City University of Hong Kong

Department of Electronic Engineering

EE5415

Mobile Application Design and Development

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Final Report

[ULife]

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Table of Contents

Abstract

In order to make life of students in CityU more convenient, we planned to develop the APP of ULife.

Our target users are students in CityU. Based on current situation in Hong Kong, it is hard to deliver or collect express. And many students have a lot of two-hand products to dispose. Besides that, students also lack a platform to discuss their academic problems. ULife could help students deal with these problems easily. We gather the students who have the same demand. So they do not need to find many different ways to ask for help. When registering, it is necessary to carry out the real-name authentication of the student card, and relatively improve the security problem of express and second-hand transactions. Most of the students now look for courier help, as well as second-hand transactions and other services in WeChat groups. The strict real name of APP can avoid the non-CityU students in the WeChat group stealing express, stealing information, defrauding money and other bad behaviours.

The platform contains three functional modules of express delivery collection, second-hand transactions and course discussion. Students can post their requirement by posting in the corresponding module.

When the user selects a service partner, both sides can implement the private chat function, which can further inform the other side of the relevant information such as express delivery and the second-hand products. It improves privacy by avoiding the need to add both sides as friends in WeChat.

The received order post will be added with the received order flag to prevent the user from browsing invalid information multiple time. The default time of valid posts is one day. Users can also choose their own suitable time according to their own needs.

Chapter 1: **Introduction**

1.1 Background

1.1.1 Express Delivery Collection

As we all know, in mainland China, shopping online has become one of the most popular ways of consumption, just as Figure 1 shows. There are kinds of online shopping APP, such as Taobao and Jingdong.

Figure 1. Statistical results of online shopping

One of the factors that make online shopping so popular is the convenient express service with low charge, which makes you do not need to go to crowded and far shopping malls. However, when it comes to Hong Kong, the degree of development of online shopping in Hong Kong is backward in the world. Although netizens in Hong Kong have grown steadily in recent years, online shopping is not common. According to some surveys, the number of Internet users participating in online shopping in Hong Kong increased from 4.9% in 2002 to 24.4% in 2012, mainly due to "booking", "purchase clothes and footwear", and "arranging travel matters". The satisfaction of Hong Kong consumers in online shopping experience is also the last among all surveyed regions, only 38%, far less than 83% in the United States, less than 60% in the Mainland, and lower than the Asian average of 50%.

The high cost of shipping is also a major obstacle to local online shopping in Hong Kong. Because Hong Kong's labor costs are high, and the express delivery industry is a labor-intensive industry. So, the price of postage in Hong Kong is extremely high compared to mainland China. The same city express delivery in Hong Kong of 1 kilogram on the same day is more than 30 Hong Kong dollars, and the next day is at least 25 Hong Kong dollars, and this is only the express delivery price of the industrial and commercial area, even if the residential area is a few kilometers next to the business district, plus 15 HKD "remote area" fees, online purchase of electrical appliances, baby diapers and other large pieces of goods, generally have to pay 50 HKD to 150 HKD, the freight has greatly reduced the online shopping of Hong Kong people interest. However, the postage in the same situation in mainland China is much cheaper only need no more than 12 RMB. Some Hong Kong netizens complained, "I often see a lot of activities on Taobao, but the shipping area does not include Hong Kong."

Therefore, some Hong Kong people are accustomed to transporting goods to multiple consignment points in Shenzhen, Zhuhai and other places, and then transport them back to Hong Kong. However, even if the seller delivers goods in time, it is often more than two weeks from the time of purchase to receipt. If one or two of the shipments are delayed, the buyer may be fined for higher storage costs at any time. There are also some private online shopping express collection points near the major gates. Although the cost is relatively cheap, it also lengthens the shopping time. It may take three to four weeks to receive the desired goods. It could save the postage in a certain degree but took too much time.

Moreover, the delivery of Hong Kong Express will not be sent to the user directly but will require the user to pick up the place designated by the courier company. This location is generally a distance from where you live. Even if you pay a high-cost postage, you still need to go out and take it yourself. This is very inconvenient for many users who are used to receiving their own express delivery at home. If you require door-to-door delivery, you will need to pay for the building. The higher the floor, the more expensive the cost. Generally, the upper floor fee needs to be more than 20 HKD.

Therefore, many students will set the delivery address as a collection point near Shenzhen Lo Wu or Futian or bring the place they need to send to the Shenzhen Pass instead of sending it locally in Hong Kong. If the person choose to go to Shenzhen collect the express by himself or herself, the round trip tolls can be expensive. Assume that the departure fee from

Kowloon Tong to Lo Wu is as high as 80 HKD. In addition to high costs, time costs are also high. Round trip time takes at least 3 hours. So it is not cost-effective to go to Shenzhen to get the courier. The value of the things that everyone buys is not particularly expensive. If you set the delivery address in Hong Kong, or if you go to Shenzhen to pick up the courier, then the cost of courier will be very expensive, sometimes even more than the item itself.

Therefore, they will ask those students in WeChat group who often travel to and from Hong Kong and Shenzhen because of internships in the Mainland or other reasons to help express or help send a courier back to mainland China. These students traveling to and from the two places need a lot of transportation expenses. They are also willing to help students send couriers or take couriers to get some compensation to subsidize their own transportation expenses.

Specifically, The express "Express delivery collection" is a very common phenomenon among students in City University of Hong Kong and other universities in Hong Kong. If student A has a package to be expressed, and student B just plans to do to Shenzhen for some reasons, B can help A express his or her package and charge a fee (usually below 20 HKD per package). It is a win-win situation, because Student A can save time and money, and Student B can earn a part or even all of the car fare to Shenzhen.

The information about the requirements for "express delivery collection" is mainly posted in WeChat groups. There are even some WeChat groups exclusively used to post this kind of information, just like Figure 2 shows.

(a)

(b)

Figure 2. Chatting records from WeChat groups

If Student B found himself or herself can meet the requirement of Student A, they would friend each other on WeChat and do further communication, mainly about how much to pay and where to meet. But using WeChat to deal with this thing can bring some troubles. The following are some examples:

(1) Student A and Student B have to friend each other on WeChat, although they may never talk to each other again after finishing the deal. However, WeChat is a relatively private APP, we are not willing to add strangers. Actually, they don't talk anymore in WeChat.

(2) It is possible that Student A and Student B had made a deal, but Student C, who can also meet the requirement, did not know. This means there may be several strangers try to add Student A on WeChat, which will disturb him or her.

(3) Some people in the school WeChat group may not the real students. It is easy for some non-student people to add the student WeChat group. The members of WeChat are mixed, and it is easy to mix into the bad guys who are ill-intentioned, use the students' demand for express delivery, carry out express stealing, or illegally obtain the student's private information, and even carry out deeper fraud. The main reason is that the student WeChat group lacks a strict regulatory measure for the group.

However, if they use our proposed APP, there will be no need to friend each other on WeChat, which will reduce troubles.

1.1.2 Second-hand Goods Trading Platform

There are also a lot of information about second-hand goods trading in WeChat group. As we know, most of the master students in City university of Hong Kong just stay in Hong Kong for one year. After graduating, they would probably leave Hong Kong to go back mainland or change different place to live. They can't take away all the things of their own. It is urgent for them to find a platform to sell or donate some second-hand objects that they cannot take away, such as beds, some furniture, home appliances. They could also save some money from this transaction. These objects could be used again. There are also some second-hand transactions in ordinary day, just as Figure 3(a) and Figure 3(b) shows.

