Integrated Fieldwork 2021

WP 6: Mobile Laser Scanning and Visualization of Multiple Point Clouds

Supervisor

Norbert Haala
Philipp Schneider
Michael Kölle

Team Member

Cindy Chun
Tzu-Hsuan Lai
Nadine Sprügel
Yihan Tao
Xuanxuan Wang

Contents

1. Introduction

Mobile laser scanning is a technique applied for 3D mapping. In the task, we will apply Geoslam's handheld Zeb sensor for a visualization of the Hysolar building and sports field and obtain a point cloud of the respective areas. The measurement is conducted based on the ground control points in order to reduce the loop closing errors and for georeferencing. In addition, visualization of the point clouds inside and outside the Hysolar Building will be achieved by the Cesium framework on the website. The designed website will allow the 3D presentation of the main products of WP 5 and 6 as well as the trajectory of WP 4.

2. Measurement during fieldwork

2.1. How to measure and collect data with the Geoslam scanner

Before the start of measurement, connect the hand held laser scanner and data logger with the cable. Then put the Geoslam scanner on a control point and turn on the sensor by pressing the on/off button. If the Scan head LED array is flashing red or all LEDs in the array are red, then long press the function button until the LEDs turn from red to flashing orange. Now the scanner is initializing. Notice that the scanner must remain static during initialization. After the initialization, the Data Logger LED and the Scan head LED lights green and the scanner head starts rotating.

After the measurement, place the Geoslam scanner on the same control point and press the function button until the head stops rotating. For a new measurement with the scanner, the scanner needs to be placed at a control point again and the initialization needs to be started again. The collected data is saved automatically. To export and save the raw data on a USB stick, just insert the USB into the data logger for the download. The transferring of the data is not done until the AUX LED turns to green. When finishing all the measurements, press the on/off button for a few seconds until the instrument emits two beeps in order to shut down.

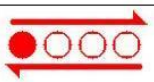
	Data Logger LED		Scan head LED array
	REVO	DATA	
Standby mode		-	
Initiate new scan Long press the function button on either the scan head or the data logger until the REVO LED and scan LED array light solid red to initiate a new scan		-	
Initialization mode The scan head must remain stationary for a period of 15 seconds. If the scan head is disturbed during initialisation the system will revert to standby mode (Step 4)		-	
Scanning mode After the 15 second initialization, the REVO LED and scan head LED array will light green and the scan head will start rotating. Pick up the scanner and conduct the scan.		-	

Figure 1: Overview of the different lights of the Data Logger LED and the Scan head LED array

2.2. Important information for the measurement and collection of the data

Each route should contain at least 3 ground control points and start and end with one of them. During the measurement, the scanner should always point to the object of interest (here the Hysolar building). Additionally, make sure to minimize presence moving objects (i.e., cars, pedestrians) in the field of view of the scanner.

2.3. Measurement route of Hysolar building outdoors

For the measurement of the area around the Hysolar building, as example, the following loop was designed:

