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2D-based Indoor Mobile Laser Scanning for Construction Digital Mapping Application with BIM

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Research Team Introduction

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Study Background Introduction

Issue: 3D laser scanning technology used for construction indoor data collection for as-built quality control or retrofitting of existing buildings. However,

- **Terrestrial Laser Scanning (TLS)**

Disadvantages: high cost, stationary, inconvenient carrying, complex preparation work, long duration etc.

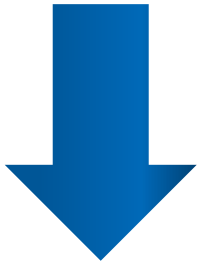
- **Aerial Laser Scanning (ALS)**

Disadvantages: high cost, risk of taking off, site limitation (indoor), weather influence, etc.

Study Background Introduction

Therefore, a lower-cost, more time-saving, more convenient and flexible method of laser scanning is required particularly for building indoor mapping applications. This study proposes that:

2D laser scanner + indoor positioning approach = 3D indoor mobile laser scanning



2D laser scanner + IMU/GPS positioning = 3D indoor mobile laser scanning

Study Background Introduction

Building Information Modelling (BIM) is an emerging digital technology for AEC industry. It brings lots of benefits such as:

- ❖Visualization;
- ❖Design optimization;
- ❖Clash detection;
- ❖Construction simulation;
- ❖Multi-disciplinary collaboration;
- ❖Cost estimation;
- ❖…

Therefore,

Indoor Laser Scanning + BIM Modelling = Indoor Digital Mapping

Aim and Objective

Aim:

Develop a 2D-based mobile laser scanning method that can be integrated with BIM for construction indoor mapping applications.

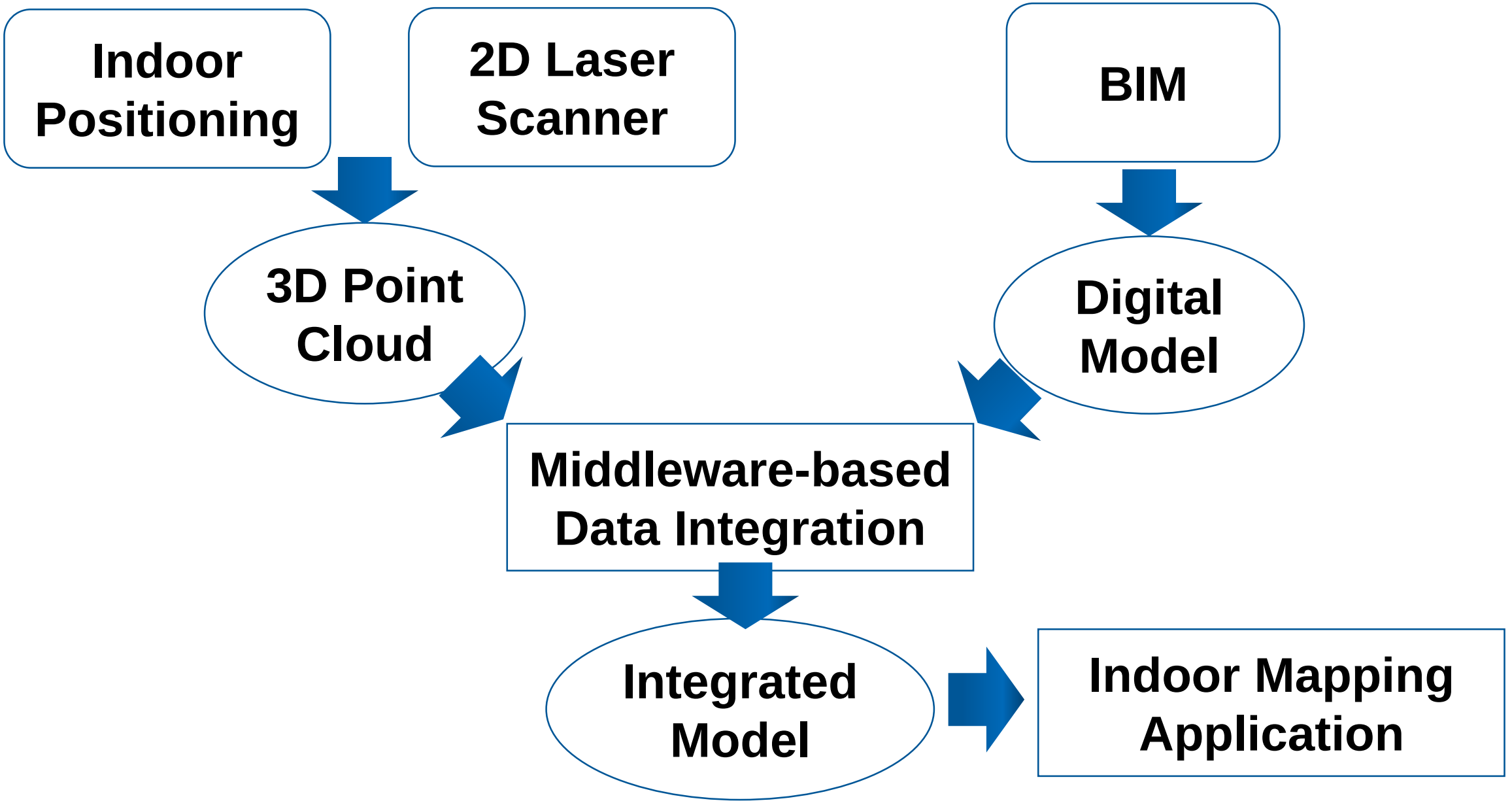
Objectives:

