Demo: Using Wearables to Learn from Human Dynamics

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Abstract

Recent technological advances have allowed the development of miniaturized sensors and the emergence of a wide range of connected objects. Whether it's smartphones or in the broader sense wearables, the diversity of these devices and their accessibility opens up new fields for applications in the computer sciences [2,3]. Smartwatches, which are experiencing a boom on the market, will be integral to the research that will shape the Internet in the years to come, namely big data, sensing systems and human behavior. Our demonstration falls within this context and aims to demonstrate the potential of these emerging technologies to respond to problems and to way of thinking introduced by industry and the scientific community, which are generally limited to smartphone sensing frameworks [1]. Further, we plan to present our research platform, SWIPE, which is dedicated to collecting, studying and learning about human dynamics by means of an ecosystem of wearables. A short presentation video is available online at `http://swipe.sfaye.com/mobisys15/`.

SWIPE architecture

In summary, the SWIPE architecture is based on three fundamental elements described below.

(1) Firstly, the sensing system itself. On the one hand, a smartwatch worn on the user's wrist tracks his direct activity and health indicators, which are mainly provided by a built-in heart rate sensor and a 9-axis accelerometer. On the other hand, a smartphone in the user's pocket determines the context in which he is located by recording, for example, sound data or GPS localisation. Social interaction is determined via technologies such as Bluetooth Low Energy, which normally connect these two devices.

(2) Subsequently, the smartphone serves as a link to a pool of servers responsible for data storage and access management to protect the users' privacy. This Big Data aspect introduces issues related to code offloading and data management, finding a compromise between sample rate, rate of transmission and the consumption of energy.

(3) Finally, when correlated, data collected from a user can turn up some surprising findings. For example, apart from recording the user's heart rate, motion recognition can also lead to conclusions about his lifestyle or even his personality. Image 1 gives an example of data collected on our platform from one of the volunteers.

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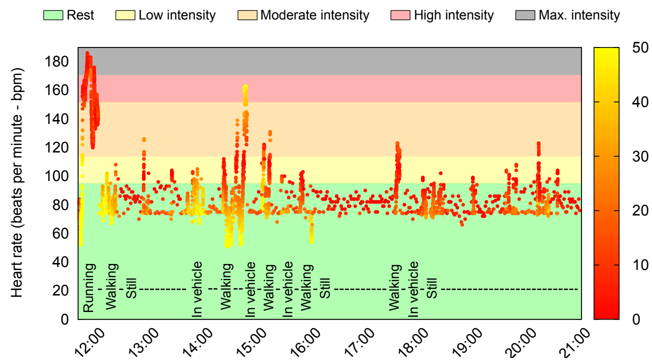

Figure 1: Heart rate profile and detected activities (the color gradient indicates the difference in bpm between the heart rate measured with the smartwatch and the one measured with a heart rate belt).

Demonstration

Our demonstration is divided in two parts.

In the first, we will present the platform to the audience. By the means of a web interface we will visualize aggregated data that we have collected through our experiments on a few dozen users with whom we have an agreement, and derive non-obvious correlations. By presenting the platform architecture and the dataset, we want to demonstrate that the potential of these devices is not limited to specific applications (e.g., sport or health). We also want to highlight issues of energy, reliability and data management that we encountered during our experiments.

In the second part, we will equip a volunteer from the audience with a smartphone (LG Nexus 5) and a smartwatch (Samsung Gear Live) and show how our platform is able to retrieve and visualize data in real time. Further, we will ask the volunteer to perform several basic activities in order to calculate and present a quick assessment of his profile, broken down into several objectives presented as a score. Among them, a stress indicator based on the sensors built into the watch, and on the environmental sensors in the phone.

References

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