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Date : 17 August 2015   Date : 17 August 2015

SMART INFORMATION CENTRE FOR WEARABLE DEVICE (HEALTH-CARE)

BY

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A REPORT

SUBMITTED TO

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for the degree of

BACHELOR OF COMMUNICATIONS AND NETWORKING (HONS)

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DECLARATION OF ORIGINALITY

I declare that this report entitled "**SMART INFORMATION CENTRE FOR WEARABLE DEVICE (HEALTH-CARE)**" is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

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Finally, I must say thanks to my parents and my family for their love, support, and continuous encouragement throughout the course.

ABSTRACT

This project is an application project for wearable device. This project developed to provide better display structure and good presentation of dashboard in health care field of wearable device. This application will provide user's daily activity for their health monitoring as well as previous history of their health status record to consistently monitor their health condition by providing a good dashboard to user. The application itself would have a local database which will store some data locally in a text form and those data would be retrieved for generating graphical presentation to user. The application was developed in Java for its widespread compatibility with a multitude of wearable devices.

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CHAPTER 1: INTRODUCTION

1.1 Motivation and Problem Statement

Recently, major electronic makers are focusing efforts in developing products featuring functions that are innovative than mobile computing. This is so-called wearable product made a big change in terms of the distance between the electronic device and human body which has become closer. The new frontier for displays are wearable.

The wearable displays tend to be smaller than handheld mobile devices, however, wearable products require display according to the purpose and its main function which user satisfy with the products. In order to fully utilize the wearable functions, the displays structure on the wearable must be good and clear so that user can be understand the content shown on wearable. Besides, the wearable product's display market is expected to develop into flexible, proper as well as stretchable display. Few of motivations in this project is listed below.

Need of effective and good information display structure in health monitoring

In this modern life, there is a need of Infographic for a better understanding of information shown to user. Infographic is one efficient way of combining design, writing and analysis that are ideal for an age of big data to represent complex data. Infographic are easy to digest and extremely engaging because human would be suffer from information overload in the form of words. For an instance, a student who asked to read one summarize poster will easily captured the big picture of it while another student who asked to read a book will less likely to know the whole concept at a limited time given.

CHAPTER 1 INTRODUCTION

Need of information interpretation at a glance in small interface

There is a need of good and proper information display on wearable for people to grab information quickly. The method for efficiently utilizing display space providing time and other function is very useful for a user to knowing all kinds of information on the small interface of wearable in a quick glance. Therefore, the purpose of this project is to help people grab as much information as possible by glancing through the small interface of wearable.

Need of using some smart feature to convey information in health monitoring

Smart feature in an applications nowadays is getting more popular. For example, Waze ,which is an application that can show route for driver to reach their destination using GPS technology. The smart feature within the Waze is showing the best route to reach destination based on the condition of the road and this is a form of self-advisory to advise the driver to follow the best path to destination. In health monitoring field, the self-monitoring and self-advisory are important features to let user to monitor their body status and provide some good advice to maintain their healthy status. Therefore, the smart feature on wearable device for health monitoring is necessary.

Need of high mobility of information to be carried around

Information is always important to any people and the information is needed around a people so that people can retrieve information around the user. For example, a soldier who wearing a wearable device during a war. Some information regarding enemy's position is shown through their wearable device and those information has to be carried around the soldier which means that the soldier does not have to keep contact with their

CHAPTER 1 INTRODUCTION

base station during the war. In this case, we can clearly see that high mobility of information centre is needed.

We have discussed about how the displays of wearable would benefits to us. However, there are some problems encountered on the display of wearable device.

Lack of proper display structure

Some wearable device do not organize their display structure well before showing the information to user and sometimes the text message and information is being displayed in a complicated way. This can causes a particular user is confusing and difficult to understand with the display on their wearable. In this era, a proper display structure is needed to convey certain information to users for better acquisition and interpretation of those information.

Lack of good interpretation method

People are unable to interpret information displayed in wearable in a quick and fast way if the method of display is not suitable. For instance, some information shown on wearable in such a way that text message are close and gathered together. Instead of showing up the text message at one time, wearable can convey some information in form of symbol. Symbols are important because they can facilitate communication and identification of ideas and can have literal as well as figurative meanings.

Lack of effective display structure for health monitoring data

People who have awareness of important of body health is having difficulties in viewing their body status information on wearable since some of wearable do not plan on how to

organize to show the data as an information towards users. A good display structure can let user quickly knowing their overall health status at a glance. For example, a graphical display of information and deploying colour for showing status of health can be easily understood and interpreted by people who care about their own body health.

1.2 Project Objectives

Nowadays the wearable are becoming a new trend and are very convenient to user, these wearable targeting most of the field including health care field. Therefore, this project will carry out to overcome the problem of display structure of wearable

The main objective of this project are:

- To construct easily understandable and effective information display structure by using different form like symbol, colour, and graphical presentation.
- To create innovative information display structure for quick information interpretation on wearable.
- To develop an effective information display for health monitoring by implementing some smart feature inside the applications.

1.3 Project Scope

This project aims to develop an android application which running on wearable device. The focus of this project is to provide and create a proper display interface for user to view important and relevant information. The display on wearable interface

should be easily understand and interpret by the user. This project should also display user's body health status to let user to know their body health condition by glancing through the interface. This will be a useful application for user who needs to know their body conditions info quickly through their wearable device. Therefore, in this project, an information centre dashboard or graphical presentation will be utilize smart features, and display critical and useful info to user. Besides, this project also provide some self-healthcare advisory to user. In short, the project scope is listed as below:-

- Aims to develop effective info structure which implement on wearable device.

- Create a good presentation of content for user to view info.

- Provide status of body health information to user in an effective way.

- Create symbolic information display structure.

- Self-health care advisory.

1.4 Expected Contribution from the Project

Wearable such as smartwatch will become available in the market sooner or later, which the interface will have a smaller size. The expected contribution of this project is to provide user with good display structure of info in wearable devices since in this modern society, there is a necessary that the users can view the information display on the face of wearable quickly which means the display should present the most important information to users.

This project will create a proper displays on wearable provides a quick glance of the most important and relevant information from the application interface. This is why a new way is required that will make changes to interaction between user and wearable which allow user to have quick glance by using picture or symbol. Imagine how people feel when look at a wearable device close to their face, they probably feel that the text on interface is too small to read. Therefore, a wearable's success will largely depend on how effectively make use of glances and can provide convenient way for user to grab information.

1.5 Organization of the report

Chapter 1 describe the motivation and problem statement, expected contribution from the project, objectives and scope of the project. In chapter 2, we will review the technologies of the project and review other related or similar applications. In chapter 3, we will discuss few methodologies and select suitable methodology to develop this project, system requirement, functional requirement, expected system testing, expected challenges, project milestone and estimated cost. In chapter 4, we will discuss the system design in this project. How does the project's system flow, functional modules of the project, and GUI design. In last chapter, there is a conclusion to summarize the whole project

CHAPTER 2: LITERATURE REVIEW

2.1 Review of the Technologies

Wearable computer or body-borne computer, are small, portable and interactive computer that can wear on our body. . This class of wearable technology has been produced or developed for specific purpose. Wearable computer are particularly helpful for applications that need more complex computational support for example, accelerometer or gyrators. An example of modern wearable computer, Fitbit system, allow users to monitoring his/her distance walked, calories burned in a wristband. For another instances is Google Glass which can interact through some gesture movement of user. A common features of wearable computer is there is a constant interaction between wearable and a particular user, so this not require a user to open or close wearable device constantly.

In most of the applications, user's body will actively engaged as the device's interfaces, which include your hands, eyes, skin and your body motion. This technology is largely applied in the field of health care monitoring system.

2.1.1 Hardware Platform

Wearable computing is an evolution of the computing hardware. The first invention of computer is Mainframe computer, then come with desktop computer or personal computer. After that come with a portable computer allow people to work anywhere. Then, a small computing technology that enable user to carry in proximity with their body and stick everywhere with user.

CHAPTER 2: LITERATURE REVIEW

The internal hardware of wearable devices is various. For example, many of them have a rechargeable battery, graphical display as well as touch screen. The hardware platform used by wearable device, Apple Watch, is 32-bit ARM architecture (ARMv7-A).

One of the big concern of wearable hardware is energy. A good power management in wearable device allow the wearable computer to function with a longer period. Peripheral devices may have accelerometer, barometer, thermometer, GPS and speaker. These feature or embedded sensors can collect some information from external or internal environment. The hardware may support wireless technologies like GPS, Wifi, and Bluetooth.

2.1.2 Operating System

Different wearable devices runs different operating system. For example, Apple Watch runs Watch OS, which is based on iOS operating system and has many features similar to features in iOS. The Apple Watch is running watchOS and the API called WatchKit. Another famous OS for wearable devices is Android Wear. Android Wear support both Wi-Fi and Bluetooth connectivity. Pebble OS is used for pebble watch and Samsung Gear runs Tizen as their OS.

2.1.3 Programming Language

There a few programming language that can be used to develop apps for wearable devices. Objective- C or Swift is the programming language used by Apple watch. For Android Wear commonly used Java. Pebble watch can be developed using C language and Samsung gear watch uses HTML5 or C to develop their apps.

2.1.4 Summary of the Technologies Review

Wearable computing technologies is a new trend in this modern society. Since the demand of this kind of technology is increasing, many company that come out with this wearable product keep finding ways to improve the features or hardware component of wearable, for example reducing the battery consumption of wearable to have a long lasting period. Besides, software developer also striving to create applications in those wearable devices to bring enormous advantages to mankind. Table below shows some review of technologies used by few wearable devices in the current wearable devices' market.

Development platform	Operating System	Programming language	SDK	IDE
Apple Watch	Watch OS	Objective-C / Swift	WatchKit	Xcode
Android Wear	Android Wear	Java	Android Wear	Eclipse or Android Studio
Pebble	Pebble OS	C	Pebble	CloudPebble
Samsung Gear	Tizen	HTML5 / C	Samsung	-

Table 2.1.4 Review of wearable development platform

CHAPTER 2: LITERATURE REVIEW

2.2 Review of Existing Applications

In this section of literature review, we explore the notion of display of different wearable device more broadly to understand possible alternative user interface design. In this section will be examine the different capabilities of existing wearable display structure, several product concepts and research to show how different wearable device use different user interface design to create their ''smart'' way to show info to user.

2.2.1 Apple watch OS2 app (Strava)

Figure 2.2.1 Strava app running on Apple Watch OS 2

Strava is a great all round fitness app that will track your runs, rides and cross training. It gives you stats on your speed, distance, elevation, calories burned and more. This app

showing info of distance traveled by users for each week in a column bar. Besides, different color is used to let user have a clearer view on the dashboard.

Strength: Strava display its information in a combination of circular structure and the use of color wisely to let users get to know their desirable info in a quick and "smart" way in their wearable device.

Weakness: Strava app do not show much info in a single user interface and user have to move to next page to view more info on wearable.

2.2.2 LG Watch R app (V08 watch face)

Figure 2.2.2 V08 watch face app on LG Watch R

The V08 can display many helpful information to users. One of the features is that it can show local time and UTC time at top of the watch face using circular display structure. It also show information about weather such as temperature (^oF or ^oC), wind speed, show wind direction in circular display structure, humidity (0%-100%) and atmospheric pressure. Some symbol and abbreviation is being used in V08 to save the display space in order to show more information to user. Besides, it can also show sunrise and sunset event.

Strength: V08 watch face's display structure for time, weather, sunrise or sunset event all are separate by rectangular border shape whereby the information will not mix up with each other and info are group together on each section based on category.

Weakness: V08 watch face did not show any information related to health monitoring. User also require to takes some time to digest all info shown on single interface.

2.2.3 Asus ZenWatch app (F04 Watch face)

Figure 2.2.3 F04 watch face app on Asus ZenWatch

F04 watch face show an easily understood display to users mainly about the weather. F04 separate the display structure by using five section where each section show different category of information. One of the section shows weather forecast information from

now to future three hours and weather of tomorrow in separated column. Besides, the moon phase and sunset/sunrise event is shown in a circular graphic manner. F04 also shows weather condition which consist of temperature, wind speed, wind direction, humidity and atmospheric pressure at below rectangular section. Some abbreviation is used to simplify the words in F04, some symbol is also used to represent the weather.

Strength: F04 watch face is can show almost all info related to weather of different category on different section.

Weakness: Its weakness is that not much color is used to show the info to user.

