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Mobile application system for intelligent skin management

by

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Abstract

Mobile phone development mainly includes Apple system and Android system development. In the vast app market, it seems that every developer's goal is to design a novel and unique app that can help people's life. The development of app is mainly divided into UI design, back-end function design, and database design. This research is mainly for Android development, the development platform used is Android studio, and the database is firebase, which is a cloud database of Google company. The biggest advantage of this database is that it hardly takes up computer memory, and the operation of this database is very simple, which can save a lot of time for developers.

The main purpose of this study is to develop an app that can judge the skin characteristics of users, and let users find suitable skin care products for their own use. In the design function, the text options are converted into numerical values to determine the size of the number so as to judge the user's skin characteristics. Product recommendation function mainly uses matching algorithm to achieve the purpose.

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Chapter 1: Introduction

1.1 Project aim

Due to the increasing number of cosmetics on the market, many consumers blindly believe in advertising or marketing, consumers buy some cosmetics that are not suitable for themselves. This mobile application system aims to detect the type of user's skin, recommending suitable products for users through recommendation algorithm, and providing scientific skin care scheme for users. The scientific articles launched by the platform also provides users with comprehensive scientific skin articles, which enables users to understand skin scientifically and trust the system platform more.

The detailed aims of this project are listed below:

1. The mobile application of intelligent skin detection system is committed to a series of questionnaires. According to the user's answers, the system gives the users the correct skin type and give users suggestion about how to take care their face skin, and then the system can provide the users with the correct skin care suggestion.

2. Almost all the data of cosmetics information on the market will be stored in firebase, and they are labeled and classified according to the category. The different classification will be convenient for users to find the products what the what in this APP. Users also can find out the information of the products like: price, purchased URL, cosmetic ingredients and whether this product is suitable for users.

3. This system can provide the popular science articles on reasonable skin care for users reading, these articles are come from the BBC news or Some popular science websites.

4. This APP use the recommendation algorithm to recommend the suitable products to users according to the users' skin type.

Managers can publish the articles on the system, and users refresh the page on the client side to see the latest article content.

Users and administrators can update personal information in the app

1.2 Project Objective

This project design mainly uses Android Studio to develop and connect to the fire base database. Android development mainly includes UI front-end design, back-end functional design and data design. I mainly use linear layout for the front part of the UI design to make the app interface more beautiful. I use the same colors and themes for the background design, which makes the interface look uniform. In terms of back-end design, I mainly implemented basic functions such as login, product searching, product details, product recommendation, and user information settings. At the same time, I designed the function of user skin detection, which is the main highlight of this APP. I also designed different functions from two roles of user and administrator. The administrator can publish articles for users to read. In terms of database design, I also distinguish the two

roles of user and administrator. The basic information of the personnel hired in the database also includes the protection of the personnel's email account and password. At the same time, the database also stores detailed product information, including the name, price, function, and purchase website of the product. The product information collection mainly comes from the product information on the official website to ensure the accuracy of the product information. What's more worth mentioning is that the database contains the user's skin type information, which is mainly derived from the user's skin test data. The user's skin type data is the key to the system to complete the appropriate product recommendation function.

1.3 The contributions and innovation of project

The app helps people better understand their skin and know their skin type. This app can help people avoid being cheated by false advertisements and let users buy products that are really suitable for their skin in shopping. Solving the problem that users do not know how to use skin care, the app can play a role in popularizing skin care knowledge. At the same time, through some functions of the app, users can understand their own skin characteristics and give users suggestions when purchasing products.

Innovation at the technical level:

This app uses firebase to store data, and the app uses information matching algorithm to match the product label with the user's skin type, and realizes the system's recommendation function with this method. The app is divided into user side and administrator side. Users can upload popular science articles, and users can read and obtain scientific skincare knowledge. This app is also a scientific knowledge acquisition platform, which can bring some useful skin care knowledge to people.

1.4 Plan of the project

Having a good plan is conducive to the successful completion of a project. I mainly used Gantt chart to make time plan. Gantt chart is a kind of chart which mainly shows the relationship between the development progress and time of the project through bar chart. The production process of Gantt chart is simple, and the content of the chart is easy to understand[1]. As can be seen from my Gantt chart, my project development mainly includes four stages:

1. Preparation before the project and data collection in the research field
2. Designing and developing the project
3. After completing the project, testing and optimizing the system
4. Showing the results to teachers and writing academic papers.

After the completion of the Gantt chart, I carried out the project in strict accordance with the schedule. Although I was affected by the novel coronavirus (COVID-19) epidemic during the research period, which was mainly restricted by the network, the progress of the experiment was very slow for a period of time. Through constant exploration and unremitting efforts, I finally completed the project on time according to the schedule. The schedule is as follows:

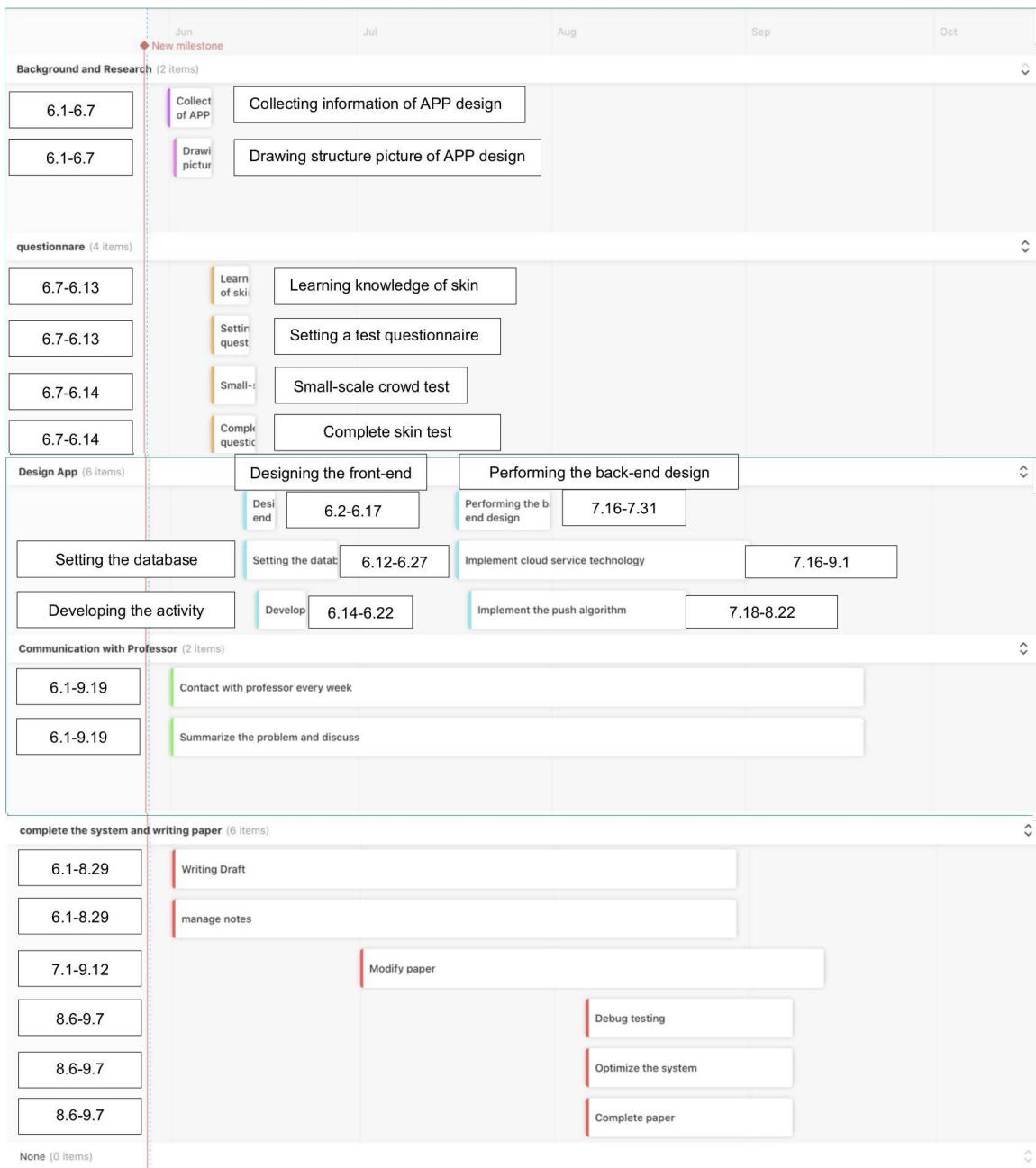


Figure 1.1 Gantt Chart

Chapter 2: Background Research

2.1 Background of skin test and management app

APP's health management of people enters people's lives, such as mobile phone blood pressure detection, mobile phone heart rate detection, and mobile phone monitoring of human sleep. According to Google's survey, there are currently about 3,800 apps for human health testing by 2010[2], and there are many different types of apps for skin testing. For example, there is an app for skin detection. Professor Xiangfeng Dai is dedicated to detecting whether users have skin cancer. He mainly uses machine learning algorithms to distinguish patient skin images to detect skin lesion[3]. For example, an APP that detects skin cleanliness. There is a app called "Sunz" that can detect the intensity of the sun and remind users to apply sunscreen. It can be seen that skin detection apps come into human life. These apps can detect the skin condition of the human body and give scientific skin care solutions. Since most of the skin management apps on the market are used to detect skin lesions and cancer, there are relatively few apps for skin detection and skin care management. So my research direction is to design a skin management and detection app, which can detect the user's skin type, and the app can also teach the user the correct skin care. The system also provides skin care product query and skin care product recommendation functions.

2.2 Personal survey of cosmetic users

In the skin care industry, the global sales of skin care products of various brands are rising to 6 billion US dollars by 2015[4], and it is a trend of increasing year by year. However, in such a large consumer market, people are often deceived by advertisements when buying skin care products. Some users have sensitive skin. Using products with too strong cleaning power will increase the sensitivity of the skin and cause skin damage. Due to the wide variety of skin care products on the market, it is difficult for users to choose the right product for their skin characteristics[5]. Skin care should be more frugal care. Daily sunscreen application and use of vitamin A products, and the use of products rich in niacinamide are important ingredients for the skin to fight aging[6]. Most of the people who passed the survey still lack the knowledge of the correct use of skin care products, so I will design this app to give users an opportunity to understand their facial skin in an all-round way and provide users with suitable skin care products

2.3 Method design and technical background

This project has been developed by a powerful software-----Android Studio, which is one of the most popular mobile application development platform. Since its inception in 2014, the Android technology has extremely rapid progress[7].

Until now, he is an integrated development platform that supports multiple development languages and multiple versions.this software not only can provide practice opportunities for students who will be engaged in android development field, but also used in many company-level projects[8]. It can be seen that the diversity, functionality and stability of this software are trustworthy. The front end chooses to use its own xml language, and the UI design is constantly updated, and it is compatible with many mainstream frameworks. The back-end chooses the java language that has been developed for a long time, the back-end development system is perfect, and the optimization is simple.

Firebase evolved from Envolve and was promoted in 2014. Using it as a database is easy to accept and easy to master for students[9]. There is no need to list the underlying architecture data of ordinary databases. You only need to quote firebase in the platform. The functions in electrophoretic paint can be completed. And do not need to install, directly in the google server, you can log in anytime, anywhere. Knowing that now, many countries in Europe use firebase for data processing and visualization.

The recommendation function now generally appears in the app, using the user's information to make reasonable recommendations to the user, the purpose can be to retain the user and increase the favor of the app.