(a)

(b)

Figure 3

Actually, the second-hand transaction platform not only is convenient to the students with needs to sell their second-hand products, and also reduce waste, encourage recycling and waste recycling. Besides that, students also could donate to the people in need. We will work with charities to donate these second-hand items to children in remote mountain areas. This platform has a deeper meaning.

Some universities in mainland China already developed this kind of platform, just like the "在工大" APP of Harbin Institute of Technology. The students can make the second-hand transaction in this APP. It is very convenient for students to change the things that they need.

However, there are also some troubles similar with those in "express delivery collection". The strangers also need to add the publisher in WeChat. If several different students meet the requirement, many strangers will add him. It will bother the publisher. The ill-intentioned people also could make use of this WeChat to do some bad behaviour, such as stealing express, stealing privacy and defraudation.

1.1.3 Course Discussion Platform

According to the survey, up to 9% of university students in Hong Kong exhibit moderately severe to severe depressive symptoms. Up to 5.8% of university students in Hong Kong exhibit severe anxiety symptoms. Respondents reporting regular exercise, higher self-confidence, and better satisfaction with both friendship and academic performance had fewer depressive and anxiety symptoms. Students in the universities of Hong Kong suffers a lot from their homework or exam. We will also provide a course discussion platform through our proposed APP, which will be necessary and useful. The following are some reasons specifically:

(1) Taking 5-6 courses per semester makes us have rigorous coursework.

(2) There is no fixed class helping us know each other. As a result, if we meet problems, it may be difficult to find someone to consult.

(3) Teaching assistants can only answer our questions with weekly schedules.

At present, the platforms where we can discuss are mainly WeChat Group and the discussion board of CANVAS. But they have the same problem, which is that members cannot be anonymous. After all, we may be too shy to ask questions, sometimes. In addition,

chat messages in WeChat are relatively confusing. It is hard for us to organize the information.

In conclusion, we propose to develop a one-step APP, which contains functions of Express delivery collection, Second-hand goods trading platform and Course discussion platform.

1.2 Market Research and Analysis

There are mainly two types of applications focusing on the same function: professional applications like “香不香港”and amateur applications like WeChat.

1.2.1 Hong Kong Or Not

香不香港 is a professional application which focuses on the express service. But there are still a bunch of demerits in this application.

Figure 4

The first issue of this app is the privacy, namely security problem. When you get into this app, you are required to register an account before you enjoy any services in it. And here is the screenshot of their registration page. You are asked to fill the blanks with your real name, WeChat number, and phone number. Sounds really secure, right? But unfortunately, I was a

lucky guy. Because I was authenticated with a dummy WeChat account and phone number successfully.

In our app, we don't ask you for this kind information. You need to upload your student card picture. Well, perhaps you will think what if uploading others' student card. We also need you to leave a CityU email address which is used to receive our authentication email. This can ensure that you are indeed the CityU student.

After the login, here is the service page where you can scan that information about supply and demand. But before any actions, you have to click the pay button. It's very annoying for the users who haven't known enough about the service provider.

The second problem is relative to the user experience-the right of choice. After registration, you can access to the express delivery service. But you can't talk to anyone, can't have a look at the detail of the business unless you pay for it first. I think this is really annoying on the user experience where users are forced to pay before diving into it.

So, instead of disgusting users, we have better designs which means you can negotiate with others before making the deal. And we don't provide online transactions for the security reason. It's better to make a face-to-face transaction.

Figure 5

The last is the complaint problem. When I was experiencing this application, I found there is no complaint entrance for users who are facing with unfriendly guys or who are just getting in trouble with the services. If you encounter these situations, I have to say sorry that you properly need to address it by yourself. This is a disaster upon the users' experience.

In our app, we use a compression algorithm to transfer all your chatting history into a QR code and the system will automatically upload the QR code to the cloud server, i.e., you can extract all your chatting history as the proof when there is a conflict happening. And my partner will talk about it later.

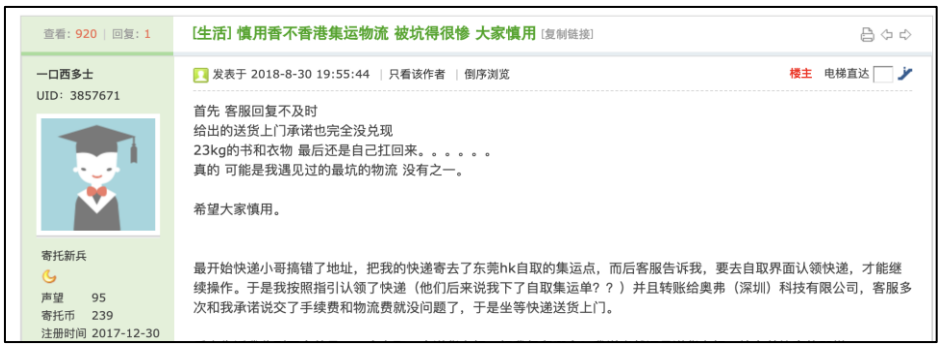

Figure 6

Below is another screenshot of the problem mentioned above:

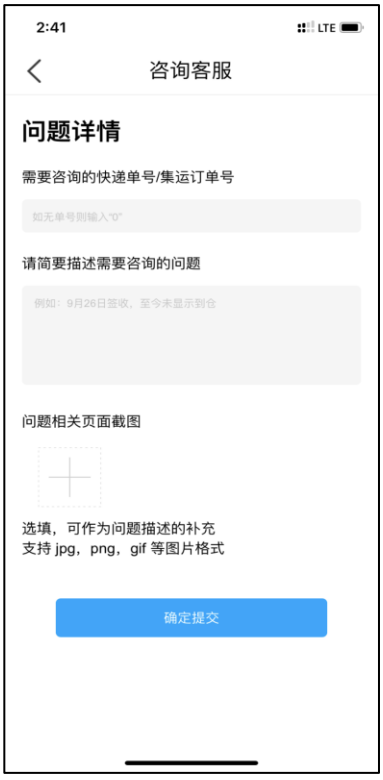

Figure 7

Overall, although 香不香港 is a professional software to try to solve this problem, it still has many defects in software details and user experience that need to be improved, and these problems have been well solved in our software.