➢Develop a low-cost, time saving and portable laser scanning approach which integrates a 2D laser scanner with indoor positioning method;

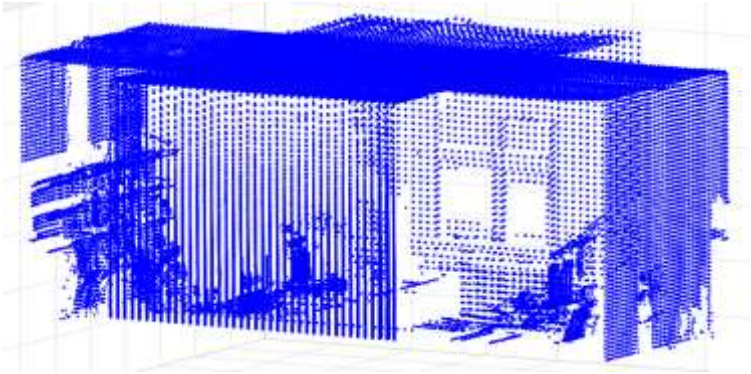
➢Combine the laser scanning result with BIM design model to check the discrepancy between reality and design;

➢Propose an idea which combines laser scanning and BIM to extend further applications for construction indoor mapping, such as quality control, maintenance management, repair plan making, etc.

