





Name	Date modified	Type	Size
 mlii0076.gpx	29/10/2023 5:47 pm	GPX File	75 KB
 Script-2.sql	29/10/2023 1:52 pm	SQL Source File	1 KB
 Script-3.sql	29/10/2023 8:22 pm	SQL Source File	1 KB
 vis.qgz	29/10/2023 8:19 pm	QGIS Project	20 KB

Task 2: Import GPX file

[illegible]

mlii0076 1 ×		Enter a SQL expression to filter results (use Ctrl+Space)						
select * from a5.mlii0076								
Grid Text Spatial Record		ogc_fid	track_fid	track_seg_id	track_seg_point_id	ele	time	
	1	1	0	0	0	85.9345400333	2023-10-29 15:45:56.000 +1100	
	2	2	0	0	1	87.706451878	2023-10-29 15:46:01.000 +1100	
	3	3	0	0	2	87.2181205507	2023-10-29 15:46:05.000 +1100	
	4	4	0	0	3	86.8483988363	2023-10-29 15:46:07.000 +1100	
	5	5	0	0	4	87.0665671322	2023-10-29 15:46:08.000 +1100	
	6	6	0	0	5	86.9022852536	2023-10-29 15:46:09.000 +1100	
	7	7	0	0	6	86.6722577419	2023-10-29 15:46:11.000 +1100	
	8	8	0	0	7	86.8540743152	2023-10-29 15:46:13.000 +1100	
	9	9	0	0	8	86.5816095993	2023-10-29 15:46:15.000 +1100	
	10	10	0	0	9	86.7371737827	2023-10-29 15:46:16.000 +1100	
	11	11	0	0	10	86.5813543526	2023-10-29 15:46:17.000 +1100	
	12	12	0	0	11	86.9285547975	2023-10-29 15:46:24.000 +1100	
	13	13	0	0	12	86.7353655519	2023-10-29 15:46:29.000 +1100	
	14	14	0	0	13	86.9687444605	2023-10-29 15:46:30.000 +1100	
	15	15	0	0	14	86.7897159038	2023-10-29 15:46:31.000 +1100	
	16	16	0	0	15	87.0078810574	2023-10-29 15:46:32.000 +1100	
	17	17	0	0	16	87.1909743166	2023-10-29 15:46:33.000 +1100	
	18	18	0	0	17	86.7931087194	2023-10-29 15:46:34.000 +1100	
	19	19	0	0	18	86.7595077567	2023-10-29 15:46:36.000 +1100	

Task 3: Data Analytics

3.1 Speed analysis

```
WITH avg_speedt AS
(
    SELECT
        st_distance(t1.wkb_geometry::geography, t2.wkb_geometry::geography) AS distance,
        extract(EPOCH from t2.time-t1.time) AS time_betw
    FROM
        a5.mlii0076 t1
        JOIN a5.mlii0076 t2 on t1.ogc_fid + 1 = t2.ogc_fid
)
SELECT sum(distance) / sum(time_betw) AS avg_speed
FROM avg_speedt;
```

WITH avg_speedt AS (SELECT st_distance(t1.wkb_	
Grid	123 avg_speed
1	2.1386542861

3.2 Further Data Analysis

```
CREATE TABLE a5.visual2 AS
SELECT
    t1.ogc_fid,
    st_distance(t1.wkb_geometry::geography, t2.wkb_geometry::geography) AS distance_spot,
    extract(EPOCH from t2.time-t1.time) AS time_betw,
    CASE WHEN extract(EPOCH from t2.time-t1.time) = 0 THEN 0 ELSE
        st_distance(t1.wkb_geometry::geography, t2.wkb_geometry::geography) / extract(EPOCH from t2.time-t1.time)
    END AS instant_speed, -- instance speed in meters per second
    t1.wkb_geometry,
    t1.time
FROM
    a5.mlii0076 t1
JOIN
    a5.mlii0076 t2 ON t1.ogc_fid = t2.ogc_fid - 1;
```



Task 4: Summary report

Introduction

Purpose and Aim:

The primary objective of this report is to provide an analytical breakdown of movement, specifically tracking the speed and route. Through this analysis, I aim to comprehend patterns, efficiencies, and anomalies within the chosen route, providing insights that could have broader applications.