2.2.4 Moto 360 app (A48 watch face)
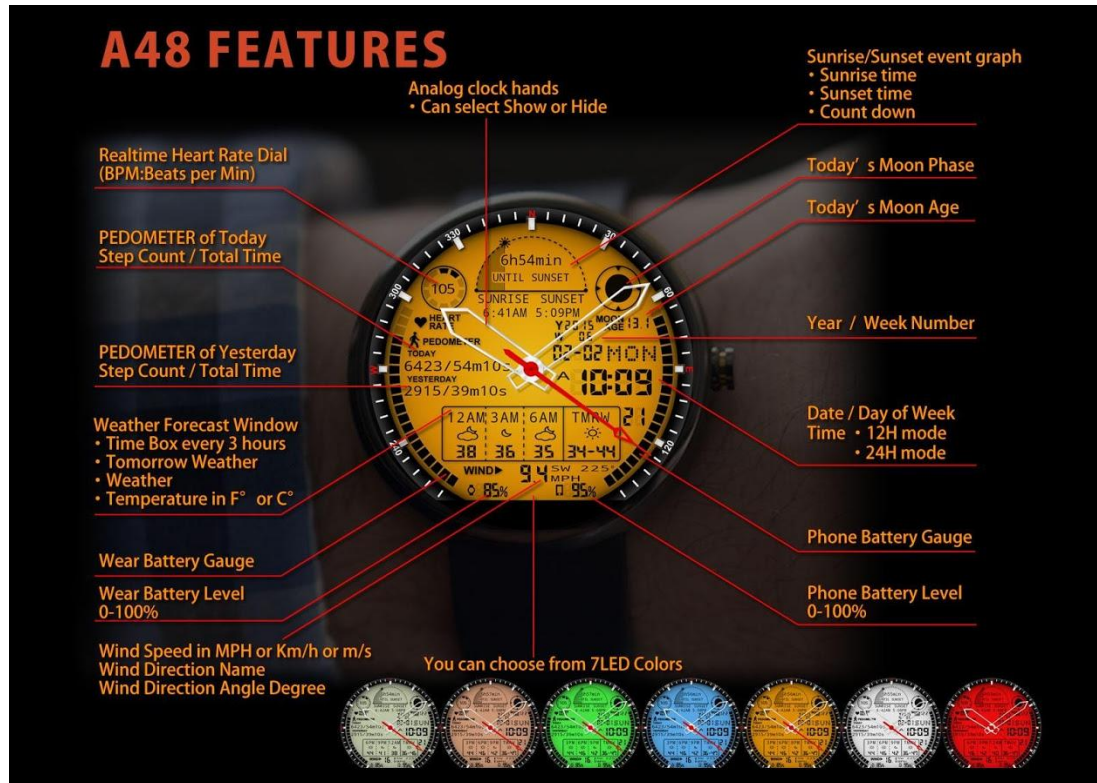
Figure 2.2.4 A48 watch face app on Moto 360

There are many features can be found on A48 watch face on Moto 360. There is a good designer's full function watch face for user. It shows pedometer of today and yesterday, step counts of the day and total elapsed walking or running time of the day. Besides, it show real-time heart Rate in beats per minute unit in a circular structure. For A48, it show weather forecast in a column form which can shows weather today with different time interval and weather of tomorrow to user. Furthermore, A48 has feature to monitor

sunrise and sunset event, it shows the time and countdown for sunrise and sunset in a semicircular display structure.

Strength: A48 watch face for Moto 360 can let user to choose their favorite color from 7 LED Color.

Weakness: The display of info is not separated by shape border or section which will cause info to mix up together.

2.2.5 Huawei Watch app (activity monitoring)

Figure 2.2.5 Activity monitoring app for Huawei Watch

Great in using symbol with color to shows different important info to user. The display structure is good since Huawei Watch is utilized circular with some info shown inside the circle. The use of abbreviation is appropriate and different color is used to differentiate among information. The different font size in this activity monitoring's app is used so that users can view important info with larger font size.

Strength: The Huawei Watch activity monitoring app use a good way to deliver info in form of symbol, color and its display structure.

Weakness: Lack of animation in the app.

2.2.6 Sony SmartWatch 3 app (Endomondo)
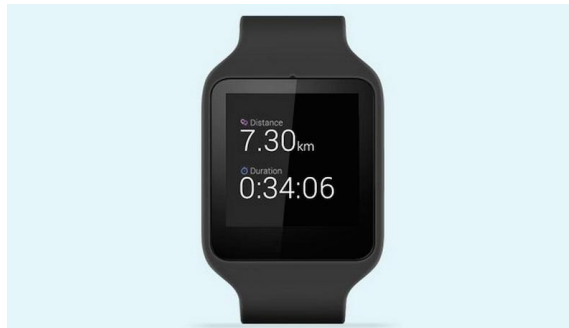
Figure 2.2.6 Endomondo app on Sony SmartWatch 3

Endomondo apps can be installed in Sony SmartWatch 3, this app is hugely popular fitness platform for android wearable. The use of abbreviation is very frequent in SonySmart watch 3. Endomondo make use of different font size to let user view most important info at a glance.

Strength: Simple and straight forward user interface made user easy to react with the wearable display.

Weakness: Less info can be shown to user with the display of screen on wearable and there is less animation and graphical presentation to let user have a glance to know every important info.

2.2.7 Summary of Existing wearable applications' display structure

	Apple Watch OS 2 (Strava)	Sony SmartWatch 3 (Endomondo)	Moto 360 (A48 watch face)	Huawei Watch (activity monitor-ing app)	Asus Zen Watch (F04 watch face)	LG G Watch R (V08 watch face)
Symbol	Yes	Yes	Yes	Yes	Yes	Yes
Colour (pixel)	Yes, 326ppi	Yes, 224ppi	Yes, 205ppi	Yes, 286ppi	Yes, 278ppi	Yes, 247ppi
Animation	Excellent	Moderate	Good	Good	Moderate	Moderate
Abbreviation	Frequent	Frequent	Frequent	Less	Less	Less
Display structure	Excellent	Good	Excellent	Good	Moderate	Moderate
Strength	Utilize combination of circular display structure and color wisely	Simple UI made user easy to react with wearable display	Let user choose their favorite color from 7 LED color	Good display in the form of display structure, color and symbol	Show info of different category on different section	Can separate all info by using border to group info of same category on one section
Weakness	Do not show much info on single app page.	Display less info, less animation, less graphical presentation	Display of info do not separate by shape border, info mix together	Lack of animation	Lack of color used	Takes times for user to digest all info shown in single interface.

Table 2.2.7 Comparison of different wearable app display structure

2.3 Concluding Remark

Only few of the existing apps' display in wearable having a good method of information display. Most of the existing apps do not have a proper and organized way of info display although the interfaces is presenting many info for reader. Too many info inside one small interfaces of wearable may made reader takes time to find particular info that the user need to know. Furthermore, few of existing applications do not utilize the use of symbol, colour, and symbol together to make their info display easier to read by user.

2.4 Resolved Solution

Result of the study uncovered the following requirements of this project in order to overcome issue of lack of proper display structure on wearable interface.

Wearable design specification:

- Glances and not stares. A quick glance on the display of wearable is required in this modern lifestyle. This can be achieved only by using a good and proper display structure on wearable. Spend a long time to read information from a device is waste of time and spending longer time erodes any advantage over a smartphone.

- Interact once, display many times. A smart wearable should primarily provide displays of information in animation to show abundant info to user. A user need only provide less input to the wearable as a command then some animation would automatically show to user. Thus, this is consider a "smart" to convey information to user.

CHAPTER 3: SYSTEM METHODOLOGY

3.1 System Development Models

In this section, an analysis of three software development process models will be carry out and discussed. The three software process models are Waterfall Model, Agile Model, and Throw-away prototyping. By comparing those model, the most suitable process model will be selected for this project.

3.1.1 Waterfall Model

The Waterfall Mode is a traditional software development process that consist of 5 phases which is Analysis, Requirements specification, Design, Implementation, Testing and Integration and Operation and Maintenance.

CHAPTER 3: SYSTEM METHODOLOGY
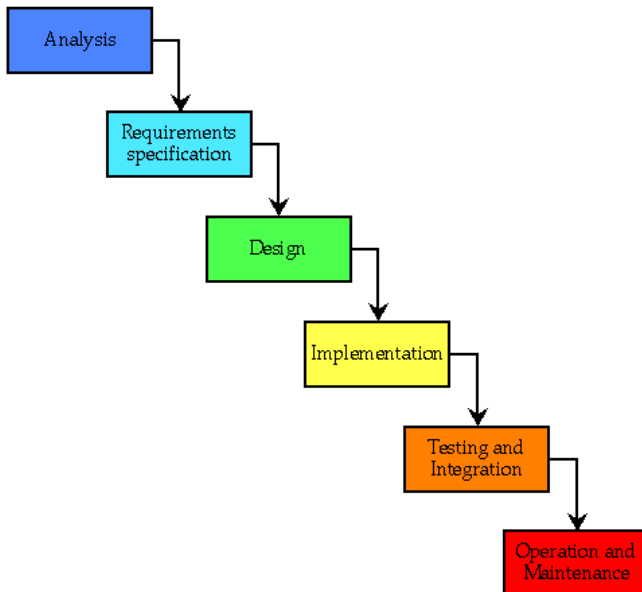
Figure 3.1.1 Waterfall Model

For Analysis and Requirements Specification phases, the developer will do some researches and collect the requirement from the user. This is to determine the software or system features. In Design phase, software developer will determine that which method is being used to develop the system. For the Implementation phase means that the software will be start coded and produce the outcome based on the previous phase. In Testing and Integration phase, the software will be integrated and tested before delivered to the customer. The last phase, which is Operation and Maintenance means that software will keep maintenance time by time to ensure that it is perform well.

The advantages of Waterfall Model is all the requirement will be collected in Analysis and requirement specification phase. When proceed to Design and Implementation phase, the requirement will cannot be change. So, we can focus on implementing and design the software.

3.1.2 Incremental Development
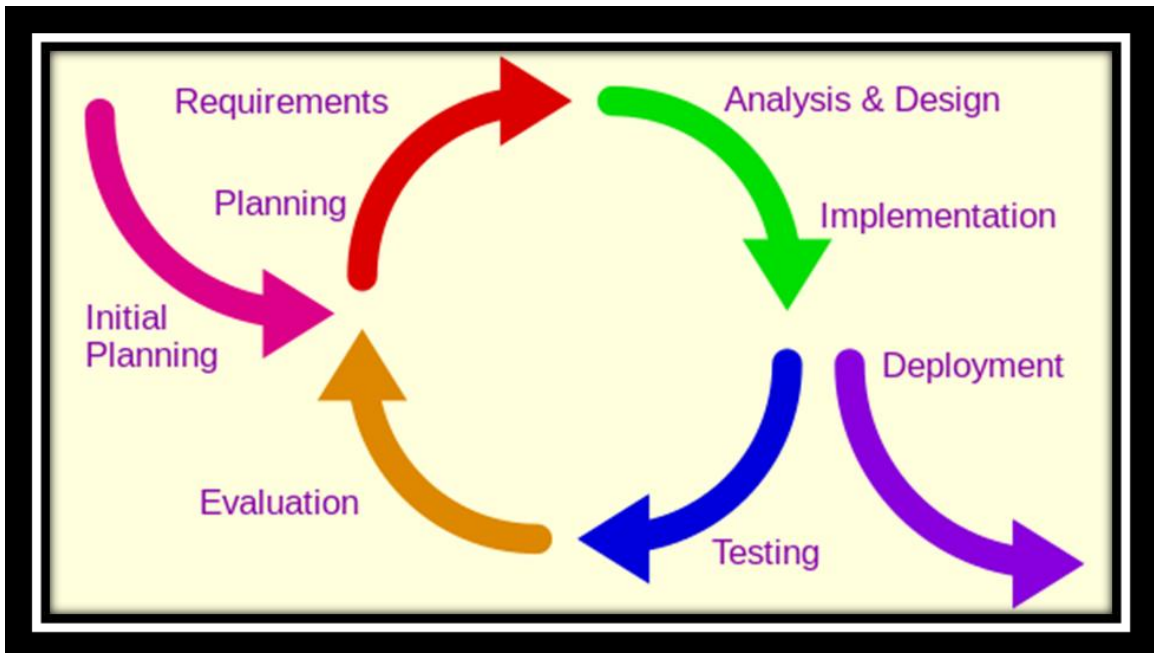

Figure 3.1.2 Incremental Development

Incremental development is one of the common software process models. The idea of incremental development is divide the system into few small sub-systems and develop it one by one. Each of the sub-systems had its own life cycle (waterfall model) when developing it. Once the sub-system is done and release, it will be ready to integrate with

other sub-system which is done using the same method. The development time for each sub-system will be short. This is to allow the developer to get the feedback from the user so that the system can be enhanced. Once all the sub-system are done and no more change request from the customer, the system can combined into a full complete system can ready to deliver to customer.

The advantages of this model are the risk and the complexity can be reduced since we will keep on gaining feedback from the customer. The disadvantages of this model is the needed of time and recourse will be more because we need keep on changing the system based on the feedback of customer.
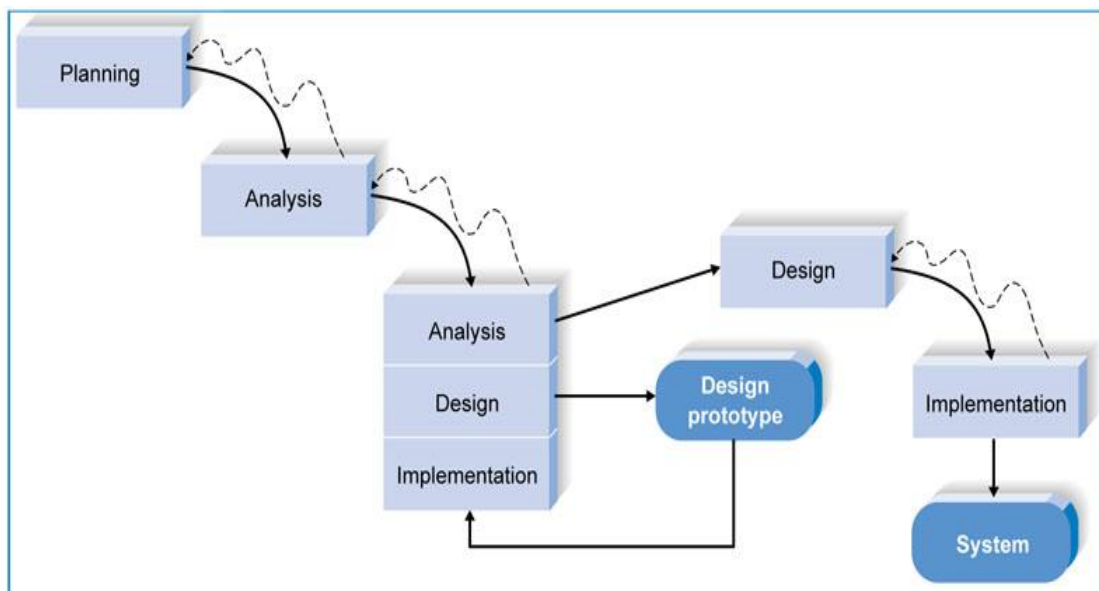
3.1.3 Throw-away Prototyping

Figure 3.1.3 Throw-away Prototyping

The throw-away prototyping is one of the modern software process models. It is one of the Rapid Application Development (RAD) methodologies and it is similar with prototyping method. In Throw-away prototyping, the system will develop part by part. When the small part of the system is complete, the system will give to the customer to try and evaluate. The prototype will be thrown away once it is delivered for experiment. The throw-away prototype cannot consider as final system, the purpose of it is to make the requirement become clearer after the evaluation of customer.