1.2.2 WeChat

As the most popular communication applications among mainland students, it is so convenient for users to search the service providers on this platform. But every coin has two sides. The convenience brings the privacy trouble to users. What's more, it's also too complicated to make a deal on this platform. If you want to enjoy the service on WeChat, you have to complete the following steps:

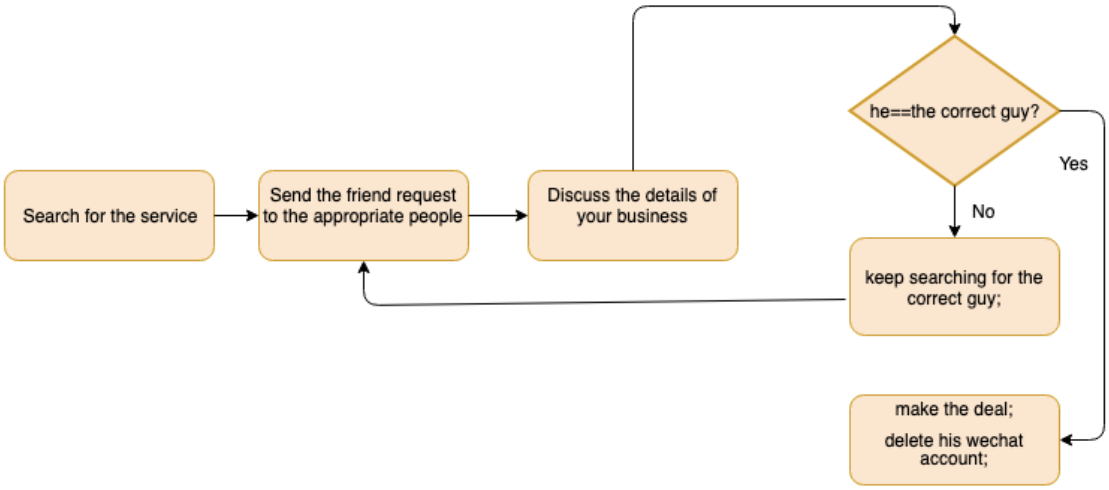

Figure 8

WeChat provides the message recall function for users. But the time limit is two minutes which means your message will stay there forever after two minutes. And this will lead to a disaster shown in the picture. You will receive enormous friend requests although you have already finished your business.

Figure 9

So, in order to avoid this situation, we require users to set up the expiry time for their business. When the time is up, your service information will disappear automatically.

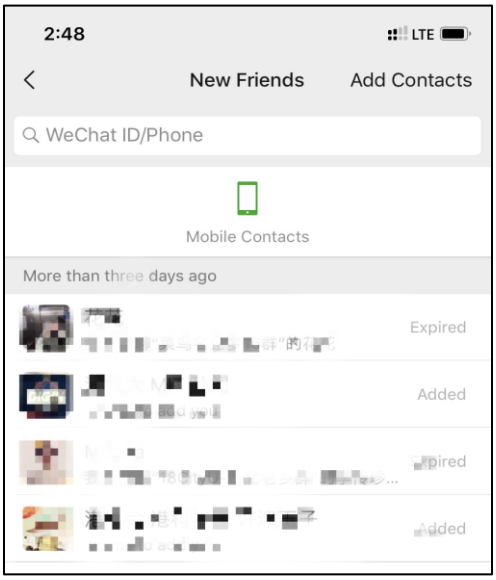

Figure 10

So, with the concept “Less is more”, it is not a wise idea to use the WeChat as the appropriate tool to get the express service.

Chapter 2: **Application Design**

2.1 Function Design

In this subsection, the function design of ULife will be divided into four parts, Register & Log in, Post & Browse messages, Deal and Set. And we will introduce them respectively.

2.1.1 Register & Log in

In order to ensure the reliability of information as much as possible, ULife only serves CityU students so far. And there will be related explanation on the registration interface. For a CityU student who uses the APP for the first time, he or she should register an new account using his or her official email address (EID-c@my.cityu.edu.hk) and a clear photo of the student ID card. Once the information is submitted successfully, our team members will check it and send an email to the new user in 24 hours. There will be an account number and the corresponding initial keyword in the email. The account number will be his or her student number and the password can be changed in another functional part after the student logs in.

2.1.2 Post & Browse messages

Before talking about the process of posting and browsing messages, we should understand that the essential information of a message usually includes the service type, the express size, the expected commission and the valid duration. There are two service types. One means that the user who posted the message can help deliver or pick up an express. The other means that user needs someone to help deliver or pick up an express.

It is very convenient to post a message using ULife, because when inputting essential information, there is no need to type. Users can click a button, drag a bar or roll a spinner to choose the information of the service type, the express size, the expected commission and the valid duration. There will also be a textbox for more detailed information. Users can type in the textbox to explain whether it is a delivery task or pick-up task, the place to exchange the express and commission and the place to pick up the express. They can also start a title for the message. In addition, if the valid duration of a message expires, the poster can prolong it.

When users browse messages, they can see all the information directly and there is no need to click. And they can filter messages by searching keywords.

2.1.3 Deal

In this functional part, the process of dealing will be introduced. If a user would like to do the task posted in a message, he or she should send a chatting application with a brief note to the poster first. They can start chatting only if the poster accepts the application. This function is designed for avoiding unnecessary chat if there are more than one people applying for the same task. When chatting with each other, users can send texts, pictures and videos. After exchanging the express and commission, any one of both sides can send a confirmation dialog which is the ending sign of the deal. And once the other side also confirm the end, they cannot chat anymore. This function is design to avoid unnecessary disturbance after the deal. In addition, users can receive offline chatting application and offline messages, which can be kept for 48 hours.

2.1.4 Setting

Each user has a personal homepage, which shows his or her personal information including the avatar, the nickname and the personal status. Users can make some settings on that page, such as updating personal information and changing the password. In addition, there is also access to a questionnaire, which is used to collect feedback from users.

2.2 UI Design

User Interface refers to the overall design of the human-computer interaction, operation logic and beautiful interface of the software. A good UI design is not only to make the software personal and tasteful, but also to make the operation of the software comfortable, simple, free, and fully reflect the positioning and characteristics of the software.

The user interface (User Interface, also known as the user interface) is a medium for interaction and information exchange between the system and the user, which realizes the conversion between the internal form of information and the human acceptable form. The user interface is a software that is designed to communicate with each other between the user and the hardware. The purpose is to enable the user to conveniently and efficiently operate the hardware to achieve two-way interaction, and to complete the work that is desired to be completed by hardware.

2.2.1 Log-in Page

In this interface, we use the full screen technology, which greatly increases the aesthetics of the interface, and the translucent technology is applied to the interface effect, which makes

the interface artistic sense increase, in line with the aesthetics of college students. And the overall interface is very simple, the application is clearer, in line with the needs and preferences of the corresponding users.

The student ID and password are needed to log in for old users, only if someone have a valid account, he or she can log in. as Figure 11 shows.

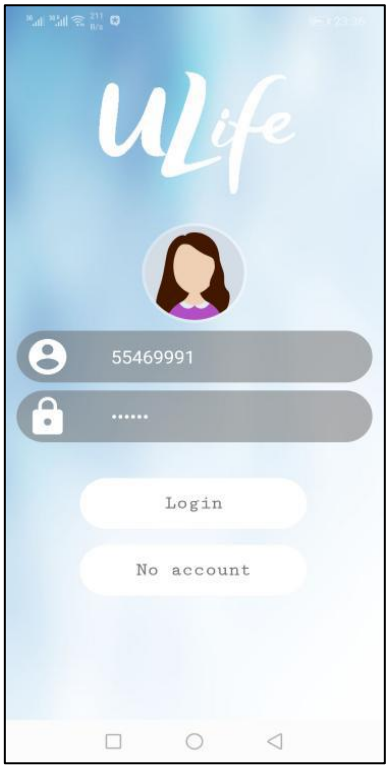

Figure 11. Log-in page

2.2.2 Register Page

If someone is new users, “No account” can apply to register directly, as Figure 12 shows.

In this interface, we let the user pass the photo into the cloud, the staff will manually check and send the email to verify the identity of the applicant. In this interface, we use some processing of the image, which can be more reasonable without affecting the quality of the image. In this interface, we all use the floating window reminder in the same interface to reduce unnecessary interface jumps, which can be clearer and more convenient to operate.

