Strategies for a Reduction of Indoor Point Clouds to 'Purified' Room Geometries and their Interactive Presentation

by **Sathish Raymond . E**

Light Detection And Ranging (LIDAR), which is an active Remote Sensing technique is used to examine the object present on the surface of the earth. The terrestrial acquisition of LIDAR technique is used to map indoors of the buildings such as balcony, rooms, basement etc for mapping and visualization of Building Information Model (BIM) in 3D form. The Indoor mapped BIM provides the realistic information such as colour, texture and Level of Details of an object. The BIM model is visualized using web tools and technologies for high interactivity of the end user customer.

MOTIVATION

An innovative path/idea to provide that the recorded geometric 3D information can be converted to a semantically tagged 3D models based on user purpose and needs with an interactive visualization.

METHODOLOGY

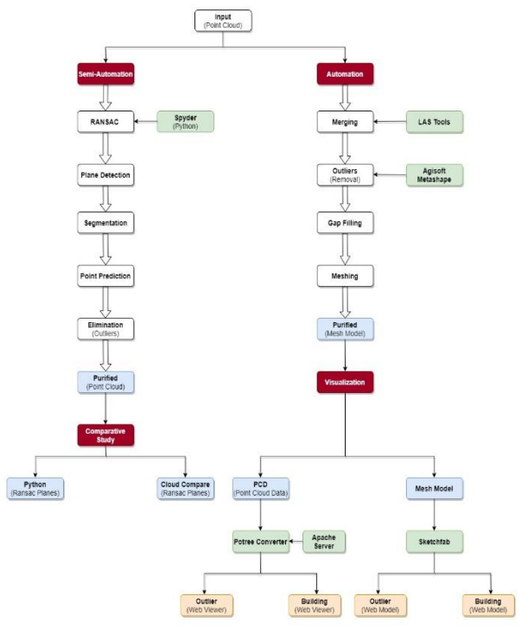

Figure 1: General Project Workflow

DATA PREPARATION

The process covers the investigation of 16 overlapping scans and conversion of all the raw scans to a suitable format, which is required for semi-automation and automation technique.

Figure 2: 16 Raw scans of PCD

SEMI-AUTOMATION

The semi-automation technique is a program based approach which uses Ransac computer vision algorithm for detecting the high-favorable geometric planes and to predict the suitable points from point cloud samples. The outliers/ obstacles are removed based on valid proper selection of planes, iterations and user-defined parameters.

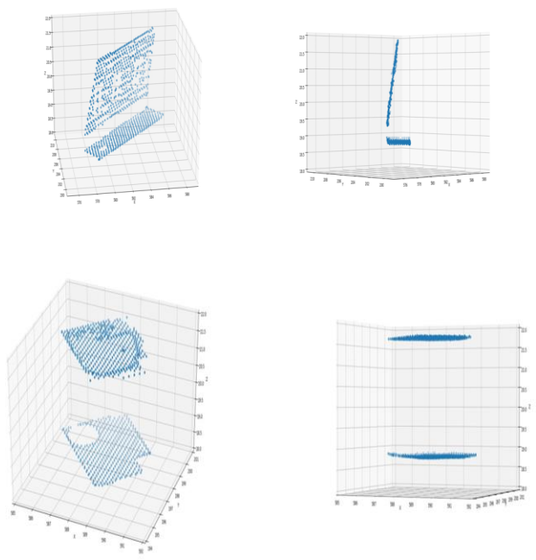

Figure 3: Purified Geometry Points for Sample 1(Top) & Sample 2(Bottom)

COMPARATIVE PLANE STUDY

The predicted geometric planes of semi-automation technique is compared with the external automated software called CloudCompare for visual cross validation of correctness and accuracy of planes and outlier removals of sample 1&2.