The advantages of Throw-away prototyping is the delivered system will be more quality and the problems and errors can be identify early since there are keep evaluate by the customer. The disadvantages of it are the development time will be longer and the developer may use too much time focus on one part on the system that will cause the delivered time delayed.

3.1.4 Selecting a Software Development Process Model

After evaluate and analysis the three software process model. The throw-away prototyping will be chosen as a software development life cycle throughout the whole project lifetime. The reason of choosing this model is because the system can be dividing into several task based on the objectives. By this the complexity will be reduced and the success rate of the project will be higher. In addition, this project is developing application with GUI, so it is important to produce the prototype for user to experiment and evaluate it time by time.

CHAPTER 3: SYSTEM METHODOLOGY

3.2 System Requirement

This project requires hardware listed below and some software tools to develop the mobile application.

3.2.1 Hardware

The technologies and tools involved in this project are as below:

i)   Newton board
ii) 2 Universal Serial Bus (USB) Cables
iii) Hardware (disk capacity at least 128 GB and RAM size at least 4GB).
iv) Software (Korulab SDK is recommended)

Newton platform come from a company called Ingenic, the strength features of this platform is high performance with low power consumption. Ingenic is a moderately low profile organization that is focus around semiconductors and gadgets and was established in Beijing, China in 2005. Diagram below shows the development Kit of Newton.
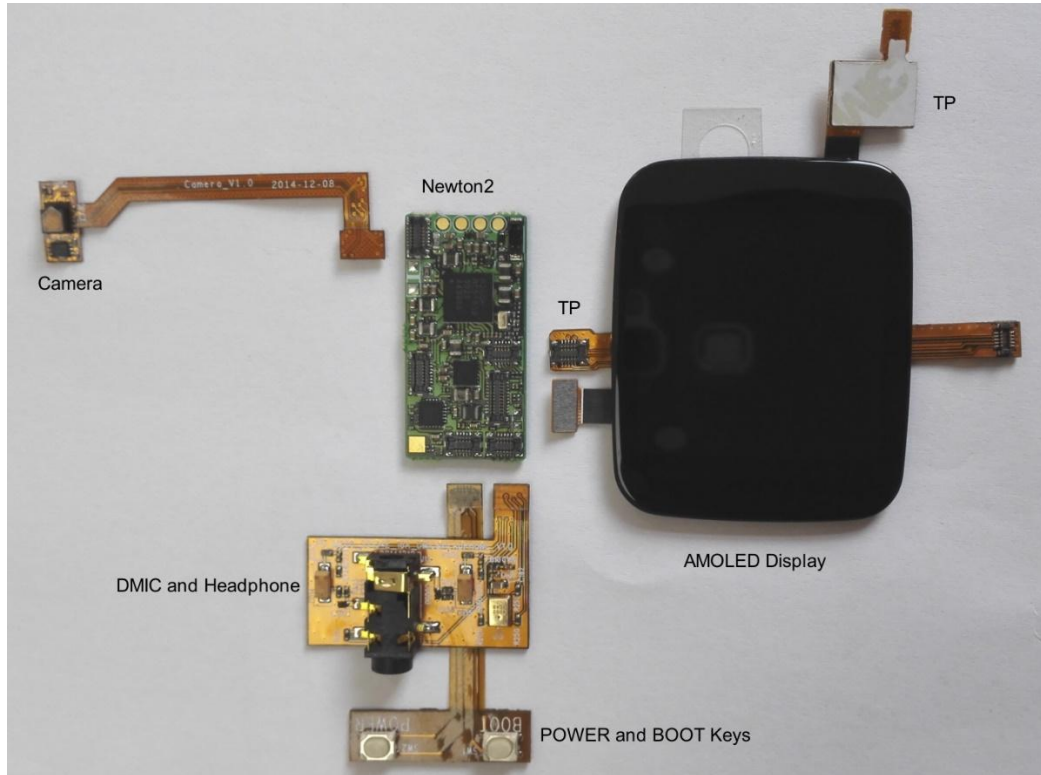
Figure 3.2.1 Newton Development Kit

3.2.2 Software

This project development require some of the software tools:

     i.   Java Eclipse and Android Studio.

    ii.   Java programming language.

Java Eclipse or Android Studio both are integrated development environment for developing Android platform. Currently, Android Studio is being used to develop this

project. Android Studio is an official IDE for android development. This project development need this software to compile codes and runs the application in an emulator of Android Studio. Some additional software is also installed into Android Studio which is SDK packages and system image for wearable devices.

3.3 Functional Requirement

The functional requirements of prototype of project 1 include:

Develop health monitoring applications on wearable that will prompt user to input their goal in the applications.

In the prototype, there will be a progress bar that can show user's progress. The progress bar can show their progress according to the goal that the user set previously.

The health monitoring application must contain some "smart" feature or ways to notify user regarding to their progress or status.

3.4 Expected System Testing and Performance

During the development of this project, many testing is carried out to ensure the system will run in an expected result. In this health monitoring applications, the angle of progress bar that shows user's progress is expected to be shown accordingly based on the goal set by user. After each user reach his or her goal, the apps is expected to have some visual effect to notify user that he or she already reach their goal.

3.5 Expected Challenges

For many wearable device, the display is the key and major new challenge because the information need to be show in very small interface on the wearable device (Soneira, 2014).

During the development of this project, some challenges can be expected. First of all, graphical dashboard design is major obstacles for apps developer to create and organize since the graphical presentation are easier to view in larger device, unlike the small interfaces of wearable. The way of using animation, symbol, and color must use appropriately to generate a good presentation content. Besides, the display must be simple and easily to understand by user because interfaces that too complicated will made user feel annoying when finding their desired info in small interfaces of wearable devices. Therefore, a good display structure must be created to enable user to have a glance on their wearable device to know the information. Furthermore, the system must have some smart feature to display information in a smart way to inform user which is also another challenge in this project.

3.6 Project Milestone

Activity	Start Date	End Date	Activity Details
Project Start	18/1/2016	25/1/2016	Research and Data Collection
Milestone 1	26/1/2016	1/2/2016	Define the software involved (eg, Android studio, Eclipse)
Milestone 2	2/2/2016	8/2/2016	Familiarize with Java emulation tools
Milestone 3	9/2/2016	15/2/2016	Specify system requirement and start develop the function
Milestone 4	16/2/2016	29/2/2016	Continue with the function development
Milestone 5	1/3/2016	5/3/2016	Testing
Milestone 6	6/3/2016	6/3/2016	List out and complete with the project timeline
Milestone 7	7/3/2016	7/3/2016	Correct and finalize report
Project End	8/3/2016	8/3/2016	Submission of final report

Table 3.6.1 List of the activities and milestone of Project I

CHAPTER 3: SYSTEM METHODOLOGY

Activity	Start Date	End Date	Activity Details
Project Start	1/6/2016	3/6/2016	Research and Data Collection
Milestone 1	4/6/2016	8/6/2016	Understand and define the system flow of the application
Milestone 2	9/6/2016	9/7/2016	Setup database and testing
Milestone 3	10/7/2016	30/7/2016	Coding
Milestone 4	1/8/2016	10/8/2016	Implementation and UI design
Milestone 5	10/8/2016	20/8/2016	Fixing bug or logic error in the system
Milestone 6	20/8/2016	24/8/2016	Final Testing of application
Milestone 7	24/8/2016	26/8/2016	Correct and finalize report
Project End	26/8/2016	26/8/2016	Submission of final report

Table 3.6.2 List of the activities and milestone of Project II

In this project, due date is being set at 15/3/2016. Since the date and time is limited, a project timeline and milestone is created to ensure that this project can be completed before the due date.

CHAPTER 3: SYSTEM METHODOLOGY

Therefore, during the execution of the project, the milestones is being review every time. Milestone can add significant value to project management and scheduling. It can mark at specific points in a particular project. In this project, a few milestone have been set. After a small milestone is completed, then the next milestone is targeted to make sure the progress project is keep on going smoothly, until the project is finish. The milestone allow us to manage a project more efficiently and to determine whether the project is on schedule and on the right track.

Besides, a list of activities that required to complete this project has been identified. Those activity are categorized into a work breakdown structure. Critical path method is used for identify the highest priority in the project and duration needed to complete each sub-task of the project. The activities wad planned carefully so that dependencies of each sub-task is known, for example, task B cannot be done if task A is not completed. The purpose of using this critical path method is to ensure that whole project is not delay by achieving each sub-task on the right sequence and on time. After the list of activities is listed out. Then, each milestone was targeted in order to accomplish the project.

The first milestone is to do some research and data collection on wearable devices and some user interface of few wearable (UI) and also review the user experience (UX) on each wearable device. The second activity is to define and determine software required to complete. In this step, Eclipse, which is an integrated development environment (IDE) is chosen as the tools that used to accomplish the project. Then, the third milestone is to familiarize with Java language as well as android wear emulator tools. Android SDK tools has been downloaded to be used as a tool to emulate the android wear. Then, system and function requirement is specified and start develop the function using Java. Then,

next milestone is to test the function several time to make sure there is no bug or error during execution of the function. After the testing phase is finish, the report is written based on the function developed. Before 3/8/2016 (Monday), the report is finalized and submitted on time.
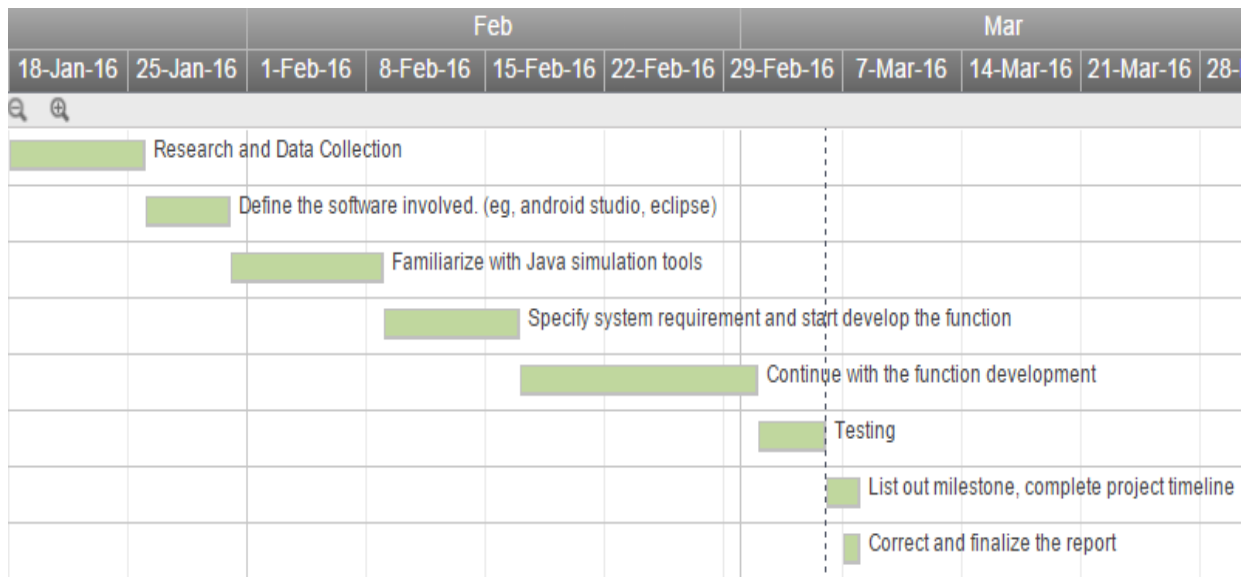
	Feb						Mar			
18-Jan-16	25-Jan-16	1-Feb-16	8-Feb-16	15-Feb-16	22-Feb-16	29-Feb-16	7-Mar-16	14-Mar-16	21-Mar-16	28-

Research and Data Collection

Define the software involved. (eg, android studio, eclipse)

