An Investigation into the Smart Watch Interface and the User Driven Data Requirements for its Applications

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3 March, 2014

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Problem Statement

With the introduction of smart watches and their recent commercial success evident with the Samsung Galaxy Gear and the Pebble Smart Watch, the question has been posed as to whether these devices can be implemented successfully in the modern digital world in the long term and provide their users with useful and viable solutions to everyday tasks using enhanced human-computer interaction (Bieber et al., 2013).

Smart watches which were available previously on the market offered a limited number of applications at the discretion of manufacturers with no intention of taking advantage of any open source software solutions (Smith, 2013). With the standardisation of an application programming interface and the increasing availability of libraries through software development kits for such devices, new applications can be created more quickly by developers and are able to meet the needs of users more dynamically; penetrating the market faster than in the past (Sachse, 2010). There are already a number of

applications available for smart watches; however there has yet to be an investigation into the need to use such a device over already established mobile platforms and what data the users of such devices would want, especially in situations where mobile phones could be difficult or inconvenient to access (Chyla, 2013).

The device which will be used in the current study is the Pebble Smart Watch [1], which offers users an interface to a connected Android or iOS device through Bluetooth radio technology. The Pebble is powered by an ARM Cortex-M3 processor and runs its own Pebble operating system, which is a customized version of FreeRTOS [2]. It differs from its competitors, the Samsung Galaxy Gear [3] and Sony SmartWatch2 [4], in that it is not a stand-alone device and requires a pairing with a mobile phone within its Bluetooth range (Bieber et al., 2012). The Pebble was selected for this study on the basis of its simplicity and minimalistic e-paper display.

This study aims to investigate the data with which university students deem to be useful, this will be conducted by means of a survey. The differences between how that data is accessed and generated on applications on other mobile platforms such as smart phones will also be analysed. Once it is known what data is wanted by this subset of smart watch users, a set of applications will be developed as a proof of concept based on the data needs.

These applications will then be evaluated by a representative sample of these users in order to ascertain whether smart watches can fill the gap between the multi-functionality of the mobile phone interface, and the convenience of an always available interface on the user's wrist. It should be possible to ascertain with some level of confidence at the end of this study, the relevance of a smart watch interface for users in a university environment and their data needs.

[1] https://getpebble.com/

[2] http://www.freertos.org/

[3] http://www.samsung.com/za/consumer/mobile-phone/mobile-phone/mobile-phone-accessories/SM-V7000ZKAXFA

[4] http://www.sonymobile.com/global-en/products/accessories/smartwatch-2-sw2/

Objective of Research

The objectives of this research project as specified in the problem statement above are to achieve the following goals:

1) Conduct research by means of a survey into whether the smart watch interface is a relevant alternative to the ubiquitous smart phone interface, and the type of applications that university students who would use a smart watch would want based on their data requirements. These requirements can be based on how convenient it is to access data on smart watches in comparison to similar applications on smart phones.

2) Develop as a proof of concept a few of the most popular applications selected by these smart watch users and allow a representative sample of these users to test those applications, reporting on the usefulness of each application in the generation of data.

From the testing of the applications by the end users, the relevance of each data need and the convenience through which such data is accessed must be assessed. It can then be determined whether the smart watch interface is a relevant source of data in comparison to other already established interfaces on mobile devices.

Background and History

The wristwatch has been around for centuries, and has become a standard accessory used for its functional and fashionable aspects in both its analogue and digital forms. However, with the proliferation of the digital age, wristwatches have become increasingly less pronounced in society and the function with which the wristwatch has been associated has become almost redundant and replaced by the technologies of multifunctional mobile devices. The digital watch revolution first began in 1982 with the advent of the Pulsar NL C01 created by Seiko, which was the first wristwatch to differ from the already conventional digital watches from that time period as it incorporated user-programmable memory (Smith, 2013).

