

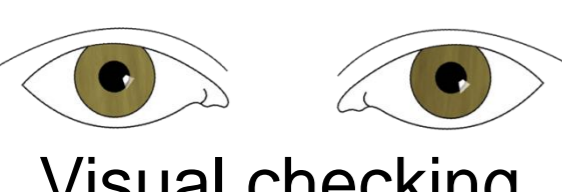



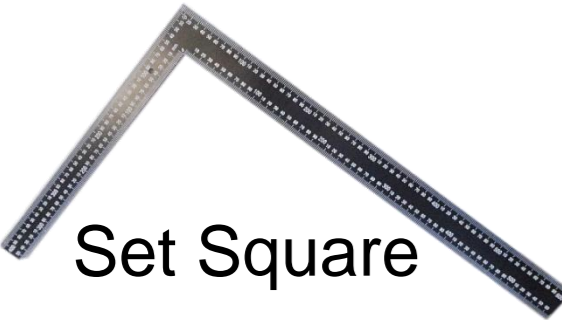



Automated Construction Quality Assessment Robot System

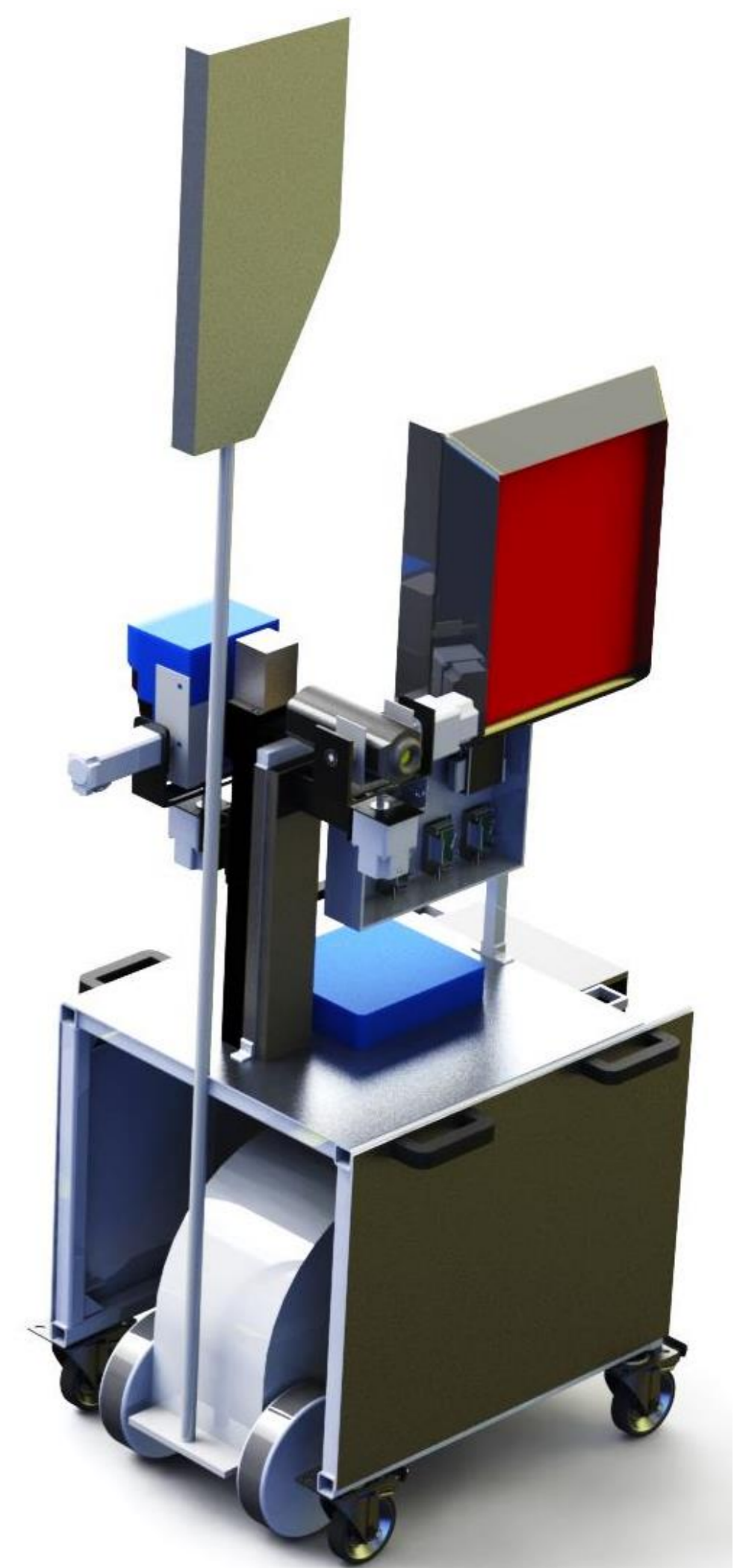
Project Motivation & Objectives

Construction quality assessment is an integrated part of construction project, which can guarantee the quality of constructed building and improve security capability. Currently, manual inspection process plays an important role in the assessments including evenness, hollowness, cracks, verticality, and fishing issues. However, manual assessment has the disadvantages of being time-consuming, low efficiency, and has greater error. Assessment robot system that comprises of a mobile robot and different kinds of inspection instruments can realize autonomous and consistent quality assessment.

