Exercise: GNSS-Based Positioning with Avenza Maps and Geopackage Creation

Objective of the Exercise:

In this exercise, you will use the GNSS functionality of your smartphone to track a route and measure points using the Avenza Maps app. This app works on both Android and iOS, making it the best choice for available open-source/free applications. You will then create a Geopackage in QGIS that contains the recorded path and the measured points. In the follow-up session, we will check their variance concerning the accuracy of individual measurements.

Procedure:

Forming Pairs:

Work in pairs. One person is responsible for tracking the path and can keep the PDF with the point characteristics open, while the second person measures the points along the route.

Preparation:

1. **Install the Avenza Maps app** on your smartphone.
2. Make sure that the **GPS on your smartphone is activated**.
3. Download the map or simply scan the QR code, **so that you can find and orient yourself to the points and the path**.
4. Download the file **"avenzamaps_howto.pdf"** or print it out (or try it out at home) so that you know how to enter points and track paths.
5. Also download the **PDF with the point characteristics**. It contains sample images of what you need to measure.

Task 1: Tracking the Path

One person in the team is responsible for continuously tracking the path and keeping an overview. Always stay on the designated path, for example, on the right side of the path if it is wide. Avoid deviating from the path (do not go into the forest or similar). If you must leave the path, ensure that the device stays on the path (e.g., temporarily hand it to the other person). Additionally, the person tracking (which runs primarily in the background) can have the PDF with the point characteristics available to find the points that need to be measured.

Record the entire circular route seamlessly.

Task 2: Measuring Points

The second person should **measure specific points along the route** during the circular run. These points are significant locations that can be easily identified on the map (e.g., forks in the path, viewpoints, benches, corners, etc.). They are predefined!

Use the Avenza Maps app to mark these points directly on the map. Number the points using the scheme A, B, C, … and specify the sky visibility for each point (e.g., shaded by trees) in tenths of a percent, i.e., a **number between 1 (10% covered) and 10 (100% covered).** Write this in the "Description" field (or "Beschreibung" if the smartphone language is set to German).

After completing the route, export the **tracked path as GPX** and the **measured points** from Avenza Maps as **CSV**.

Task 3 (optional): Data Processing in QGIS

Import these data into QGIS and **create a Geopackage** that contains the following layers:

- Path as line layer: The tracked path of the circular route.
- Points as point layer: The measured points, numbered with A, B, C…
- **Please name the path layer in the Geopackage simply as "path" and the point layer as "points."** No spaces, no uppercase/lowercase differentiation, nothing—just as specified here :)

If you have significant issues with this step, it is also okay to skip it and just send me the GPX and the CSV :).

Task 4: Submission

Export the Geopackage (if available) and name it with your initials as follows:

group_MF_TK_round.gpkg (for example, if **M**aximilian **F**abi and **T**eja **K**attenborn were a team).

The Geopackage should contain the following layers:

- Line layer: The tracked path.
- Point layer: The measured points.

Now pack the following files into a ZIP file:

1. Geopackage as .gpkg file
2. Path as .gpx file
3. Points as .csv file

Send the finished ZIP file via email to [maximilian.fabi@geosense.uni-freiburg.de].

Here's an example of how the Geopackage should look at the end:

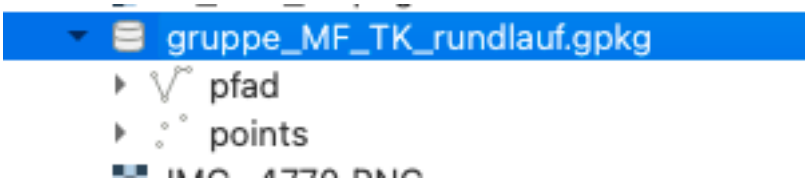

Figure 1: Save Geopackage

This is how the CSV should look at the end (example):

Title	Date Created	Latitude	Longitude	Northing	Easting	Description	Elevation
A	2024-10-10T10:05:42+02:00	47.999945	7.8622122	0	0	6	298.01294
B	2024-10-10T10:07:24+02:00	47.99975	7.8616747	0	0	5	292.74325
C	2024-10-10T10:09:32+02:00	47.999595	7.8613513	0	0	2	291.89217
D	2024-10-10T10:10:34+02:00	47.999501	7.8609371	0	0	2	289.85358
E	2024-10-10T10:11:35+02:00	47.999992	7.8614337	0	0	3	284.96251
F	2024-10-10T10:15:35+02:00	48.00344	7.8549364	0	0	4	269.07001

Figure 2: Example how the CSV looks like at the end. The name of the point (e.g. A) and the number for the sky visibility in the "description" field (e.g. 6 in the point of A).

Required Materials:

- Smartphone with GPS

- Avenza Maps (free version)
- Laptop/PC with QGIS installation

Assessment Criteria:

- Completeness of the tracked route (path on the designated way) and the measured points.
- Correct creation and structure of the Geopackage (1 line layer and 1 point layer).
- Complete submission of all files.