3D Mapping in GNSS-denied Environments Using a Low-cost LiDAR Backpack

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SUMMARY

Today people spend 90% of their life in indoor environments. Today's population may be someday known as an "indoor generation." Many human activities take place indoors such as in shopping malls, hospitals, schools and universities, airport terminals, etc. Therefore, indoor maps or information are needed for various such indoor applications ranging from indoor navigation and routing, 3D visualization, 2D maps, public participation, and emergency response. When try to map large enclosed multi-level environments, such as buildings, we can face many obstacles, for example no GPS coverage, restricted time on site, multiple levels complex environment with limited light of site. Face to these challenges, what options do we have? Traditional survey tools, such as tape measures, laser distance meter, total stations, all of which are too time consuming. Modern mapping tools, such as static laser scanning (TLS), but requires too many setups to eliminate all the closures; while trolley-based indoor mapping systems are too limited for multi-level environments. Backpack mobile mapping systems offer solutions to all these problems! This paper presents our self-developed low-cost LiDAR backpack and its application for 3D mapping in underground parking lots to support autonomous parking in such GNSS-denied environment. Results obtained show our LiDAR backpack and its associate software tools very promising for indoor localisation and mapping. The accuracy of the enclosed loop show 25 cm after 100 m long walking indoors. The deep learning based structural line extraction algorithms also demonstrated very promising results.

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