Interim Report

Programming An Intelligent Watch

COMP4801 Final Year Project

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Summary

The project is an individual project with the topic “Programming an Intelligent Watch”. The original system of the intelligent watch has some defects in user interface design and functionality. Therefore, the objective of the project is to develop a new system based on the current system and the new system needs to be more user friendly, intelligent and have more functions. The final deliverable is a new system which can better fit to the rounded watch screen and has more applications and functions such as wifi setting, browser and typing input method. The major technology used in this project is android programming. Currently, some applications with rounded user interface have been developed and the interim goal has been achieved. The next stage of the work is the part of system customization .

Acknowledgment

I would like to express my sincere thanks to my supervisor, Prof. Francis Lau. His guidance helps me to come up with some ideas in the project, and he offers me the development kit required by the project.

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Abbreviations:

IWOP: Ingenic Watch Open Platform

UI: User Interface

MVC: Model, View and Controller

JDK: Java Development Kit

SDK: Software Development Kit

NDK: Native Development Kit

1. Background

A new android watch based on the Ingenic Watch Open Platform (IWOP) has been designed recently.

Processor	Ingenic dual-core M200 SoC, one core up to 1.2 GHz, the other core up to 300MHz. - GPU: 3D with OpenGL ES 2.0/1.1 and OpenVG 1.1. - VPU: H.264 720P@30fpsencoding and decoding. - ISP for image pre-processing.
Memory	eMCP (4GB eMMC + 4Gb LPDDR2).
PMIC	power management IC.
Sensor	9-axis gyroscope + accelerometer + magnetometer.
USB 2.0	Micro USB device.
UART	Serial debug port.
Wi-Fi	single-band 2.4GHz IEEE 802.11b/g/n.
Bluetooth	Bluetooth 4.1 (Bluetooth Low Energy), Bluetooth 3.0, Bluetooth 2.1 + EDR.
Clocks	24MHz, 32.768kHz; 26MHz (Wi-Fi/BT).

Table 1: The hardware components of the watch. [1]

The watch has excellent processor, memory and other hardware components (Table 1). Compared with other android wear devices, the IWOP watch has the Wi-Fi component which is not found in other android wear devices except those newest published android watches. Since it has good hardware support, the watch can realize more functions than other android wear devices. As for the system, the watch is currently running the IWOP android wear system. The system is a modified version of android 4.4 system. The current system has several applications, including calculator, recorder, alarm, calendar, stop watch, music player, weather forecast, album, and compass. However, those applications have poor UI design. The shape of the watch in this project is rounded, but most of those applications cannot fit well to the rounded screen. Thus, some parts of the application' layout cannot be shown on the rounded watch face. Moreover, the styles of the default installed applications are inconsistent. Some applications use black color and some use blue color. Also, the system lacks some basic functions, for example some system settings and a power indicator. So in

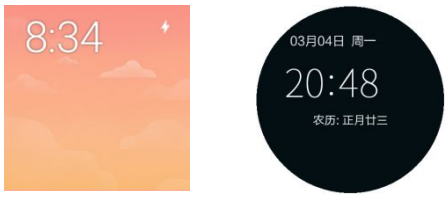
conclusion, the original system is not so user friendly and powerful. The purpose of this project is to design and program a new system on the basis of the current IWOP android wear system. The new system will have a more user friendly design, more intelligence and more functions.

2. Objectives

The previous project plan had two objectives. The first was to develop a new set of applications and a new watch face. The second was to add some drivers to the system. However, when the development kit of the watch was received, it was found that it was unnecessary to add any drivers. Therefore, the second objective was changed to modify system layout and add system functions. Thus currently, the objectives of this project can be divided into two parts: application development and system customization. The application part covers new application development and old application redesign and redevelopment. The old applications contain all default installed applications of the IWOP system, and the new applications contain a typing input method, a browser, a notepad, a translator, a weather application, and a flight search application. The system part covers the supplement of system settings, system layout and system intelligence. The interim goal of the project is to complete the application part of the project.