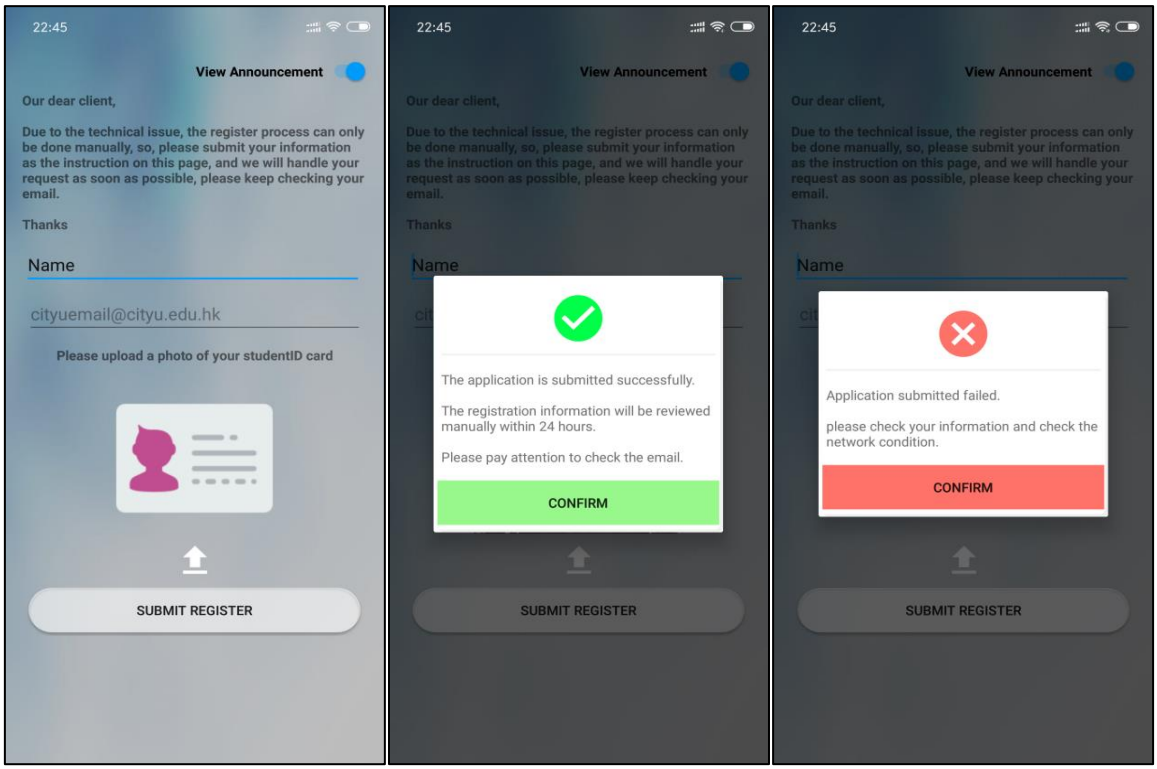

Figure 12. Main pages of register

The city university email account and the picture of city university id card are needed. When users submit the register, manager of ULife will check the name and id card manually.

Within 24 hours, users will receive a email of first log-in password. The email can be shown as Figure 13 shows. Only user use this password to login, it is valid, we use this method to double check the user's ID, we can use this email to verify that the user is a student of City University of Hong Kong. This method can reduce unnecessary technical cumbersome, which can also increase the likelihood of implementation.

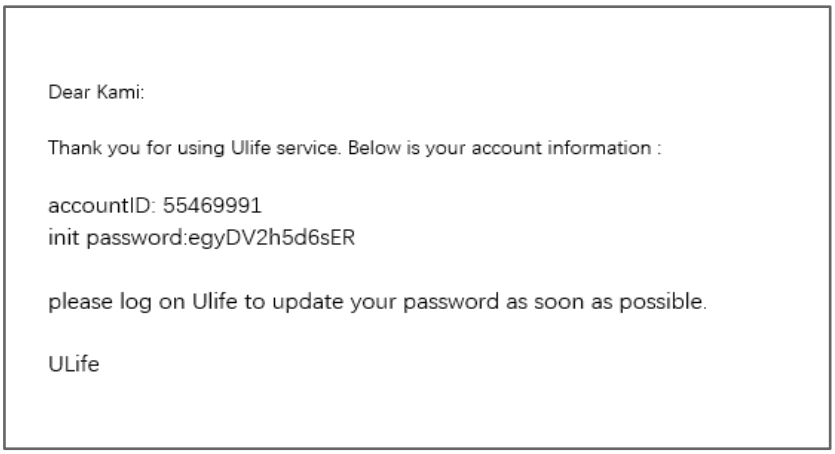

Figure 13. The email of first password

2.2.3 Personal Homepage

In this page, users can check his or her history of post, and set his or her avatar and account. As Figure 14 shows. In this page, user can set the account, let others know you clearly. It allows to change avatar. The button of My Post can jump to the history of user's post. It can show whether user's post is active or expire, it depends on the time user set in the editor. And user can click to check the main information of his or her message. It is online operation, it means when user change another phone, it is also can be stored and can be checked.

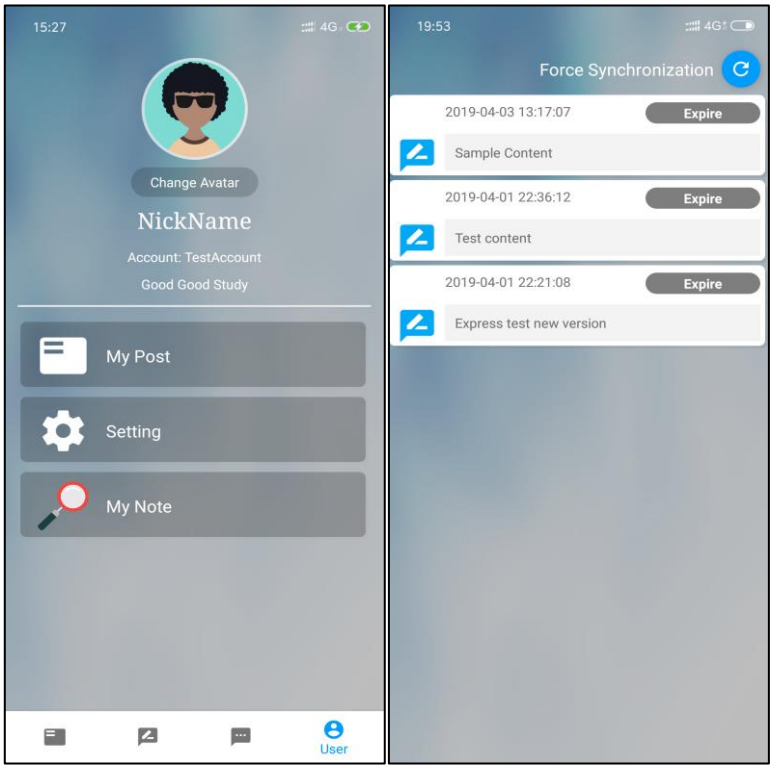

Figure 14. Personal homepage

2.2.4 The Page of Editor

In this page, users can edit his or her messages. Firstly, select the type of users' post, there are two different types: "I NEED HELP", "I PROVIDE SERVICE". Secondly, users should type the title of post and describe the main needs briefly. Thirdly, drag the bar to select the size of express and commission of this transaction. Fourthly, click "POST" button. Then the app will notice users to select the duration of post, which means in this time the post is valid, as Figure 15 shows.

