Schedule for last year of research

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Abstract

This document presents the updated schedule for the remaining of research work.

1 Introduction

As a result of the predoctoral examination and the originally planned activities, it has been defined a set of specific tasks that must be fulfilled in order to finish our research work.

Broadly speaking, they refer to three main aspects, namely, integration of components, on-device implementation, and experimentation, which are briefly described in the following sections for giving context to the reader. The detailed schedule for these tasks is presented in Table 1.

2 Integration of components

In first place, there are a number of system modules and requirements that ought to be assembled in the main solution for improving its performance and adjusting to mobile app requirements.

A Human Activity Recognition (HAR) module is already developed and implemented in the mobile device, but not considered by the Cognitive Controller (CC) for adjusting GPS sampling. Thus, it is needed to consume the speed information inferred from the transportation mode identified by the HAR module for fine tuning of the GPS sampling.

In this regard, high speed transportation modes require a faster GPS sampling rate, so that the impact on the observed spatial-time accuracy is reduced. On the other hand, low speed transportation modes could imply that a reduction of GPS sampling rate can be performed with a minor impact on the observed spatial-time accuracy.

Also, it is needed to incorporate the accuracy requirement by the hosted Location Based Service (LBS) in the operation of the CC. For our research work, the accuracy refers to a minimum timespan that must be held between consecutive location update requests.

A low accuracy value would then mean that such timespans are larger than when a high accuracy is requested.

3 On-device implementation

For the on-device implementation, there are a number of modules that are already developed for a desktop version of the system (which was employed during simulations). Thus, it is needed to implement these modules on the mobile platform for completing the actual architecture. The modules are:

- Sigmoid-driven sampling: A sampling strategy that distributes sampling interventions using the non-linearity of the sigmoid function during a visit to a stay point: location updates are more frequent at the beginning and at the end of the predicted stay time, while less frequent at the middle when the user is not likely to exit a stay point.

- Watchdog mechanisms for both *Geofencing* and *Sampling Decision Maker* modules. The Geofencing module verifies the enter and exit events to stay points; however, user speed and a sparse sampling could cause that exit events are not recognized; the watchdog verifies their detection.

  On the other hand, the sigmoid could generate a high frequency sampling that would increase the energy consumption without providing considerable spatiotemporal accuracy improvements; thus, a watchdog would ensure that a lower bound for the sampling is maintained.

- The Geofencing module calculates the distance of the latest fix to a list of stay points. At the moment, the whole list of learned stay points is employed, which increments the amount of distance calculations. Such calculation represent a high energy consumption, so it is needed to reduce the list of stay points, so that only those in the spatioptemporal estimations provided by other components of the system (specifically the Probabilistic Reasoning Machine (PRM)) are accounted for distance calculation and, hence, for producing energy savings.

4 Experimentation

Regarding the experimentation tasks, there is the need for evaluating the system performance on transportation modes other than vehicle (walking and biking). Such experiments could provide a way to refine the system parameters to be employed for specific transportation modes.

More importantly, the system has to be evaluated under location data generated from other users and with larger time intervals. In particular, it is considered to employ available location datasets for evaluation purposes. The exposure of the system to larger and heterogeneous mobility data will help to validate its mobility understanding features and evaluating the obtained energy savings.

Tied to this point, there is also the need for completing a reliable evaluation framework that automatically produces the metrics for analyzing system performance under different parameter values.

Finally, although the differences in existing mobility sensing system solutions make it hard to perform a comparison between them, it is possible to generate an estimation of the overall performance of proposed system solution against other solutions proposed in literature. This could be done not by fully replicating proposed solutions, but by implementing only their core components inside the CC module, and measuring the spatial-time accuracy of generated data in consideration of the energy consumed.

5 Research work activities

Finally, there are research work activities that are needed for obtaining the degree. The English language certification and the thesis writing-review are to be performed at the final two periods, while the thesis defense is planned for the last month of the doctoral program.

#	Activity	2017 Aug	Sep	Oct	Nov	Dec	2018 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
	I Integration of components													
1	Incorporation of the HAR module in the CC	■	■											
2	Incorporation of the accuracy requirement in the CC		■	■										
	II On-device implementation													
3	Implementation of sigmoid-driven sampling				■									
4	Watchdog mechanisms for Geofencing and Sampling Decision Maker modules				■									
5	Refinement of the list of candidate stay points employed by the Geofencing module				■	■								
	III Experimentation													
6	Experiments with larger and heterogeneous mobility						■	■	■					
7	Completion of evaluation framework					■	■	■						
8	Comparison with other solutions									■	■			
	IV Research work activities													
9	Thesis writing-review								■	■	■	■	■	
10	Thesis defense													■

Table 1: Schedule of pending activities of the research work for the last year of the doctoral program.