3. Literature Review

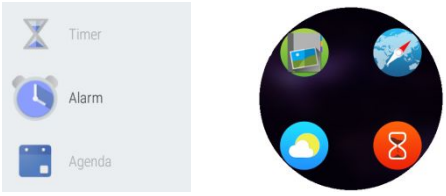
There are some other published android wear systems. ASUS Zenwatch system is one of those most famous android wear systems. The Zenwatch system is significantly different from the IWOP system in the UI design and functionality. This part will briefly introduce the Zenwatch system and IWOP system, and make a comparison between the two systems.



(a) (b)

Figure 1: *The UI design of Zenwatch and IWOP. (a) The watch face of Zenwatch. (b) The watch face of IWOP watch.*

The Zenwatch has a rectangular watch face. The default watch face shows the current time on a colorful background (Figure 1(a)). The background color changes as time flows. For instance, the background color will change to midnight blue after 23:00 pm. The watch face of the IWOP system shows not only the current time but also the current date and the current date in traditional Chinese calendar (Figure 1(b)). However, the background of the IWOP watch face is just black, which seems dreary and lacks attraction. Hence, in this project, a new watch face will be designed. Besides, a supporting application will be developed to help user design his or her own watch face on the computer and apply it to the watch.



(a) (b)

Figure 2: *Ways to display applications. (a) The application list of Zenwatch. (b) The application list of IWOP watch*

Furthermore, the two systems have quite different ways to display applications. The Zenwatch system uses a list to display all the applications, as well as the application names (Figure 2(a)). User can scroll the list up and down to view all the applications. And the icons of the applications are in the same style with gray and blue color. The IWOP system employs panel pages to display the application icons (Figure 2(b)).

There are four icons on one page. User can scroll up and down to switch pages. The application names are not shown on the page, and the application icons are quite different from each other. The new system developed in this project will use the list layout of the Zenwatch system to display the applications, and the styles of icons will be more consistent compared with those in the current system.

The Zenwatch system has more functions than the IWOP system. The Zenwatch has an Agenda application, a Flashlight application and a Translator application, all of which are not found in the IWOP system. The Zenwatch system supplies two more settings than IWOP system. The Zenwatch allows user to change the watch face and font size. The Zenwatch system also permits the user to choose the phone to connect through bluetooth setting.

The Zenwatch system is based on the voice recognition input technology and does not have an typing input method. But the accuracy of the voice input method is not high enough, and in some cases, for instance, in the noisy environment, voice input is not the most suitable input method to input words. Therefore, a typing input method is needed. And the system in this project will introduce a new typing input method to help user input words.

Figure 3: *The problem of the UI design of the IWOP watch. The Music Player application on IWOP watch.*

As for the IWOP system, it does not fit well to the rounded watch face. The layouts of most default installed applications cannot be completely shown on the rounded watch face (Figure 3). Some parts of the applications are missing from the screen and user cannot see the whole layout of the application. Thus, one of the purpose of this project

is to redesign those applications in order to make them better fit the rounded screen of the watch.

In conclusion, although the IWOP system has some basic functions, the style of the system and the layouts of the applications in the system are not good enough to make the watch published. Hence, the project is aimed at the modification of the IWOP system. The new system will abstract some good points from other android wear systems like the Zenwatch system. Besides the UI design, the project will also add more functions and intelligence into the system to make it more powerful than the original IWOP system.

4. Approaches

Since the project has two parts of objectives, the approaches utilized in this project can be divided into two parts as well. The first part is application design and development, and the second part is system development and system image generation.

4.1 Application design and development

The first part is application design and development. The current system already has some basic functions. However, the system and the watch are too simple and lack attraction. Thus the aim of the development is to program applications not only with more powerful functions but also with more user-friendly user interface. Since the user interface is very important in this project, the first step to develop the android applications is to design the user interface. After the step of design, the android programming technology is used to program and develop the application. The programming is operated on the Android Studio platform; and the test is performed on the development kit of the watch during the development.

