SESSION BASED ACTIVITY MONITORING APPLICATION FOR ANDROID

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PROJEK SARJANA MUDA II

Tajuk Projek : **SESSION BASED ACTIVITY MONITORING APPLICATION FOR ANDROID**

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Specially dedicated to my beloved father and mother, the one and only

Tan Leong Tek and Gan Bee Lian

as well as my whole family who have encouraged, guided and inspired me

throughout my journey of education.

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ABSTRACT

Nowadays, technological advance especially in development of Android application has grown rapidly. In addition, the innovation of mobile android application with the capability of several sensors give an alternative way for human to monitor their health. Unfortunately, current suitable application to monitor several activities are limited. Hence, the objective of this project is to develop a session based activity monitoring system which including motion sensors, location tracking by using GPS and heart rate measuring. Besides that, the data collected is then stored in an internal storage. Generally, this project involves of software and hardware implementation. For the software implementation, this project using Eclipse software which utilizes Java language to develop programming work. Throughout the end of this project, all the software and hardware implementations together with the layout designing work will be combine together to form a monitoring system which are able to run in mobile phone.

ABSTRAK

Baru-baru ini, kemajuan teknologi telah mengalami pertumbuhan yang pesat terutama dalam pembangunan aplikasi Android. Tambahan pula, inovase telefon mudah alih memberikan penyelesaian alternatif kepeda kita untuk memantau kesihatan kita. Malangnya, aplikasi yang sesuai boleh digunakan untuk memantau aktiviti-aktiviti amat terhad Oleh itu, objektif projek ini adalah melaksanakan sistem aktiviti permantauan berdasarkan aplikasi android dengan adanya sensor pergerakan, pengesanan lokasi serta pengukuran kadar degupan jantung. Selain itu, data-data yang dikumpul akan disimpan dalam simpanan dalaman yang terletak dalam telefon mudah alih. Secara umumnya, projek ini melibatkan perlaksanaan perisian dan juga perkakasan. Untuk perlaksanaan perisian, projek ini menggunakan perisian Eclipse dengan menggunakan Bahasa Java untuk melakasanakan kerja pengaturcaraan. Sepanjang akhir projek ini, semua perlaksanaan perisian dan perkakasan sekali dengan reka bentuk susun atur menggabungkan untuk menjadi satu system aktiviti permantauan yang dapat fungsi dalam telefon mudah alih.

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GPS	-	Global Positioning System
OS	-	Operating System
ECG	-	Electrocardiography
PPG	-	Photoplethysmography
SDK	-	Software Development Kit
API	-	Application Programming Interface
ADT	-	Android Development Tools
JDK	-	Java Development Kit
ADV	-	Android Virtual Device
GUI	-	Graphical User Interface
USB	-	Universal Serial Bus

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CHAPTER I

INTRODUCTION

1.1 Project Introduction

In the era of globalization, technology is everywhere and keep growing in the global market especially for the smart phone device. Nowadays, smartphones are becoming one of the sophisticated technology in the world. Most of the people own smartphone in this 21st century. Due to the development and competition of smart phone, the number of applications available for downloaded are rapidly increasing. There are a lot of services or information provided pertaining to education, business, social media, entertainment, fitness exercise and so on in the smartphone applications. The application development of android not only based on education, entertainment, social media, business but it has wider development on health care application as well.

Nowadays, healthcare applications development using smart phone become one of the top 50 best android applications. This is because nowadays more people concern about health care due to the number of patients in the hospital is keep increasing. In addition, capability of sensor technology located in smart phone can monitor people activity much easier. Activity monitoring play an important role in health care system whereby users do not have to go to the hospital or clinic to monitor their body conditions. Instead, self- activity monitoring can improve medical care and

reduce the medical treatment cost since it is using smartphone which having Android platform.