Chapter 3: APP function design

3.1 The overall function design of app

For the functional design of the app, I thought of the login function, skin test function, product query function, user reading article function, system internal recommendation function, and user personal information modification function. These functions provide a good platform for users. The APP is not only to test and manage the user's skin, but also to have a more robust system to give users a good experience. Since APP can give users a good skin care guidance and suggestions, the app can publish scientific skin care articles in the system through the administrator terminal, and users can read them in real time. The functional design of the administrator is also essential. The administrator also enjoys the login function, the function of publishing articles and the function of setting personal information. The main function diagram of the APP is as follows:

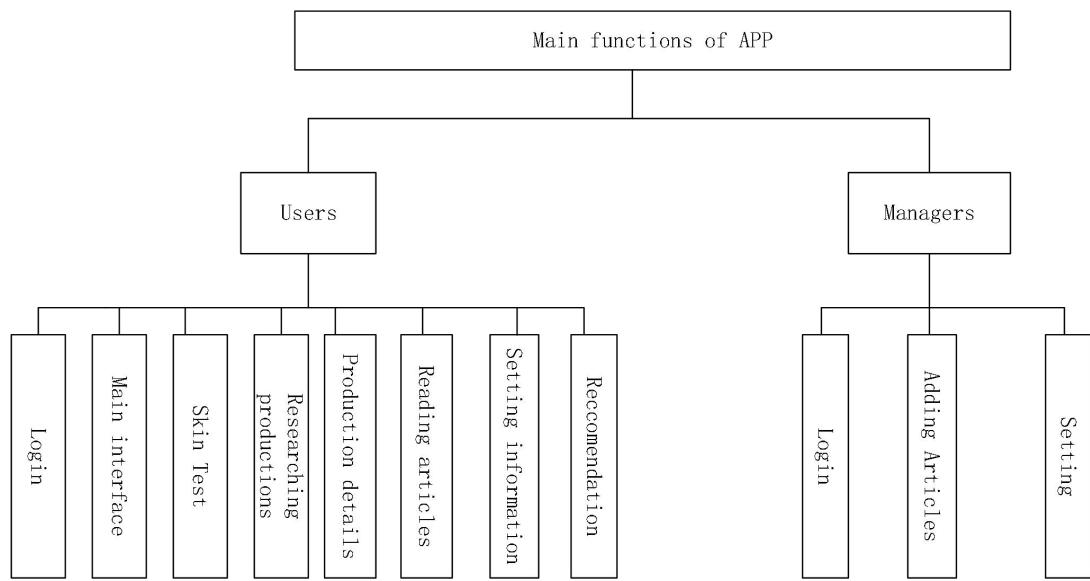


Figure 2.1 Main function diagram of the APP

3.2 Login function design:

In order to provide users with a good login function, the login interface is roughly divided into two situations. When new users enter the APP for the first time, they need to register an account and set a password, and then log in. When the old user logs in, after entering the email

and password, the system will automatically judge, and the user can enter the main interface of the app if the password is correct. If the user password is entered incorrectly, the system will prevent the user from entering the next interface. The user can click the forgotten button to reset the password. At this time, the system will send a link to the user's email, and the user can successfully reset the password by clicking. The flowchart of the login interface is as follows:

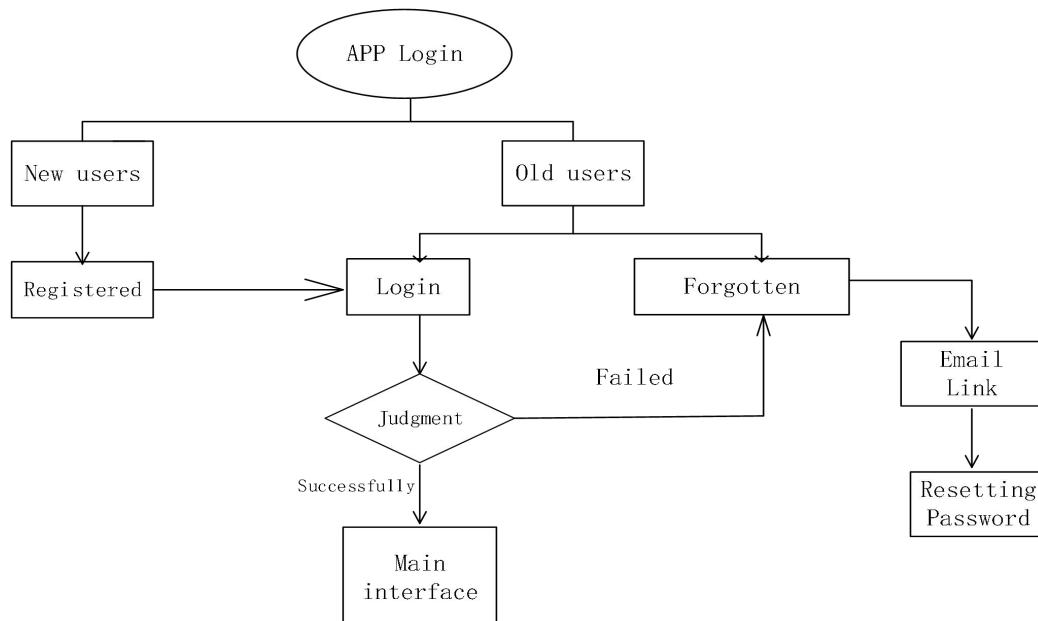


Figure 3.1 Flowchart of the login interface

3.3 Function design of user's main interface

In user roles, the functions of the main interface mainly include:

- 1) Users can search the product name by themselves in the search box and click the product to enter the product details interface.
- 2) Users can click on the items in the list to enter the product details interface.
- 3) Click the advertisement ball picture to enter the product list, and click the product on the list to enter the product details page.
- 4) The user conducts skin tests. The system determines the skin type of the user and recommends appropriate products according to the skin type of the user.

The flow chart of main functions of the client is as follows:

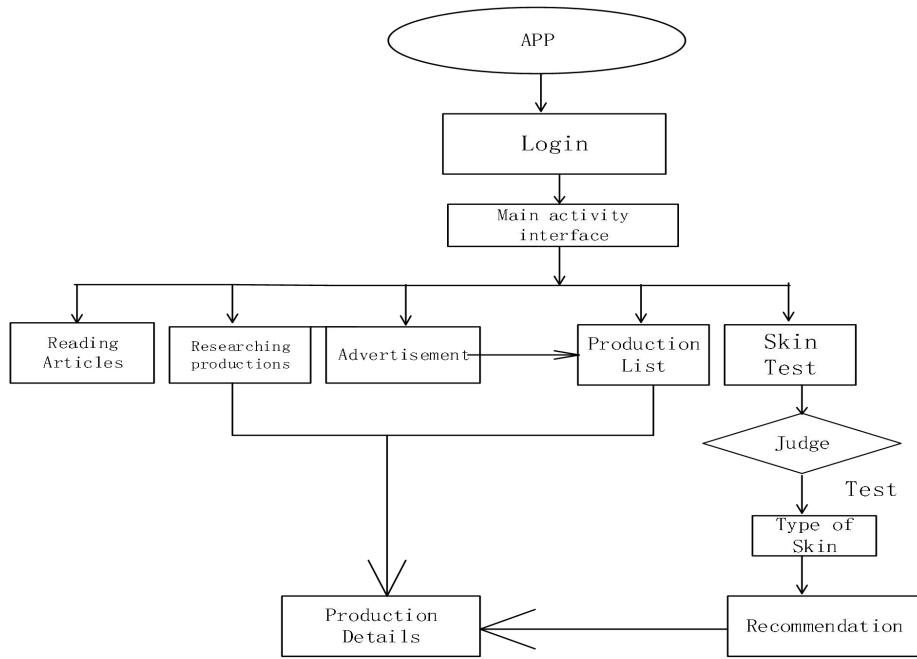


Figure 3.2 Flow chart of main functions of the client

3.4 App recommendation function for users design:

After the user logs in and enters the main interface successfully, the user starts to click on the skin test and four different types of skin tests will appear. The tests include: oil/dry test, sensitive/tolerant test, pigment/non-pigment test and firming/ aging test. The skin test of each part will be evaluated according to the user's choice of answer, and the user will be informed of the skin type of this part. After completing the four-part skin test, the database contains the user's four skin tags. In the section of product details, the product also has four different skin category labels. Here, the recommendation algorithm is applied to match the user with the type of the product. If the match is successful, the list of products suitable for the recommended user will be displayed on the main interface of the app.

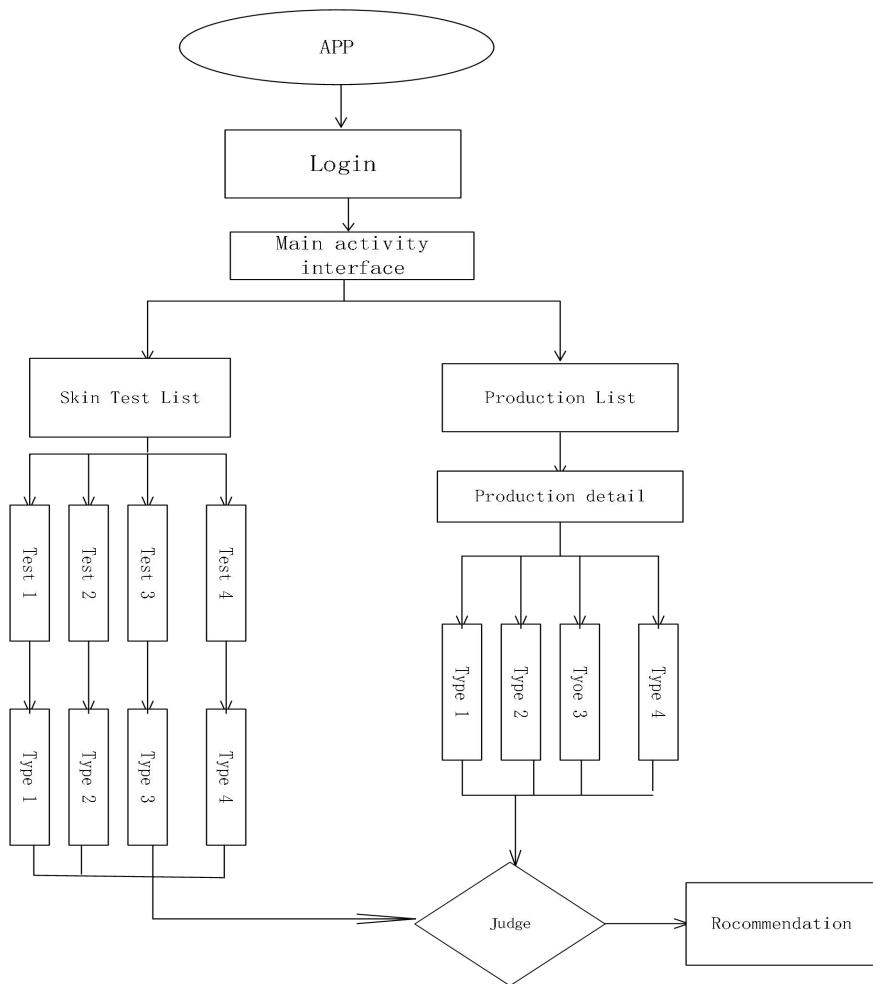


Figure 3.3 App recommendation function for users

3.5 Function design of reading articles for users:

For the administrator, the administrator selects the administrative role to enter the system, clicks the article button, and then edits and publishes the article content on the main page. The article content is first sent to Firebase, and the back end of the system links the Fibase data and Database, and the article information in the database is transferred to the client page. After the user logs in successfully, the user clicks the article button and refreshes the APP. You can get the latest content and see when the article was published. The design of this function can bring the guidance of authentic skin care products to users. Send some popular science articles at any time, can let the user trust the system more. Function flow chart is as follows:

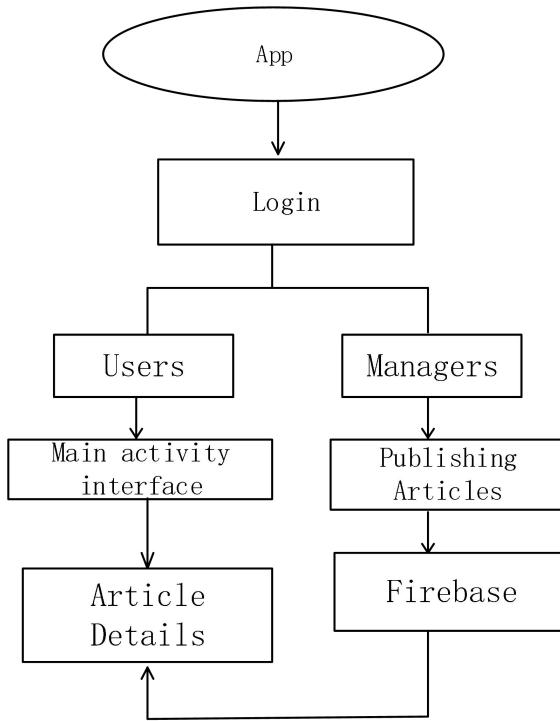


Figure 3.4 Flow chart of Reading Articles

3.6 The function design for user and managers updating setting:

The user and the administrator successfully log in to the APP and click the Setting button on the main page to enter the Setting information interface. At this moment, the user sees the information list is the original personal information, including email account, password, name, age and home address. Users can modify personal information. For security reasons, users cannot modify their email address and password. The user clicks the update button, and the database linked in the background updates and saves the user's personal information in real time. When the user clicks the delete button, the user's entire account information will be deleted from the database, the user will automatically log out of the app and return to the login page. The user needs to register a new account to log in. On the administrator side, it is similar with the user side. After the administrator enters the setting information interface, he sees the original information list including: Email account, password and name. The administrator can only change the name information, and the email account and password are not allowed. The modified information is updated and saved in real time in firebase. If the administrator clicks the delete button, the administrator will be forced to exit the system and return to the login interface. At the same time, the administrator's account information has been deleted from firebase. The administrator needs to re-select the administrator role and re-register the account. The functional flow of Setting information is as follows:

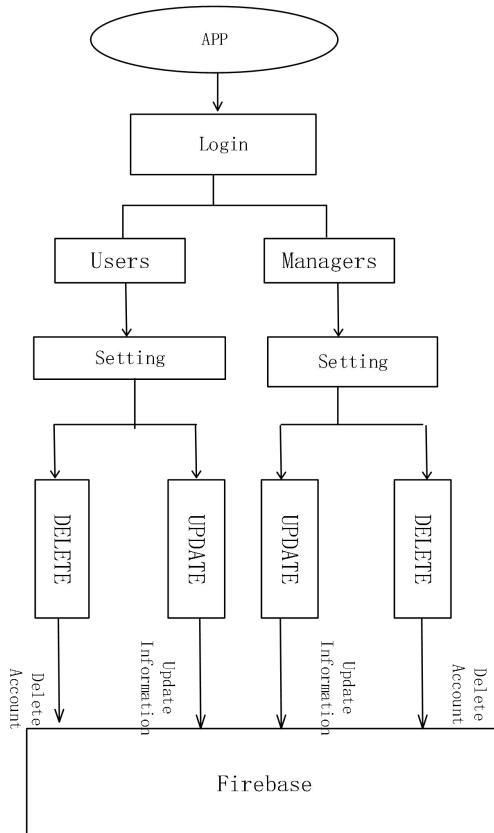


Figure 3.5 Flow chart of setting information

Chapter 4: Database design

4.1 Introduce the firebase:

Firebase is a real time online program database, this product belongs to the Google Company. Like the almost database, firebase can add, store, delete the data and other operations to manage the data. It plays a important role to assist develop a android or iOS system mobile application[10].

4.2 The reason of using firebase:

Firebase is a cloud database for backend, it can use for designing database, and firebase also can offer many frames and different language deployment application, it can be safety and stable for iOS and Android system to develop[11]. What is more, the firebase has the function of publishing data, developers like use this publishing function to attract more users. The most important to use the firebase is saving a lot of cost, because it is a cloud database, it hardly takes up computer memory. Developers can learn the firebase quickly which can save much time.

4.3 Connecting the firebase with Android Studio

Starting to work, I create a new project in firebase. My firebase is the google account xylm19@soton.ac.uk. Then I created a new database which called Skin Management. I used the firebase and Android studio to contact with configuration file.

At the first, I use the Json file to make the serialization format. In firebase, it plays a role in authentication and a bridge between the project and firebase. Then in android studio's module, I found the file which called build.gradle.

If you want to make the function of firebase, you can find the tools in android studio, and then you can find the installation assistant. Since installation assistant, you can select the function of firebase like:

- 1). Clicking on connecting firebase
- 2). Clicking on dependence, and you can make the related libraries of firebase added the libraries of project which is the build. grade app.

4.4 Data storage of database

Firebase realtime database is a database based on cloud management. Real database can be applied to the development of IOS, Android, JavaScript SDK and other platforms. The main function of realtime database is to automatically receive the latest updated data [12]. Instead of using the usual HTTP request, firebase realtime database uses data synchronization. Realtime database can update data whenever the data is updated or changed.

In the skin test and management app, the database mainly stores the data of four modules, including manager information table, user information table, good details table and article details table. Realtime data is responsible for managing and updating these data in real time. I will briefly introduce the four data tables

4.4.1 Manager information table

The Manager information table mainly stores the administrator's registration information, including the manager's name, registered email address and password. Every time an administrator is registered in the app system, firebase receives the new registration data, and automatically generates an administrator uid number under the realtime database. The uid is used to distinguish different managers. The administrator information table is as follows:

Manager Information Table	
PK	Manager ID
	Name
	Password
	Email

Figure 4.1 Manager information table

4.4.2 User information table

The user information table mainly stores the user's registration information, including the user's name, registered email address, password, age and home address. Whenever a user registration is completed in the app system, firebase receives the new registration data and automatically generates an administrator uid number under the realtime database, which is used to distinguish different administrators. After the user completes the skin detection of the system, the data of the user's skin type is quickly stored in realtime data. The user information table is as follows:

Users Information Table	
PK	Users ID
	Name
	Password
	Email
	Address
	Age
	Skin Type 1
	Skin Type 2
	Skin Type 3
	Skin Type 4

Figure 4.2 User information table

4.4.3 Article information table

The article information table mainly stores the information of the article published by the administrator, including the article title, the article content and the pictures uploaded by the manager. Every time the manager publishes an article, the uid number of an article is automatically generated under the realtime database. The uid is used to distinguish different articles. The back-end program completes the call of transferring the articles in the database to the preceding paragraph, and the user can read the articles. The article information table is as follows:

Article Information Table	
PK	Article ID
	Title
	Time
	Content
	Author
	Image

Figure 4.3 Article information table

4.4.4 Good details table

Good details table includes good's name, good's price, good's description, good's picture ULR and ULR of the official website of good purchase. There are also category labels for goods to prepare for recommendation function. The uid number of an item is automatically generated under realtime database, which is used to distinguish different goods. The information collection of commodities mainly comes from the information inquired by the official website of commodities in class to ensure that the information is safe and reliable. The commodity details are as follows:

Good Detail Table	
PK	Good ID
	name
	Price
	Description
	Purchase URL
	Image URL
	Skin Type 1
	Skin Type 2
	Skin Type 3

Figure 4.3 Good details table

Chapter 5: App development and technology

5.1 Introduction of development and technology

In this chapter, I will mainly introduce the front-end design and back-end function design process of each page of the app. I will follow my implementation logic and verification method in turn, and I will introduce in detail from the app functional process and technical level. The app is divided into 9 key pages, which are login interface, main interface, skin test interface, product list interface, product details interface, article reading interface and settings page. The administrator side includes publishing login interface, article interface and setting page. I will introduce them in turn and write down my design ideas.

5.2 UI design and technology

5.2.1 UI design of login interface

I. Linear layout design

I almost use the linear layout to design this interface. The linear layout is more suitable for pages where all the controls are neatly arranged, and the relative layout is a little more casual. What is more, the linear layout is easy to manage and it is convenient to deal with the special requirements of some controls. I also use the Text Input Layout. TextInputLayout is mainly used as a container for EditText[13]. If users are careful when they login the APP, users can find that you can read the prompt statement when users inset the information of email and password. These prompt statement can tell them the correct format to write.

II. Designing bottoms

In order to make the app front-end interface look neat and unified, setting unified buttons looks very necessary. Designing several uniform style buttons, which can be easily referenced by other pages. The design of the button is mainly in the drawable menu, under which developers can create multiple buttons.

5.2.2 UI design of Main interface

I. NestedScrollView Control

Nestedscrollview is mainly used as a control layout. Its main function is to make Android system have sliding function[13]. Creating the controls which is NestedScrollView. This control can show all content of this interface. Users only need to scroll up and down the page, users can read the content which they want to see. This control realized the function of freely displaying book content.

II. Searchbox Control

Searchbox control can realize the function of researching. When the user enters the first letter such as A, when they drop down menu of the search bar will display the product name starting with the letter A. I also used the hint control to prompt users insert the right format.

III. Showing scrolling ad images

In the main interface, I designed a scroll axis to load pictures, and three different advertising pictures scroll in order. In the scroll image below, I created a banner control, which essentially inherits a FrameLayout. The FrameLayout is a simple layout of the UI design. All the views added to this layout are displayed in a cascading manner. In this control, I support image scrolling, text prompts, and various user-defined extensions[14].

5.2.3 UI designing for Good Detail interface

I. Layout settings at the front of the interface

From the front of the UI design, the main layout is still a linear layout which has the compact Structure. At the top of the page, I replaced the CationBar with toolbar, and I remove the item's name from the Firebase and placed it in “TextView “with a size of fixed height and adaptive width. The pictures of the products are filled horizontally, with fixed height set vertically. For the details of goods, the content also came for Firebase. NestedScrollView is used in the page of product details. Many contents can be added and the screen can be moved up and down freely. This page also shows the type of skin to which the commodity applies, represented by types 1 to 4, they are also from firebase. At the bottom of the slide, a button isdesigned to click the event to directly jump to the URL of the official website and purchase the product on the official website.

5.2.4 UI design for Test Questions interface

I. ScrollView control

In the frame, ScrollView was used to make the page slide up and down to display all topics. The test question page is just to create a container for the question, add the content of the question in the ScrollView, and call it in the test. In the scrollview, the corresponding question is deployed.

II. RadioGroup and RadioButton

In the deployment question, the answer option function in the question is managed by the RadioGroup. In the RadioGroup, 4 different RadioButtons are created to provide the selected area to realize the single choice of the question. The entire page is embedded in the ScrollView to slide up and down. When the question is completed, a dialog will appear to display the results. The user clicks “Cancel” button to return to the topic page. The user clicks “Submit” button to return to the main page of the question.

