Geoprivacy Platform: First Experiences from an Open Service for Sharing Personal-level Location Data

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Abstract. The Geoprivacy platform is a service for sharing sanitised personal-level location data as open data. At the moment, it runs as a pilot service of the Geoportti Research Infrastructure. Our LBS conference presentation will briefly review the technical solutions developed for the platform and focus on privacy issues raised during the development of the platform, legal aspects tackled during the development of the service, and summarises the first experiences gained during the autumn 2023 on the interest of the public audience towards the service. For others who have a vision of setting up a similar service, we'll provide lessons learned during the development process.

Keywords. GPS, GNSS, trajectory data, cycling, privacy-preserving data publishing, VGI, open data

1. Introduction

The current climate goals and the ongoing green transition mean that societies must reduce their overall consumption to a sustainable level. Ambitious decarbonisation objectives will be impossible to achieve without a sustainable urban mobility transition, as in cities the traffic, and especially road transport, is the source of 26% of GHG emissions (DESTATIS 2022). The perfect solution would be to increase the share of cycling and walking, which alleviates traffic congestion and reduces GHG emissions and pollution, thus making cities attractive and functional at the human scale. In addition, cycling demonstrably provides health benefits for cyclists (Oja et al. 2011), and the problem of the non-inclusivity of cycling as a transport mode

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can be mitigated (Aldred et al. 2016). Therefore, all efforts and investments to promote cycling and walking should be considered, including making cities more suitable and safer for cyclists and pedestrians. Furthermore, to achieve a real revolution in urban mobility, we need to create a better and more supportive cycling environment for all people, not just enthusiastic cyclists (Aldred et al. 2016). It is crucial to direct the scarce public resources for developing and maintaining infrastructure to the most cost-beneficial targets. One critical and currently underused source of supporting data is the volunteered geographic information (VGI) provided by pedestrians and cyclists using global navigation satellite systems (GNSS) enabled devices to track their personal mobility (Nelson et al. 2021). Despite the known challenges of VGI, such as participation inequality (e.g., Bergman and Oksanen 2016), the data appears to have vast utilisation potential (e.g. Oksanen et al. 2015, Brauer et al. 2021).

In today's modern society, smartphones and wearable devices integrated with GNSS receivers have become an integral part of everyday life. Individuals use various applications to record their movement as trajectory data. These trajectory datasets would offer invaluable insights into the patterns of non-motorized mobility within urban areas, but the EU's GDPR (EU 2016) and individuals' privacy concerns have hindered the innovative use of personal-level trajectory data. The utility of commonly seen heatmaps from various service providers (such as Strava, Endomondo, and Suunto) has already demonstrated their effectiveness in traffic planning. This approach offers a pragmatic means of harnessing spatially aggregated trajectory data without infringing on privacy concerns, as highlighted by e.g. Sainio et al. in 2015. While more versatile services, such as Strava Metro (Strava 2022), do exist, their usage is currently restricted to "organisations responsible for active transportation infrastructure or those influencing planning processes positively." This limitation excludes start-ups and researchers who could potentially introduce innovative applications for utilising the data.

This has been the basis for us to find solutions for sharing sanitised personal-level location data as open data. As the first step of the process, we created a survey where attitudes towards sharing personal location data and concerns related to privacy protection were investigated (Jokinen et al. 2021). Based on the results of our survey, there seemed to be a positive inclination towards contributing personal tracking data to a privacy-preserving open data repository. The majority of survey participants valued their privacy and emphasised the need for robust data safeguarding measures. The primary driving force behind contributing data appeared to exist around the anticipation of enhancements in biking and pedestrian infrastructure. However, these improvements are geared towards the long term, which raises the question of how immediate feedback could be provided to contributors.

Encouraged by the outcome of the survey, we started designing and implementing a service enabling citizens to donate their personal tracking data and share it in a sanitised form where all data revealing personal identity has been removed (e.g. Mäkinen et al. 2022a and 2022b, Brauer et al. 2023). In May 2023, the pilot service was launched for the public as a Geoportti Research Infrastructure service.

2. Our solution: Geoprivacy platform

The current version of the Geoprivacy platform (Figure 1) has four modules: 1) the Donation module, 2) the Sanitation module, 3) the Statistics module, and 4) the Open Sharing module. Within the Donation module, users have the capability to contribute their trajectory data by uploading it via the designated donation webpage (supported formats: .gpx and .fit). The Sanitation module eliminates personal identifiers from the contributed data, including potentially identifying spatial and temporal attributes. Engaging with the Statistics module grants users access to descriptive statistical summaries derived from their uploaded data. Lastly, the Open Sharing module packages the sanitised trajectories of all users into a downloadable collection database accessible to all registered users and users of the Fairdata IDA service (https://ida.fairdata.fi/).

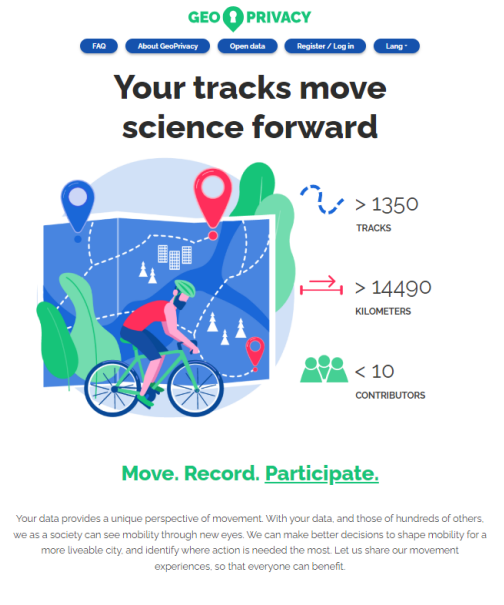

Figure 1. The opening page of the Geoprivacy platform as seen on Aug 31st 2023.

Upon the arrival of data to be processed at the backend, we employ two distinct methods for the purpose of sanitation. Initially, we undertake

trajectory truncation, which hinges on the nearby buildings situated at the trajectory endpoints, as well as potential prolonged pauses along the trajectory route. This truncation procedure is executed using the S-TT algorithm (Brauer et al. 2022). The effective implementation of this method necessitates comprehensive building data pertinent to the specific geographical region under consideration. Consequently, during the pilot phase, trajectory donations can solely be accommodated for trajectories within Finland and only within relatively densely populated areas. Subsequently, the second method involves **temporally shifting the truncated trajectories** (Brauer et al. 2023). The method aligns the first point of each trajectory to the nearest predefined time of the day; these times are defined at regular 6 h intervals. This temporal alignment makes linkages between the obfuscated trajectories and external datasets, such as surveillance camera recordings, significantly more challenging.

3. First experiences of the service

At the time of writing the abstract, the service has been open to the general public for some weeks, but marketing of the service in social media channels is still work to be done. The LBS conference presentation will briefly review the technical solutions developed for the service, and focus on privacy issues raised during the development of the platform, legal aspects tackled during the development of the service, and summarises the first experiences gained during the autumn 2023 on the interest of the public audience towards the service. For others who have a vision of setting up a similar service, we'll provide lessons learned during the development process.

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