According to the survey in 2014, Figure 1 shows that Android has the highest percentage of mobile Operating System (OS) in Malaysia market with 79.2%, followed by other OSs at 10.7% and Blackberry at 4.1% [1]. The reason Android leading in mobile operation in Malaysia market is mainly because Android is an open source operating system and can be embedded to any devices.

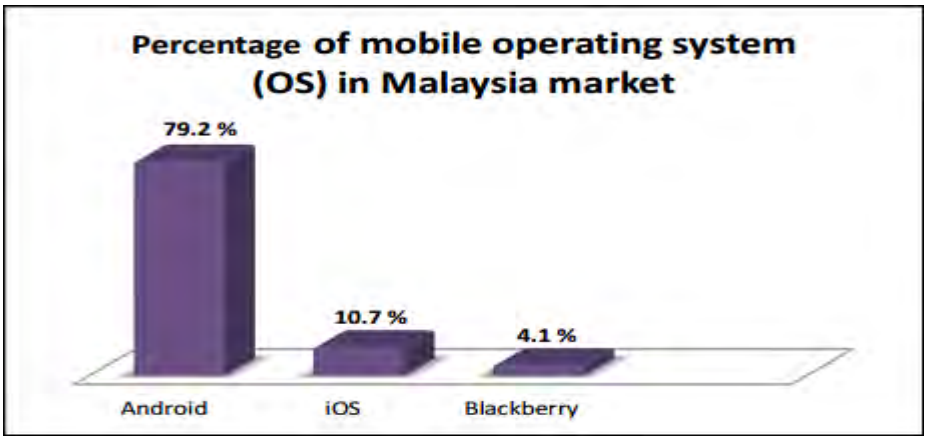

Figure 1: Percentage of mobile operating system (OS) in Malaysia market [1]

1.2 Problem Statement

Nowadays, the activity monitoring application using wireless communication becoming more popular. However, there are some limitations for current activity monitoring Android application. Current application are using 3 axis accelerometer sensor to monitor the movement of individual while doing a specific activity. This sensor only measure the directional movement of a device but unable to measure the orientation correctly during a movement from the activities. This can sometimes give an incorrect data. Furthermore, 3 axis accelerometer are not be able to measure data during a movement from complex activities such as rowing.

This application are implementing a 9 degrees of freedom accelerometer sensors. This sensors consist of three sensors which are accelerometer, gyroscope and

gravity. By combining this three sensors, the monitoring becomes more precise especially during complex activities. Besides that, the developers are able to utilize their own algorithm on the detection for more flexibility by getting nine degrees of freedom accelerometer data.

Besides that, the existing system used for health monitoring only available in hospital or clinic and the size of the device and equipment are huge. However, there is a situation where the heart rate is unable to be monitored by such device especially while doing exercise like jogging. Although the heart rate monitoring from the ECG device is more accurate, but a person need to regularly visit the hospital for the checking. Normally device like Electrocardiogram (ECG) is been used for monitoring heart rate at the hospital. As such, an application using Zephyr Bluetooth wireless connection is created to monitor people while doing specific activities. It is a device without using wired connection and subsequently reduce the hardware cost.

1.3 Objectives

The aim of this project is to develop an Android App to monitor and record the available sensor reading in the smart phone for a specific activity or task. In order to achieve that, a few objectives have been made for this project which are:

- To acquire the basic information data such as heart beat, accelerometer and GPS while doing the specific activity.
- To display the accelerometer, heartbeat and GPS data in the form of table, graph and map on the smartphone.
- To publish the application online and frequently improve the application based on the user feedback

1.4 Scope of Project

The usage for this application is to run their outdoor activities. The activities are specified on three activities but not limited to Jogging, Walking, Cycling, and Running. This activity will be monitored based on the accelerometer, GPS and heart rate. Acceleration data collected from the start time and stop time were recorded into internal storage. Furthermore, Zephyr heart rate monitoring device which are the only hardware using in this project is integrating with the smart phone to get the heart rate for users. Information data is collecting from smart phone and display in the form of graphical to the users when doing a specific activities like jogging and cycling. In addition, GPS track the current location of users and shows it in the map. Furthermore, an analysis will be performed on the data collected in the form of table, graph and map in order to monitor users when doing a specific activity. Finally, a mobile phone application for monitoring the activity of an individual will be published in the Google Play Store and collecting the feedback from the users for the further improvement.