5.2.5 UI design for Adding Articles interface

I. EditText and ImageView

For Adding Articles UI design, mainly designing three EditText for managers entering the title and content of the article in the text box. The ImageView is for managers uploading some pictures.

5.2.6 UI design for Setting information interface

I. Adjust width and length

We can find the activity_user_setting_information.xml firm, when I design this interface, I used the linear layout, I also use the TextView and EditView to make text box for user inserting their personal information. As the content of the page is more, there are certain requirements for the height and width of the text box design. Edit the width and height of the layout, so that all the content can be displayed in the mobile phone screen. EditText is mainly used to automatically adapt to the screen width and make the interface more beautiful.

5.3 Function design and technology of back end

5.3.1 Back end design of login interface

I. Authentication method

The main method of the function is the Authentication in firebase. The Authentication method in firebase is for the any account to log in the system easily. This method provide a way to verify the user's identity information which supports the email address and pass word, telephone number and so on. It also supports to use the Google account, Twitter account and other login mechanism with other vendors[15].

When people started the operation of logging in, I used the signInWithEmailAndPassword method in Java library MainActivity. The content of signInWithEmailAndPassword part connected to the Authentication of firebase. The function is to verify whether the user's account and password is matched. In this part of signInWithEmailAndPassword method, I use the addOnCompleteListener method to verify whether the user's account and password is matched successfully. If the match failed, the APP page can pop up a login failure prompt to tell users the account and password do not match. If the user's account and password matched, the login page can jump to the next interface successfully. The password is entered incorrectly, the login fails as shown in the figure:

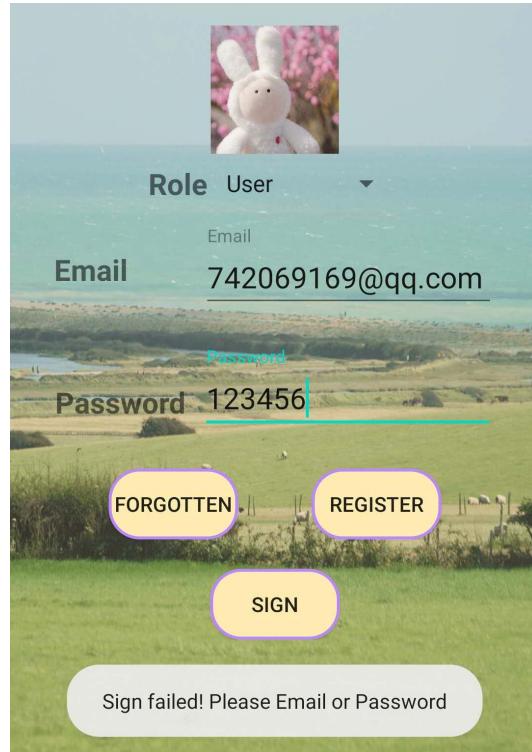


Figure 5.1 login failed

II. Forgetting password

For the function of forgetting the password, in addition to setting up click events, a test view is also established at the back end. The TestView is fixed in the center of the layout, and the layout and position of the dialog box are managed and controlled by the linear layout manager. When the user clicks the cancel button, the user will return to the main activity. The user clicks recover to send the specific firebase reset password link to the user's mailbox.

The resetting password link in email is like that:

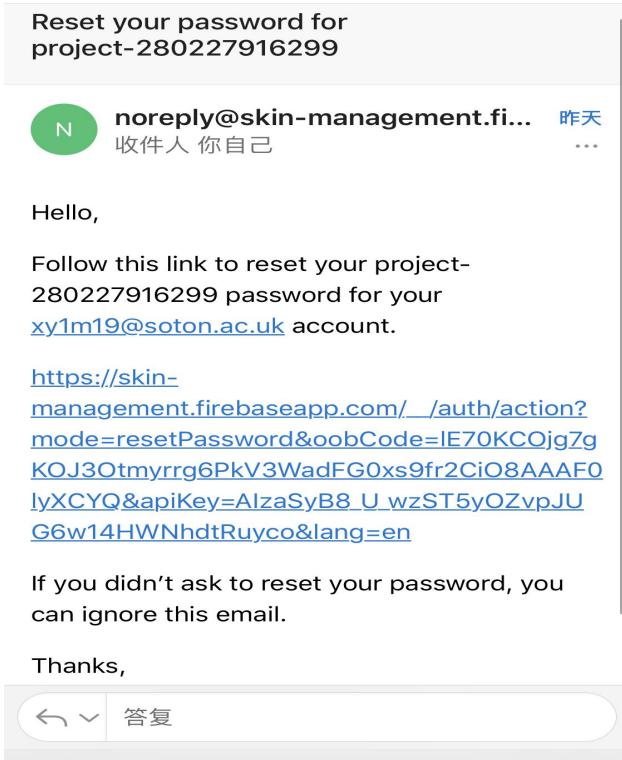


Figure 5.2 Sending Email

In the process of resetting the password, users also read the prompt of toast which asks to insert the right format of the email and password.

5.3.2 Back end design of Main interface

I. Researching function design

When users insert the name of production in the research box, the current page will realize the jump function. When the user clicks the search button, the current page can automatically jump to the GoodSearchActivity page to realize the searching function. In this search category, a simple adapter is established, which is suitable for displaying the searched products as required. It is worth mentioning that the product search results use keywords as the only basis for retrieval, and the results of keyword retrieval all come from the product information which in the firebase. Then I input the item_good layout to show the detail of the product details. The search box supports the first letter query function. If I enter F in the search box, all products with the initial letter F will appear. The picture is as follows:

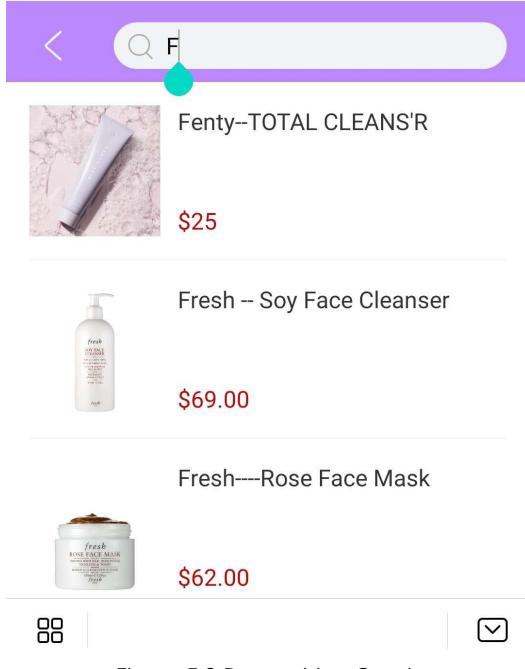


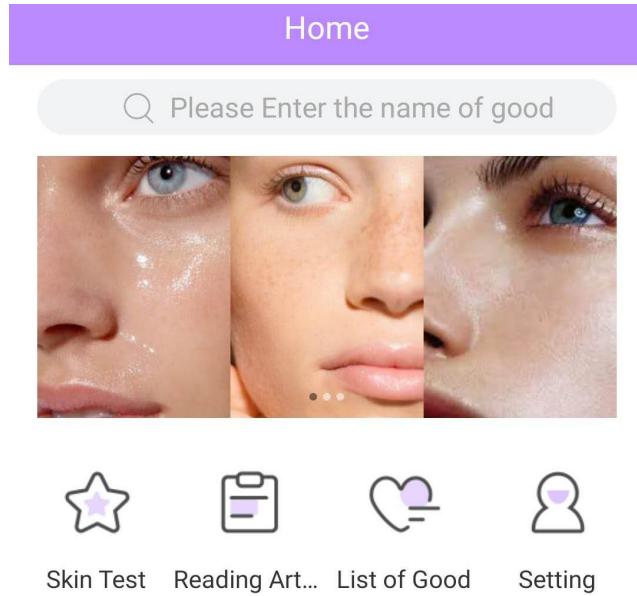
Figure 5.3 Researching Goods

II. Realization of rolling picture function

For designing the scrolling pictures, I directly connect the pictures through the url address, and the front-end interface can quickly display the corresponding pictures.

```
List<String> url = new ArrayList<>();
url.add("https://encrypted-tbn0.gstatic.com/images?q=tbn%3AAnd9GcSm7FL8uB8aEp7urYNChzTGTcaZOkMwqrrmcA&usqp=CAU");
url.add("https://encrypted-tbn0.gstatic.com/images?q=tbn%3AAnd9GcQfN5t-hJnK_BqLos15oamQY_W7ZavUHPGEmg&usqp=CAU");
url.add("https://encrypted-tbn0.gstatic.com/images?q=tbn%3AAnd9GcThj9qnIZBowGzAOHMiZ-5abgdgt908WM-n2A&usqp=CAU");
banner.setImages(url);
banner.start();
```

I also used the setBannerStyle and setImageLoader to complete loading pictures, and then I added the banner.setDelayTime(2000) to customize the time that each picture stayed. The effect of roller picture is shown in the figure below:



Recommend

Figure 5.4 Rolling picture

III. Function designing of Recommendation

The logic of the design is about that there are no production or item for a new user who hasn't completed the skin test. In this situation, the skin type information of users can't be found in firebase. When the attribute retrieval is empty, an empty list can be returned is allowed.

When users finished the skin test or users did the skin test again, the firebase can store user's skin type information, the recommendation function will upload products based on the skin attributes of specific users. I mainly used the dataSnapshot performs a mapping search in the database and returned it in the list.

```
public void onDataChange(@NonNull DataSnapshot dataSnapshot) {
    Object skin = dataSnapshot.child("skin").getValue();
    Object type = dataSnapshot.child("type").getValue();
    Object pigment = dataSnapshot.child("pigment").getValue();
    Object age = dataSnapshot.child("age").getValue();
```

Figure 5.5 dataSnapshot

DataSnapshot contains data from the database location. DataSnapshot is effectively generated at the database location, an unchanging copy of data. It cannot be modified and will never change[16]. Whenever data is read from the database, the system will receive the data in DataSnapshot.

5.3.3 Back end design of Good detail interface

I. Serializable to transfer data

In the back-end design, I used Serializable to transfer data, comparing with dataSnapshot, this method is more relatively stable and fast in terms of the structure of the system. The Serializable interface is an interface that enables its serialization, which is primarily intended to provide a simple and extensible mechanism for saving and restoring objects. For remote calls, it makes it easy to encode and decode the object, just like the object is transferred directly[17].

II. Loading pictures

In terms of image loading, the image loading function in firebase has changed due to the Android Studio version update, the images cannot be uploaded from the firebase. I need to get the URL address of the picture, and then images can be uploaded from the firebase to the system using glide.

III. Jumping to the official website link of the goods

For the official website of purchasing at the bottom of the page, first I set the click event for the Button at the bottom, and then this interface can jump to WebViewActivity directly. In this page, it is not the traditional Android page, this page need to be able to load the PC side of the web interface. Therefore, I used WebView. In this page, we can directly jump to the official website of the product through the URL access, it need not to consider whether the official website is compatible with mobile devices. SetWebChromeClient is a method that allows APP to accept an important part of the web layout and helps the WebView handle various notifications, events, and requests which without opening an external browser. However, it is important to note that this method requires access to the Web in the AndroidManifest, otherwise the system will crash or the page will appear blank. In addition, after Android was updated, there was a load exception problem, which may be due to a bug in URL updating by Android SDK.