Methodology

Proposed construction quality assessment system (CONQUAS) is shown on the right, which comprises of one mobile robot, two laser scanners, one thermal camera with one heater, and one inclinometer. Mobile robot with SICK LMS100 laser scanner has the capability of localization, mapping and navigation, which is the basis of autonomous inspecting of a house. In the inspection process, assessment of evenness and verticality of walls is done by extracting line and planes from scanned sensor data with SICK LMS 500 (maximum measuring distance: 80m, accuracy: 6 mm). The inclination of ground is inspected by using inclinometer which can measure the inclination angle in X and Y axis. Heater is used to heat the environment first, and then thermal image captured from thermal camera is used to inspect hollowness and cracks of ground and walls.

Manual Assessment		CONQUAS	
Tools	Assessment Items	Sensors	Assessment Items
 Visual checking	Cracks of grounds, wall, and ceiling	 UTM-03LX laser scanner	Navigation, localization, mapping and obstacle avoidance
 1.2m Spirit Level	Evenness of ground and walls	 LMS500 laser scanner	Evenness of ground and walls, and verticality of two walls
 Set Square	Verticality of two walls	 FLIR A310 thermal camera	Hollowness and cracks of ground and walls
 Conquas Rod	Hollowness of ground (By distinguishing the sound)	 AGS005 inclinometer	Inclination of ground



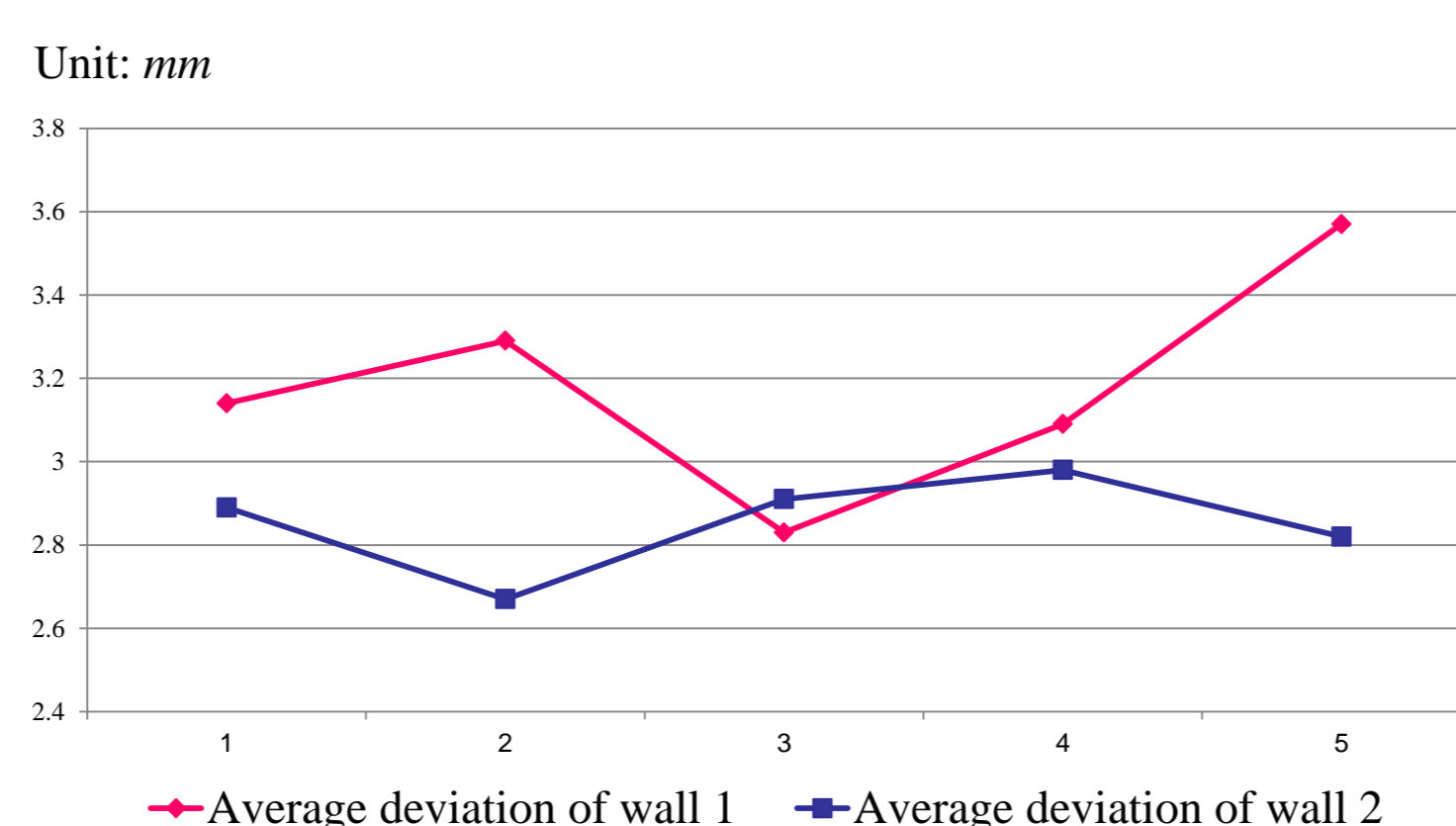
Complete assembly of robot system

Results

A testbed with two walls and one ground is constructed where construction error is manually added. The evenness and verticality for the two walls are assessed using a laser scanner. Assessment results of evenness is shown in following figure. Assessment angle of the two walls is found to be 91.686 degrees, which is much closer to the ground truth value of 91.24 degrees.



Constructed testbed



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