CHAPTER II

LITERATURE REVIEW

This chapter includes the previous studies that are related to this project which are using motion sensors in activity tracking purpose, heart rate detecting using smartphone application and tracking location using GPS. This chapter also includes a discussion on comparison of existing and proposed sensors as well as heart rate device.

2.1 Android

Android is a platform used for development applications in mobile phone. Android SDK provided different application programming interface (API) used for develop Android application. Google had bought Android in 2005, in other words, Google owned Android starting from 2005. The coding for application development can be verified in emulator which has the same function as mobile phone before install the APK file into mobile phone. Android keep updating the operating system started from Android 1 in Nov, 2007 until the Oct, 2013. The latest OS that had been developed by Android is Marshmallow (6.0) that was released in October 2015 [2]. Figure 2.1 shows a timeline of the Android API from 2007 until 2013.

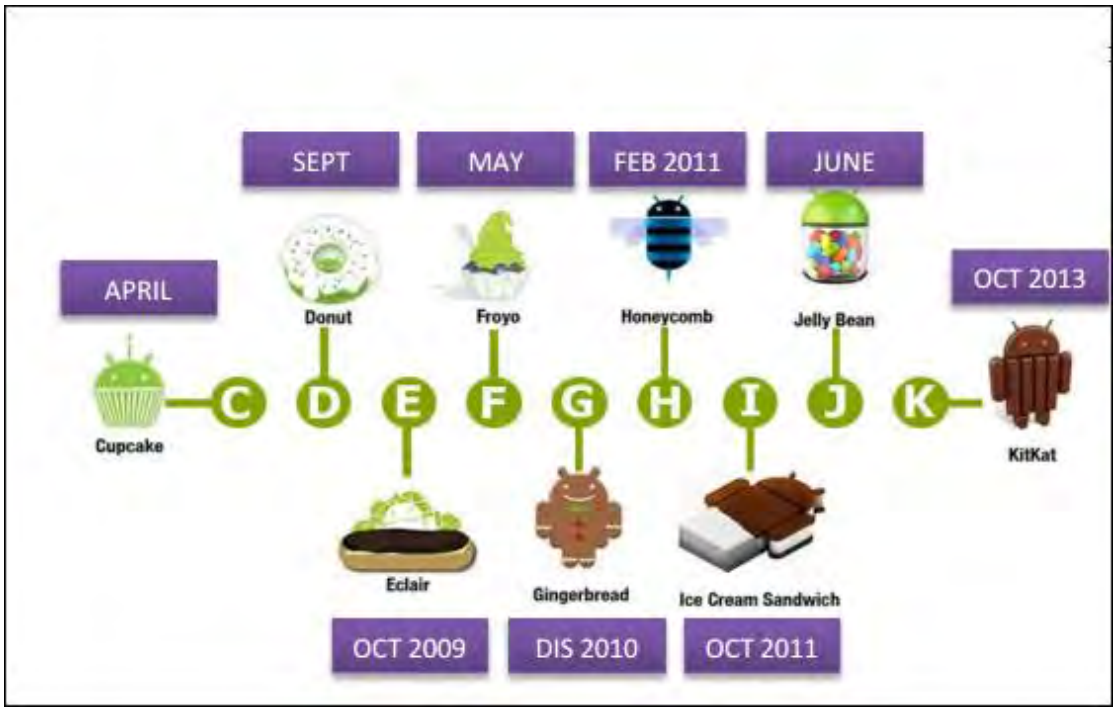

Figure 2.1: Timeline of Android [2]

