ISPRS BENCHMARK ON
MULTISENSORY INDOOR MAPPING AND POSITIONING
Report of Scientific Initiative 2019

Investigators

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Project Goals

The ISPRS BENCHMARK ON MULTISENSORIAL INDOOR MAPPING AND POSITIONING (MiMAP) project provided a common framework for the evaluation and comparison of LiDAR-based SLAM, BIM feature extraction, and smartphone-based indoor positioning methods. Datasets are available from the specially designed project webpage on the ISPRS website (ISPRS MiMAP, 2019) and the mirror website http://mi3dmap.net/. Interested participants are invited to download datasets and submit their results for evaluation. For each of our datasets, we provide an evaluation metric and an evaluation submitting webpage. The evaluation results will be published on each dataset webpage.

Activities and Results

MiMAP project team upgraded the XBeibao system (a multi-sensory backpack system developed by Xiamen University) to develop the MiMAP benchmark. The upgraded system (Figure 1) can synchronously collect data with multi-beam laser scanners, fisheye cameras, and sensor records from smartphones.

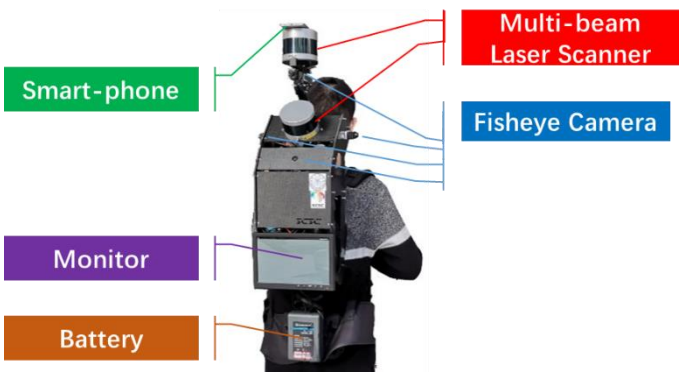

Figure 1. The XBeibao System with Smartphone attached on top

The MiMAP benchmark includes three datasets:

（1） Indoor LiDAR SLAM dataset (http://mi3dmap.net/isprsDatatype1.jsp)
We collected indoor point clouds dataset in three multi-floor buildings with the upgraded XBeibao. This dataset represents the typical indoor building complexity. We provide raw data of one indoor scene with ground truth for users' evaluation. We also provide raw data of two scenes for evaluation by submitting. The evaluation criteria encompass the error to the ground truth point cloud acquired with a millimeter-level accuracy terrestrial laser scanner (TLS) (Figure 2(b)).

（2） BIM feature extraction dataset (http://mi3dmap.net/isprsDatatype2.jsp)
We established three data for evaluating the BIM feature extraction on indoor 3D point clouds. Ground truth BIM framework data was manually built, and examples are presented in Figure 3.

（3） indoor positioning dataset (http://mi3dmap.net/isprsDatatype3.jsp)
We provide two data sequences with ground truth for users' evaluation. We also provide three data sequences for evaluation by submitting results. The evaluation criteria encompass the error to the centimeter-level accuracy platform trajectory from the SLAM algorithm (Figure 4).

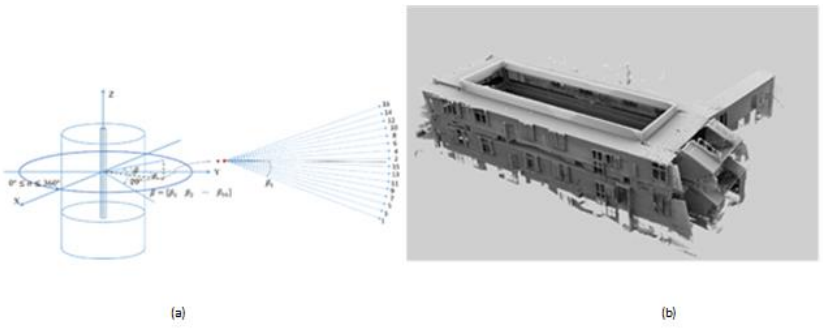

Figure 2. Illustration of indoor LiDAR-based SLAM dataset
(a) multi-beam laser scanning and (b) the TLS reference point cloud.