Familiarize with Java simulation tools

Specify system requirement and start develop the function

Continue with the function development

Testing

List out milestone, complete project timeline

Correct and finalize the report

Figure 3.6.1 Gantt-chart for Project I
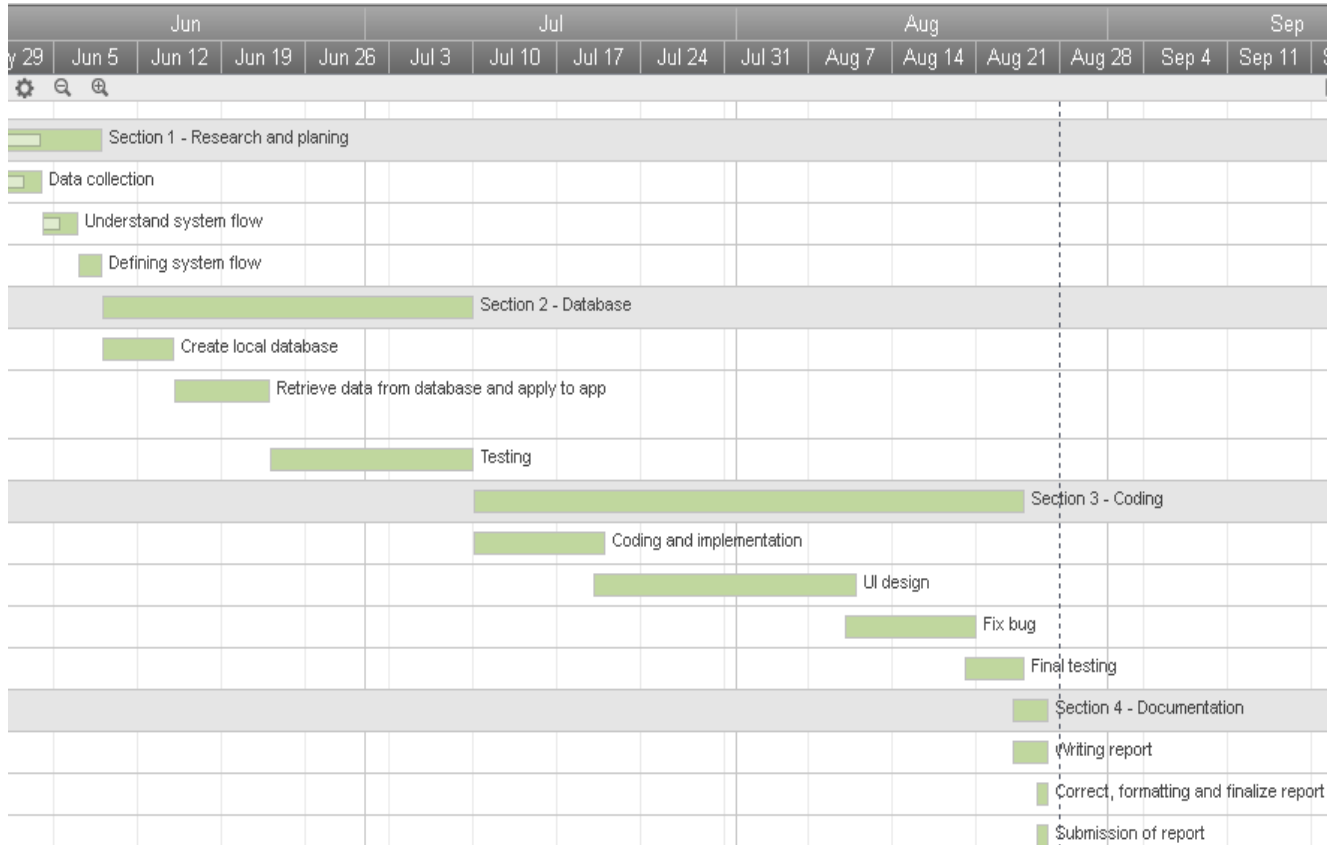
CHAPTER 3: SYSTEM METHODOLOGY

Figure 3.6.2 Gantt-chart for Project II

CHAPTER 3: SYSTEM METHODOLOGY

3.7 Estimated Cost

Items	For Final Year Project Development	For Commercialisation Usage
Android Studio(software)	Free	Free
Device for running apps	Emulator (Free)	Wearable device (running Android 4.4 and above) At least 700 MYR
Total	0 MYR	At least 700 MYR

Table 3.7 Estimated cost

3.8 Concluding Remark

The final year project 1 uses throw-away prototyping development mode. The throw-away prototyping will be chosen as a software development life cycle throughout the whole project lifetime since it is important to re-produce the prototype for user to experience and evaluate it time by time.

To develop the application in wearable device, there are several hardware and software which can support developing Android application such as an Android operating system, a laptop or pc for android studio software and etc.

The functional requirements in this project include progress or status bar to show user's progress, show some smart feature to inform user regarding the info.

CHAPTER 3: SYSTEM METHODOLOGY

The expected challenges included required a good graphical presentation in small interface of wearable device and the proper display structure of applications. Besides, symbol and color must use appropriately to produce simplified and understandable info to user.

The project milestone used to track the project management in this project. This project had reached the entire milestone and all the tasks in the project are on track. The Estimated costs for final year project development are free, because the software tools used is an open source which is free, and the hardware are using own hardware such as laptop to run an emulator. For commercialization usage user need to own a wearable device which running Android OS which is approximately 700 MYR at least.

CHAPTER 4: SYSTEM DESIGN

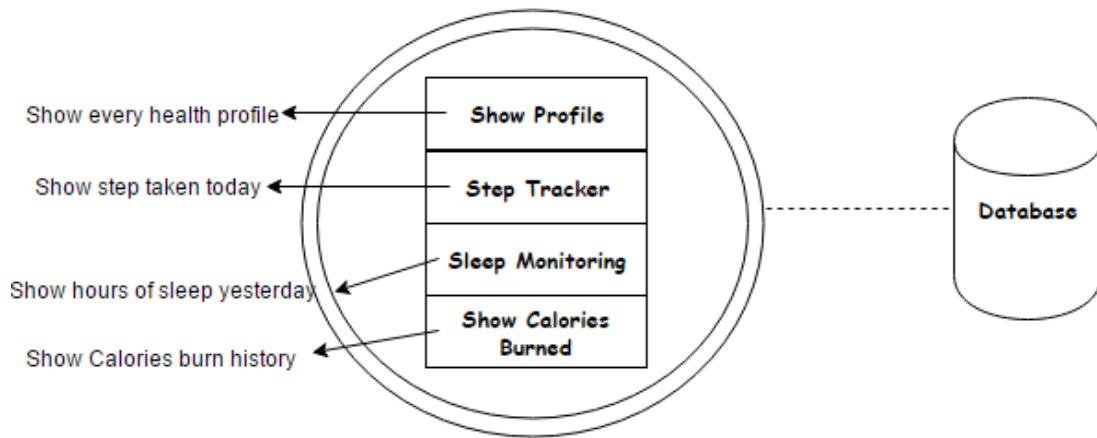## 4.1 System Architecture

Figure 4.1 System Architecture Design

4.2 Functional Modules in the System

There are seven function modules in this project, profile function, Step Tracker function, Sleep Monitoring Function, Calories Burned Record function, and Body Mass Index (BMI) function.

Advisory function, users can view the recommended health-care advice from this function. The system will get the latest health value of the users from SQLite database within the wearable device and generate some useful advice for the users to improve the health condition of particular user.

CHAPTER 4: SYSTEM DESIGN

User health profile, this function allow users to quickly view their overall health profile. The system will get the latest health data of user from database and present user's latest health condition in a simple text form.

Historical chart function, user can view their profile details of various kind of progress and their own history record. Therefore a user can quickly know all their records in this profile function. The historical graph is being shown to user in an automated way without much input from user.

Step tracker function, user may set their target goal for number of steps taken in each day. A progress bar status is being shown accordingly to user which depends on the goal that user have been set for it. Some smart features in the progress bar will be shown to user if a particular user have achieved their target goal.

Calories Burned checking function, a line graph will be generated for showing the history of calories burn by that user in a daily manner (Monday, Tuesday, Wednesday, etc).

Sleep Monitoring function, showing information regarding total hours of sleep by yesterday and further dividing total hours of sleep and categorizing them into deep sleep, light sleep, and hours of awake in the midnight.

Body Mass Index (BMI) function, prompt input of height and weight of the user and calculate their BMI value, showing their status and giving some advice to user. The BMI value is divided into five categories which are underweight, normal, marginally overweight, overweight and obesity.
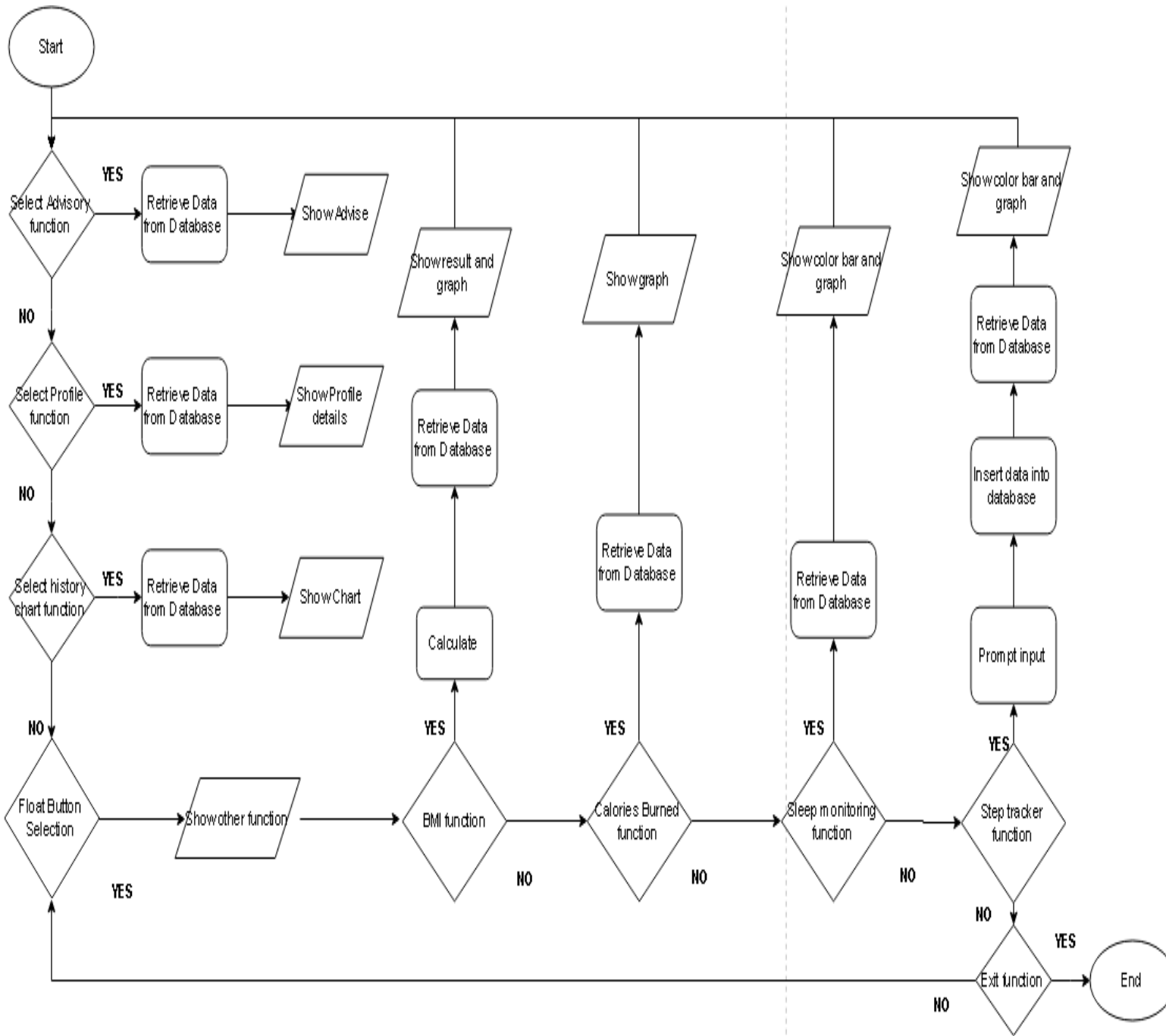
4.3 System Flow

Figure 4.3 System Flow Design

CHAPTER 4: SYSTEM DESIGN

The flowchart shows the results outcome based on the user input. The system will launch a splash screen when the application is started, then user will redirect to main menu page which consists of three function followed by a float button menu with other few functions.

User can view their latest health profile and track their history health data in the main page, besides, user can also view the health advisory by clicking the historical chart buttons shown in the main page.

In the selection in the float button menu, there are five available function which are step tracker function, sleep monitoring function, BMI function, calories burned checking function and exit function.

Furthermore, all of the function in the application will get some data from the local database and display those data in a graphical presentation to users.

CHAPTER 4: SYSTEM DESIGN

4.4 Database Design

The database named "Userprofile" is being created locally by using SQLite. Inside this database, there is a user table.