2.2 Accelerometer sensor

Accelerometer in mobile phones are used to measure the orientation of the phone device as well as linear acceleration of movement [3]. Accelerometer consists of three axis X, Y and Z as shown in figure 2.2. Accelerometer that has been used rapidly in smart phones sensors based activity monitoring. This is because accelerometer can directly measures the motion of the movement. For example, if user is jogging, it will reflect the huge changes of data in the X, Y and Z axis and a big changes in the amplitude of the graph. All the forces acting on mobile phones are able to be detected by accelerometer. If the device is slightly uplift, the z axis in accelerometer shows the positive value data and the value will be more than 9.81. Furthermore, if the device is move to the left side, the X axis will give a negative value.

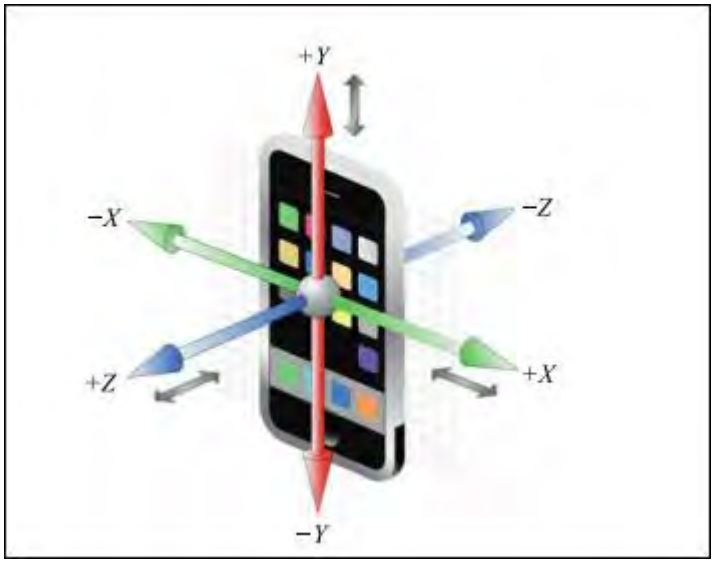

Figure 2.2: Accelerometer sensor in smart phone [3]

2.3 Gyroscope sensor

Smart phones use gyro sensor to detect the orientation of the device. The difference between gyroscope and accelerometer is that gyroscope has an additional dimension of tracking the rotation. In order to measure the rotation rate, Gyroscope detecting the roll, pitch and yaw motions of the smartphone along the X, Y and Z axis as shown in figure 2.3 [4]. It gives a reading zero when the device is kept on a plane horizontal surface. The application for gyroscope sensor is very useful in 3D racing games where users are able to control the car by rotating the smartphone device.

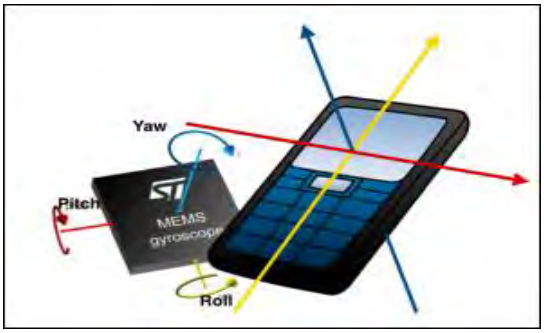

Figure 2.3: Gyroscope sensor in smart phone [4]

2.4 Gravity sensor

The gravity sensor is comes from the 3 axis accelerometer sensor. It measures the vector components of gravity when the device is at rest or moving slowly. Normally, when a user do a movement during an activity, the movement forces are showed in the accelerometer immediately. Gravity sensor located in smart phone filtered out the forces for movement and the only remaining force was a steady force, which is gravity [5]. A very good example for gravity sensor usage in smart phone is game control using tilting motion. Figure 2.4 shows a gravity sensor in smartphone.