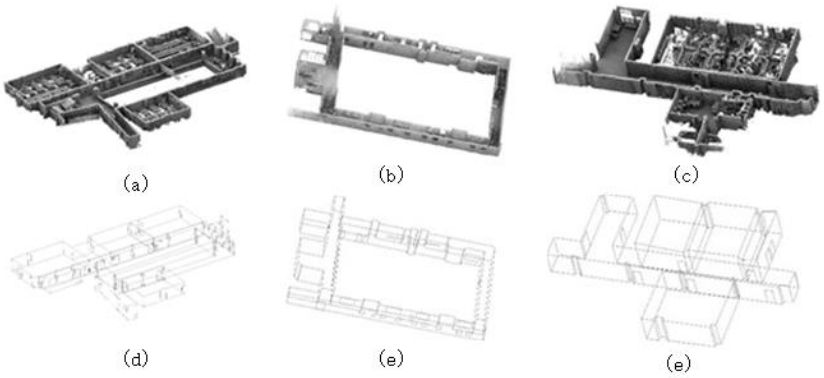

Figure 3. Illustration of BIM feature extraction dataset
(a) (a-c) indoor point clouds, (d-f) the corresponding BIM frame features.

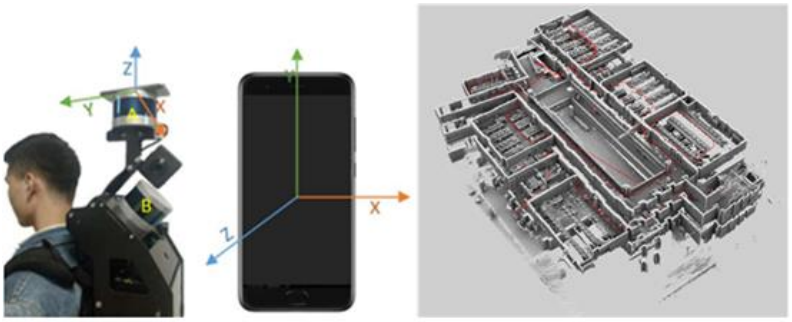

Figure 4. Illustration of smartphone-based indoor positioning dataset
(a) Setup of the attached smartphone, (b)SLAM platform trajectory as synchronize reference

A detailed description of the benchmark dataset, sensor specifications, reference datasets, and the evaluation method is provided in a paper presented at the ISPRS Geospatial Week 2019, in Enschede, The Netherlands (Cheng et al., 2019).

The MiMap website for the benchmark dataset was set up in September 2019. Since then, the dataset has been downloaded by researchers from different countries. Figure 5 shows the download statistics of the benchmark dataset.

As a follow-up activity of the scientific initiative, we aim to organize a benchmark test in the ISPRS Congress 2020. We will issue a call for participation inviting interested researchers to participate in the benchmark test by applying their methods to the benchmark dataset and submitting the results for evaluation. We will evaluate the submitted results and publish them on the benchmark page at the ISPRS website.

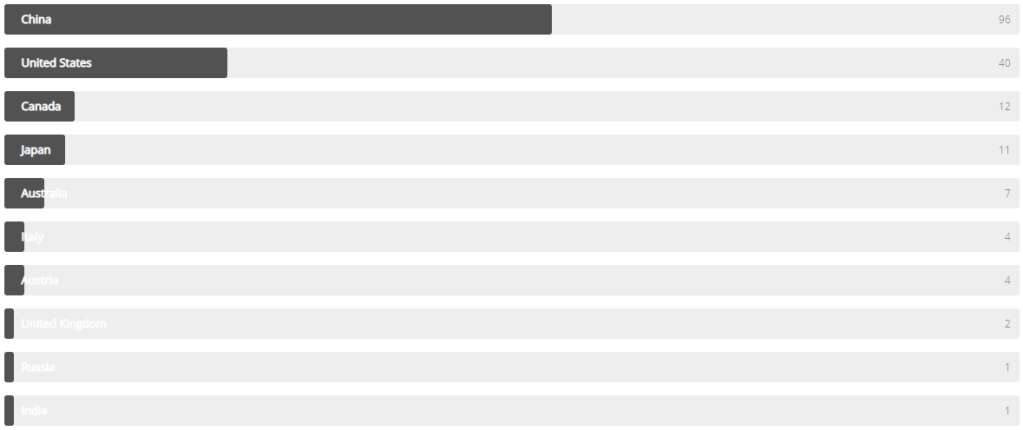

Figure 5. Download statistics of the benchmark dataset.

Project Expenses

The total grant received from the ISPRS for this project was CHF 10,000.00. The following is a breakdown of the project expenses.

- Upgrade of the backpack system CHF 1,000.00
- Data acquisition CHF 2,600.00
- Generation of reference models CHF 4,100.00
- Evaluation software development CHF 1,500.00
- Travel CHF 800.00

Reference:

[1] MiMAP project ISPRS website, 2019, http://www2.isprs.org/commissions/comm1/wg6/isprs-benchmark-on-multisensory-indoor-mapping-and-positioning.html

[2] Cheng Wang, Yudi Dai, Naser El-Sheimy, Chenglu Wen, Guenther Retscher, Zhizhong Kang, and Andrea Lingua, PROGRESS ON ISPRS BENCHMARK ON MULTISENSORY INDOOR MAPPING AND POSITIONING, *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Volume XLII-2/W13.