GPX Data and Source:

The data for this analysis is sourced from the GPX Tracker app, a popular application for tracking geographical movement. For this report, I chose a specific route to provide a focused analysis. This route was selected due to its diverse terrain and its frequent use in daily commuting, making it an ideal candidate for in-depth study.

Key Questions:

Throughout this analysis, the central questions I intend to explore include:

- What is the average speed of movement across different segments of the route?
- Are there significant variations in speed across different parts of the route?
- How does the terrain or other external factors influence speed and efficiency?

Methodology

Data Exploration and Analysis:

Import and Initial Exploration:

I commenced the analysis by importing the GPX data into a PostgreSQL database, utilizing the PostGIS extension for spatial operations. Initial exploration of the data was achieved using SQL queries to understand the basic attributes and metrics present in the dataset.

Data Cleaning and Pre-processing:

Upon close examination, I ensured data consistency by checking for any missing or inconsistent timestamps and spatial points. Minor corrections were made to ensure the accuracy of subsequent calculations.

Additional Investigations:

My detailed analysis focused on determining the instance speed between consecutive data points, allowing for a granular understanding of movement speed variations. This approach was chosen to get insights into how speed fluctuated across the route and to identify potential causes for significant speed changes.

Data Visualization:

Choice of Visualizations:

To represent the instance speed and the tracked route effectively, I opted for heat map. The colour gradient showcases the time spent in area, with segments coloured from

lightblue (higher speeds) to red (low speeds). The number indicates the instance speed in that area. This visualization method was selected for its intuitive nature, enabling a clear and instant understanding of speed variations and time spend along the route.

- **Software and Tools:**

The visualizations were generated using QGIS, a renowned open-source geographic information system. The tool's capabilities for handling spatial data and its flexibility in styling made it apt for representing the GPX data effectively.

Results

Average Speed:

Upon analyzing the GPX Tracker data, the computed average speed over the entire journey was found to be 2.13 m/s. This average speed considers all forms of movement, including preparation at home, biking, and walking. It really shows how simple bicycle can dramatically improve one's travelling that even I spend some time in home recording and walked 1/3 route at the end the average speed is still higher than walking.

In-depth Investigations:

A. Heatmap Analysis:

The heatmap provided a visual representation of time spent at various locations. Darker shades indicated areas where I was stationary or slow-moving for extended durations.

Findings: The darker regions effectively indicated points where I might have been waiting, such as traffic lights or perhaps taking breaks. It serves as a testament to external factors that might delay movement, like traffic or logistical interruptions.

B. Speed Labels Analysis:

Speed labels were used to differentiate between the speeds of different segments of the journey, like biking versus walking.

Findings: The labels showed a clear distinction between faster biking segments and slower walking ones. This distinction was pivotal in understanding how different modes of transport influenced the overall average speed.

Conclusion

Summary of Findings:

The analysis of the GPX Tracker data offered insightful revelations into my movement patterns. The visual representation, particularly the heat map, effectively highlighted segments of my journey: the preparatory phase at home, the bike ride to meet my friend, and the subsequent walk to the restaurant. The darker shades on the heat map pinpointed areas where I spent considerable time, often hinting at external factors like waiting at traffic lights.

Answers to Initial Questions:

The main questions revolved around understanding speed variations and the potential reasons behind them. The findings directly addressed these queries:

1. The speed labels distinctly showed the transition from faster bike speeds to the slower walking pace.
2. The heat map's darker areas, corresponding to longer wait times, provided insights into interruptions like traffic and other logistical delays, verifying initial hypotheses about potential speed inhibitors.

Reflection and Limitations:

The journey through this analysis was enlightening. However, like any analytical study, this one too had its set of challenges. The primary challenge was ensuring data consistency and accuracy. While the tools employed provided excellent visual feedback, deriving actionable insights required meticulous observation and interpretation. One limitation observed was that while the heat map showed where I spent more time, it did not provide explicit reasons. For instance, the time spent could be due to traffic, personal choices, or other unforeseen events. Furthermore, I was not fully aware how GPX records my track and spend some time just in home, it makes the time and speed value calculated not consistence with the other, also caused some problems in heatmap max value percentage. Despite these challenges, the insights gained were invaluable, showcasing the potential of GPX data in understanding personal movement and logistics in urban settings.