Mobility Collector: Battery Conscious Mobile Tracking

Adrian C. Prelipcean, Győző Gidófalvi

Geoinformatics, KTH, Drottning Kristinas väg 30, 44 Stockholm

Telephone (+46)767159117, Fax: (+46)87908580, E-mail address: acpr@kth.se

Tracking and analyzing the location of users to understand, to predict (and ultimately control) the movement of humans (or animals) has been an important part of research in different groups such as human geographers, urban planers, behavioral scientists or movement ecologists. Despite the availability of tracking technology, the above research activities have been limited by: 1)the spatial granularity of tracking data, 2) the willingness of users to share their private 3) the fact that a tracking mobile application drains a user's battery, and last but not least 4) the absence of a generic, configurable, open-source trajectory collector and annotator. Most studies that exceeded this barrier restrict the collection to settings where an obvious "unlimited" power source is available (i.e., taxi cabs and cars). Thus, to combat the aforementioned limitations, this paper describes the features and design of the *Mobility Collector*, a configurable, open-source, battery conscious Android mobile tracking application and provides a prototype implementation that works uniformly across multiple hardware devices and Android OS versions.

According to the official Android developer's web page [weblink], two main parameters are considered when requesting location updates: *minTime*, which controls the location update interval and *minDistance*, which is the minimum distance between location updates. The intended advantage of the method, i.e., battery preserving *equitime* location sampling, is linked to a degradation of spatial data quality. This approach is relevant for the majority of mapping-oriented applications, which require data that is equally distributed in time, but, in the case of tracking services, an implementation that focuses mostly on *equidistance* sampling can be vital in order to accurately determine and infer activities while being aware of the user's context.

The *Mobility Collector* provides high quality data in a battery conscious manner. On one hand, the custom implementation of the *Location Manager* class using a linear movement model based on the recent samples, which duty-cycles the parameters dynamically, allows the data to have a high spatial granularity, making it suitable for different tracking settings (*Figure 1*, *Table 1*). On the other hand, the battery life is considerably extended by using a motion-enabled alarm, which switches the service that gets location updates on and off, thus allowing for any Android phone to be used for data collection without compromising its usability (*Figure 2*). While using the *Mobility Collector*, the usability of a phone is approximately 75% of the daily basis usage plan.

The *Mobility Collector* was designed specifically for research purposes and it offers a high degree of extensibility and usability. First, the source-code will be provided for customization and the platform can be configured either as a standalone client application or as part of a client-server architecture. Second, it provides a configurable user-friendly interface for point- and period-based trajectory annotation. Finally, while the configuration can be done manually by modifying the source-code, a web client that takes configuration-specific parameters (i.e., *equitime* vs. *equidistance* sampling, sampling frequency, annotations, etc.) and produces a version of the application according to specific needs is available.

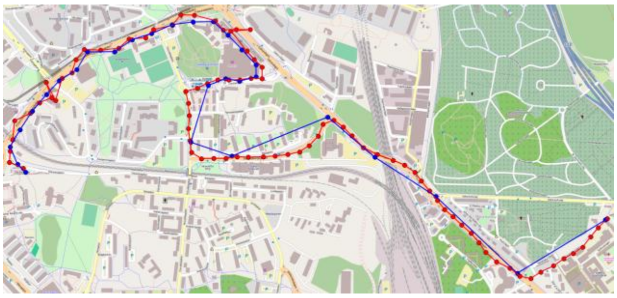

Figure 1. Equidistance (Red) vs. Equitime (Blue) Tracking

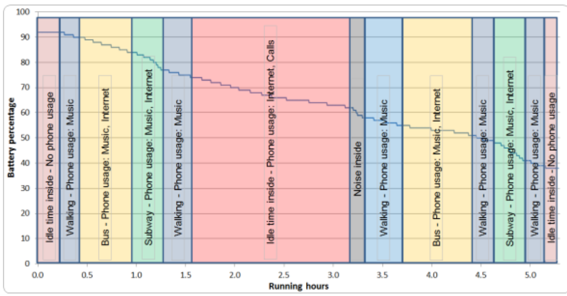

Figure 2. Battery Profile: one day with Mobility Collector

	Equitime (1 minute interval) Tracking	Equidistance (50m interval) Tracking	Equidistance (50m interval) Tracking after Noise Filtering
# samples	29	84	76
Avg. samplingDist (m)	157	61	59
Stddev. samplingDist (m)	134	13	10
% sampleDist < 75m	11%	86%	91%

Table 1. Tracking Statistics for Figure 1