SMARTPHONE BASED HEARTBEAT VIEWER

NIK SYAZWI BINTI NIK MANSOR

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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Faculty of Electronic and Computer Engineering
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ABSTRAK

Idea di sebalik projek penyelidikan ini adalah untuk membangunkan informasi penjagaan kesihatan melalui teknologi telefon pintar dengan merekacipta satu aplikasi perisian Android. Umumnya, aplikasi ini akan memfokuskan untuk melaksanakan satu sistem bagi mengesan status dan keadaan kadar denyutan jantung seseorang pengguna itu. Segala keputusan dan maklumat berkenaan kadar denyutan jantung pengguna akan dipaparkan pada skrin telefon pintar. Idea ini dilakukan dengan menggunakan kamera bercahaya bagi mengesan denyutan pada hujung jari. Informasi berkenaan kadar denyutan jantung ini boleh dikesan selepas gambar yang ditangkap dari hujung jari pengguna melalui kaedah pemprosesan imej. Maklumat tentang kadar denyutan setiap minit (*bpm*) akan dipaparkan dan pengguna bole melihat graf seperti ECG pada skrin telefon pintar pengguna. Bukan itu sahaja, pengguna juga boleh memilih samada untuk menyimpan segala data dan maklumat yang telah dianalisa. Segala data dan maklumat yang disimpan akan ditunjukan sebagai sejarah dalam aplikasi ini. Sebagai kesimpulannya, projek ini dijangka akan menjadi satu aplikasi yang berfaedah apabila pengguna boleh memeriksa keadaan kadar denyutan jantung mereka di mana-mana sahaja dan pada bila-bila masa.

Kata Kunci: Telefon Pintar; Aplikasi Android; Kadar Denyutan Jantung

ABSTRACT

The idea behind this project is to develop healthcare information through Smartphone technology by creating an application of Android. This application is basically focused to implement the system which to detect the heart rate status condition of the user. All the result and information regarding the heart rate of the user will be displayed on the screen of user's Smartphone. This idea was done as the flash camera will be used to detect pulse on the fingertip. The information of the heart beat can be detected after the image captured from the user's fingertip undergoes image processing technique. The information of beats per minute (bpm) will be showed and the user can observed the ECG-like graph which will be displayed on the Smartphone. Not only that, the user also can choose either to save the data and information which has been analysed. All the saved data and information will be displayed as the history in this application. At the end, this project was expected to be useful application as user can check their heart rate condition at anywhere and anytime.

Keywords: Smartphone; Android Application; Heart Rate

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ROSMAN BIN ABD. RAHIM
Pensyarah
Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Karung Berkunci No 1752
Pejabat Pos Durian Tunggal
76109 Durian Tunggal, Melaka.

Tarikh: 15/6/2012

Tarikh: 15/6/2012

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SIGNATURE : ……

SUPERVISOR'S NAME : KHAIRUL MUZAMMIL BIN SAIPULLAH

DATE : 16 JUNE 2012

For my beloved father, mother and families

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LIST OF ABBREVIATIONS

2D	-	Two Dimensional
3D	-	Three Dimensional
6 MWT	-	Six Minutes Walk Test
AD	-	Alzheimer's disease
ADT	-	Android Development Tools
AVD	-	Android Virtual Device
App	-	Application
bpm	-	Beats per Minute
CPU	-	Central Processing Unit
CVD	-	Cardiovascular Disease
ECG	-	Electrocardiograms
IBM	-	International Business Machines
IDE	-	Integrated Development Environment
LED	-	Light Emitting Diode
NDK	-	Native Development Kit
OHA	-	Open Handset Alliance
OS	-	Operating System
PC	-	Personal Computer
PDA	-	Personal Digital Assistants
PPG	-	Photoplethysmography

QOL	-	Quality Of Life
RGB	-	Red Green Blue
SDK	-	Software Development Kit
US	-	United States

CHAPTER 1

INTRODUCTION

1.1 Introduction

Our technological future has showed some improvement these past few years. Through the years, this technology becomes wider and more develop than before. We as people that carry the role as the technology users has to pay attention to trends, technologies, and possibilities in order to remain relevant in the lives of our users. Nowadays, many people are further pushing the boundaries of services that can be delivered on Smartphone. There are focusing on mobile messaging, mobile access to information and many more. A Smartphone is a mobile phone like iPhone, Android, Blackberry or Symbian offering advanced capabilities, often with PC-like functionality. Smartphone run operating system software which provides a standardized user interface and platform for software applications. Smartphone have advanced features like e-mail, Internet, e-book reader capabilities, enhanced video camera, touch screen keyboards and much more. In short, Smartphone are miniature computers that have phone capabilities.