Database Tables

Name	Type	Not Null	Default Value	Primary Key
TIMESTAMP	DATETIME	0	Null	1
STATUS	TEXT	0	Null	0
STEP	INTEGER	0	Null	0
SLEEP	INTEGER	0	Null	0
BMI	DOUBLE	0	Null	0
CALORIES	INTEGER	0	Null	0

Table 4.4.1 User table

4.5 Use Case Diagram
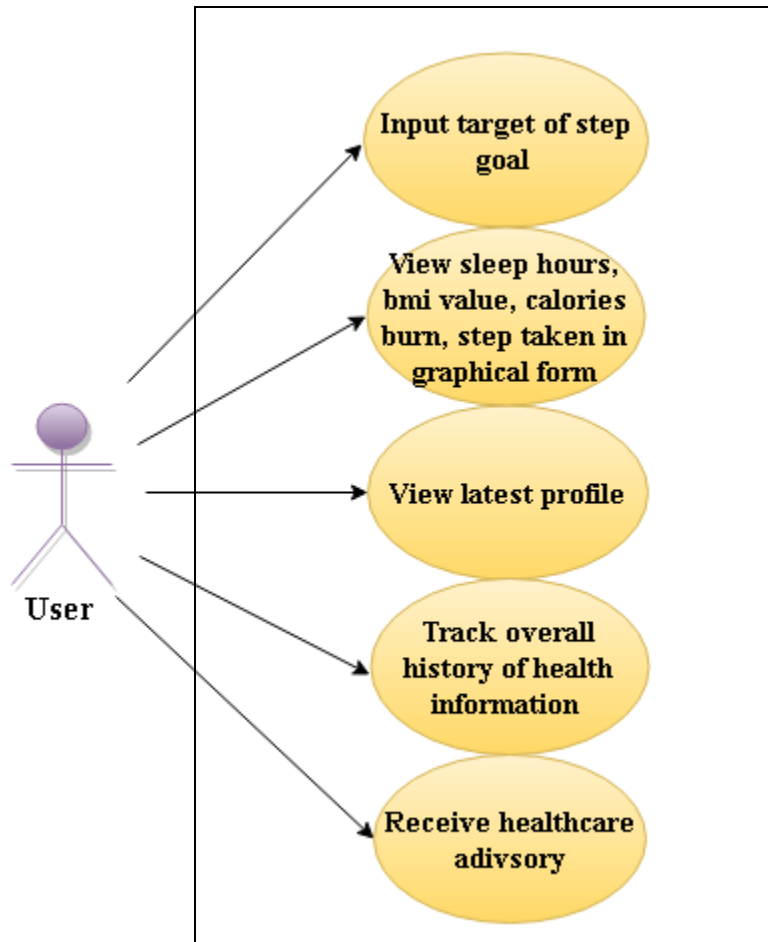
Figure 4.5.1 Use Case Diagram Design

4.6 GUI Design
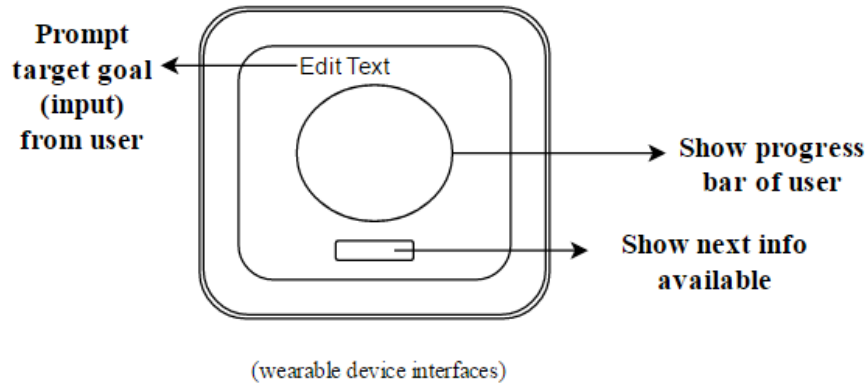
Figure 4.6.1 Sketch of basic GUI design

As in the sketch of prototype GUI design, the interfaces contain basically have one edit text to prompt some input from user, a progress bar that will show their health monitoring result, and a button that can view next record or return into the main page.

After a user select one of the function in the main menu, a progress bar will show to user to indicate that the percentage of their activity compare to the goal ,which the user have been set their target goal earlier.

Besides, a dashboard regarding their history of the activity will be shown at below position of the progress bar to let user have an overview on their activities history.

CHAPTER 4: SYSTEM DESIGN

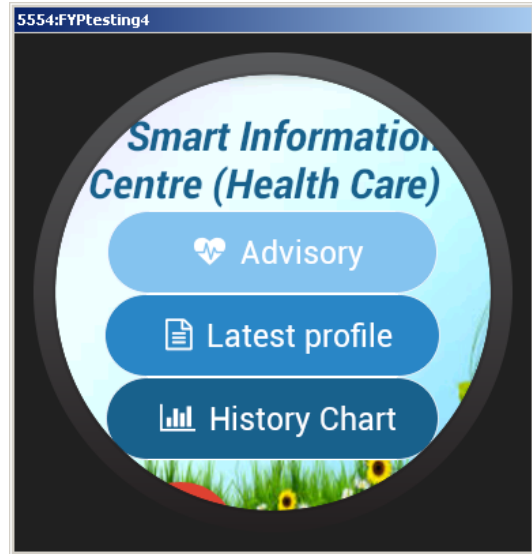Figure 4.6.2 Splash screen design
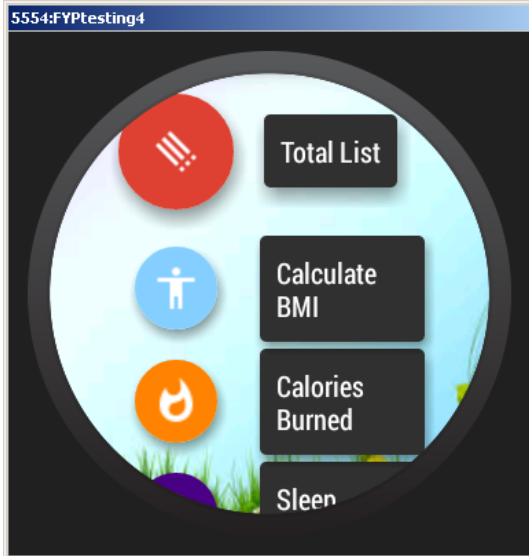

Figure 4.6.3 Main menu page design
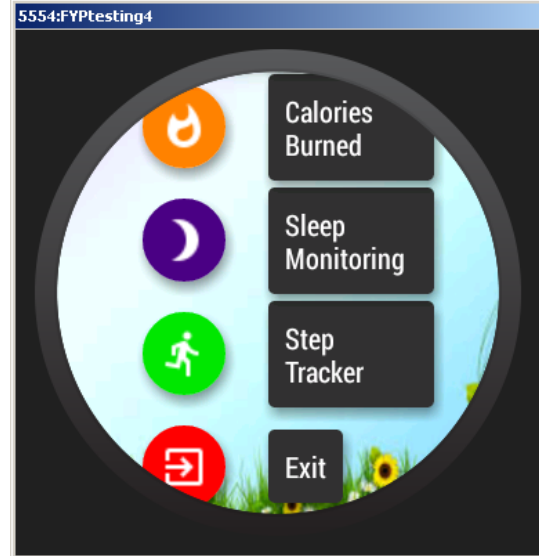

Figure 4.6.4 FloatButtonMenu design(1)

Figure 4.6.5 FloatButtonMenu design(2)
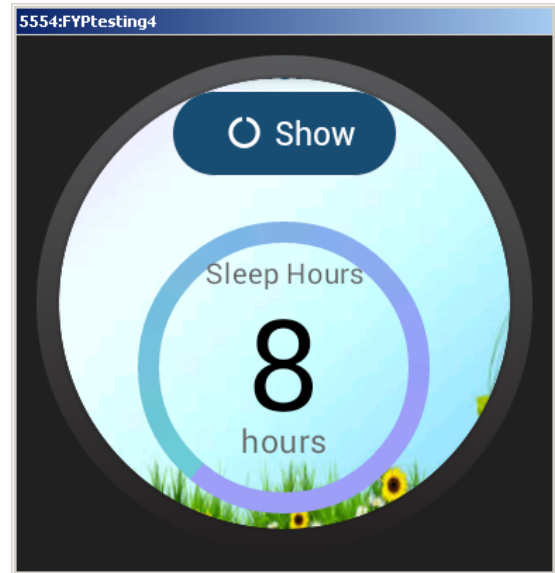
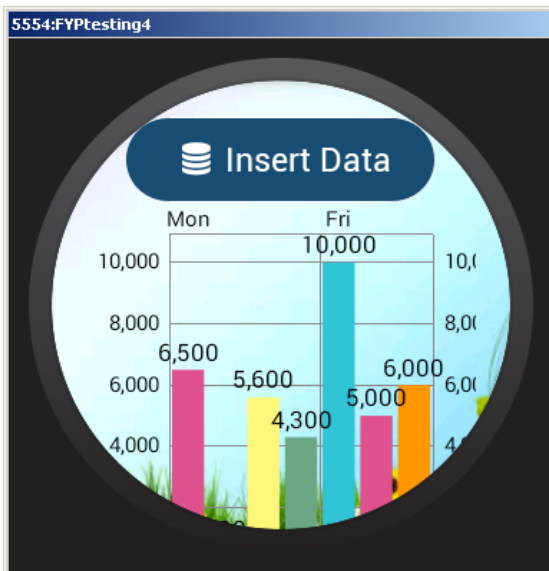Figure 4.6.6 Step tracker progressbar design

Figure 4.6.7 Sleep monitoring progressbar

Figure 4.6.8 Bar chart design
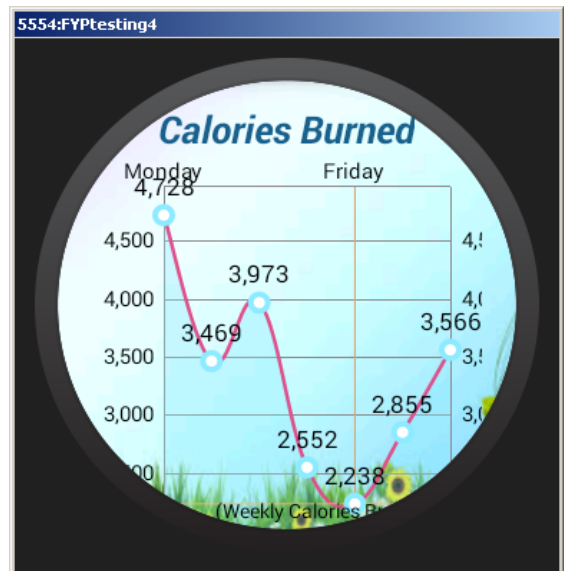

Figure 4.6.9 Line chart design

In above GUI design, the main menu page consist of buttons and a float button menu. Each of the button would redirect user to another new activity or functions. Some function would using the color progress bar to show the user's progress towards their goals. The color of the progress bar will change accordingly to show user about how much effort left to achieve their own goal. For example, for the step tracker function, red colour inside the progress bar shows that user's left many steps to achieve their goal, while green colour means user have to walk few more steps to achieve their goal or already achieve their goal.

4.7 Concluding Remark

This chapter is about the system design of the project. There will be seven functional modules in this project; it included advisory function, user health profile function, Step Tracker function, Sleep Monitoring Function, Calories Burned checking function, and Body Mass Index (BMI) function. The system architecture is shown in figure 4.1 and the applications will be deploy at small wearable devices. Figure 4.6.1 shows the sketch of GUI design at the early stage planning of this project. A table is created in the SQLite database which containing six column field which representing the timestamp of the health data insert (attribute field name: TIMESTAMP), current status of user whether they achieved their goal or not (attribute field name: STATUS), number of hours sleep (attribute field name: SLEEP), number of step taken by user (attribute field name: STEP), current Body Mass Index, BMI value of user (attribute field name: BMI), amount of calories burned by user (attribute field name: CALORIES). The table design and table details are shown in Table 4.4.1 including the attribute name and type of the attribute. The system flow diagram is shown in Figure 4.3.1 to show how the flow of the

application is. As in the GUI design shown above, Figure 4.6.3, 4.6.4, 4.6.5 shows some symbol to user to save user time to read the description text beside since appropriate symbols is being used to describe each of the function inside the application. However, the description text is shown to user too incase some user did not understand the symbol used at the first time they deal with this new application. In the figure 4.6.8, the bar chart design used different color to represent each data in x-axis instead of using the same color in the bar chart. Therefore, this can avoid some confusion or misread their health profile while user trying to interpret the graph

CHAPTER 5: SYSTEM IMPLEMENTATION
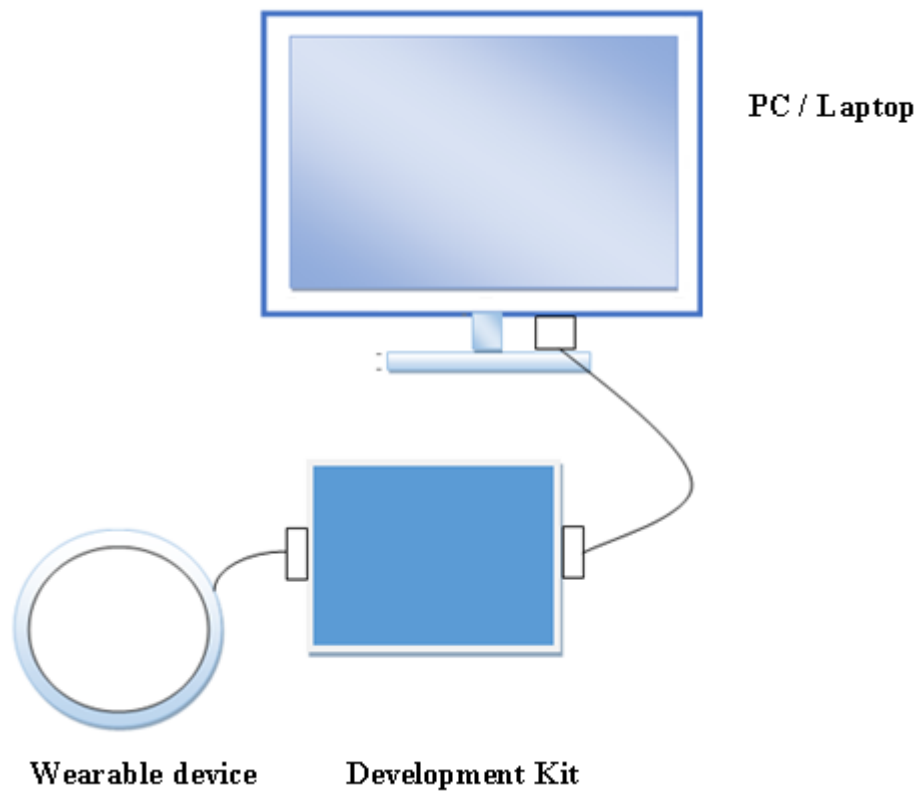
5.1 Hardware Setup

Figure 5.1 Hardware Setup

In hardware setup, the android wear device need to be connected to development kit. Then the development kit is connected into personal computer or laptop via USB for application debugging and apk installation.