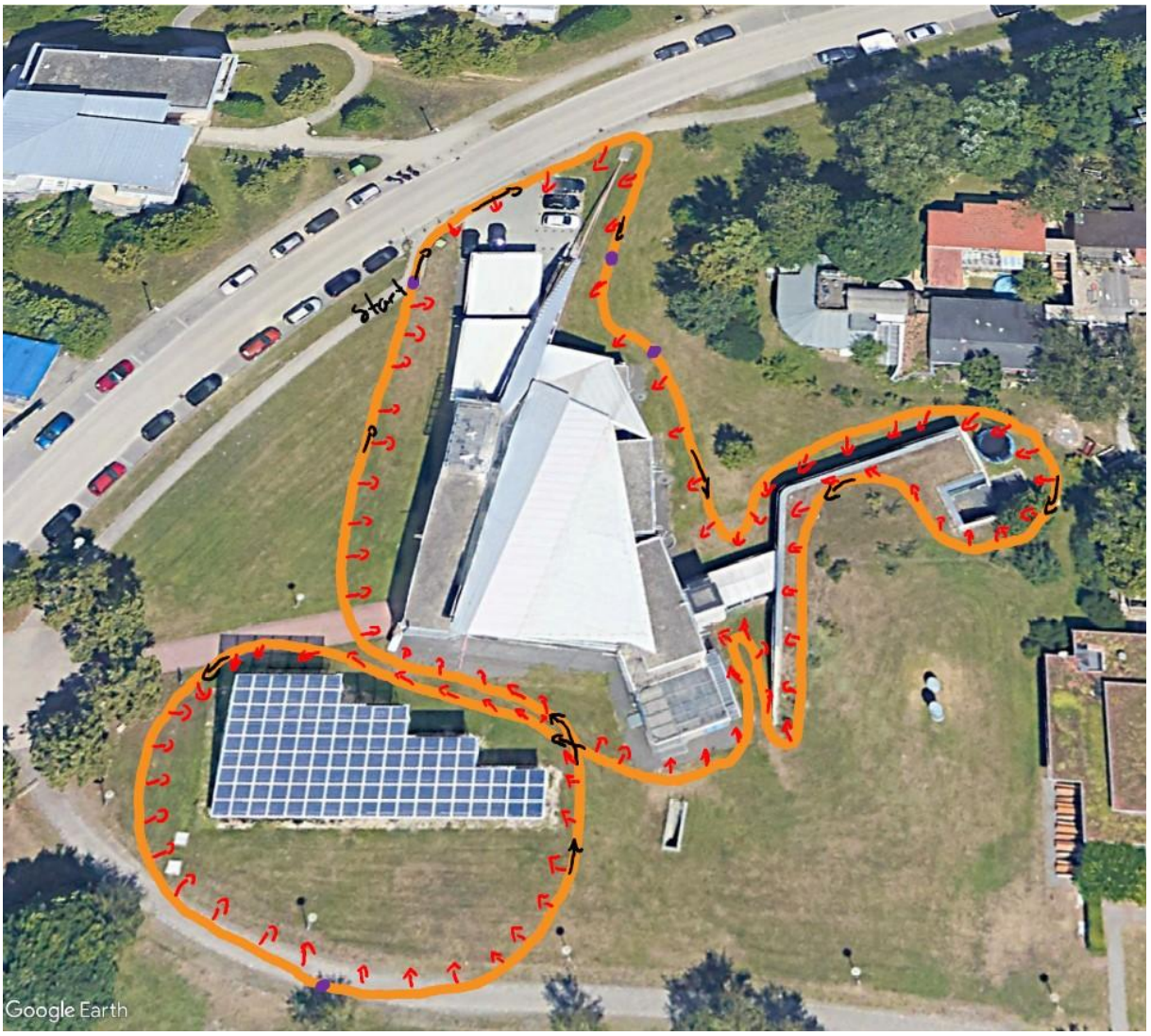


Figure 2: Small loop around the Hysolar building

In Figure 2 the orange line is the route, the purple dots are the control points (approximate positions, the exact position will be obtained after the measurements of WP2), the black arrows are the walking direction and the red arrows are the direction in which the Geoslam scanner should point. The route must start and end at the same control point. First put the Geoslam scanner on this control point and start with the initialization. After that, a continuous walking and handling of the scanner without pause is necessary. Only stops at the control points are allowed. When reaching a control point, the sensor needs to be placed on the point and must remain on the point for 15 to 20 seconds. If you are on the roof near the Unithekle, tilt the Geoslam scanner a little bit down, so it is faced more downwards. If you are finished with walking the route, put the scanner on the same control point as the loop started and stop the scanning. After the end of the scan, start a new scan and walk the route a second time.