The demand for these advanced mobile devices which boast powerful processors, abundant memory, and large screens and open operating systems has outpaced the rest of the mobile phone market and is anticipated to continue for years to come. In general, a Smartphone will be based on an operating system that allows it to run applications. Apple's iPhone runs the iOS, and BlackBerry Smartphone run the

BlackBerry OS. Other devices run Google's Android OS, HP's webOS, and Microsoft's Windows Phone. Thus, pursuing on this matter there is some idea on giving the service and sharing the information and important data in the aspect of health care through Smartphone and specifically by using Android Operating System.

The point of this study is on the development of wireless patient monitoring system that can monitor heart beats in real time environments. Now, there are lots of devices which are portable and easy-to-use in that field. It has been developed with multiple functions not only real time monitoring but also doing signal analysis and signal transfer to doctors using wireless communication technology. It means that patient can receive healthcare services such as prevention, diagnosis and prognosis management at any time and in any place [1]. As we know the heart beat usually only can be displayed on the electrocardiograph (ECG) machine. The idea behind this project is to develop healthcare information through Smartphone technology by creating an application of Android. The flash camera will be used to detect pulse on the fingertip. The information of beats per minute (bpm) and ECG-like graph will be displayed on the Smartphone. The result of the analysis is displayed on the Smartphone. This application program on Smartphone gives the health care information to patients and doctors and would be useful for patients who have chronic heart disease that will act as their daily basic check-up.

Figure 1.1: Electrocardiograph (ECG) machine

1.2 Objectives

The objectives of this project consist of three parts which are:

1. To design and implement an application of Android that giving the service and sharing the information and important data of heart rate in the aspect of health care through Smartphone.
2. To convert the image to analyse the beat per minute by detecting the pulse on the fingertip uses the flash camera and image processing process.
3. To verify and analyse information based on result shown on the Smartphone.

1.3 Problem statement

The electrocardiograph (ECG) is a diagnostic tool that measures and records the electrical activity of the heart in exquisite detail. Interpretation of these details allows diagnosis of a wide range of heart conditions. In an ECG test, the electrical impulses made while the heart is beating are recorded and usually shown on a piece of paper. This is known as an electrocardiogram, and records any problems with the heart's rhythm, and the conduction of the heart beat through the heart which may be affected by underlying heart disease [2]. Although the information obtained by this machine can be very useful, the service and cost of this machine is very expensive. On the other hand, the size of this machine is big and for now, it is normally available as the facility in the hospital. Thus, to overcome this problem this present paper was proposed to develop a personal healthcare device which is Smartphone based heart beat viewer. This is because the devices that will be created in this research have some valuable aspects which are portable and easy to use in any field. Furthermore, it can be downloaded as an application in users Smartphone.

With the increasing number of patient worldwide, it would also be expected to increase the demands in health and social care. A potential solution to these demands for care provision is the use of Smartphone technology. Smartphone handsets now offer the potential for explicit and implicit interactions using buttons, touch screens, motion sensing, and voice recognition. This alongside high degrees of connectivity supports handsets to capture, analyze, and distribute large amounts of

data securely across great distances. A major benefit of Smartphone is their ability to connect and interact with other devices through wireless communications along with supporting a variety of software applications. Therefore, considering the opportunities provided by this broadening of the modes of interaction, functionality, and the connected nature of mobile phones, a more clinically valid approach to Smartphone technology is being investigated.

Monitoring of vital physiological parameters is important not only for patients, but for healthy humans as well, because it allows adjustment of the intensity of physical exercise according to the current level of capacities and age. Thus, by completing this research the device is not only useful for the patient but also can be used for everyone.

1.4 Scope of the project

1.4.1 System Operability

The prospect for this project is to develop one Android application. This application can be downloaded by any users that have Android operating system on the Smartphone. This application also can be one of the systems that can be used as a daily basic check up for heart rate monitoring. This application can detect beat per minute (bpm) value and displayed the ECG-liked graph within all range of age. All the resulted data and information can be viewed as it will be displayed on the Smartphone screen.

1.4.2 System Functionality

For system functionality, this application consists of three layouts which are main layout, analyze layout and history layout. Start button, history button and exit button are three types of different buttons with different function available on the first layout which is main interface layout for this application. After main layout, this application will followed by the analyze layout that consists of two buttons which are save and exit button. Lastly is history layout that will displayed the number, date, time and heart rate value in bpm that have been saved in

this application. All of these features in this application will be further discussed on the result and discussion part.

1.4.3 System User

Publics who have Smartphone and Android as its operating system can download this application all the time. Other than that, professional like medical doctor can use this system as one application in monitoring the heart rate of their patient. This application then can be suggested by the doctors to their patient. The patient can apply this system as their daily basic check-up before they need to refer to their personal doctor for further treatment. Athletes also can use this application to check their heart rate during exercising or during rest time to check any irregularities or some abnormal situation occurs on their health.

