

GLOBE SLAM: Hilti SLAM Challenge Report

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In the approach used, a sliding window submap optimization of the LiDAR point clouds is first performed along with the IMU data. The images are not used within this approach. The submaps are then registered to an active part of the map. The result of this registration is considered as odometry estimation. Depending on the scene size, the odometry runs with 10% to 50% real time with the resolution selected for the challenge. The odometry serves as a initial guess for the global optimization, which is the core of the algorithm and with which higher accuracies can be achieved. An odometry pose is considered a keyframe if the overlap to the active map falls below a threshold or a distance threshold is exceeded. In global optimization, all keyframe poses determined during odometry estimation are optimized relative to each other. Parameters such as thresholds for new keyframes were adjusted for each sequence to achieve a maximum result. In the sequences with the robot, ceiling points and floor points were removed in the point cloud to obtain a more accurate result.

Currently it is implemented in such a way that the global optimization is only executed once at the end. The global optimization of the keyframe poses takes between 5 min and 30 min. The approach is prototypically implemented in C++ and has not been published yet.

Sequence	Odometry [s]	Global optim. [s]
Site 1 handheld 1	2093	300
Site 1 handheld 2	1576	300
Site 1 handheld 3	1433	300
Site 1 handheld 4	2455	-
Site 1 handheld 5	438	-
Site 2 robot 1	2134	-
Site 2 robot 2	652	120
Site 2 robot 3	738	154
Site 3 handheld 1	861	60
Site 3 handheld 2	1263	-
Site 3 handheld 3	1475	1755
Site 3 handheld 4	673	330

Table 1: Processing time per sequence divided in odometry processing time and global optimization processing time.

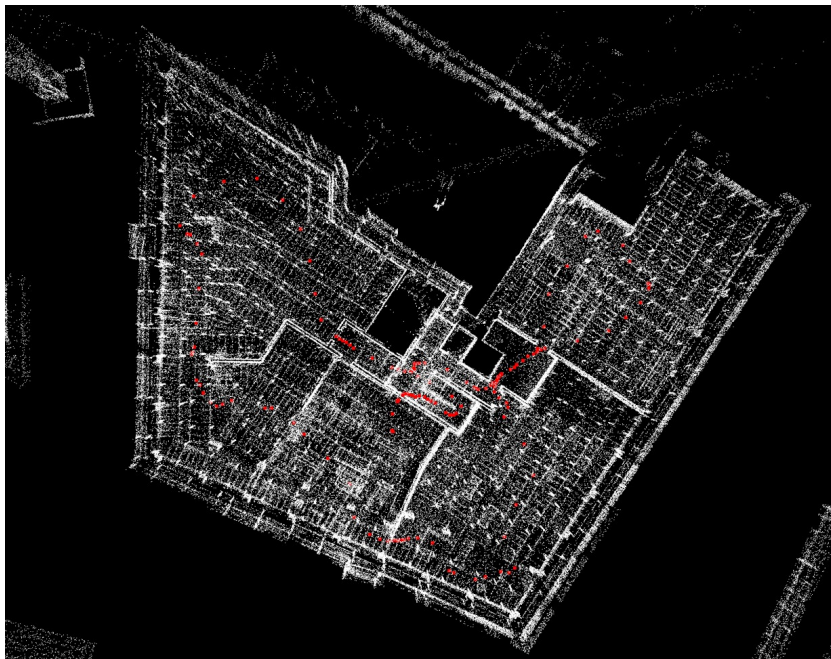


Figure 1: Birds view **Site 1**: optimized keyframe point cloud, keyframe positions marked with red dots.

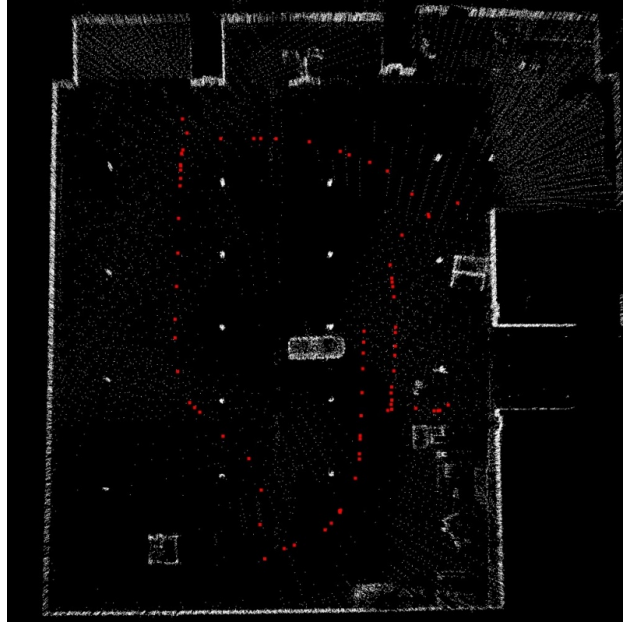


Figure 2: Birds view **Site 2**: optimized keyframe point cloud, keyframe positions marked with red dots.

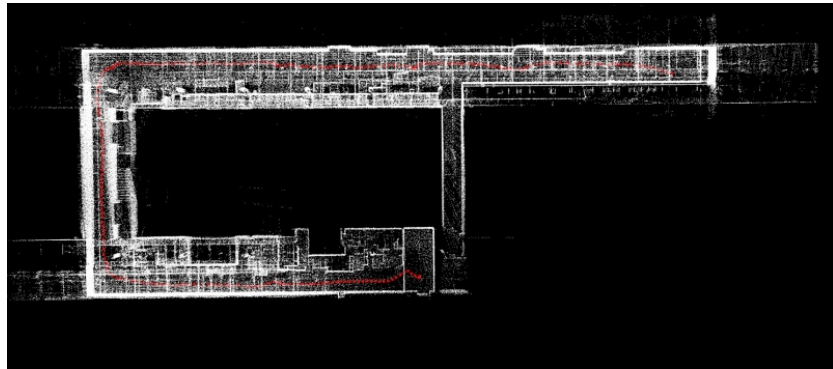


Figure 3: Birds view **Site 3**: optimized keyframe point cloud, keyframe positions marked with red dots.