying vehicles over extended areas. Most of the modern ALS systems consist of three basic components: a laser scanner, a kinematic Global Positioning System and an Internal Measurement Unit. The range of a typical ALS system varies from 0.5 to 5 km.

Satellite imagery and aerial photos coupled with 3D data may be used for creating a comprehensive atlas of damage caused by a major event. This is especially important for helping recovery and reconstruction. This research is establishing strategies for highlighting damage in these complex post-event environments.