Accuracy Assessment of the ZEB1 Hand–Held Mobile Mapping System

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Key words: Engineering survey; Laser scanning;

SUMMARY

Indoor mobile mapping systems have been introduced in recent years that use autonomous positioning methodologies developed originally for the robotics domain. These systems produce 3D point clouds and offer a very rapid alternative to more conventional survey techniques for indoor mapping. The systems are typically laser scanner-based and the hardware is mounted on a push-cart for mobility. While this arrangement is suitable in many indoor environments, issues arise when mapping areas with stepped or uneven floors, stairwells, building voids or in other irregular spaces, such as caves. The ZEB1 is an autonomous mobile mapping system that overcomes the mobility limitations of push-cart systems. With the ZEB1, the data collection hardware is carried on a hand-held device and the management and storage system hardware is carried in a backpack. The purpose of this research was to evaluate the accuracy and efficacy of the point cloud produced by ZEB1 in a typical indoor environment. The test site was a c. 150 m long four-sided, corridor. The corridor closes back on itself but is off-square and includes a change of level involving an up and a down stairs along the corridor route. Ground truth was provided by a precise 3D point cloud of the corridor that was captured by a tripod-mounted laser scan survey that was registered to control points established by precise traversing. Two ZEB1 point clouds were gathered. The first represented a ZEB1 transit of the corridor wherein the unit was returned to the start point and a closed-loop was specified at the data processing stage. The second point cloud represented a ZEB1 transit of the corridor that was not closed. The ground truth point cloud was compared to the closed and open ZEB1 point clouds with respect to extracted distances, extracted angles and positional differences at intervals along the corridor. The results show significant variability in the accuracy of the ZEB1 data ranging from 0.002 m to c. 0.200 m for X and Y and 0.001 m to 0.087 m for Z. A comparison of common points at the start and at the end of the closed and open ZEB1 transits resulted in differences of 0.005 m and 0.066 m, respectively, indicating that the loop closure adjustment was significant. Overall, these results are in-line with those of other researchers and demonstrate that the ZEB1 would be suitable for many uses provided high accuracy is not required.