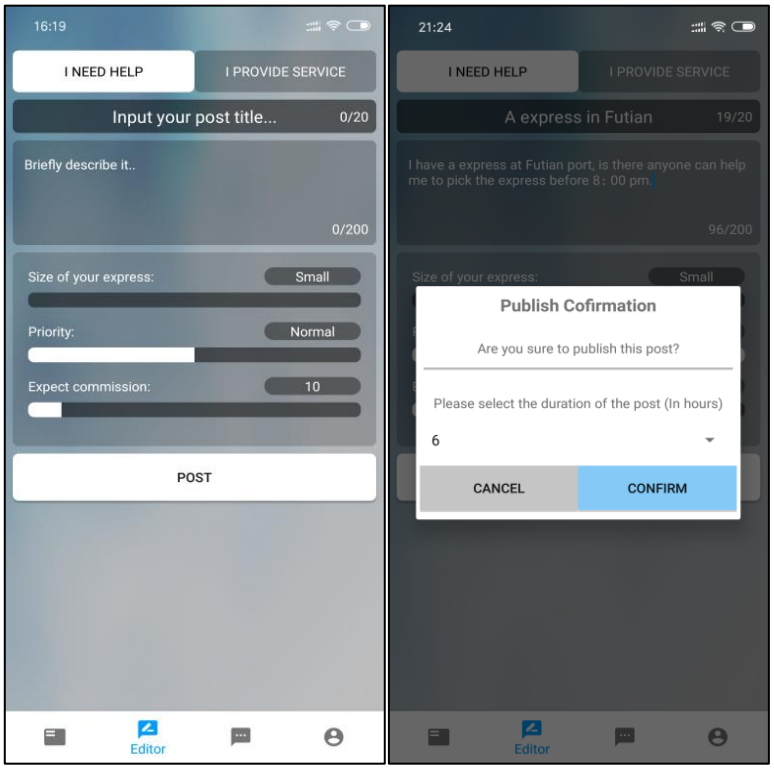

Figure 15. The pages of editor

2.2.5 The Functions of Express

When users post their message, the information of post can be checked in the express page. At the same time, every user can check the information, if the requirement is fit for someone, he or she can click “CONTACT HIM” to contact. At this page, users can also use “refresh” button at the top of the page, it is convenient for users to select what their want. When users click “CONTACT HIM”, they are allowed to leave a message to the person, and after he or she agree the friend apply, the chat will start! It shows in Figure 16

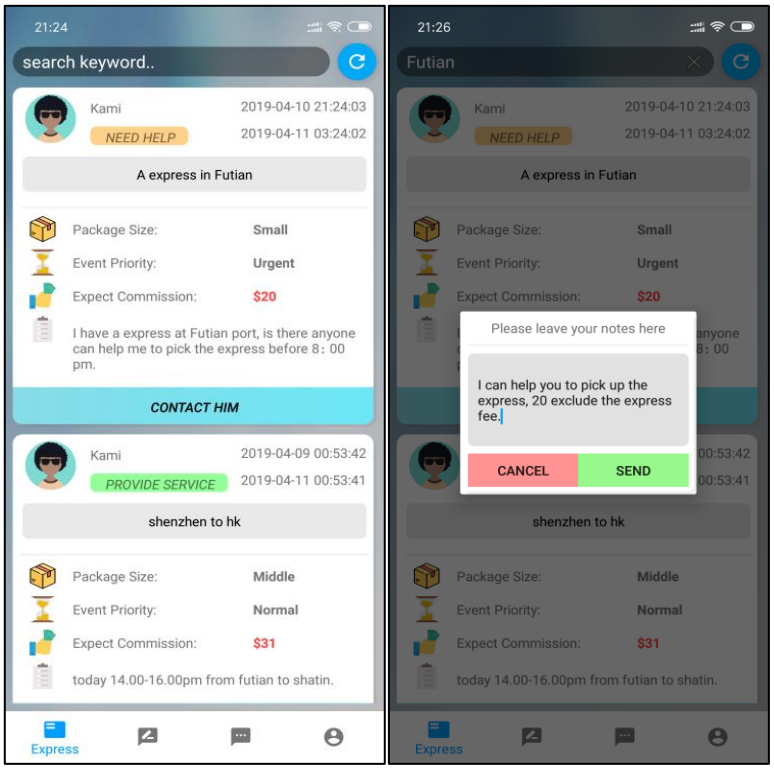

Figure 16. The function of express

2.2.6 Start Private Conversation

After some user click the “CONTACT HIM” button, the owner of the post will receive the apply, only he or she agree the apply, they can go to the chat page. As Figure 17 shows. Here we set up not to be able to chat directly, but to need a friend authentication, which can reduce unnecessary interruptions, just have a transaction to have a dialogue, greatly reducing the waste of time. And in the process, both sides have the factors of screening, and can also reduce the follow-up trouble.