1.5 Thesis outline

In this thesis outline will be covered in five chapters. The first chapter is for Introduction. This chapter covers the introduction of the project, objectives, problem statement, and scope of the project.

For the second chapter, will be represent the literature review that related to this project. The methodologies will be cover in chapter 3. Results and discussion will be further explained in chapter 4. The conclusion will be covered in chapter 5.

CHAPTER II

LITERATURE REVIEW

In this chapter, reviews will be made regarding the history of Smartphone, Android operating systems and its development, ECG machine that characterized the heartbeat condition and lastly the Smartphone application specifically that has be used to monitor healthcare. This review has been made based on the journals, articles, engineering handbooks and electronic letters.

2.1 The History of the Smartphone

The popularity and range of Smartphones has exploded in the last few years, but it was said that Smartphone first appeared nearly 20 years ago in 1992 [3] even though they were not called Smartphone back then. In the year of 1992, IBM was launching 'Simon' which was a nickname for the first phone launched which could do much more than make and receives calls and sends texts. It was incredibly advanced for the time and offered amongst other things a calendar, world time, address book, notepad, and emails and even had a touch screen. During that time, it was only available in the US.

During the late 90′s which around in the year of 1996, Nokia launched a range of phones aimed at business users. This range started with the hinged Nokia 9000, which was a cross between a phone and a PDA, and was quickly followed by the 9210, 9300 and 9500. The Nokia 9210 was one of the first phones to use an open operating system. A year later (1997), the first handset to actually be called a Smartphone was the strangely named Penelope from Ericsson was born. This was a concept phone and only around 200 units were ever made, but it paved the way for Ericsson to develop the R380 a few years later. Ericsson's development of their concept phone Penelope led to the launch of the R380 in 2000, the first phone to be marketed as a Smartphone. It featured both communication and PDA functions and used a clever touch screen which could be covered by a hinged keyboard when it was being used to make calls. The R380 was the first commercially available Smartphone to use the Symbian OS.

Year 2002 was a busy year for Smartphone and saw the release of the Palm Treo with its full query keyboard, the P800 from newly merged Sony Ericsson and the first ever Blackberry. The P800 added several new features to the Smartphone market, including a MP3 player and a colour touch screen. Blackberry concentrated on providing wireless email access which something it continues to do and provide today. This year was called as mobile media platform for the history of Smartphone. In the year of 2005, Sony Ericsson launched the N-series of Smartphone. This series of phones were initially marketed as mobile multimedia computers. The N-series continues to improve and innovate year after year and has become a favourite of business people. During this year, some consumers doubt whether the device that have been launched was called as Smartphone or multimedia PC.

The much-hyped and subsequently much-loved iPhone hits the shops and sells by the bucket load in the year of 2007. The Apple brand undoubtedly helps to sell the phone, but it is the success of the App Store in 2008 which keeps it ahead of the game. To date there are close to 200,000 commercial and free apps available to iPhone users, turning the iPhone into everything from an art studio to a spirit level. In the year of 2008 also, we can see the arrival of Android. In was influenced as the developed as an open-source product and backed by Google, HTC, Intel and several other influential companies, Android was touted as the future for Smartphone

Operating Systems. The first phone to use this new OS was the HTC Dream (or T-Mobile G1 as it was also branded). Android is quickly becoming a favourite OS for Smartphone manufacturers and it is thought that there are already 70 000 applications available.

During the year of 2009, we can see several companies launch their own App Stores, including Nokia's Ovi Store, Windows Marketplace for Mobile and Blackberry App World. Android sees its market share grow from 3% at the start of 2009 to nearly 20%. It is a fairly quiet year for Apple, with iPhone fans waiting for the new iPhone 4 handset due out the following year. New versions of the iPhone 3 appear, including the 3GS. Many Apple fans object to the wallet-busting price tag for even a standard model. A year later (2010), Apple announces reaching the 3 billion download mark on its App Store and launches iOS 4 and the iPhone 4 which uses Api's to allow third party apps to multitask. The new iPhone sells in massive amounts but suffers something of a blip when it is discovered that gripping the metal frame too hard can make the signal drop. Android makes huge inroads into the Smartphone market and grabs a 20% market share, largely thanks to the release of the Nexus One and some brilliant handsets from Samsung and HTC. Sales of all Smartphone increase by 72% in 2010 and make up nearly 20% of all mobile phones sold.

In the year of 2011 and the future, with Apple, HTC, Samsung, Nokia and every other major manufacturer releasing a new, faster, more powerful Smartphone on almost a weekly basis, the future of Smartphone certainly seems bright. Screens are getting bigger and brighter, processors are getting more and more powerful and the amount of free and commercial apps available is growing daily.

2.2 Android

The Android is a software platform and operating system for mobile devices or Smartphone developed by Google. Since the operating system is open source and based on the Linux kernel, it has received much enthusiasm from the public and development community [4].