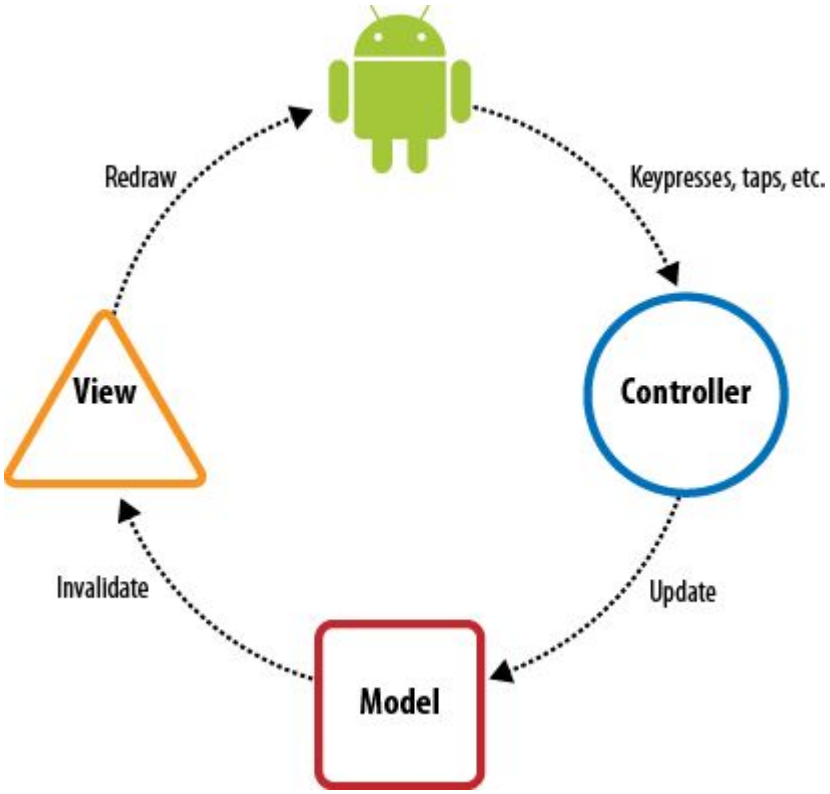


Figure 4: The MVC structure of the Android programming. [2]

The android programming is based on MVC (model, view, controller) architecture (Figure 4), which means that the programming can be separated into three parts.

The model part contains java classes and content provider classes which are used to handle the data computation and storage. The view part contains the XML files that control the layout of the application. The controller part contains the activity classes, services classes, and broadcast receiver classes, controlling the process of the application. The controller part receives orders from user and passes them to the model part; the model part updates the data according to the information got from the controller part; and lastly, based on the updated data, the view part is changed to respond to the user.

4.2 System development and system image generation

The second part is system development and system image generation. The new system is based on the original IWOP system. The development of the system is performed on the Linux environment. The first step is to download the *repo* folder from the IWOP website. The *repo* folder only provides the way to download the system code but does not contain the source code. Then the Repo and Git commands are utilized to download the whole source code of the project from the Git repository. After the downloading, the Java environment is needed to compile the system. Therefore, the next step is to set up the Java environment, including the JDK, SDK and NDK. The IWOP system is based on the Android kernel. The lower architecture of the Android kernel is the Linux Kernel. Since there are no hardware components to be added to the watch, it has no need to modify the Linux Kernel. Hence, most of the work on the system are performed on the Android part. The modification of the system has two parts. The first part is to add the developed applications, and the second part is to modify the system. To add the developed applications, the source code of the applications are required to be moved into the *elf* folder in the source code file folder. The android source code in the */system/apps* folder will be compiled into apk files when the system is complied. And those applications will be installed in the system as default applications. To modify the system, the *frameworks* folder under the source code folder has to be modified. The source code in the *frameworks* folder controls the font, background, layout, and the starting face of the system. To change system settings, the source code in the */system/app/AmazingSettings* folder will be modified as well.

5. Current Status

Currently, some new applications of the system have been developed, and some default installed applications have been successfully redeveloped. Compared with those old applications, the new applications can fit well to the rounded watch face. An

input method is also developed. The old system has an input method of the android phone system. The problem of that input method lies in the size of the keyboard. The keyboard of the old input method nearly covers the whole screen of the watch, and some parts of the keyboard cannot be shown on the screen. Compared with the old input method, the new input method corrects the keyboard and has a complete layout. In the next stage of the development, the input method will continue being modified. In addition to the input method, a notebook, a web browser, a translator and a flight search application have also been developed for the system.