CHAPTER 5: SYSTEM IMPLEMENTATION

5.2 Software Setup

In the software setup, we need to install several software to develop the application.

    a) We need to install Android Studio IDE into laptop or personal computer to develop the mobile application.

    b) We need a virtual device for debugging and testing purpose, a virtual device need to be opened in Android Studio.

    c) We also need a SQLite Manager Tools to monitor the database that created locally in the wearable device.

5.3 Setting and Configuration

Installing Android Studio and setup environment

Step 1 :   Download and launch the Android Studio installer on your PC from the Android Studio home page.

Step 2 :   Follow instruction on setup wizard in order to install Android Studio.

Step 3:   We need to set an environment variable to direct installer to proper location. Click Start **Start menu** > **Computer** > **System Properties** > **Advanced System Properties**. Then, open the **"Advanced"** tab and Click onto **"Environment Variables."** From here, add a new system variable called **JAVA_HOME** that points to your JDK folder.

Installing SDK needed to develop application

Step 1 :   Open Android Studio.

Step 2 :   On tab above, click **Tools** > **Android** > **SDK Manager.**

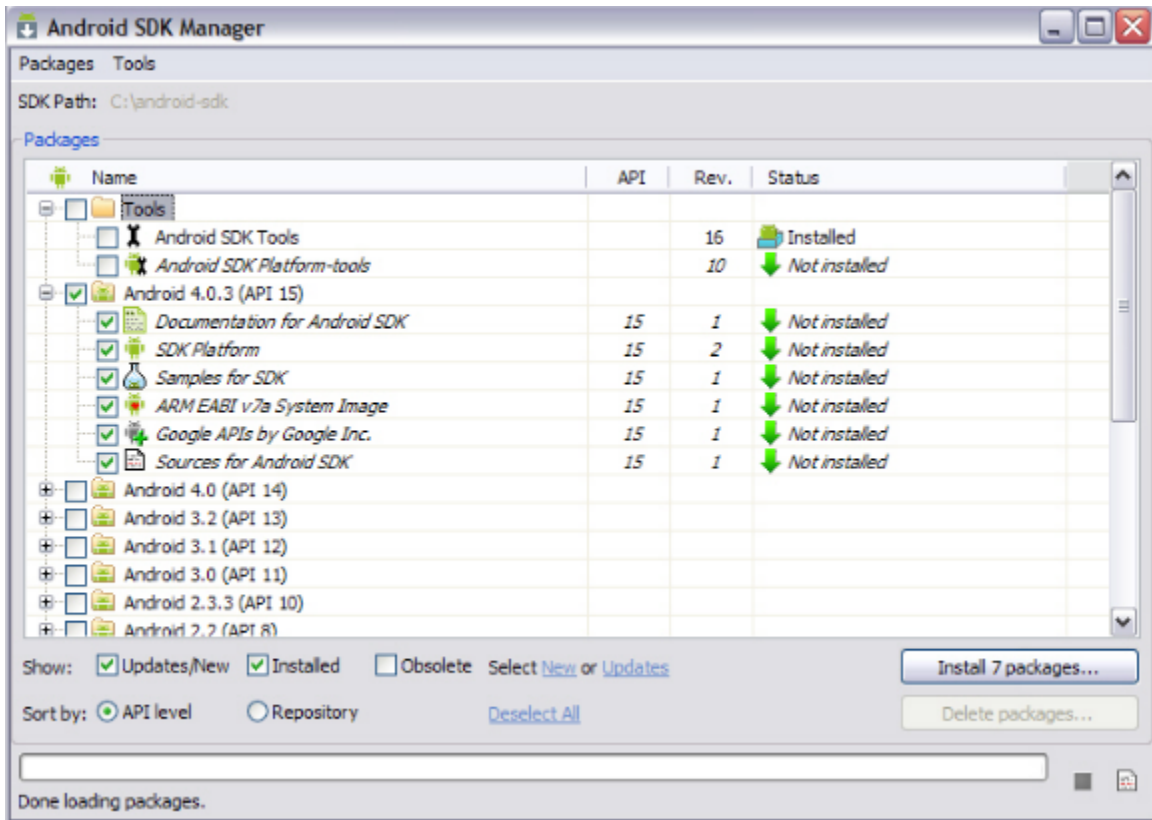Step 3 :   Select and install any version of API needed and Intel x86 Emulator **Accelerator** (**HAXM**).

Figure 5.3.1 API installation on Android SDK Manager

Creating android wear (virtual device) on Android Studio

Step 1 : Open Android Studio, click **Tools** > **Android** > **AVD Manager.**

Step 2 : An AVD Manager page will pop out. Click **create virtual device,** to create the virtual device.

Step 3 : Choose the type of virtual device needed to create your own desire device. Then click **Finish.**
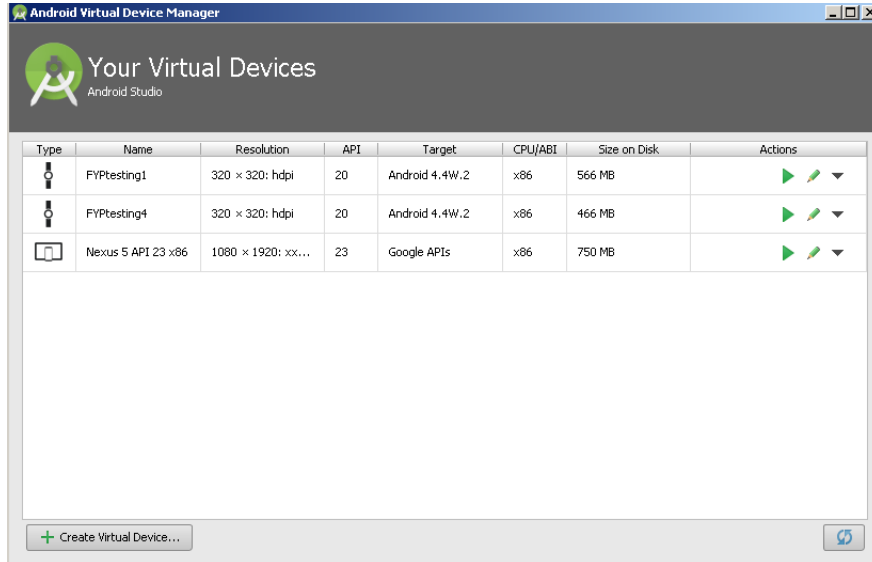
5.3.2 Android Virtual Device Manager
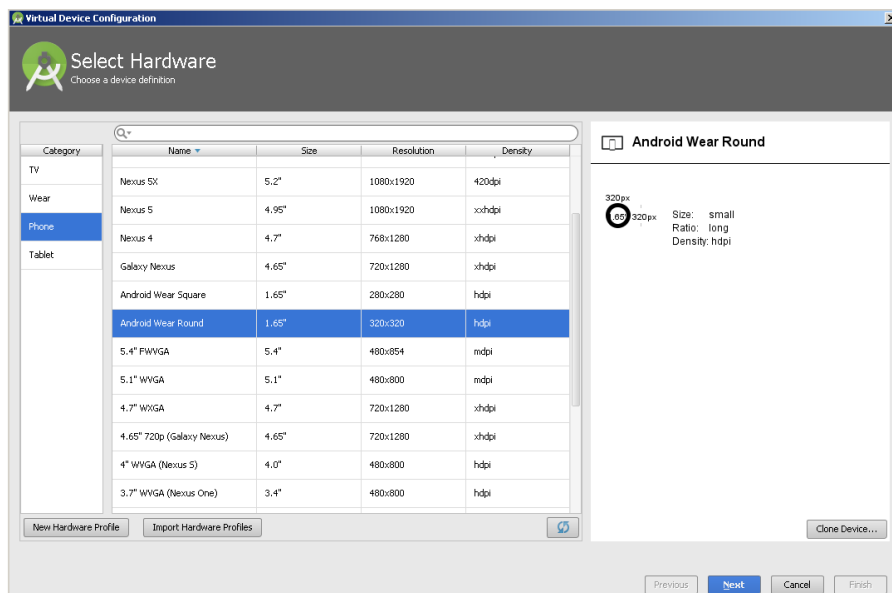
5.3.3 Android Virtual Device selection and setup

CHAPTER 5: SYSTEM IMPLEMENTATION

Installing SQLite Manager

Step 1 :   First, download latest version of Mozilla Firefox installer. After finish download, click Mozilla Firefox.exe to open the browser.

Step 2 :   Click more list at top right side of firefox browser. Click "**Add-ons**".

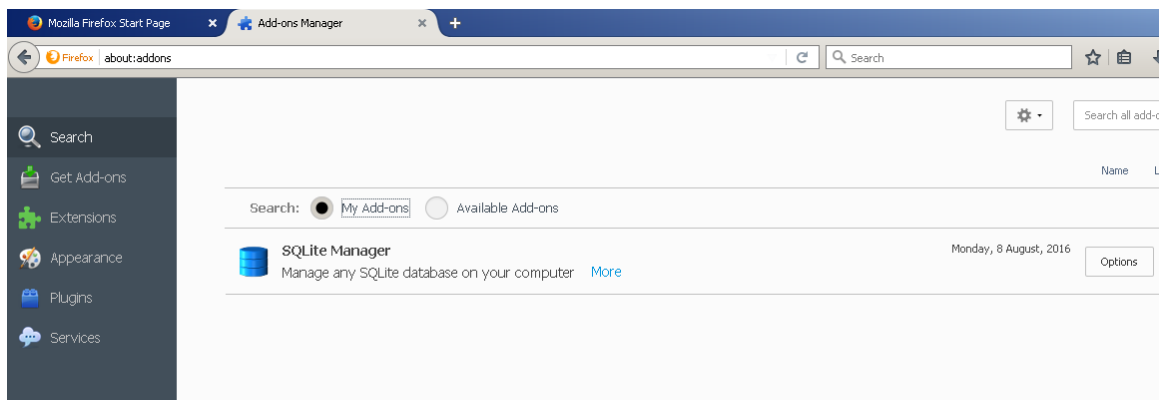Step 3 :   Then click the "**Plugins"** on the left pane and search for SQLite Manager and download it.

Figure 5.3.4 Download add-ons of SQLite Manager on Mozilla Firefox

Extracting local database file on virtual device

Step 1 :   Open Android Studio. Click **Tools** > **Android** > **Android Device Monitor**.