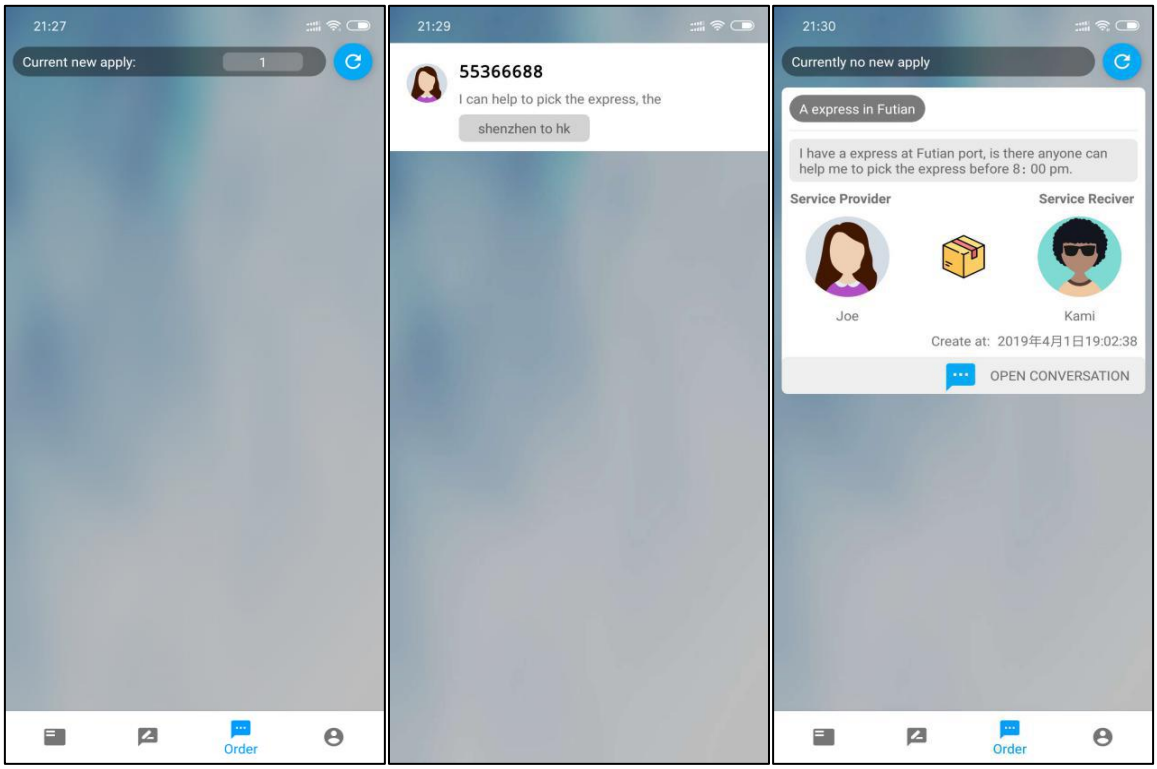

Figure 17. The function of starting chat

2.2.7 Chatting

The function of chatting is allowed to send pictures and emoji. Users can appoint the date and location of transactions. After the transaction two of them can start the transaction finish, it can make a closing request and users can wait for confirmation. As Figure 18 shows. We use the operation that both parties can initiate the termination of the transaction, but it must be approved by the other party before it can be truly terminated, ensuring that the interests of both parties are not destroyed. We have realized not only support text in chat, but also support pictures, which is in line with the chat preferences of young people nowadays, and can also greatly reduce unnecessary misunderstandings, increase interest, etc.

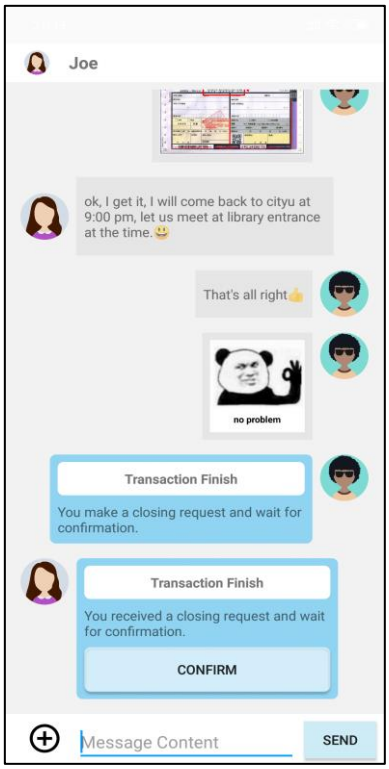

Figure 18. The page of chatting

After the transaction is over, the chat page will disappear, but the next time you chat with the same person, the last chat history will appear, which will make the user choose to trust or give up the transaction, which is more practical and convenient. If the user and the user have unpleasant transactions, he can choose to abandon the transaction, which can make the transaction safer and less troublesome.

Chapter 3: **Implementation**

3.1 Development Model and Version Control

Since we want to have a systematic management and control of the overall development of the software, combined with the features of our app, we decided to use the incremental development model in our software development life cycle which can be visualized in Figure 19.

The incremental model is a combined derivative model of the prototype evolution model and the waterfall model, and it is also known as planned product improvement model, which starts with a given set of requirements and implements development activities by constructing a series of executable intermediate versions. The first version incorporates some of the core requirements, the next version incorporates more extra requirements, and so on, until the system is completed.

As the development will involves multiple rounds of iteration, thus, in each iteration, the waterfall model can be used to define the development life cycle well. However, the original waterfall model has some disadvantages when the project involves team collaboration, it required to wait for each stage totally complete before moving into next stage, this will leads to very low cooperation efficiency. Therefore, an optimized waterfall model will be used in our project to replace the original version which is show on Figure 20, the core concept of this improved solutions is that once the previous work has produced enough basic resources for the next work, the next work can begin.

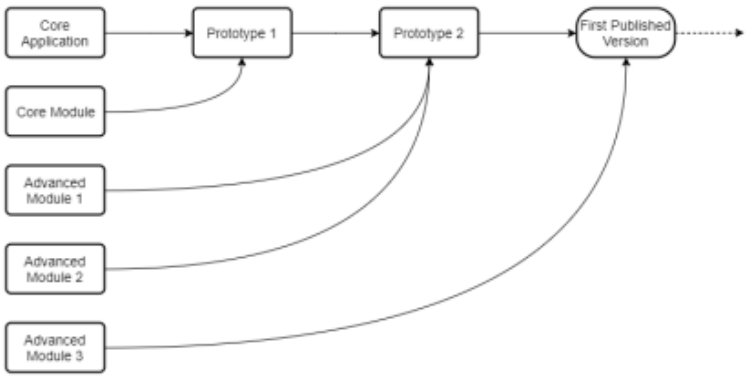

Figure 19

Figure 20

The version control system used in this project development is a Chinese code host platform called Gitee, whose functionality is very similar to the famous open source community Github as the Figure 21 and Figure 22 showed below. Since we mentioned above that we are using the incremental model, thus each prototype will be stored in a individual branches, this will make our development much easier.

Figure 21

Figure 22

3.2 Application Architecture

For the application architecture, we choose to use the simplified MVVM framework to develop our App, since it can be done easily by using Android's data binding function. This data binding function support bidirectional data binding for the view and view model layer, which can allow a automatic synchronization between them, it can make our development much faster since we don't need to make too many modification when the logic is changed. And also for the communication between the view model and the model layer, since our App is an event driven based application, thus, we design a in-app communication system to transfer data between different component and layers based on observer pattern. The view model layer will keep observing the corresponding model layer, once the source data has changed, it will make synchronized adaptive changing and notify this changes to the view layer, based on this framework, in later development, our APP will be very easy to extend without causing a lot of code refactoring when adding new features, and the Figure 23 is for visualization of this framework.

