SWIPE: Monitoring Human Dynamics using Smart Devices

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Abstract. SWIPE is a platform for sensing, recording and processing human dynamics using smart devices. The idea behind this type of system, which exists for the most part on smartphones, is to consider new metrics from wearables – in our case smartwatches. These new devices, used in parallel with traditional smartphones, provide clear indicators of the activities and movements performed by the users who wear them. They can also sense environmental data and interactions. The SWIPE architecture is structured around two main elements, namely (1) an Android application deployed directly on the devices, allowing them to synchronize and collect data; and (2) a server for storing and processing the data. This publication is intended to communicate on the platform with both the scientific and the industry communities. SWIPE is freely distributed under a MIT license.

Key words: Sensing System, Wearable Computing, Activity Detection

1 Introduction

Growth in the market for smartphones and connected devices opens up opportunities for new applications and areas of research. Integrated sensors within the devices allow us to monitor not only of the user's movements (e.g. using an accelerometer sensor) and interactions (e.g. Bluetooth), but also the environment in which they take place (e.g. microphone, GPS).

Recently, many mobile sensing frameworks have been developed to monitor user activities [1]. For example, EmotionSense [2] detects activity, verbal interaction and proximity between members of a group. Another example is SenseFleet [3], a platform to compute driving profiles, by using solely standard smartphone sensors. However, two observations can be made. (1) Very few of these systems are accessible to the public, thus limiting their development to highly targeted business models. (2) Although most of these systems rely on the use of smartphones, more recent devices, such as smartwatches, can bring real advances in understanding human activities and open up new ways of interacting with the user.

In [4], we show that using a smartwatch in parallel with a smartphone could improve the performance of a simple activity and context recognition system

based on Support Vector Machines. In [5], we introduce SWIPE, i.e. the system that we developed for the purposes of conducting our research. The work introduced here is complementary to these papers and aims to present the first released version of SWIPE, which is now freely available online[1] under a MIT license.

2 Overview of SWIPE

Figure 1 shows the overall architecture of the SWIPE platform. The first part of the architecture is a local sensing system, in which the equipment carried by the user uses an Android application. Users can start or stop a recording session from their smartphones. During recording, data is collected automatically by the smartwatch while the smartphone serves as a local data collection point. Because smartphones generally have better energy capabilities and direct access to cellular and Wi-Fi networks, they also serves as a local gateway to the Internet, sending data to a global data collection server through an independent web service. The second part of this architecture is the data storage server, which recovers the data transmitted to the web service and stores it for processing and analysis.

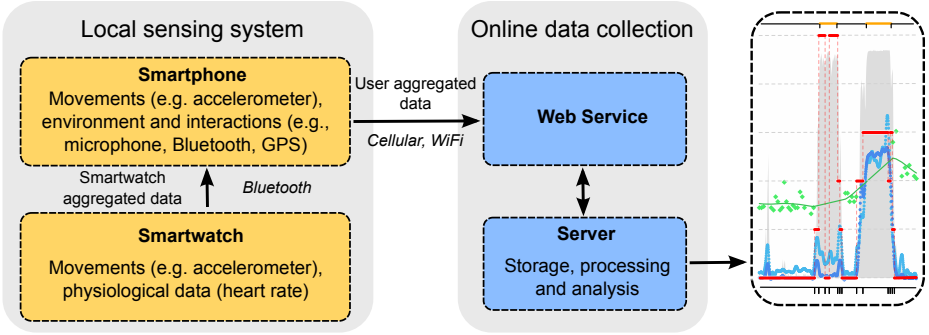

Fig. 1. Overview of the SWIPE architecture.

Currently, the application considers the three sets of metrics described in the introduction (i.e. movements, interactions, environment) in addition to physiological data. The system records include: average and maximum linear acceleration, Wi-Fi access points, Bluetooth and Bluetooth Low Energy devices, heart rate, sound level, battery level, GPS location and speed, pedometer, smartphone proximity sensor, luminosity, information on cellular networks, activity (Google Play Services).

Finally, note that the system we propose adopts certain strategies to conserve battery life and thus facilitates a full day's recording. In [4], we choose to (1)

[1] `https://github.com/sfaye/SWIPE/`

repatriate data on the smartphone from the smartwatch every 20 minutes; (2) send data to the web service only once (at the end of the session); and (3) record data only when it is really necessary (i.e. heart rate only when the user is moving). These points, combined with finely studied recording frequencies (e.g. average linear acceleration instead of raw data), allow us to send more diverse data and process light operations, while saving energy.

3 Excepted results

Our presentation aims to provide visitors with additional technical features that were not included in our main study.

By choosing deliberately to share our work, we open the way to interested developers and present the functioning of our system, in addition to providing feedback on the problems we have encountered during development, which is currently in its early stages. For this, we will be presenting a smartphone and a smartwatch running on Android 5.1 to test the acquisition of data. To illustrate this, a real time collection mode, allowing visualization of environmental and sensory information, will also be presented.

References

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