2.4. Measurement route of Hysolar building indoors

The Hysolar building should also be scanned indoors. For that it is necessary to explore the inside area of the Hydrosolar building first. After that, walk through the building and be aware that while the Geoslam scanner is scanning, no doors should be closed, they should already be open. So, if a door needs to be open, this door needs to be opened while the scanner scans in the opposite direction (the back of the person scanning should face the door) and then the scanner should go backwards through the door. The door needs to stay open until it is outside of the scanning area of the scanner. Also, no elevators should be taken during the scanning. To coregister this point cloud to the other point cloud also three control points are required during the scan. So, the scan should start on a control point close to the Hysolar building and also should end on it. During the measurement two different control points need to be measured, so that in total three control points are used.

2.5. Measurement big loop on the Hysolar building

For the measurement of a bigger area around the Hysolar building, as example, the following loop was designed:

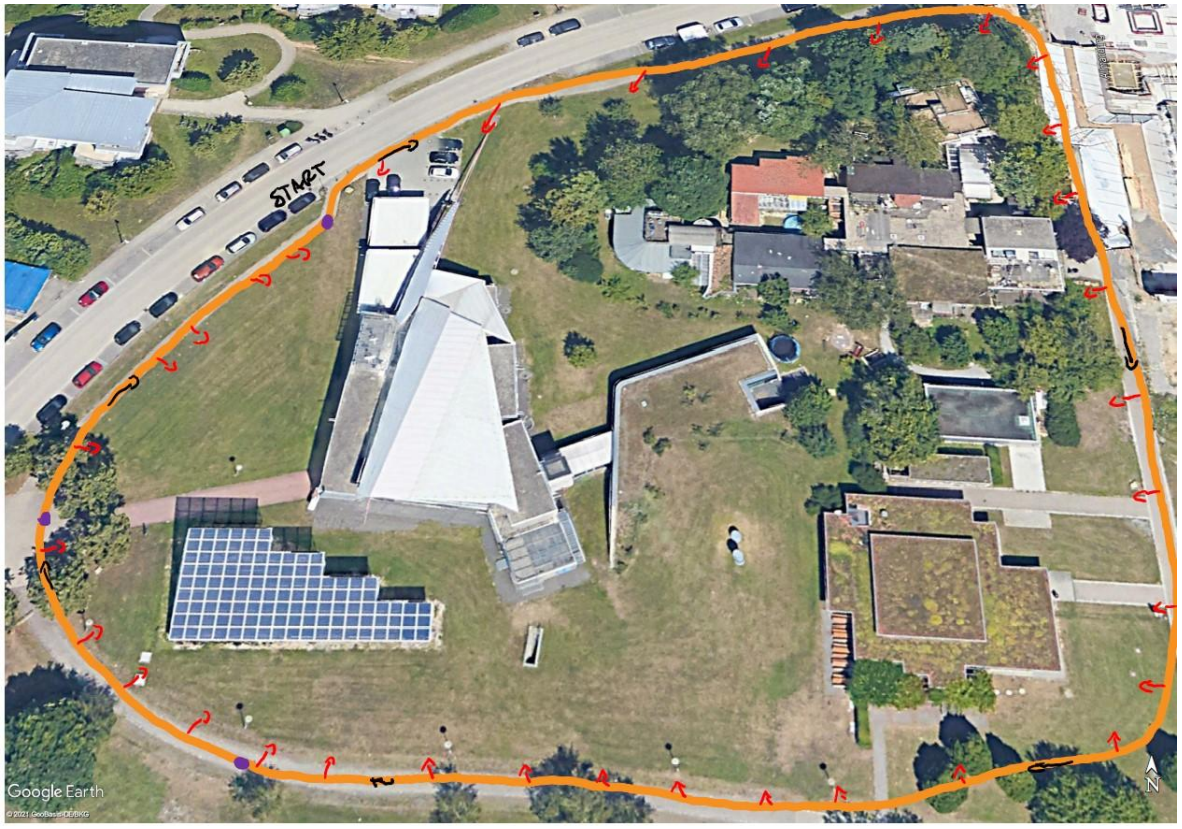


Figure 3: Big loop around the Hysolar building

In Figure 3 the yellow is for example the path to walk, the black arrows are the walking direction, and the red arrows are the direction in which the Geoslam scanner should point. The purple dots are the approximate position of the control points. The exact position will be obtained after the measurements of WP2. The route must start and end at a control point. First put the Geoslam scanner on this control point and start with the initialization. After that, a continuous walking and handling of the scanner without pause is necessary. Only stops at the control points are allowed. When reaching a control point, the sensor needs to be placed at the point and must remain on the point for 15 to 20 seconds.