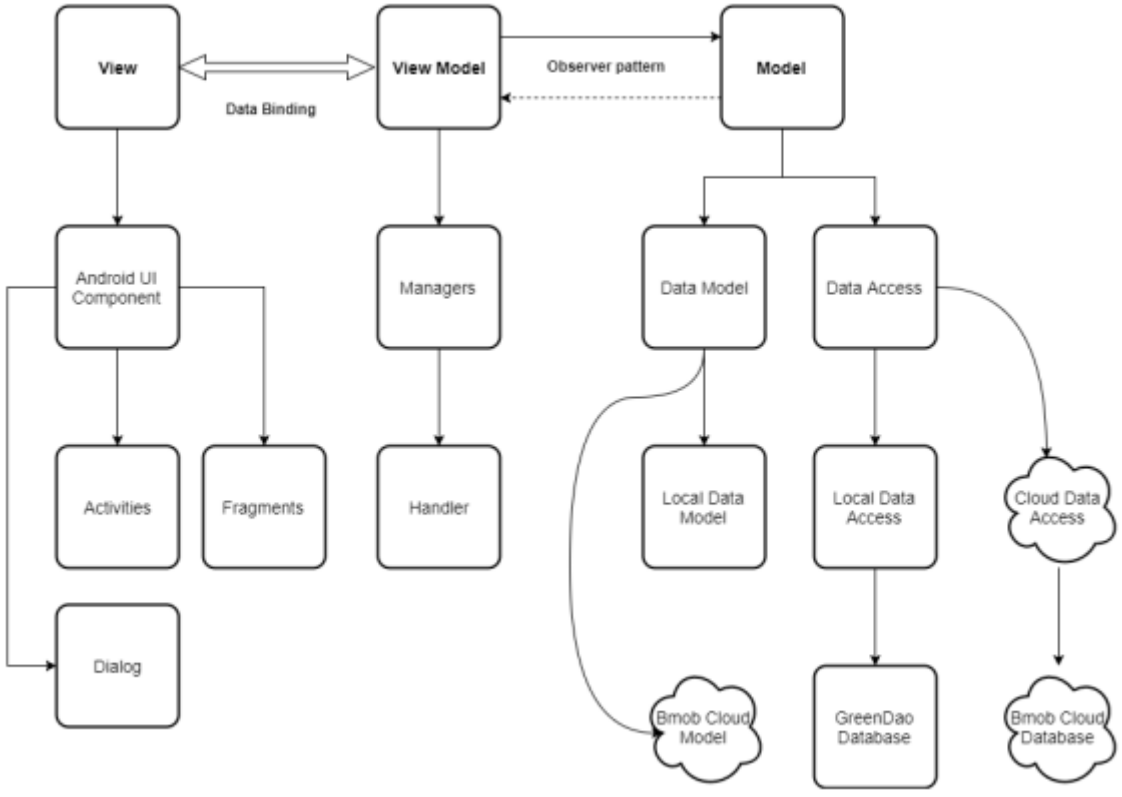

Figure 23

3.3 Technology Used

3.3.1 Bmob BaaS for Cloud Database

Since our App is a network-based application, a server will be involved to handle all the user data, due to the time limitation and the In consideration of development costs, we choose to use a BaaS platform called Bmob.cn instead of build our own server to handle this task.

The Bmob platform provides a complete back-end solution for mobile applications. It offers a lightweight data service SDK that allows developers to use the services provided by the Bmob back-end cloud platform with minimal configuration and easiest way, which completely eliminates the developer's ability to write server code and maintain the server.

3.3.2 Bmob BaaS for Instant Message Communication

The Bmob has also provide instant message SDK for us to extend and develop our own IM chatting system. In our development chatting system, normally the communication between two end user is based on P2P communication, and a heartbeat packet will be send out regularly to detect whether the target user is offline, if the user is offline, or the heartbeat packet is time out, which means the network environment for P2P communication is not suitable to transfer messages, then the system will automatically change the communication mode into CS mode, which mean the cloud server will become a middle man to forwarding the message, there will be a TCP connection between end user and the server, if the heartbeat packet send from the server has no response, the target user will be considered as offline, all the following messages will be considered as the offline messages and will be temporary stored in our cloud server, which will be preserved for 48 hours. When the user next time to connect the server, no matter is re-login or re-connection after change the network, a pulling request will be send to the server and ask whether any offline messages need to be handle. On the one hand, the design of this message mechanism can greatly reduce the burden on the server. On the other hand, for the user, the accurate delivery of the message can be guaranteed as much as possible without missing key information.

3.3.3 Greendao

Green DAO is an open source Android ORM, which makes the secondary development of SQLite simpler, reduces the need for developers to deal with low-level databases, and saves development time. Greendao is a lightweight and fast ORM solution that maps objects to SQLite databases as illustrated in Figure 24.

Figure 24

We choose to use Greendao as the tools to handle our local database instead of using the native SQLite, since the maintenance of the SQL codes is a very tedious business, once the business logic has changed or the table structure has changed, majority of the SQL command need to be refactoring as well, This is obvious a disaster. Also Green DAO has the following features:

(1) It's a very lightweight but powerful library.

(2) Almost the fastest relational database of Android.

(3) Minimizing the memory consuming.

(4) Provide easy used APIs.

(5) Highly optimized based on Android and support database encryption.

3.3.4 Luban Image Compression

A core function of our app is to provide a conversation between two end users when they have intent to negotiate about the detail of the service, in this process, it is inevitable to send some pictures to help describe the requirements or give some feedback. However, those pictures shoot by our smart phone usually have very large data size.

For example, a high quality 24 depth bitmap image shoot by XiaoMi 8 with 4032 x 3024 resolution will have a file size of 34.8Mb, this is obviously too large to send for real-time communication, even though our smart phone will compress a bitmap image into JPEG format to save storage, the compressed file size is still too large, for the image above, in JPEG format, the file size will be 3.59Mb, thus, a deep compression method called Luban has been implemented to solve this problem. After compression, the image size usually will around 80 kb - 300 kb, which can be fast send through internet.

3.3.5 Multi-layer Image Caching

As our app involves a lot of image such as chatting image, user avatar or some image in the post, we need a more efficient way to handle this task. Therefore, we choose to user a multi-layer image caching technique called Universal Image Loader framework.

All the image in our system will be cached in 3 different layers:

(1) Network layer

(2) Local storage layer

(3) Memory layer

And all the image resources will be organized with a unique tag and a hash code, by comparing the hash code from the old image and the latest resources, we can decide whether we need to update the image other than make a full pulling request to or server every time user refresh the page, which is very slow. By using this framework, some image can be cached in the local storage, if the image do not need to be update, the app will request the image from the local storage rather than internet. And for some information display widget like recycler view, actually there is no need to acquire image from the local storage when it loaded, we can caching some image on the memory, and later loading process will become much smoother, this will help to improve the performance of the UI.

3.3.6 QR Code backup

Another problem we need to solve is that, if the user wants to save some chatting history, usually they will make a screenshot of the app's chatting page, however the organization of this image is very complicated and difficult to manage them. Another approach to handle this task is that like some famous social apps, they can allowe user to export their chatting history to your personal computer, this is actually a good idea, but the operation is also complicated. So, our app provides another approach to do this in a more efficient way since the chatting history of our app is usually light weighted, we can use QR Code to store them.

We design a function which can convert the chatting history of the user into JSON format, and further we can use a Zip algorithm to compress the JSON string and use Google Zxing library to convert it into a QR Code, user can easily save this QR code, and later use our app to recover it. Also, if user has opened the auto backup function, after each transaction is done,

those QR Code will be automatically upload to our cloud server, and the user can find their backup files.

As there some user very care about the privacy problem, by generating the QR Code, a secret password will be involved and will also be required in later recovery process, which means, without this password, the data recovered from the QR Code will just be some random characters.

Chapter 4: **Performance Evaluation**

Performance testing is a form of software testing that focuses on how the system runs system execution under specific loads. This is not about discovering software bugs or bugs. Performance testing is based on benchmarks and standards. Performance testing needs to provide developers with diagnostic information so they can clear the problem.

There are many parts that can be used to evaluate an application. but to ULife, we decide to test it from 6 parts as listed below。

(1) Request and Response Performance

(2) Capacity

(3) Security

(4) Simplicity

(5) Stability

(6) Compatibility

(7) Extensibility

4.1 Request and Response Performance

The load test detects the performance of the system as the workload increases. As the workload increases, the monitoring system detects its response time and the system's persistence. The workload is within the parameters of normal operating conditions.

After many investigations and comparisons, we finally chose Bomb as the backend server. although this company comes from mainland China, their servers are also deployed in overseas areas, such as Hong Kong. so considering the case that our main users are often commuting to and from the Mainland and Hong Kong. The user uses the service provided by the nearest cloud server in the corresponding area. it will greatly provide application request and response time.

For example, although Google's cloud server is powerful, it is not suitable for ULife. Because Google's servers are deployed outside China, it will cause a lot of network delay for users who frequently travel to and from Hong Kong and the mainland, because users in the mainland you need to access a server outside your country to use the service.

Firstly, let’s consider login request and response time, after testing, it only takes 0.1s to get connected with the server, so in the performance of connecting with server ULife performs great.