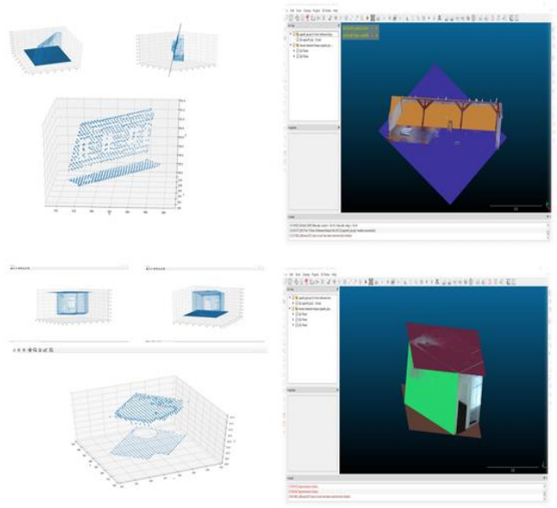

Figure 4: Comparative Plane Study for Sample 1(Top) & Sample 2(Bottom)

LIMITATIONS

- The Prediction of vertical geometric planes (walls) is not possible.
- Multiple Plane fitting is not possible.
- Absence of loop concepts for continuous iterations.

AUTOMATION

The automation technique is a software based approach which uses powerful inbuilt machine learning algorithms for purifying the point clouds using proper valid outlier selection tool and combination of different software's to create a purified mesh model.

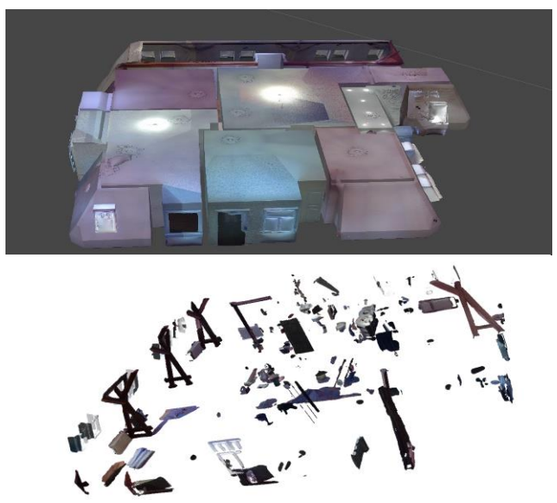

Figure 5: Purified Building Model (Top) & Outliers Model(Bottom)

VISUALIZATION

The purified building mesh model and outliers mesh model are visualized using Sketchfab for high interactive visualization.

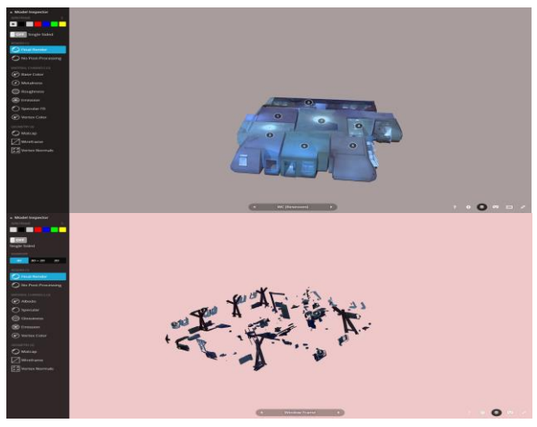

Figure 6: Purified Building Model (Top) & Outliers Model(Bottom) in Sketchfab

CONCLUSION

The application use of both semi-automation and automation technique on point clouds has shown an innovative and ingenious idea/path for solving the research and real world problems in a easy and an highly efficient way based on the users need and perspective on attaining the research goal.

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KEYWORDS

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REFERENCES

- Li, L., Yang, F., Zhu, H., Li, D., Li, Y., & Tang, L. (2017). An Improved RANSAC for 3D Point Cloud Plane Segmentation Based on Normal Distribution Transformation Cells. Remote Sensing, 9(5), 433. doi: 10.3390/rs9050433.
- Kurban, R., Skuka, F., & Bozpolat, H. (2015). Plane Segmentation of Kinect Point Clouds using RANSAC. *The 7th International Conference on Information Technology*. doi: 10.15849/icit.2015.0098.
- Yang, M. Y., & Förstner, W. (2010). *Plane Detection in Point Cloud Data*. (pp. 1-16). (IGG : Technical Report ; Vol. 1, 2010). Bonn: University of Bonn.
- Lan, J., Tian, Y., Song, W., Fong, S., & Su, Z. (2018). A Fast Planner Detection Method in LiDAR Point Clouds Using GPU-based RANSAC. *UMCit@KDD*.

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