2.6. Measurement of the sport field

For the measurement of the area around the sport field, as example, the following loop was designed:

Figure 4: Loop around the sport field

In Figure 4 the yellow is for example the path to walk, the black arrows are the walking

direction, and the red arrows are the direction in which the Geoslam scanner should point. The purple dots are the approximate position of the control points. The exact position will be obtained after the measurements of WP2. The route must start and end at a control point. First put the Geoslam scanner on this control point and start with the initialization. After that, a continuous walking and handling of the scanner without pause is necessary. Only stops at the control points are allowed. When reaching a control point, the sensor needs to be placed at the point and must remain on the point for 15 to 20 seconds.

2.7. Path nead Hysolar building (in combination with WP4)

The path of the navigation car of WP4 will be followed by the Geoslam scanner. The car will be followed in a way that the car will be captured as a “ghost car”. Also, for the scan three control points are needed. And the path should be a closed loop, which should start and end on the same control point.

Figure 5: Ghosting of a moving target in SLAM

3. Visualization with Cesium

After scanning, the raw data should first be processed with Geoslam. The result point cloud data then can be visualized, when Cesium and html are applied. The referenced point cloud should first be uploaded on Cesium ion server, and an identity number will be given. With the identity number, adding terrain source, the point cloud can be fully displayed.

As shown in Figure 6, the point cloud is displayed in red.