The interim goal is to finish the application development. Some default installed applications and new applications need to be developed and added into the system. Currently, the application part has been completed.

The work of the next stage will contain four parts: system settings, system layout, system intelligence and adding new ideas.

The system settings include 3 settings. Wifi setting enables the watch to connect to the internet. Bluetooth setting makes the watch show the bluetooth devices near the watch, and user can choose a device to connect by bluetooth. Another setting is input method setting. If there are more than one input method in the watch, user may need to set some settings. For example, user can choose the writing input method as the default input method.

The next part is system layout. The watch will use a list instead of page to display applications, and app names will be shown as well. And a search function will be added to the system to help users quickly find the app they need. And finally, a power indicator will be added and shown on the top of the screen.

The third part is the system intelligence. The first thing to do is modifying the system launcher so that the applications on the desktop will be sorted according to the usage

frequency of the user. The more times the user uses an application, the more preceding place the app will stay. Another intelligent function is wifi automatic switch. Wifi function consumes much power, so it's necessary to switch off the wifi when the system doesn't need it. The wifi switch function will automatically switch off the wifi when user doesn't use the wifi, and automatically open the most recently used wifi connection when user opens some apps that need wifi. The last intelligent function is the voice command assistant just like "OK google", so user can use voice command to control the watch.

In the next stage, the input method will continue being modified. Although the input method is workable now, it is still inconvenient for users to input words because the buttons of the keyboard are too small. Therefore, a new layout of the keyboard is required. Besides, other feasible new ideas will also be adopted in the next stage of the project.

6. Difficulties

Some difficulties and problems occurred during the development. The major problem is the change of the watch system. The system in plan was an android wear system while the system actually being used is the android 4.4 system. Android 4.4 system is a system running on the phone or pad. The IWOP system is a modified version of android 4.4 system that can run on the IWOP watch. The change of the system leads to the change of the methodology and approaches. The original methodology in the project plan was modifying the android wear system. Later, it was found that the development kit is running the IWOP android system. That means the development methods should be changed accordingly. The method of application development is changed from watch application development to ordinary android development, and the method of watch face development is changed from watch face development to android system framework development.

There are also some problems in the compilation of the IWOP system. The compilation needs to be performed on the 64-bits Linux system, so Ubuntu 14.03 was chosen to build the IWOP system. However, some tool files in the source code are built in 32 bits system. Thus, the Ubuntu requires a 32 bits library to execute those files.

Another difficulty is the layout design. The screen is very small and rounded, so there are some difficulties in the layout design.

7. Deliverables

Date	Content	Deliverable	Status
4 Oct 2015	Study the IWOP android wear system. Decide the apps that will be added in the system. Make detailed project plan. Make a project web page.	Detailed Project Plan. Project Web Page. List of applications that will be developed.	Completed
Oct-Nov 2015	Develop the set of apps.	Apk files of the applications.	Completed
Dec 2015	Develop the set of apps. Prepare for the first presentation and	The new system with the applications.	Completed

	interim report.		
Jan 2016	First presentation Preliminary implementation. Detailed interim report.	First presentation. Preliminary implementation. Detailed interim report.	Completed
Feb-Apr 2016	Finalized tested implementation Final report.	Finalized tested implementation. Final report.	Not start

8. Conclusion

In conclusion, this project aims to modify the current IWOP system because the current system has poor layout and too few functions. Therefore, a new set of applications and a new system face will be added into the new system. Currently, some applications have been developed, including a browser, a translator, a flight search app, a file manage app, an input method and some default installed applications. The interim goal has been achieved and major problems have been solved. The next stage of the work will be the system customization part, with the focus on modifying the system layout, settings and adding more intelligence to the system.

9. References:

1. Ingenic [Internet]. China: Ingenic Watch Open Platform; [updated 2015 Oct 17; cited 2015 Oct 17] . Available from: http://iwop.ingenic.com/zh-cn/develop/build-platform/burn-aw808/

2. CCSU [Internet]. USA: Central Connecticut State University; [updated 2014 Jan 14; cited 2015 Oct 17]. Available from: http://www.cs.ccsu.edu/~stan/classes/CS355/notes/03-AndroidUI.html