Step 2 :   From the Android device monitor box, select **File Explorer** > **Select Running Virtual Device** > **data > data > [name of your application] > databases** > **[select databases file with extension .db]** > **pull a file from a device**

Step 3 :   Now, you can open SQLite manager to view and monitor your database file create on the virtual device.
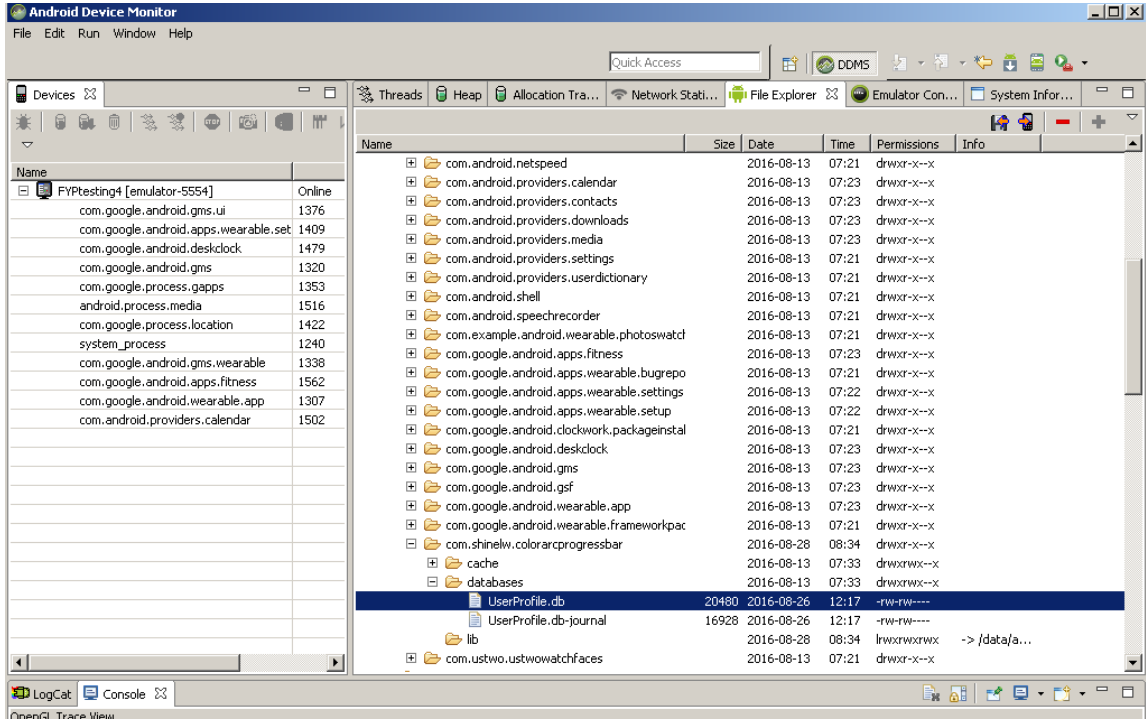
Figure 5.3.5 Pulling database file on Android Device Monitor

5.4 System Operation

In this section, some functions will be demonstrated and the flow of the function is being described.
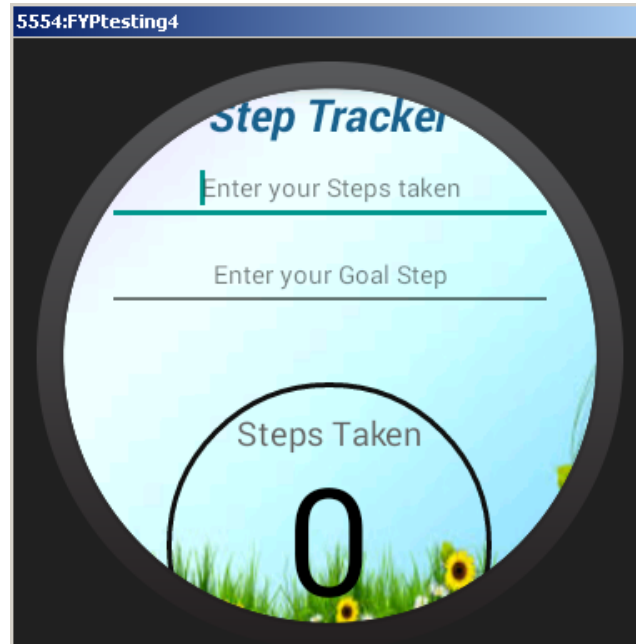
Figure 5.4.1 Input from user on Step Tracker function

In the step tracker function, we demonstrate an innovative way of display structure to user regarding their steps taken based on their target goal. Let say user have walked for 3500 steps for that days and the target goal of user is 6000. The number of steps taken by user and target number of steps need to walk by user each day is being displayed in a form of progress bar. Besides, the "status of achievement" of user is recorded in local database, the status can be "Goal Achieved" or "Goal Not Yet Achieve".
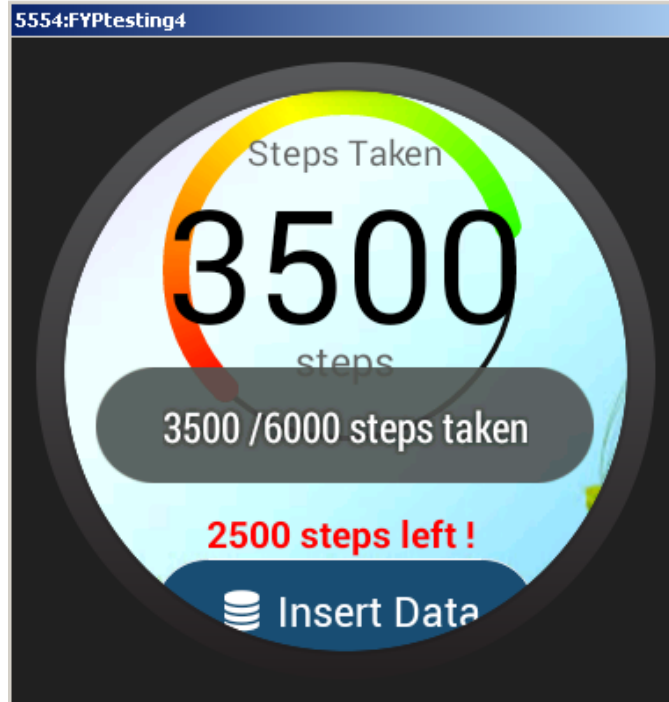
Figure 5.4.2 Circular progress bar showing step taken of user

From the figure above, after user input number of steps taken (eg,3500) and goal (eg, 6000). The degree of color progress bar will set based on step taken by user and their target goal. The target goal of user is being set to maximum value or degree, which is 360°. The number of degree of the color progress bar is 210° since the full degree of progress bar is 360°.

The degree can be calculated as in the formula:

[(step taken)/(target goal) x 360] = [(3500)/(6000) x 360°]

$$= 0.5833333 \times 360^\circ$$

$$= 210^\circ$$

If the number of step taken is less than the target goal of user, the application will record the attribute field "status" of user as "Goal Not Yet Achieve" in the local database of the device. On the other hand, If the number of steps taken by a user is more than or equal to their target goal steps, the color will be fully filled in the progress bar and the attribute field "status" of the user will be recorded as "Goal Achieved" in the database.
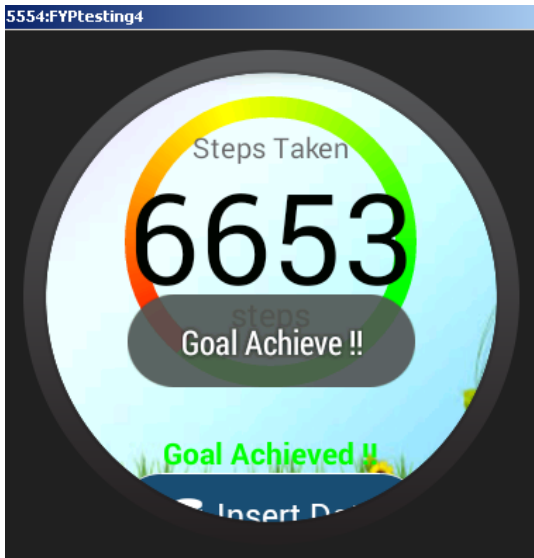
Figure 5.4.3 Progress bar showing user achieved their goal

Figure 5.4.4 Progress bar with blinking effect

From the figure above, a full color filled in the progress bar or the color surrounded by the progress bar in 360° shows that particular user had achieved their own steps goal. Besides, a blinking effect will be occur on the color progress bar which indicate that the user already accomplish their goal or achievement. Therefore, with this blinking effect, user do not really need to watch the degree of color filled in the progress bar to get know how much more step is needed to achieve their goal, instead user can consider they

achieved their target goal with blinking effect shown on the progress bar. This display method is one of the smart way of informing useful information to user which is meeting one of our objective in this project.

Furthermore, after the step information is inserted into database, a graph will be generated instantly to show the history steps record as well as the latest step taken by user to let user track his step taken record. The information in Figure 5.4.5 is being shown in a graphical way rather than of text form. This will provide a good interpretation way for user to understand the data in a quick and understandable way.
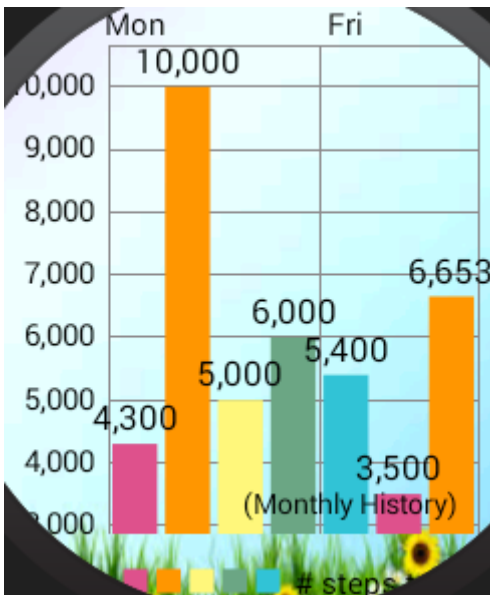
Figure 5.4.5 Bar chart of step tracker function

Other than bar chart in step tracker function, a line chart also is being used in calories burned checking function. The line chart is also consider as another good interpretation method of displaying data.

Figure 5.4.6 Line chart of calories burned checking function

Inside the calculate BMI function, user can input his/her height and weight to calculate their Body Mass Index (BMI). BMI is a value derived from weight and height of a person. BMI determined using a table which display BMI for different categories which are underweight, normal weight, overweight and obese. The formula of BMI can be calculated as below: -

Bmi = (weight)/(height x height)
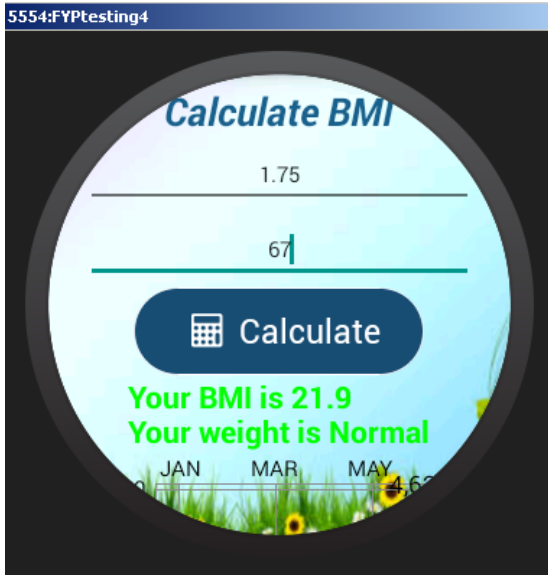
Figure 5.4.7 BMI value under	Figure 5.4.8 BMI value
category Normal	under category Obese
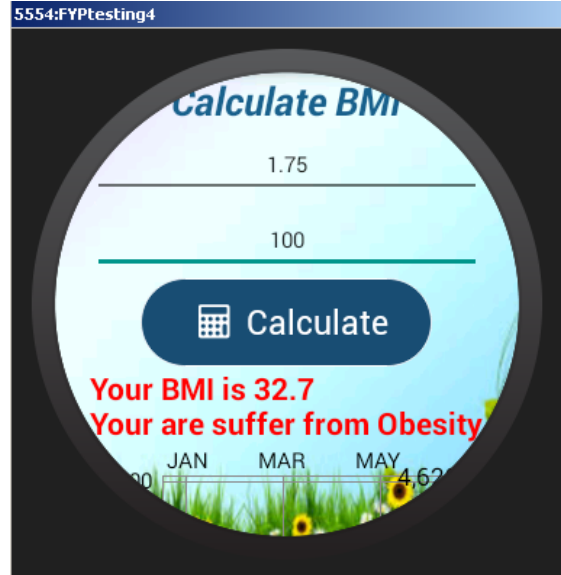
Figure 5.4.7 showing the text in green color which represent user's BMI value is safe and under normal category, however in Figure 5.4.8 showing the text in red color which meaning giving a warning to the user since red color are easier to capture attention from a user. Therefore, an appropriate color need to be used since different color can represent different understanding to user. For example, to human eye, orange is seen as a very hot color, so it gives the sensation of heat; Green can be related to nature or, as opposed to red, meaning safety.
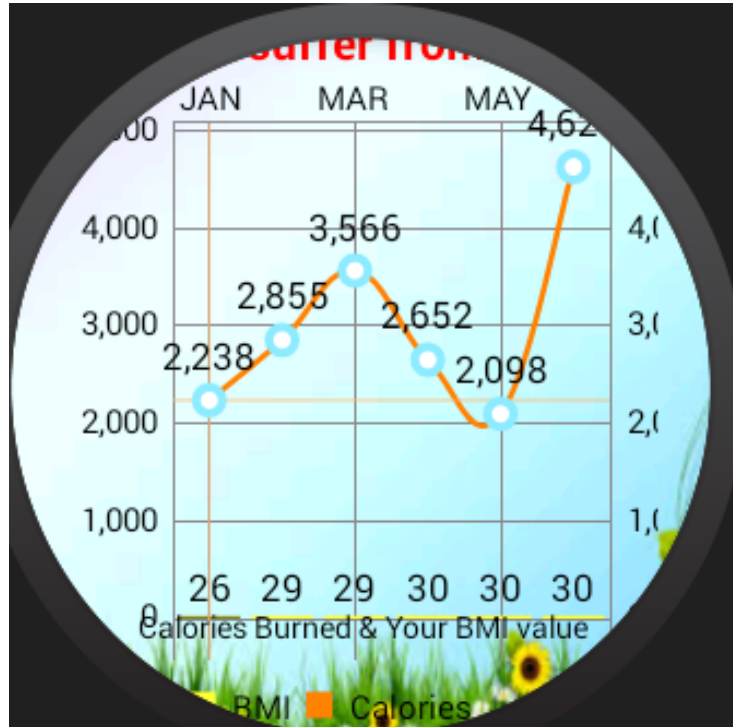
Figure 5.4.9 Combined two parameters in one graph

In the calculate BMI function, it access into database and retrieve BMI value as well as the total number of calories burn and then those two value is being shown in one graphical view. Since BMI of user and calories burn by user can be closely related to each other, so user can try to compare and observe how their calories burn affects their body mass index (BMI).
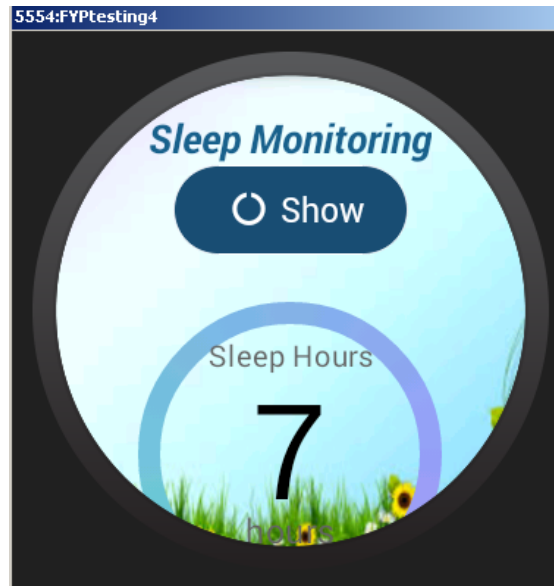
Figure 5.4.10 Progress bar in sleep monitoring function

In the sleep monitoring function, after user clicking the button "show", the application will access the database and retrieve the latest sleep hours of user and show it in the progress bar as in Figure 5.4.10. In this progress bar, the target sleep hours is eight hours since the sleep scientist recommended us to sleep eight hours per day.

