The Detection of Distinct Gestures by a Pebble Smartwatch

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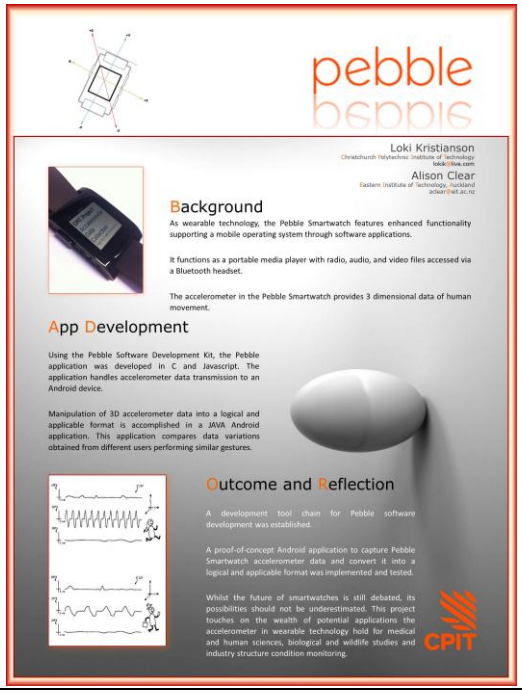
ABSTRACT
This project deals with the research into and development and implementation of a proof-of-concept software application for an Android mobile device. The purpose of the application is to connect to a Pebble Smartwatch to receive accelerometer data of human movement, and convert the data into a workable visual format for possible future use. A proof-of-concept software application for an Android mobile device was developed, implemented and tested The two major problems experienced during the project were the internet browser dependency for PebbleCloud development and the bridging of the gap left by the fact that Pebble does not support Windows for its software development kit. The Quality Assurance and Risk Management Plans pertaining to the project are discussed in view of the true results measured against it.

Categories and Subject Descriptors
H.1.2 User/Machine Systems

General Terms
Performance, Design, Experimentation,

Keywords
Smartwatch, software engineering, HCI, experimentation



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1. INTRODUCTION
Pebble Smartwatches are brand new to the market, a range of questions exist around the existing and future applications of smartwatches, development of software solutions for use on smartwatches and ultimately the inclusion of relevant theory and practice in future learning plans of the software development courses at CPIT. As a result, the software team allowed the inclusion of this project to further the research and development results surrounding smartwatch applications. The project centres around the accelerometer functionality of the Pebble. The final brief was to develop and Android mobile device application which could detect and assimilate the accelerometer data and convert it into a logical and applicable format for use in future-identified applications.
At the outset of the project, five objectives were set:
1. Research of smartwatch technology and current applications for accelerometer technology
2. Establish hardware- and development requirements for software development with the Pebble Smartwatch
3. Identify a solution/s to the research question of how to represent Pebble accelerometer data
4. Develop and implement a proof-of-concept application
5. Compile a poster, presentation and this report
Three milestones were achieved:
1. A software development toolchain was established and documented
2. Research into Pebble, smartwatch technology and accelerometer application was conducted and documented
3. A proof-of-concept software application for an Android mobile device was developed, implemented and tested

2. PROJECT DEVELOPMENT
A research-based foundation was established for the development of a proof-of concept application pertaining to Pebble Smartwatch accelerometer data detection, inclusive of a documented Software Development Tool Chain.

2.1 Development Tool Chain/s
A software development tool chain is the set of programming tools that are used to create a software application. It is referred to as a "chain" as the output of each tool becomes the input for the next.

2.2 Pebble Smartwatch applications
Pebble Technology promotes the Pebble Software Development Kit (SDK) as a primary software application development vehicle for applications to be operated on the Smartwatch. The SDK is supported for Linux and iOS, but not for Windows. Windows developers are referred to CloudPebble, a 3rd party product endorsed by Pebble Technology, for development of "primary" Pebble Applications. Compiling and running is done via Bluetooth between the development device, the mobile device and the Smartwatch, the only prerequisite being that the development device and the mobile device need to be on the same wi-fi network.

2.3 Android Mobile applications linked to the Smartwatch

To develop an Android application receiving data from the Smartwatch, the SDK import needs to be done via Linux or iOS. Software development is done on the Linux or iOS platforms. Compiling and running of the software is safest done with a USB cable connection.

3. DETECTING GESTURES WITH THE PEBBLE SMARTWATCH

The Pebble 3D accelerometer measures patterns of motion with a so-called "waveform signature" result. Pebble claims that signature, when used in a series of dynamically adjusting algorithms based on the type of detected motion, provides accurate, verifiable activity data for users of all activity levels. The device can determine total steps, activity time and speed to calculate distance and caloric burn. Pebble's algorithms are upgradeable, allowing for new and updated features to be added to the device. The Pebble hardware accelerometer is able to detect taps, perform measures at a given frequency, and transmit samples in batches to save CPU time and processing. The Pebble API relates accelerometer data events on a three-dimensional axis enumerated as raw x, y and z 16-bit signed integers. Each value is measured in milli-Gs. The Pebble accelerometer is calibrated to measure a maximum acceleration of +/- 4G, resulting in a range of possible values for each axis is -4000 to +4000. A "vibrate" service and timestamp parameter lends further opportunity to application development. Pebble allows watch-applications that support a three-dimensional range of physical gestures and motion movements. Twisting and shaking of wrist, up and down arm movements and possibly different swimming strokes can be detected.

4. PROOF-OF-CONCEPT SOFTWARE APPLICATION

The proof-of-concept application was planned to consist out of four development stages.

4.1 Stage 1

Develop Pebble Smartwatch application prompting the user to initiate accelerometer data activation with movement of the watch. A 'Hello CPIT' application was developed with the Pebble Software Development Kit with the C programming language. (In the absence of an available Android mobile device, it was hosted on an iPhone 5.) Adapting the Hello CPIT code with addition of button handlers and JavaScript, the application prompting the user to initiate accelerometer data activation with movement of the watch, could be finalised.

4.2 Stage 2

Extend the Stage 1 application to have 3D accelerometer data displayed on the Smartwatch screen The Pebble Developer website, albeit incomplete and outdated in some respects, provides comprehensive introductory chapters to developing applications and working with the various available features. Using the Pebble Accelerometer assisted in acquiring basic knowledge and skills to enhance the application created in Stage 1, to reflect real-time accelerometer data on the Pebble watch-face.

4.3 Stage 3

Develop a JAVA software application for an Android mobile device which could visually represent 3D data. Java development was done in the Eclipse Integrated Development Environment (IDE). The initial application was done in Windows using the Java GraphView library (by JJOE64). 3D x, y and z data values were randomly generated. These data values ranged between *+4 and -4 (which is the Pebble Smartwatch accelerometer data range as more fully set out in the theory above). Data was represented in a line graph with different colors for x, y and z.

4.4 Stage 4

Establish a connection between Stages 2 and 3 above with the Pebble Smartwatch transmitting and the Android mobile device receiving the 3d accelerometer data and visually representing it.

5. PERSONAL REFLECTION

Having completed tertiary studies in South Africa in 1992, this experience proved vastly different to that I had as a young student - in a time where lecturing with computing aids was unheard of. It has been an exceptional experience and I have acquired a whole new world of knowledge – unfortunately, as with any study, the knowledge only really starts to germinate results once it is applied in practice.

6. CONCLUSION

At the conclusion of this project three milestones were achieved:

1. A software development toolchain was established and documented
2. Research into Pebble, smartwatch technology and accelerometer application was conducted and documented
3. A proof-of-concept software application for an Android mobile device was developed, implemented and tested.

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