To solve this problem, we should use shouldOverrideUrlLoading method. In this method, considering that the version is the latest version, the system version cannot be reduced. I loaded the URL request in the method and get the system compatibility.

Function demonstration: click the website button, users can enter the third-party website: the official website of goods. As shown in the figure below:

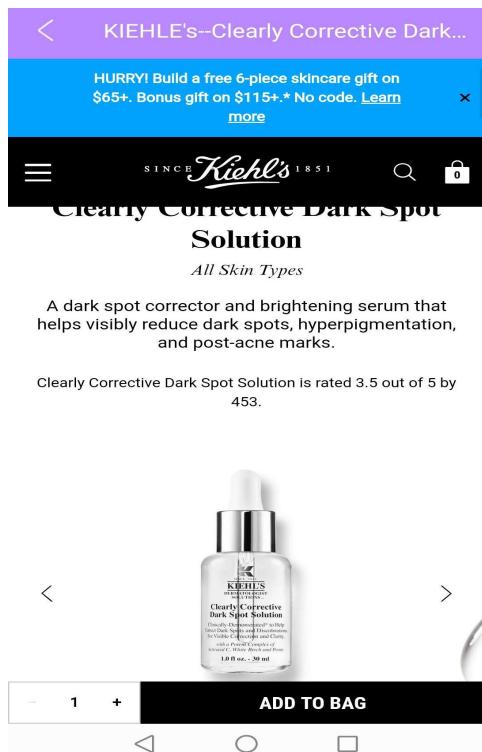


Figure 5.6 Jumping to the official website link of the goods

5.3.4 The back end function of Testing skin

I. Options are converted to numerical calculations

In the question test, it is mainly based on the user's option results, and the system judges the skin type according to the user's options of A, B, C, and D.

The back-end function design is mainly to calculate the reference and result of the space. I first control the result of the user's selection through setOnCheckedChangeListener, that is, the result of the selection is one-way, and the result of the selection can be recorded. The result is stored in the form of a string to provide conditions for the subsequent program operation. The following is the judgment of the selection result. Assign the corresponding scores to the questions in the program. Different results will have different scores.

For example, if users choose the first two options(A or B) in the first question, you will get 20 points for this question, and you will get 0 points for the latter two options C or D (the question is right or wrong, It will not be displayed in this interface, but only as a criterion for distinguishing results), the results of the first question will be displayed on the interface. The small dots in front of the options will light up, and if-else statements are used in logic to distinguish the scores corresponding to the results of different choices. All subsequent questions are scored in this format.

After the user has all the questions, there will be a Submit button at the bottom of the page. During the submission process, the score will be calculated and replaced with the corresponding output sentence (The skin type).

II. Calculating and judging

This part is still judged by the if-else statement. In the judgment process, if the sum calculation is greater than 50, one of the results is output, and if the sum calculation is less than 50, the other result is output. The Picture is like that:

```
if (sum > 50) {  
    skinResult = "oil";  
    result.setText("Your skin is oil");  
    linearLayout.setPadding( left: 10, top: 10, right: 10, bottom: 10);  
}  
else {  
    skinResult = "dry";  
    result.setText("Your skin is dry");  
    linearLayout.setPadding( left: 10, top: 10, right: 10, bottom: 10);  
}
```

Figure 5.7 Code of calculating

I Used dialog to display the results. This system judges that the data of the user's skin type will be stored in firebase, and a new attribute under each user name is created in the database list. There are 4 different attributes corresponding to 4 different test results. It is equivalent to each user has its own skin quality label, which can be used for extracting these data later. For example, in the test of dry skin and oily skin, if the score is greater than 50, it is oily; if the score is less than 50, it is dry. There are five test questions in total. If the user chooses three options a or B, and two options choose C or D, the user's score is 60 points, which is greater than 50 points. The system judges that the skin type of the user is oily.

5.3.5 The back end function of Adding Articles

I. Hashmap method transfers data to firebase

When the manager clicks the Publish button, the information of the article should be stored in firebase. The article data in firebase will be transferred to the user's front page, and the user can see the article published by the administrator. The title, address and content of articles I used the Hashmap to transferred to firebase. The HashMap class in java is used to store data with the characteristics of key-value pairs. HashMap implements the Map interface. The function of this interface is to provide customers with three ways of data display: only view the keys list; only view the values list, or View in key-value format in pairs. Hashmap transfer the data to firebase.

II. Showing when the article was published

I also used getTime() to show the time, when the managers submit the articles. The user front end can see the time when the administrator publishes the article, as shown in the figure below

5.8.3 The back end function for users setting information

I. Showing user avatars

In addition to the basic reference controls and the interface for creating firebase, the glide function is used in uploading user avatars. This function can stably transfer pictures in firebase to image view. Using this method can avoid the problem of picture address transmission, because The avatar image uploaded during registration in the database will generate a unique link, not a https URL. This method can effectively identify the unique URL and transfer the image. Setting the click event to the back button will jump to the user's main interface.

When the users enter the setting information page for the first time, all the edit text boxes appear in the personal information that the users filled in during registration. I used the addValueEventListener method to make the edit text read the contents of the database using DataSnapshot. The content of an edit text will correspond to the content of the database.

II. Deleting user's account

The method I use to add a click event to the delete button is the removeValue function. This function is specially designed for the delete user function in the firebase guide. With addOnCompleteListener in the method, it can display in the log whether it has been successfully deleted and jump to the login interface. When the user clicks the delete button, the user's email and password will become invalid, and the page will jump to the login interface.

III. updating user information

Finally, I talk about the part of updating user information. Edit text can edit the information in the box. I add each edit text to the if statement and create a boolean in the conditional brackets of the if statement. First, I created the interface of firebase database and used the if statement to determine whether it is consistent with the information in the previous firebase. If it is consistent, no operation will be performed. If it is inconsistent, the information in the firebase will be updated when the update button is pressed.

The advantage of this method is that there will be two results after the boolean value is returned, one true and one false. The judgment speed of this method is fast and the structure is clear. If the information is changed, it is true. The information is updated directly and the database is updated synchronously. If the information is not changed, it is false, and the system will not need to do any operation.

Chapter 6: Page results and Performance

6.1 Login interface

The main activity is for people entering this mobile application system. From this page, people can select their role, they can create a new account, inserting the password. What is more, they also click the Forgotten, register and login, these bottoms to complete the

whole function. The picture is like this:

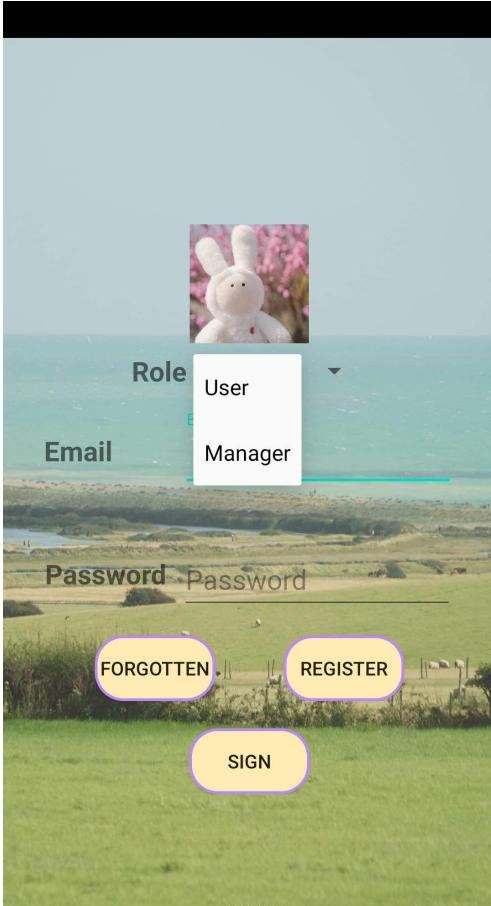


Figure 6.1 Login interface

6.1.1 The login scenarios:

Users or managers can login this mobile application

Precondition:

Users or managers has the account and the correct password. Beside they hadn't yet login.

Events:

- People firstly open the APP, selecting the role user or manager before they loin.
- Users and managers insert their email address as the account and they need pressed login button.
- This system provide “successfully” , users or managers can enter the next interface.

Alternative flow:

- The users or mangers input the wrong account's name or wrong password. The system will tell them fail to login and this system also let the users or managers retries 3 times before terminate.

6.1.2 The registration precondition:

Users or managers haven't had an account.

Events:

- People firstly select their role: Users or managers.
- People upload the different picture as their portrait.
- People click on the bottom: "Register".
- According the prompt statement, people can insert the personal information like : email address, age, name, password and family address. Password requirements: no less than 6 digits and no more than 11 digits, with capital letters. The expression of the mailbox is @.com.

Alternative flow:

If people can't insert the right format of email address or password, this system will refuse people to register a new account.

6.1.3 The forgetting password scenarios

Users or managers forgot their account and password.

Precondition:

Users and managers had an account, they insert the wrong password several times, and they have to click on forgotten bottom.

Events:

- Users or managers press the forgotten bottom, they can receive the real mail in their email address.
- Click on the link of the mail, according to the steps, users and managers can reset the new password
- The password change is synchronized with the authentication function of the established database

Alternative flow:

System command the new password is different of the old one.

6.2 Main interface

This main function interface provides the main functions of this APP for the users. The functions include: researching the productions, reading the article, making the skin test and system finishes the recommendation. This interface is the sum of all functions. When the user clicks one of the function buttons, the user can enter the next interface. At the same time, the interface also supports the back button, and the user can click the back button on other pages to return to this main function interface. The picture is like this:

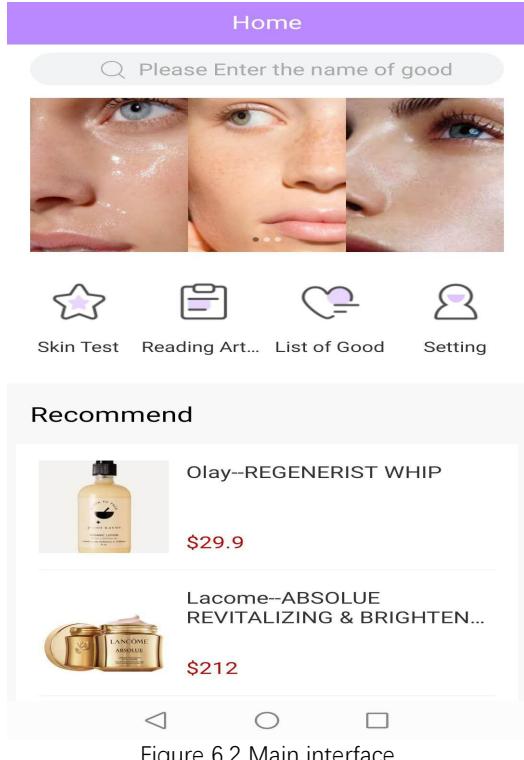


Figure 6.2 Main interface

6.2.1 The main interface scenarios:

After user logging in, they enter the main function interface.

Precondition:

Users logged in this system successfully.

Events:

- People firstly entered the main function interface.
- Users can read the roller of advertisements about cosmetics. Putting the pictures in the set scroll box, and the scroll axis will scroll in a specific time sequence.
- There four bottoms: Skin test, Reading Articles, List of Good and Setting, these are the four mainly functions of this APP. This control acts as a navigation function. Click events are set here to enter the main functional interfaces.
- Users can use the searching bar to search the productions which they want to know. In the search box, you can search for all products by keywords (for example: enter "E", you can retrieve all products with E in the product name in the drop-down menu, and return to the list).
- The rest of the interface recommends production to the users.