Methodology

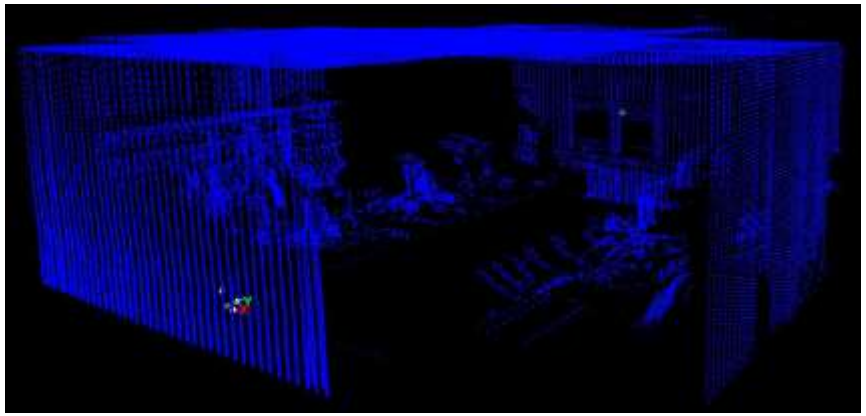


Result Analysis

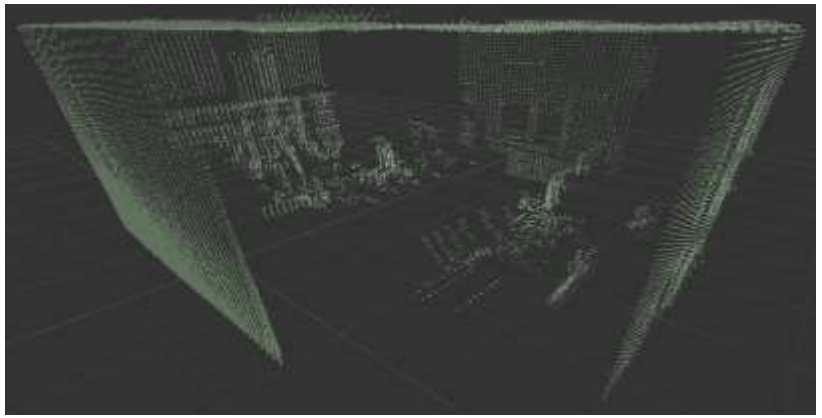


Original 3D point cloud

Processed 3D point cloud

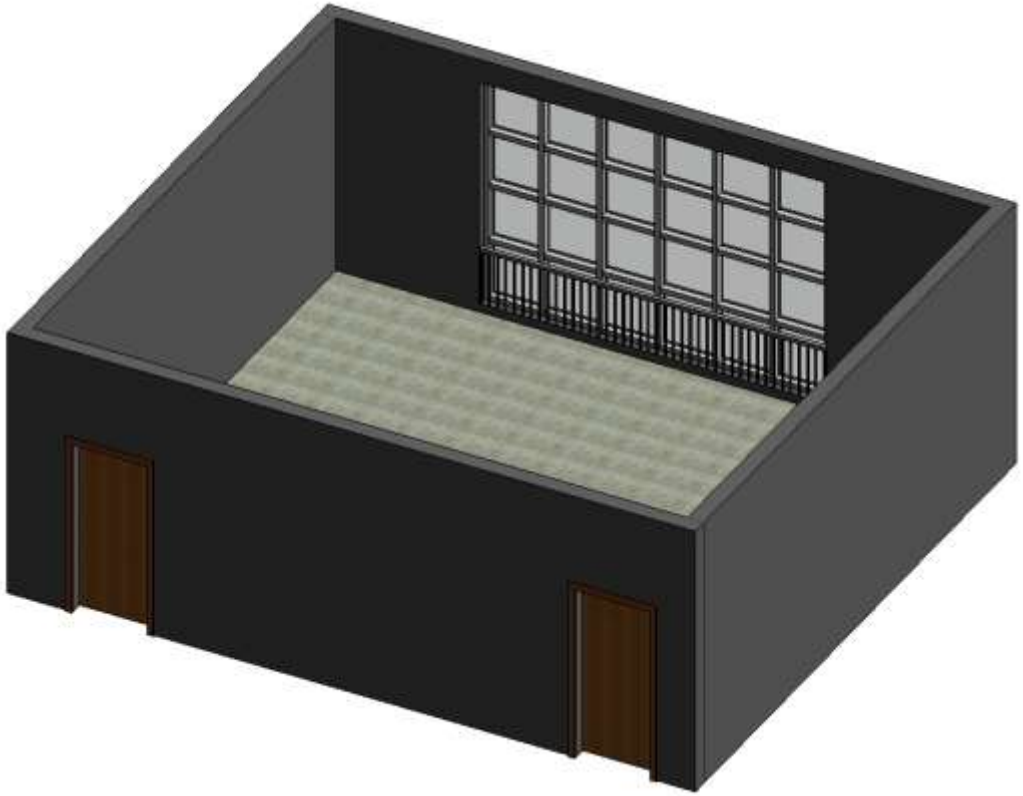


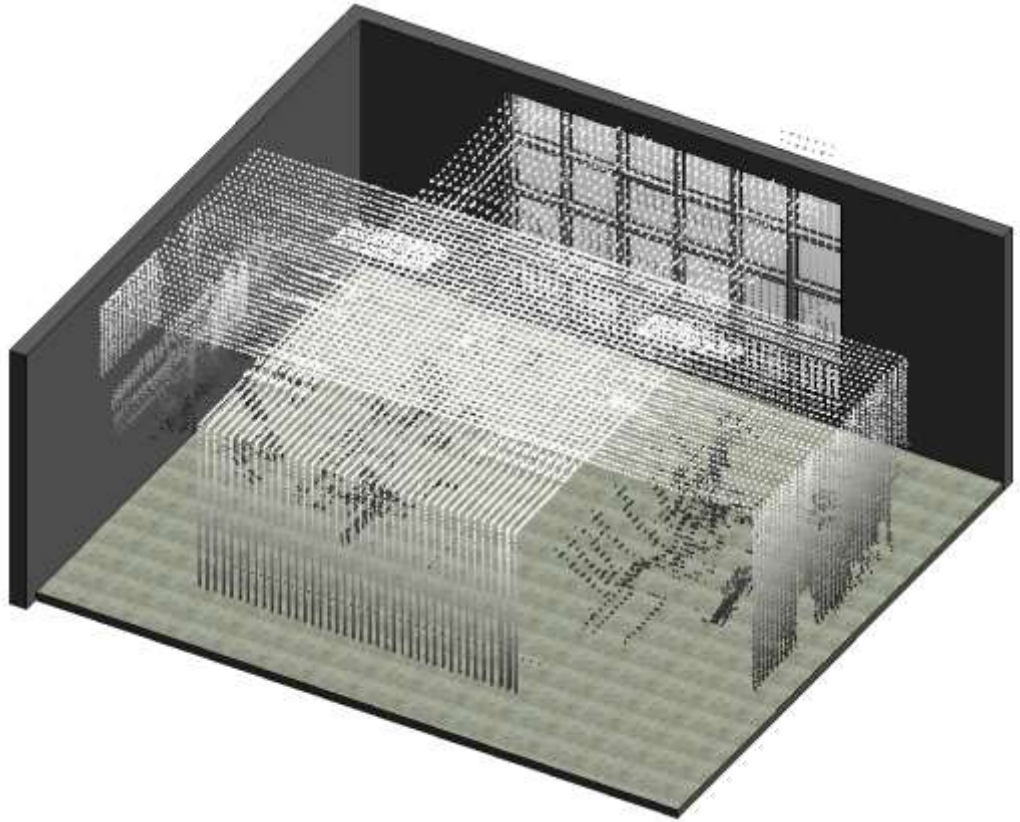
3D point cloud in middleware



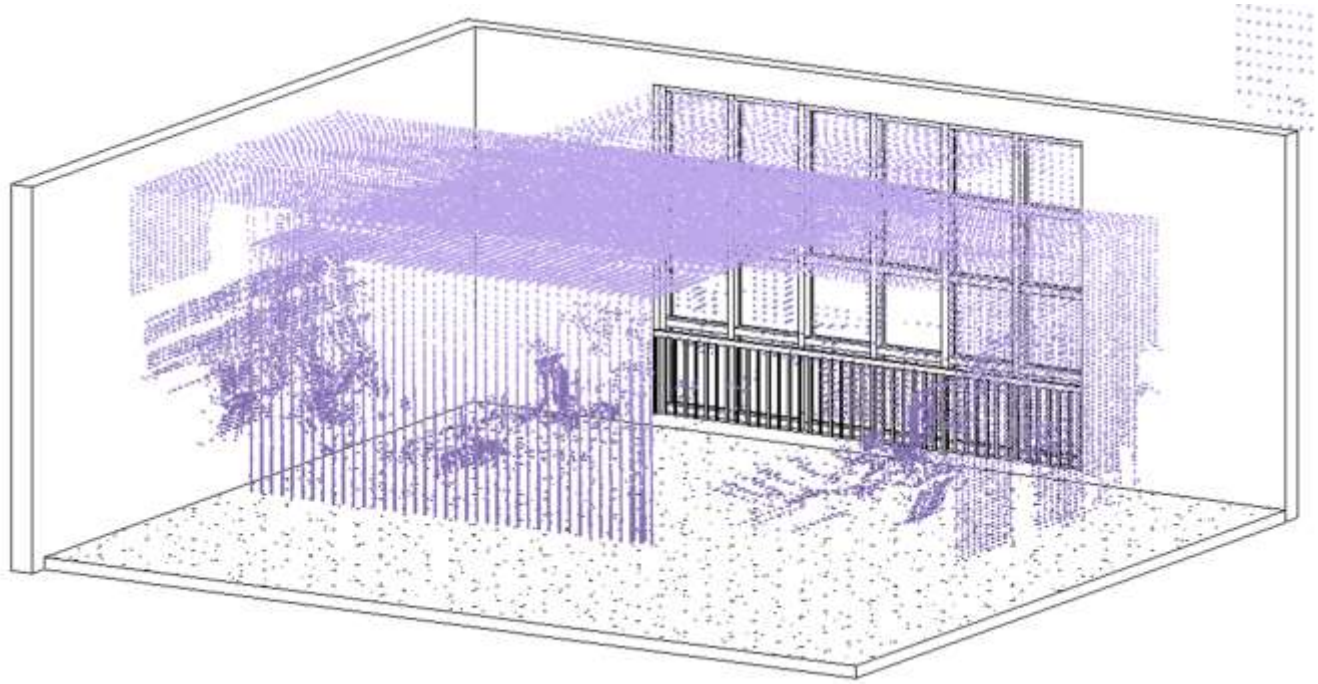
Result Analysis

Left model is the design BIM model of the experimental site room; right model is the model that combines the design with 3D point cloud.





Result Analysis



Left is the reality view of the experimental site and right is the digital model that combines BIM model and real collected 3D point cloud. Compared with the real site conditions, the information provided by digital indoor mapping is still reliable although there are some little discrepancies, which may be due to the **data processing errors** or the **variations during the construction process**.

Conclusion

- Compared with stationary 3D laser scanning technologies, this study shows an innovative laser scanning approach that has mobility, flexibility and other advantages including low cost and time saving.

- Although there are some weakness in accuracy compared with high-cost laser scanning, this approach still shows a good feasibility and reliability for practical applications.

- This study proposes a method to integrate real generated point clouds with BIM model to realize a digital indoor mapping for construction applications.

- Further improvements in equipment, data processing and operation details are expected to enhance the performance of this approach.

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