Throughout the last 30 years the number of features added to digital watches has increased dramatically with the improvement and the ever increasing miniaturisation of electronics. By the beginning of the 21st century IBM launched what would be the first modern smart watch which had fully programmable memory, the capability of external device interaction and Internet services, running a version of the Linux operating system and powered by an ARM processor. This allowed the end user to create applications for their devices, but the implementation was hindered by the lack of a standardized application programming interface (API) and the devices limited memory and processing power. The IBM variant of the smart watch was thus not commercially successful (Narayanaswami et al., 2002).

Data processing on modern smart watches is thus not done on the smart watch itself but rather sent to the paired mobile phone (Bieber et al., 2013). The processing of any data can be done on the more powerful processor cores of the paired smart phone, while data can be communicated back and forth between devices (Chyla, 2013). Unlike smart watches from a few years ago, the modern variants are able to utilise and take advantage of recent advances in hardware allowing power consumption to be less of a limitation in the underlying architecture and resulting in considerable performance gains (Treacy, 2013).

The concept of the smart watch as a whole is to keep the convenience of the conventional wristwatch while maintaining the same multi-functionality and high level convergence of modern mobile technologies in situations where the use of a mobile phone would be considered impractical (Bieber et al., 2013). The new generation of smart watches look set to open up new possibilities in the mobile sphere of modern digital electronics and push the boundaries of any smart watches which preceded them.

Approach

This project will be done in phases until completion. In the first phase, a questionnaire will be designed targeting university students in various departments at Rhodes University after the appropriate documentation is approved by the ethics committee. The questionnaire will focus primarily on asking

whether or not such an interface would be utilised if they had access to one, in addition it will be geared towards the impact of such an interface on the generation of any data they would want. It should be discovered how the access to that data would differ from the already conventional mobile phone interface. The responses from these questionnaires will be evaluated and the general trends in data requirements will be noted in preparation for the next phase.

Phase two will consist of developing applications for the Pebble smart watch to generate the data requirements of the respondents found in the previous phase. These applications will be developed for Android devices via the PebbleKit Software Development Environment which is freely available from the Pebble website.

Phase three will consist of the developed applications being used by a sample of the smart watch users at Rhodes University, whereby the usability and effectiveness of each application will be tested on the Pebble device and compared to similar applications already available on the mobile phone interface. The mobile phone which hosts the Pebble smart watch will be used for this comparison by running applications on the device which generate the same relevant data to users found in phase one. Once the users have evaluated the applications on the Pebble smart watch and the host smart phone device they will have to complete another questionnaire aimed at comparing the ease of use and accessibility of data on each device, this questionnaire will also be approved by the ethics committee before being used.

Requirements and Resources

The following Hardware and Software will be used in the project.

Hardware:
•Pebble Smart Watch
•Mobile Phone running an Android Operating System
•Desktop Computer

Software:
•PebbleKit SDK Version 2.0.1 or higher
•Linux Ubuntu

Project Timeline

Table 1: Project Timeline

Date	Task
28/02/2014	Project Proposal Submitted
04/03/2014	Seminar 1: Explain Research Goals and Project Outline
06/03/2014	Begin Design of the questionnaire to investigate data requirements of smart watch users (Phase 1)
24/03/2014	Begin deployment of questionnaires to students in their afternoon practical sessions
01/04/2014	Collate data from questionnaires and begin noting ideas for possible applications baed on the collated data
30/05/2014	Literature Review and Plan of Action to be submitted
02/06/2014	Begin Development of the Pebble applications (Phase 2)
06/06/2014	Begin designing the evaluation questionnaire for use at the end of the application development process
29/07/2014	Seminar 2: Report on data found and applications being developed
01/09/2014	Final application testing to be done on the representitive sample, collate data found (Phase 3)
15/09/2014	Short paper to be submitted
27/10/2014	Seminar 3: Report on findings
31/10/2014	Complete Project Thesis to be Submitted

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