Alternative flow:

If the users haven't finished the skin test, this system hasn't stored the skin type information of the users, this main function interface will not recommend the suitable production to the users.

6.3 The Good detail interface

On this interface, users can see the detailed information of each product, including: product name, product price, product category, product details, and product purchase official website address. The product detail page is also one of the core functions of the entire APP development. It displays product details to users well, and displays the real information of the product on the page, which can be used as a reference for users to purchase, and the purchase website address is attached to facilitate users to purchase. In the product detail page, I collect and upload real product photos to help users understand the product more intuitively. In the interface and function design, including reliable and true product information collection, firebase design storage, front-end interface design and back-end function design, etc. The picture is like that:

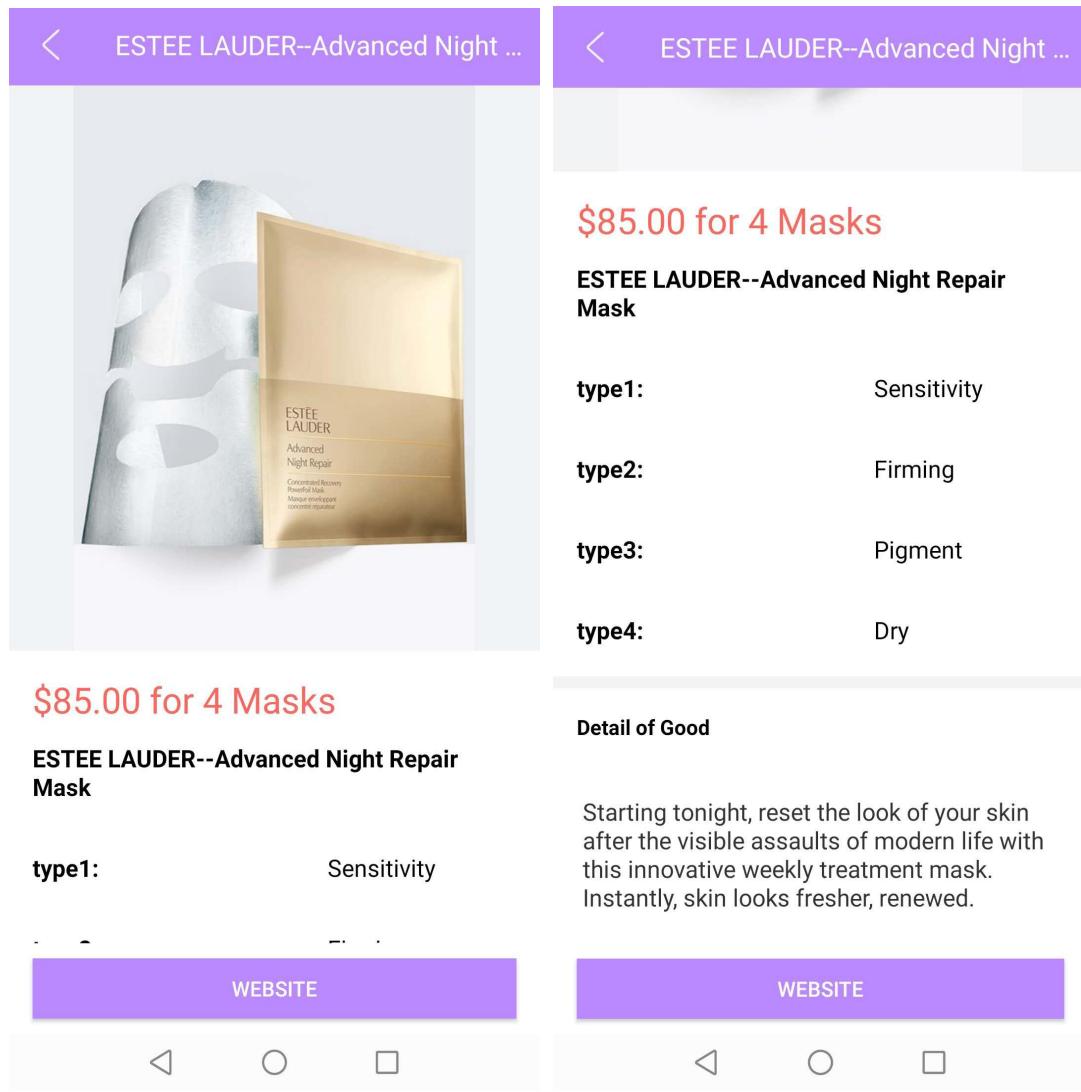


Figure 6.3 Good details interface

6.3.1 The good detail activity scenarios:

First Situation: The user searches for the product which they want to know the detail in the search bar and Users clicks to enter.

Second situation:

The user clicks on the product in the product list to enter the modification interface.

Precondition:

Users successfully logs in and enters the main interface.

Events:

- Users enter the “Good detail activity” interface.
- Users can see the name, price, detailed description and official website address of products.
- Each product has a label that matches the type of skin used, and users can choose the appropriate product based on the results of the skin test.
- Users can click on the URL at the bottom of the screen to jump to the official website of the product to purchase the product.

Alternative flow:

- If the corresponding product information is not hired in the firebase of the system, the user will not be able to find the product.

6.4 The Skin Test interface

During the skin test, the user will be asked to complete a four-part skin test. Mainly divided into Dry/oily, Sensitivity/tolerant, Pigment/Non - Pigment, Aging/Firming skin test. Each part of the test A total of five small problems, each A small problem with A, B, C, D four options, the user can choose according to their own skin condition, the system can determine the user's skin type, there will be four different skin types data firebase, subsequent skin recommendations are based on the user's skin type accordingly recommended. The pictures are like blow:

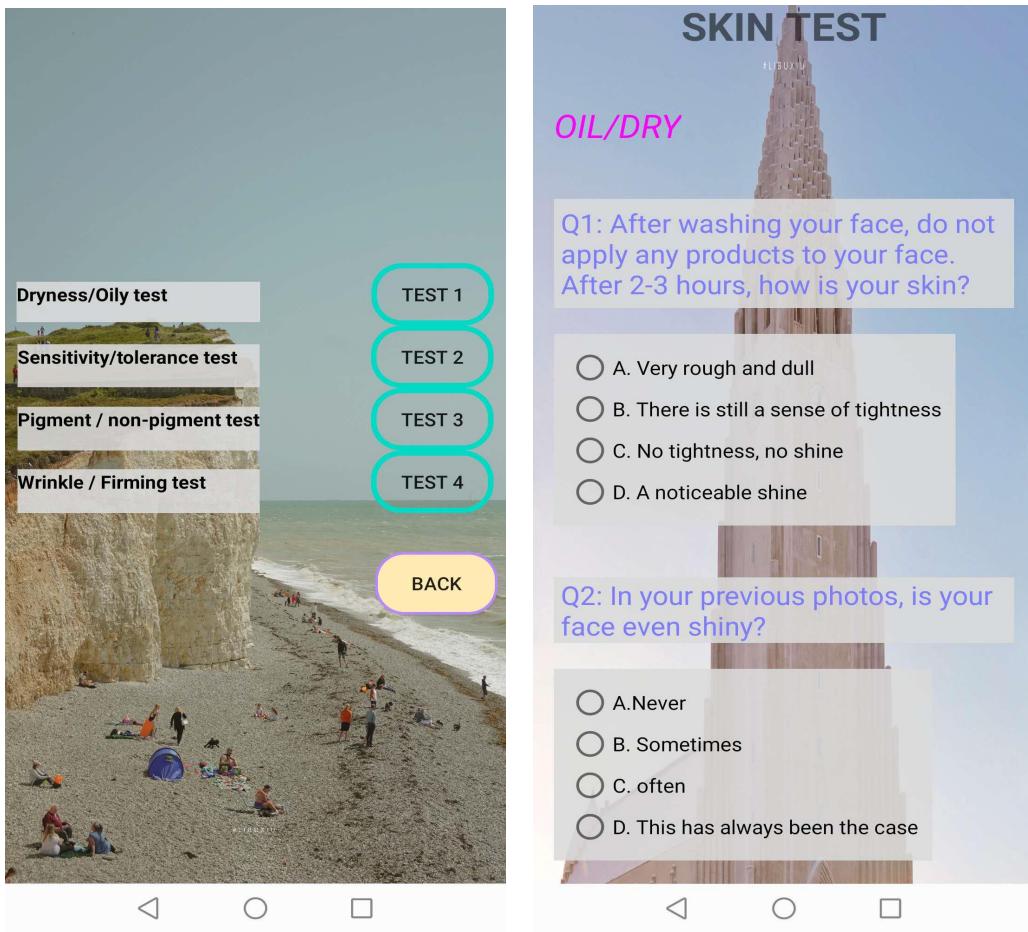


Figure 6.4 Skin test list interface and skin test interface

6.4.1 The skin test scenarios:

According to the user's answer, the system tells the user the corresponding skin type and saves the user's skin type data in firebase.

Precondition:

Users login this application successfully, and then they click on the Skin Test bottom, and they enter into the Skin main test interface, the picture likes that:

Events:

- Users clicks on the Skin test bottom in the main interface, then users can enter into the Main Skin Test interface
- The Main Skin Test interface, users can complete four different skin tests in order.
- In each part of the skin test, there are 5 questions. Each question has four options: A, B, C, D. The users can choose the option according to their own situation. Finally, clicking the Submit button, a pop-up box appears on the screen, and the system tells the user Skin type: dry or oily, sensitivity or tolerant, pigment or non - pigment, ageing or firming.
- The users' data of skin type can be stored in firebase, application can recommend products to users who have finished the skin test.

6.5 The adding articles interface.

This interface provides the administrator role with the ability to upload article titles, article content and pictures to this application. The picture likes that:

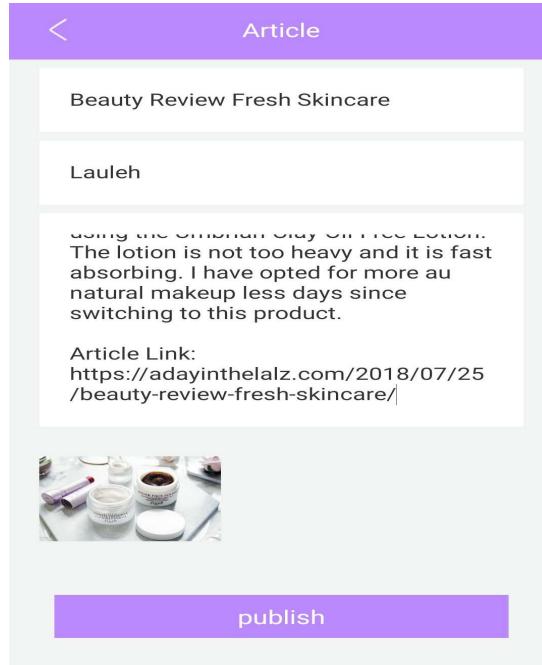


Figure 6.5 Adding articles interface

6.5.1 The Adding articles scenarios

Precondition:

Managers logged in this system successfully.

Events:

- Managers enter the Adding articles interface.
- The manager enters the specified content in the input box, such as article title and article content. The administrator can edit the text through the input method inside the system.
- The managers can upload pictures to the application.
- Managers clicks on the Submit button.
- Users renew the Articles interface, users can read the articles which the managers upload.