Secondly sending a post, when you click the submit button, it takes around 0.32541s to send it to the server successfully. This is a generally acceptable time for users.

Thirdly sending pictures to others, generally a picture occupies 3-5M of storage in bmp format, after compression by ULife, the size of the picture will reduce to around 100 Kb, what’s more, there is not obvious difference between the two pictures. after testing, ULife only takes 1.32541s to compress and send the picture to another user.

(a)Before compression *(b) After compression*

Figure 25

For example, as for the advanced technology we are using, the first is the Luban image compress algorithm, we can hardly see the difference between these two pictures with the naked eye. the left one is an image shot on Xiaomi8 and the resolution is 4K in jpeg formation and the size is 3.69MB if we store it in bmp format ,the size will become nearly over 30Mb, but the right picture is the image through further compress using Luban algorithm, it’s only 136 kb and with 2K resolution.

In this case the compress algorithm has achieved over 96% compression rate and can make the transportation of the chat image much more efficient.

Forth loading data from server and local storage. considering the pression of server, a lot of user data are stored in their local field, only when the user wants to update their state can the server override their data. it is very fast to load data from local field, the time won't exceed 0.05s. so we won't talk more about this part. when the user wants to load some data from the server, such as posts data, the user needs to load it manually. after several tests, the average loading time is around 0.22356s, it is also an acceptable time.

4.2 Capacity

Capacity testing is used to study the operation of a very large amount of data or a large number of data tasks after the program has loaded a very large amount of data. This test focuses on the operation of the function when processing large amounts of data with reasonable requirements.

As Bomb company apply distributed server policy, which means that user requests from different regions will be forwarded to the server in the corresponding region, avoiding excessive requests to the same server, that is, achieving so-called load balance.

It is expected that the number of simultaneous online users that the server can withstand is 5000. Since there are not so many users in the real world to test, we first use the code for user simulation. Randomly generate 3000 user accounts and passwords. The login interface is accessed cyclically, and no abnormality occurs. Explain that the server can withstand the use of users at this stage.

And we also tested 20 users online in real android mobile phone, it performed well as expectation without exception. In the future, as the number of users increases, we can purchase upgraded servers to meet higher capacity requirements.

4.3 Security

To the security of ULife**,** for the user's registration review, we use the dual identification of the student's mailbox and student ID. First, determine whether the mailbox is a city mailbox (by judging whether the suffix of the mailbox is consistent with the suffix of CityU's mailbox). Secondly, we will manually verify the authenticity of the student ID, verify the student's name, student number and expiration date. Finally, the password will be sent to the registered mail. If the registrant is not the owner of the mail, the registrant cannot obtain the

initial password of the account. Through the above review, we are able to guarantee the authenticity of the user's identity for the most part.

The user's account password information is stored on the Bomb cloud server, but the password is not stored in plain text, but is ciphertext encrypted by hashing, so even the staff cannot obtain the plaintext information of the user password. This ensures that someone else cannot steal the user's password from the server.

4.4 Simplicity

For a piece of software, if its operation is too complicated or cumbersome, it will greatly reduce user stickiness.

In this regard, ULife tries to simplify user operations as much as possible. For new user registration, only need to submit the necessary identity information; for the post service, user only needs to enter the necessary text description, other information can be completed by clicking and dragging the button.

4.5 Stability

Server stability is of the utmost importance. If the stability of the business can not be guaranteed, the high performance is useless. The stability of ULife depends on the stability of the server，on the one hand on the stability of our back-end business logic.

For the stability of the server, the Bomb server is maintained by Bomb company to ensure normal operation for 24 hours. Even if an abnormal situation occurs, the Bomb staff will issue an announcement in time to do the backup work.

The back-end business logic of ULife is maintained by our team. We will do a lot of testing and research before going online, and open and optimize each function step by step. Therefore, there will be no abnormalities such as data loss and request failure. If an user encounters problems during the use of ULife, he can send feedback to me through the built-in feedback function of ULife at any time. We will process the user feedback with the fastest efficiency, thus maintaining the stability of ULife.

4.6 Compatibility

Currently ULife only supports Android system, does not support iOS, the specific requirements for the Android version are shown in the Figure 26.

```
android {
    compileSdkVersion 28
    defaultConfig {
        applicationId "com.example.joe.cityumobile"
        minSdkVersion 21
        targetSdkVersion 27
        versionCode 1
        versionName "1.0"
        testInstrumentationRunner "android.support.test.runner.AndroidJUnitRunner"
        vectorDrawables.useSupportLibrary = true
    }

```

Figure 26. Android version

4.7 Extensibility

The code framework of ULife has been built, and basic registration, communication, and posting modules have been implemented, and new functional modules can continue to be added to this basic framework.

For example, if you want to increase the module of the course discussion, you only need to design a new UI interface. Adding a comment function is basically achievable, and no major changes are needed for the background business logic code. Because the construction and testing of the previous code framework requires a lot of time to complete, and the time limit of the project, ULife has realized the main functional modules (delivery service), and then code can be reused to complete other functional modules more quickly.

4.8 Evaluation summary

In this part, we have discussed and tested ULife's important indicators. Summarized as follows：

The system's request and response times are acceptable in the functions that ULife has implemented. User security requirements are ensured through manual authentication and password encryption. the optimization strategy of Bomb server and ULife selects the

corresponding server level to meet the user's concurrent needs. Simple use experience can attract more users to use ULife without cumbersome. The stability of the Bomb server and the high efficiency of the ULife staff ensure the stability of the application. Robust code framework guarantees ULife's scalability.

Chapter 5: **Discussion and Conclusion**

The key design discipline of our APP is the 20/80 rule. Here are several examples.

Firstly, for 80% of people in the buddy list of your WhatsApp or WeChat, you have only 20% chance to contact them, so there is no need to add so many people to your buddy list. Using ULife can help you avoid the trouble, because we design the functions of chatting application and end confirmation.

Secondly, for 80% of things, you could have explained them using only 20% of words that you used. ULife can facilitate the realization of the fact. When users post messages, they do not need to type all the information about their expresses. They can click a button to select the service type, drag bars to choose the express size and expected commission, and roll a spinner to set the valid duration, instead.

Thirdly, 80% of people only spend 20% of their time on mobile phones, which means that they may miss useful information. So it is reasonable to design the function of keeping offline chatting application and offline messages for 48 hours.

In addition, when using ULife, users can use 20% of time to get 80% of information that they need, thanks to the function of searching keywords.

We have completed the first version of ULife, which is easy to use and has simple user interface. It also adapts to the mobile phone with full screen. However, there are still some functions to be improved. For example, some messages about irrelevant information, like advertisement, may be posted, but the system cannot prefilter them. Another shortcoming is that users are not allowed to delete their posted messages right away when they find there are some mistakes. In addition, if a user reinstalls ULife or switch to another mobile phone, his or her historical data cannot be synced automatically. But we have designed the function of manually sync data.

For the following work, there are two points to explain:

Firstly, our proposed APP is a one-stop platform whose function is not limited to that about express. In the future, we plan to also integrate the modules of studying BBS and second-hand trading platform.

Secondly, one of the biggest obstacles to promoting our APP so far is that it can only serve Android users. But there are lots of students using iPhones. So we propose to develop its iOS version and make it a cross-platform APP.