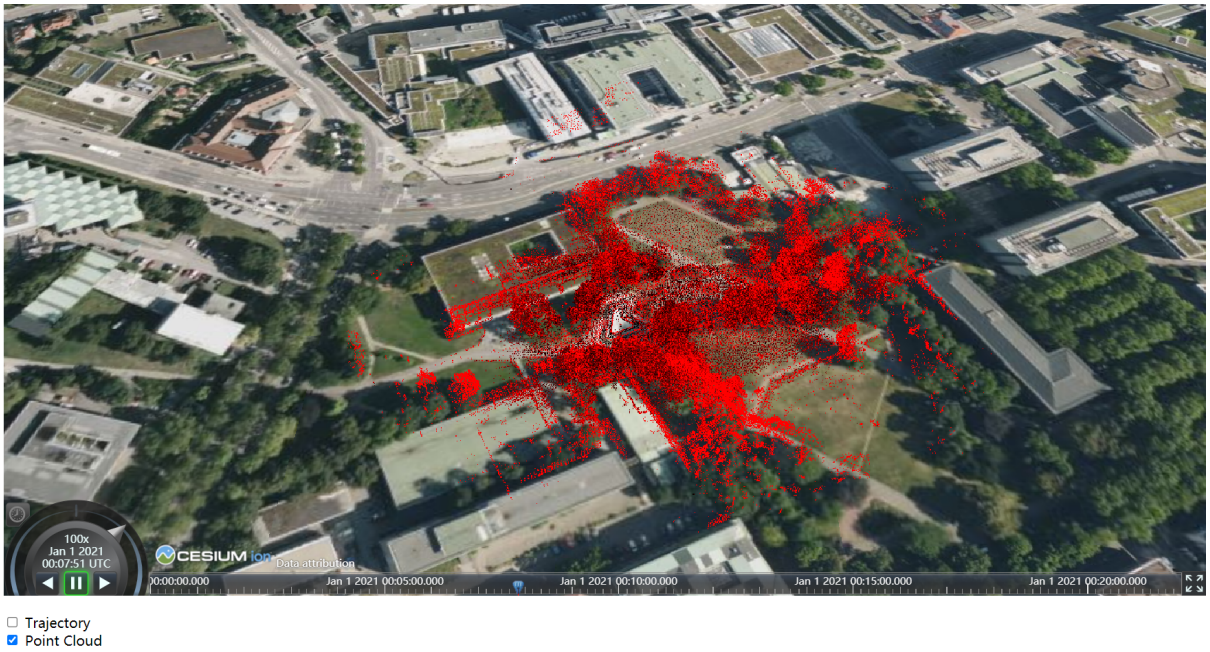


Figure 6: Cloud point displayed on website

Plus, the time dynamic trajectory is visualized on the website as presented in Figure 7.

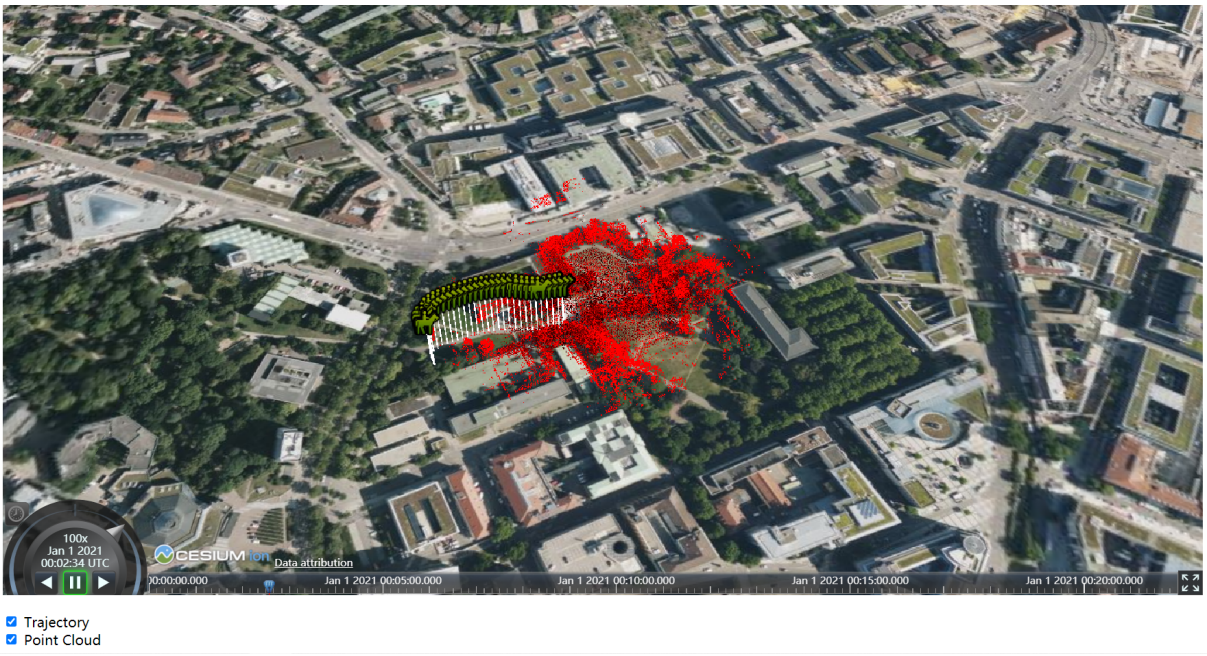


Figure 7: Cloud point displayed on website with trajectory (green pin)

4. Equipment list

- ZEB-Horizon handheld laser scanner
- ZEB-Horizon data logger
- ZEB-Horizon main cable (for the connection of the hand held laser scanner and the data logger)

- Data logger shoulder strap

5. Last check

- Are the starting reference point and the ending reference point the same?
- Are there at least three control points in each route?
- Is the position of the control points known in the area of interest?