6.6 The Reading articles interface:

Precondition:

Users successfully logs in and enters the main interface, and they clicks the button Articles

The pictures are those:

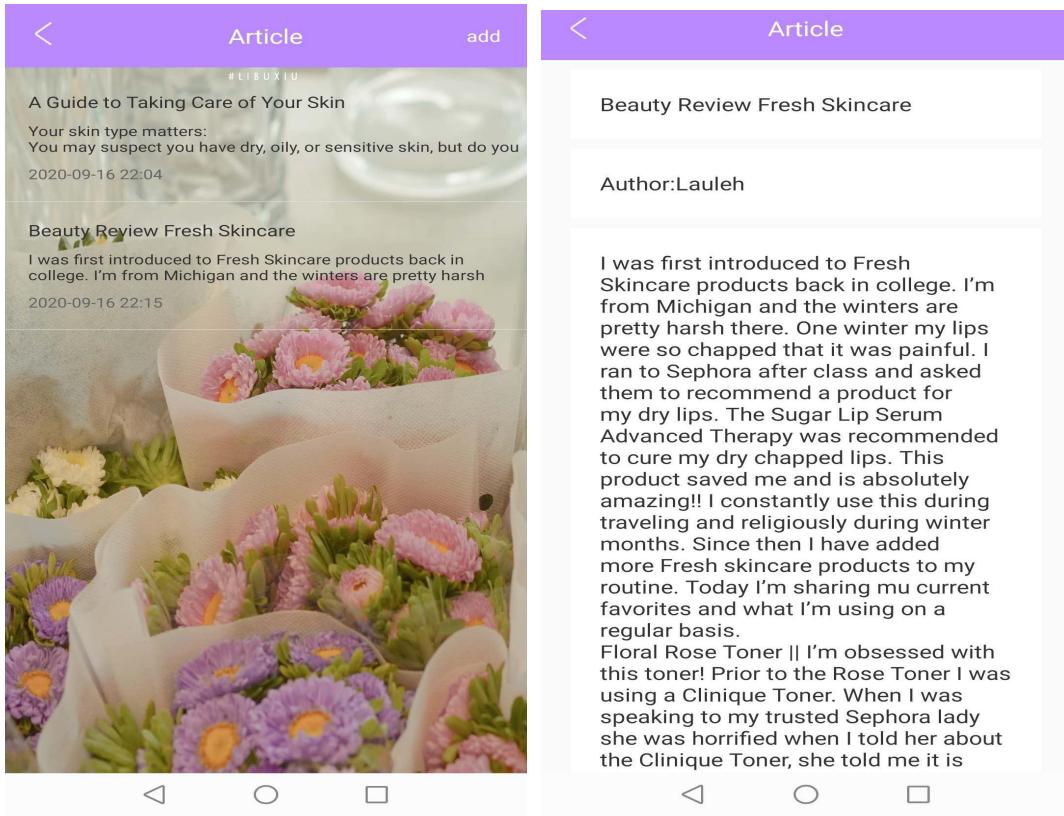


Figure 6.6 Reading articles interface

Events:

- Users enter the Article list interface.
- Users click the tile and abstract of the articles on the Article list interface.
- Users can read the completed articles includes content and picture.

Alternative flow:

- Managers have submitted the articles on this APP

6.7 Designing for users setting information interface

This interface is for users updating their personal information. They can edit address, age, and name.

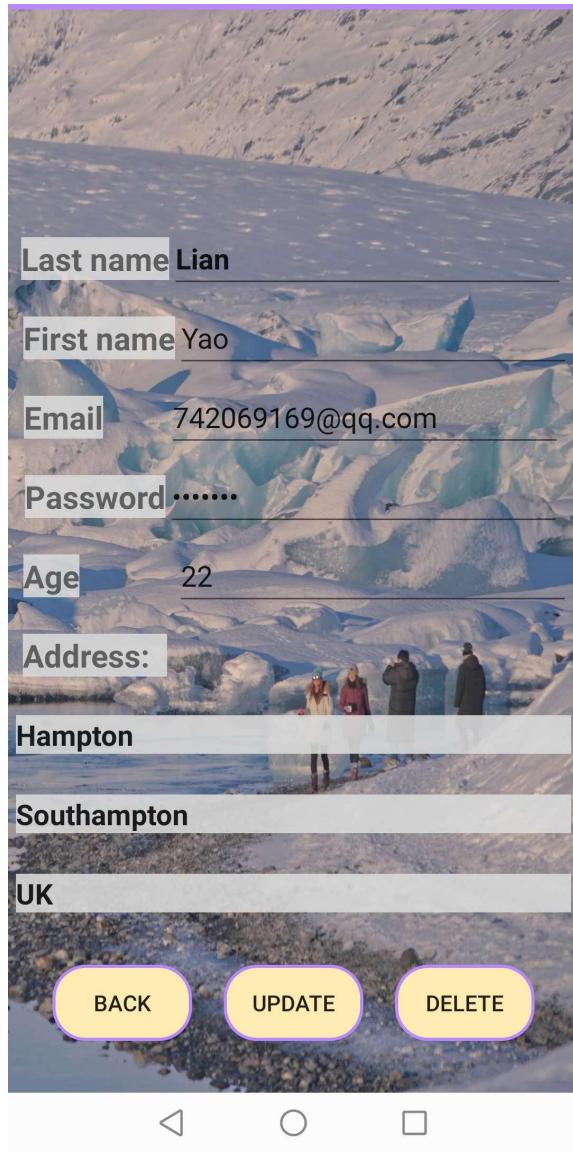


Figure 6.7 Setting information interface

6.7.1 The setting information scenarios:

Precondition:

Users login this application successfully, and then they click on the Setting bottom.

Events:

- Users can enter personal information such as name, home address, and age in the designated input box.
- User can not change the email address and password. This kind of setting can protect user account security
- Users click the back button can back to the main interface, the system will not save the data of the user's changed information. When the user clicks the setting button again and returns to the setting interface, the page still shows the user's previous personal information.

- Users click the UPDATE button, system will update the users' personal information.
- Users click the DELETE button. The users will be logged out of the system directly and return to the login interface.

Chapter 7: Issues of APP

7.1 Issues 1

There are no restrictions on the role selection when entering the login interface:

When people enter the login interface of the app, they can switch roles freely: user and administrator. According to the design specifications, this is not an optimized login interface. There is a potential possibility that if a person has two different email addresses at the same time, the person can register two accounts, namely user account and administrator account, so that the user can enter the system as an administrator.

7.1.1 Optimization scheme 1:

The login of app can only be the user role, while the administrator's login is on the web side, and the app is linked with the web address through the cloud server, so that the administrator can enter the system through the network to upload popular science articles.

7.1.2 Optimization scheme 2:

Considering that it is convenient for mobile phone users to download programs and do not need computer operation, two different apps can be designed. One is the user app, the other is the administrator app. These two apps are also connected by the cloud server, and can update data information and receive it in real time. Users can download it by themselves in the app store of the mobile phone. To download, the administrator needs to input a special key to ensure the security of the system.

7.2 Issues 2

When registering an account, the app only supports email address registration:

The system can only support the registered account of the mailbox, and the address of the mailbox is the name of the user's account. When the user forgets the password, the system sends an invitation to reset the password to the user's mailbox, and the user can modify the password. Considering that communication is not limited to email, mobile phone numbers should also be supported for registration. Increasing the registration method of mobile phone number will make the system more comprehensive.

7.3 Issues 3

The advertising scroll on the main page can only go to the product list page, not the product details page:

When users enter the main interface, they click the advertising scroll page to jump to the

product details page, which is a good operation, but the design is not convenient and fast. If the user wants to find the product on the advertisement more quickly, click on the advertisement page to go directly to the corresponding product details page.

7.4 Issues 4

When a user does not have a skin test, the recommended appropriate products will not be displayed on main interface:

Since there is no skin type label when the user enters the main interface for the first time, the product type of the system cannot match the user's skin type, so the function of the system cannot be completed. This makes the user enter the main interface for the first time with less content. In general, a function can be established to randomly recommend products, and the user can enter the recommended products for the first time. When the user completes the skin test, the database stores the user's skin type label, and the product recommendations on the home page correspond to the appropriate products for the user.

7.5 Issues 5

During the questionnaire survey, every time the user answers the five questions, user needs to click twice to submit button, and then the system can show the skin characteristics of the user:

When a user is doing a questionnaire survey, every time the user has finished answering 5 small questions, he needs to click twice to submit, and the system can display the user's skin characteristics. In an ideal state, the user only needs to click submit once, and the system can directly pop up a pop-up box and tell the user the skin type.

The main reasons for the explorer:

Firstly, the logic of the code used to judge the skin characteristics is completely correct, so the result of the judgment is correct. To determine the user's skin characteristics, you need to connect to the database, and the database's skin data needs to be transferred to the front end, so that the user can see the results of the skin type after submitting.

Due to network restrictions, firebase is a subsidiary of Google and needs to contact European networks. Due to network restrictions, results are delayed. The user needs to click submit twice to display the results of the skin characteristics.

7.6 Issues 6

The administrator can upload text when editing the article, the system does not support changing the font color, size and other functions:

When publishing an article, users can upload pictures, article titles, authors, and text content. The system supports Android phone input method. But it does not support operations such as changing the font size, color, etc. This is a pity for the design point.

7.7 Issues 7

Questions about the accuracy of the skin test results:

The code program judges the result part according to the user's options, and the logic of the program code is consistent.

The main question is whether the sources of problems and options in the four skin testing sections are accurate. The questions about skin testing mainly come from nearly 10 skin discussion websites and forums. I mainly refer to Laurent misery's skin sensitivity survey, and set the problem from the user's usual skin condition and the use of skin care products (MIsERY, 2014). I set up the judgment of dry skin and oily skin according to Baumann, L.S.'s research paper on skin oil secretion. At the same time, I have also investigated the composition of hundreds of cosmetics (Baumann, L.S, 2014). Through the analysis and comparison of cosmetic ingredients, we can set problems, which can show the rigor of setting problems and options, and can not eliminate the risk of inaccuracy in problems and conclusions.

Before the program was developed, I sent out the skin questionnaire to 50 people, mostly women and over 18 years old. All the people completed the survey, and about 70% of them thought that the skin test results were accurate under the temperature survey.

7.8 Evaluation of issues

The problems shown above mainly relate to system design and skin test problem design. In general, the design of the system is perfect and can meet the needs of users and administrators. From the function aspect, the system program design is huge, it not only supports the access of email address, the system can transmit mail to the user's mailbox, but also supports entering the third party website through internal: the official website of product purchase, which is a major highlight of the system design. The administrator publishes the article, the user can see, a system has two kinds of role function, is also a big breakthrough of this project. In the aspect of skin test, the system can provide the results of skin test for users, and this kind of products have great development space in the market. At the same time, the system also breaks through the function of product recommendation.

Chapter 8: Evaluation of APP

8.1 Evaluation of researching directions and fields

Skin test management app is mainly to solve the misunderstanding of people's skin care, guiding people take care their skin correctly, and helping people to find products which really suitable for themselves. The design of the app provides skin test, according to the user's choice to get the user's skin type, helping users fully understand their own skin condition. The purpose of this study is feasible. With the increasing number of people with skin problems, the direction of this study is to solve some problems of people.