Besides, in this application would recommend user with some advice based on the number of step taken per day and number of hours sleep each day.
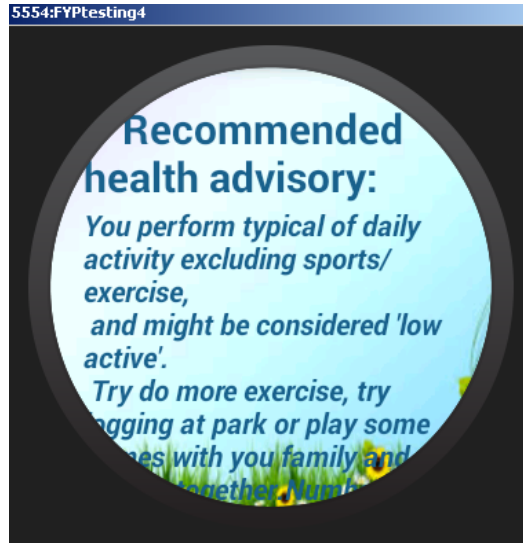
Figure 5.4.11 Health advisory function
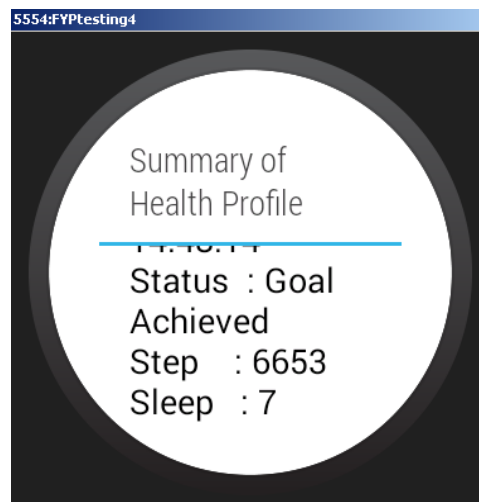
Figure 5.4.12 Health profile in text form

From Figure 5.4.12, the latest health profile is being shown to user in t text form, this let user to know their body health information in a text form since some user prefer text.

Furthermore, there is a function which is history chart which will show all user's health data in graphical presentation. In this function, all the graph will be shown in an automated way because the next graph will be display automatically to user after a few seconds. Total of four graph is shown automatically without user input. Therefore, user can view all their health information with a glance at their wearable device without much input from user.
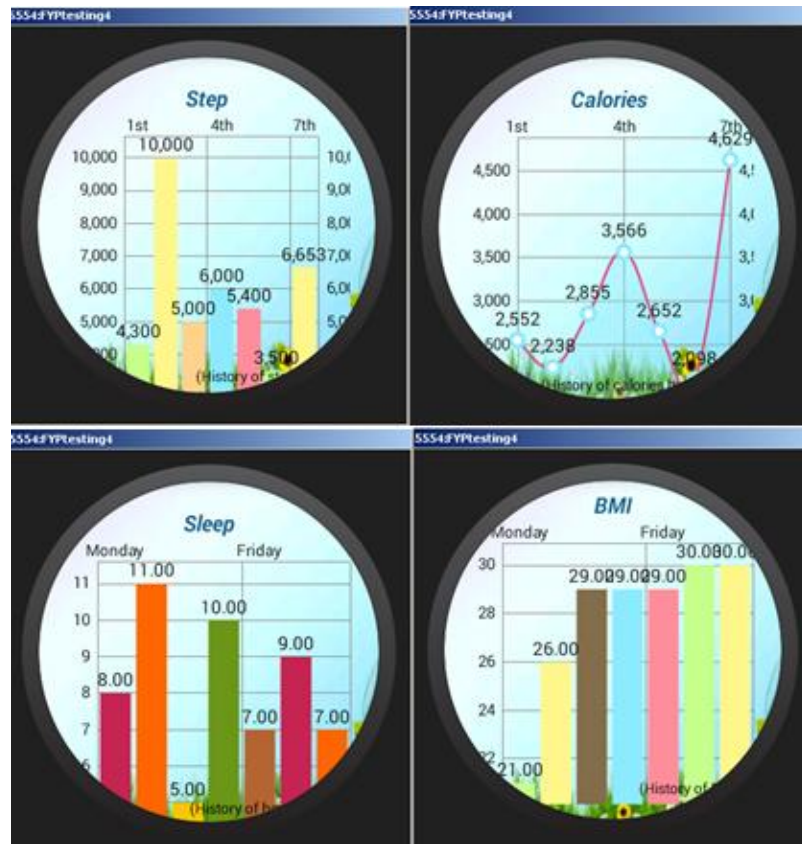
Figure 5.4.13 Health profile in graphical presentation

CHAPTER 6: SYSTEM EVALUATION AND DISCUSSION

6.1 System Testing

Step tracker function

Feature	Action	Input	Output	Expected Output	Abnormal (Yes/No)
Enter step taken and goal	Fill in input field	Enter all fields	Data inserted and show progress bar	Data inserted and show progress bar	No
Enter step taken and goal	Fill in input field	Empty all fields	Program stopped	Program stopped	No
Enter step taken and goal	Fill in input field	Empty some fields	Program stopped	Program stopped	No
Enter step taken and goal	Fill in input field	Enter negative value	Data inserted and show progress bar	Program stopped	Yes

Table 6.1.1 Step tracker function testing

CHAPTER 6: SYSTEM EVALUATION AND DISCUSSION

Calculate BMI function

Feature	Action	Input	Output	Expected Output	Abnormal (Yes/No)
Enter height and weight	Fill in input field	Enter all fields	show BMI value	show BMI value	No
Enter height and weight	Fill in input field	Empty all fields	Program stopped	Program stopped	No
Enter height and weight	Fill in input field	Empty some fields	Program stopped	Program stopped	No
Enter height and weight	Fill in input field	Enter negative value	show wrong BMI value	Show wrong BMI value	Yes

Table 6.1.2 Calculate BMI function testing

6.2 Project Challenge

There are few challenges faced during accomplishing this project. Firstly, the wearable device is too small to put the keyboard layout to let user provide some inputs in the same way just like our smartphone. Therefore, during testing the application, virtual device is always needed to provide some input to test the function in the application. Besides, user login function would not be suitable in wearable device since the interface is too small to provide accurate input. Therefore, user may lose their health data if user decided to change their wearable device since there is no user profile data uploaded to the cloud.

CHAPTER 6: SYSTEM EVALUATION AND DISCUSSION

Besides, the wearable device aims at quick grab of data from the small wearable device, and therefore storing data at cloud or server would be not efficient since accessing to remote server/cloud and process of retrieving data would be would be much more slower. As the consequences, it is better for wearable device to have local database which is faster compared to retrieve data from cloud.

Another challenge faced in this project is that creating a suitable symbol for each function is a big challenge for this project. The symbol used in the application must meet some requirements such as user must able to quickly understand the symbol used in this application. The symbol used can be consider as not suitable or not efficient if a user require to take some time to understand what does the symbol represent. Besides, provide a good interpretation of information to user is another challenging task.

6.3 SWOT
Strengths

The strength of the project is that it can show proper display structure of information in the field of health care. The application can retrieve a lot of data and show all of it to the user within seconds which will save user's time to interpret and understand those data. Showing only the critical some critical health information within the limited time is the biggest strength in this project. Besides, user not require interact much with the wearable device while tracking their own history record since some function in the application will display all information in an automated way, meaning that user does not require to provide many input into wearable device before checking their health data.

Weakness

The weakness of the project is lacking of the accuracy in showing the real health monitoring data. In this stage, this application would not able to detect the real step taken by user, actual number of sleep hours of the users, as well as the calories burned by the user.

Opportunities

In this hectic pace of society life, people are rushing doing their work, student busying prepare for examination, assignments. Some of them would just forgot to have their meal or failed to maintain a good quality lifestyle. Therefore, a wearable device that having a health monitoring and advisory app would be helpful for them since the wearable device is always in proximity with user and user can always monitor their own body health by just looking at the wearable device. The strength of this project is to display critical user health data in a quick way, and therefore it is very suitable for people who are always have a sense of time urgency in their life. User nowadays prefer to know everything within a short time rather than spending long time to interpret data. Besides, the wearable device is always convenient and portable, meaning that huge amount of useful of information is carried by user around, so people may willing to spend money on buy wearable device. Furthermore, wearing a smartwatch is slowly becoming a new trend, thus, the market of this health care monitoring and advisory apps would increase time by time.

Threat

This application require a lot of approval from hospital or health care authority. By providing some health care advisory is something crucial and this might ruin the health of a patient if a wrong health care advisory is provided. Some people might doubt the realibility of those advice by health care app. Besides, the owner or partnership of this application can be get sue by society if there is a patient 's disease becoming worsen after apply the health care advisory of this application since there is no approval from hospital or health care industry.

6.4 Objectives Evaluation

The first objective for this project is fully achieved, the application are able to provide some meaningful symbol and color to increase user friendliness. For example, user do not spend much time in knowing the function of the certain button, they only have to glance at the symbol provided and they will roughly know the feature of each function.

The project is able to display good information display structure by using graphical presentation instead of display info in text form. Graphical presentation allow user to quickly interpret all information contain on small interface of wearable device. Besides, user are able to view those graphs in a more automated way since the next consecutive graph about their health info will automatically display to user after few seconds.

The last objective is to create an effective information display for health monitoring by implementing some smart feature. The circular progress bar in this application is an innovative display structure for showing user's progress toward their goal in the field of

health care. The degree that filled with color in circular progress bar indicates their performance or progress on their personal goal. Furthermore, a blinking effect will occur on the circular progres bar when user had achieve their own goal on the field of health care. The blinking effect on circular progress bar is consider as a smart feature since the blinking effect will happens when the application detects that the user had achieved their goal. Therefore, the third objective for this project is achieve.

6.5 Concluding Remark

In this chapter, we talked about the system evaluation and discussion of the project.The application is being tested with few possile input and the output is being recorded as shown in Table 6.1.1 and Table 6.1.2. The challenge faced in this project is the interface of wearable device is too small to display a bunch health monitoring data , besides, creating an effective way of displaying information is another challenge too. In this section, we also discussed the strength, weakness, opportunity and threat of the project. Evaluation of project objectives are being reviewed and all of those objectives is achieved in the application

CHAPTER 7: CONCLUSION AND RECOMMENDATION

7.1 Conclusion

In a nutshell, the purpose of this project is provide a proper and good display structure to user for their health monitoring in wearable device. Information have to be clear and contain some "smart" way to present it for user in a small interfaces of wearable. The challenge part of this project is to find a smart way to convey many information in small interfaces. Therefore, appropriate use of color, symbol, animation, or abbreviation is necessary to convey the information of health record instead of using a lot of text in wearable device. In order to improve and save the battery consumption, a good presentation of information in small interface of wearable device is always needed in which user just have to take a glance on their wearable device and know all the record and information as quickly as possible.

7.2 Recommendation

For the future development, the application should support more automated animation for user to grab health monitoring information more easily provided that those animation should convey information in a quick and understandable way. Besides, the application can be enhanced if the application itself can collects the accurate health monitoring data from the wearable device. This is because accurate health monitoring data are needed in order to provide reliable health care advisory. Besides, those health advisory must get approval from the health industry or authority to increase the reliability and trustworthy of this application.

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CHAPTER 1: INTRODUCTION

1.1 Motivation and Problem Statement

Recently, major electronic makers are focusing efforts in developing products featuring functions that are innovative than mobile computing. This is so-called wearable product made a big change in terms of the distance between the electronic device and human body which has become closer. The new frontier for displays are wearable.

The wearable displays tend to be smaller than handheld mobile devices, however, wearable products require display according to the purpose and its main function which user satisfy with the products. In order to fully utilize the wearable functions, the displays structure on the wearable must be good and clear so that user can be understand the content shown on wearable. Besides, the wearable product's display market is expected to develop into flexible, proper as well as stretchable display.

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