R. OUEIS, D. CHDID, H. KHOURY, D. ASMAR, I. ELHAJJ. ***Infrastructureless inspection process automation in construction.*** *Gerontechnology 2012;11(2):92;* doi:10.4017/gt.2012.11.02.456.00 **Purpose** Site inspection, vital to any accurate edifice construction process, is a notably tedious, time-consuming, and error-prone process when carried out manually by construction inspectors. Hence, it is a prime candidate for automation, which would reduce both the effort and time incurred while improving the accuracy and organization of the data obtained. **Method** Building on recent developments in the fields of step detection using inertial measurement units (IMUs), and ego-motion estimation coupled with structure from motion (SFM) using a digital camera, this paper takes the initial steps and presents research targeted at automating the construction site inspection process. The IMU and camera rigs are attached to the inspector, whose role is then limited to transporting the unit around key inspection sites. The data collected from each sensor is processed and fused to yield an estimation of ego-motion[1]. This localization estimate is then used to guide a SFM-algorithm towards producing a 3D point cloud of the inspected site, which is processed by a plane-fitting routine to produce a 3D model of the edifice's as-built structural state[2]. The latter is then compared to the design intent, as described in the relevant floor plans. **Results & Discussion** The components of the proposed system have been tested through proof-of-concept experiments and preliminary results highlighted the potential of visual-inertial ego-motion estimation combined with SFM followed by plane-fitting for improving inspection processes in mobile construction engineering applications (*Figure 1*).

References

1. Nutzi G, Weiss S, Scaramuzza D, Siegwart R. Fusion of IMU and Vision for Absolute Scale Estimation in Monocular SLAM. Journal of Intelligent and Robotic Systems 2011;61(1-4);287-299; doi:10.1007/s10846-010-9490-z
2. Esteban I, Dijk J, Groen F. FIT3D toolbox: Multiple View Geometry and 3D Reconstruction for Matlab. International Symposium on Security and Defence Europe (SPIE), Toulouse, France; 2010

Keywords: automation, construction, inspection, localization, IMU, vision, ego-motion, SFM
Affiliation American University of Beirut, Riad El-Solh, Beirut, Lebanon;
E: hiam.khoury@aub.edu.lb
Full paper: doi:10.4017/gt.2012.11.02.456.768

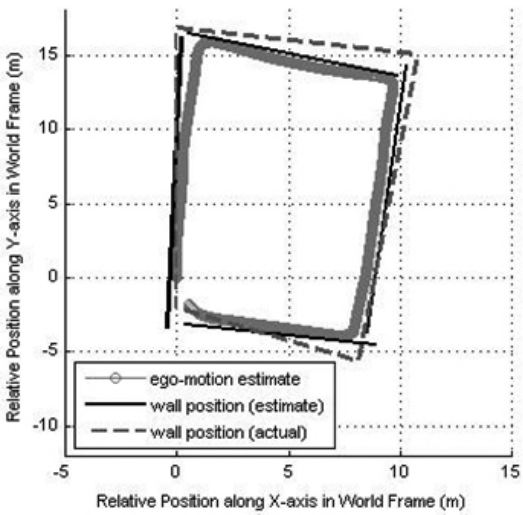

Figure 1. Top view of the estimated ego-motion, the estimated positions of the surrounding vertical walls, and the actual positions of those walls from a sample run on the 4th floor of the SRB Building at the American University of Beirut