Because this research involves the exploration of human skin. For example, the design of questionnaire survey and the label of skin care products function need a lot of data and literature to prove the accuracy of the system to draw the conclusion of user skin type. Therefore, the accuracy of the system needs to be further verified.

8.2 Evaluation of APP function realization

The function realization of app is basically completed. The main functions of this app are user skin detection, product composition query, product details display, product recommendation and other functions. At the same time, the app also provides users and administrators with basic login, modify data and other routine operations.

The function realization degree list is shown in the figure below:

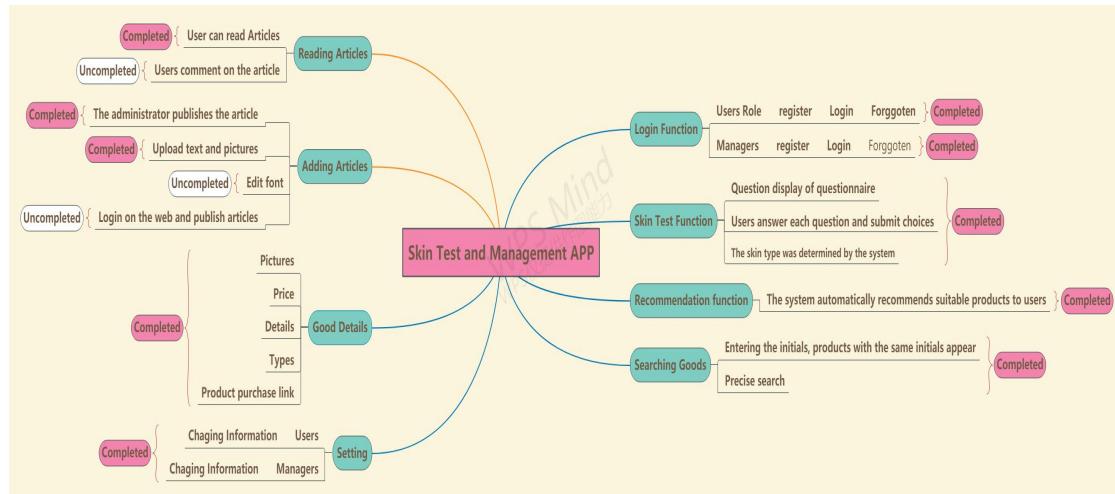


Figure 8.1 Function realization degree list

As shown in the figure, most of the functions have been implemented. I have repeatedly modified and optimized the experimental code. The code has been tested and the correct rate is 90% in the completed functions. In terms of function implementation, the main error is the limitation of European network, which takes a lot of time to run the program. In general, the project is basically completed, and the unfinished parts need to continue to spend time exploring and implementing.

8.3 Evaluation of users

After the project was completed, I found more than 50 users to use the app. These users are all over 18 years old, and the respondents are more female. I set up a questionnaire to ask users how they feel about the app. The questions of the questionnaire are mainly about the function, design, interface and accuracy of skin test of app. This questionnaire survey does not touch on health, religion and other aspects, all the questions are objective. By collecting user feedback, I come to the following conclusion.

Among them, 75% of the users are satisfied with the function of the system, and 80% of the users like the app design page very much. Among them, 70% of them think that the skin detection results of the system are correct, and 30% of them trust the product recommendation function of APP needle for different users.

At the same time, some users have questioned this research, they do not believe that the skin test setup is directly related to the conclusions drawn by the system. More people question the issue of setting up skin tests.

For the function of app, most users do not support assigning the roles of user and

administrator in the system. They think it is unsafe.

The most satisfied part of the app is the product details page. The user's task product details information is reliable, because all the product information comes from the official website. Users can click the website button to jump directly to the official website to purchase products. This design can help users quickly purchase products. And the product type tag can help users quickly find their own products. This is convenient for users.

Through people's suggestions and feedback on the project, we need to obtain more knowledge and information about skin, which is an important way to prove the reliability of skin test. If the system wants to gain more people's trust, we need to expand the sample survey, collect more users' feedback, and further update the system functions.

Chapter 9: Future and Prospect

9.1 Designing the sharing platform of web page and Android

Because the existing app can switch roles freely: user and administrator. The role of the administrator is to publish articles, which can be viewed by users in the app. Considering that it is not safe to switch two roles on one app at the same time, because switching roles is in the future research, I will find a method: the administrator logs in on the web page, publishes articles on the web page, and the data of the articles will be transmitted to the cloud server. The cloud server is connected to the Android system, and users can log in to the app, and the user can read the article. The flow chart I designed is as follows:

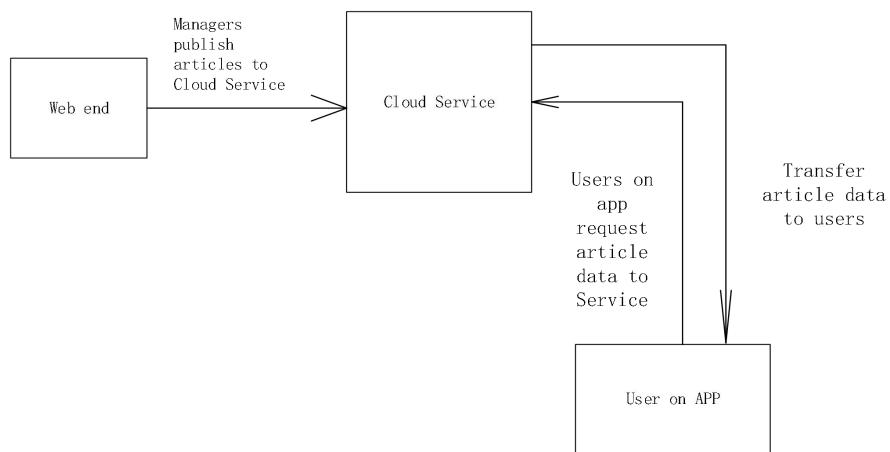


Figure 9.1 Flow chart of connecting web and android system

9.2 Making skin test in app more accurate

To ensure that my skin test results are more accurate and convincing, I will collect more information about skin characteristics in the future. As the problem of skin detection mainly comes from the collection of network data, its accuracy needs to be verified. I will carry out the research from the following three steps:

1. Carry out more user surveys and obtain more user skin information data will have

more reference value.

2. Consult more available scientific materials for in-depth understanding of biology and skin related knowledge.
3. Optimize the evaluation algorithm of the system.

Chapter 10. Conclusion

In this research project, I studied an app for skin testing and management, which lasted for three months. In the end, I succeeded according to the plan.

The main purpose of this project is to help users understand their own skin status. Users can get the results of their own skin characteristics through the skin test inside the system. The system can also recommend suitable products to users according to their skin type.

In the early stage of development, I investigated the whole project. As this research involves knowledge of skin characteristics, I studied this field. In my app development plan, skin test is conducted in the form of questionnaire survey. Collecting the questions in skin test. Before developing the app, I will write down the questions and options for answers on paper, I found some friends, classmates and family members, and conducting a small-scale investigation to ensure that the skin test is reliable.

In the development stage, I mainly used the development of Android Studio, and the back-end program is connected with firebase. In the front-end design of app, I mainly used linear layout, and set buttons, text edit box, search bar, scroll axis image settings in the front end. The back-end design includes: connection database, designing of recommendation function, skin test result judgment function and back-end design of each page. In the later stage of app development, I tested each function and optimize the code. Finally, I gave this APP to some people to use, and I collected the user's usage and opinions, and I optimized the system according to the user's suggestions again.

The function of this research is basically realized, and it can really help people understand their skin condition. Under the guidance of this app, users can understand the products of suitable users. However, there are some shortcomings in app. Because users and administrators can access the app. Developing the sharing platform of web and Android Studio is the future researching direction, which can ensure the security of the system. In the aspect of skin test of the app, it is also the main goal of future experiments to collect more information and ensure the reliability of the system preparation

References

- [1] Maylor, H., 2001. Beyond the Gantt chart:: Project management moving on. European management journal, 19(1), pp.92-100.
- [2] Liu, C., Zhu, Q., Holroyd, K.A. and Seng, E.K., 2011. Status and trends of mobile-health applications for iOS devices: A developer's perspective. Journal of Systems and Software, 84(11), pp.2022-2033.
- [3] Dai, X., Spasić, I., Meyer, B., Chapman, S. and Andres, F., 2019, June. Machine learning on mobile: An on-device inference app for skin cancer detection. In 2019 Fourth International Conference on Fog and Mobile Edge Computing (FMEC) (pp. 301-305). IEEE.
- [4] Gross, D.F., 2015. Skin care products containing multiple enhancers. U.S. Patent 8,980,344.
- [5] Johnston, C., Campbell - Yeo, M., Dishner, T., Benoit, B., Fernandes, A., Streiner, D., Inglis, D. and Zee, R., 2017. Skin - to - skin care for procedural pain in neonates. Cochrane Database of Systematic Reviews, (2).
- [6] Yang, Y., Strickland, Z., Kapalavavi, B., Marple, R. and Gamsky, C., 2011. Industrial application of green chromatography — I. Separation and analysis of niacinamide in skincare creams using pure water as the mobile phase. Talanta, 84(1), pp.169-174.
- [7] Smyth, N., 2019. Android Studio 3.5 Development Essentials-Java Edition: Developing Android 10 (Q) Apps Using Android Studio 3.5, Java and Android Jetpack. eBookFrenzy.
- [8] Khawas, C. and Shah, P., 2018. Application of firebase in android app development-a study. International Journal of Computer Applications, 179(46), pp.49-53.
- [9] Moroney, L., Moroney and Anglin, 2017. Definitive Guide to Firebase. Apress.
- [10] Khawas, C. and Shah, P., 2018. Application of firebase in android app development-a study. International Journal of Computer Applications, 179(46), pp.49-53
- [11] Moroney, L., 2017. The firebase realtime database. In The Definitive Guide to Firebase (pp. 51-71). Apress, Berkeley, CA.
- [12] Murphy, M.L., 2010. Android programming tutorials. CommonsWare.
- [13] Allen, G., 2015. Android fragments. In Beginning Android (pp. 181-195). Apress, Berkeley, CA.
- [14] Chatterjee, N., Chakraborty, S., Decosta, A. and Nath, A., 2018. Real-time Communication Application Based on Android Using Google Firebase. Int. J. Adv. Res. Comput. Sci. Manag. Stud.
- [15] Guthrie, I.J.L., Overland Storage Inc, 2007. Block level data snapshot system and method. U.S. Patent 7,225,210.
- [16] Cahill, M.J., Röhm, U. and Fekete, A.D., 2009. Serializable isolation for snapshot databases. ACM Transactions on Database Systems (TODS), 34(4), pp.1-42.
- [17] MIIsERy, L., Jean-Decoster, C., MERy, S., GEoRGEscU, V. and Sibaud, V., 2014. A new ten-item questionnaire for assessing sensitive skin: the sensitive scale-10. Acta dermato-venereologica, 94(6), pp.635-639.

Appendices

Skin test on APP:

1. Dryness / Oily test

Q1: After washing your face, do not apply any products to your face. After 2-3 hours, how is your skin?

Very rough and dull B. There is still a sense of tightness C. No tightness, no shine
D. A noticeable shine

Q2: In your previous photos, is your face even shiny?

Never B. Sometimes C. often D. This has always been the case

Q3: I use a foundation without powder or loose powder. After 2-3 hours, how does your makeup look like?

Peeling flakes B. Good makeup C. Shiny D. Serious flower makeup oil

Q4: In a dry environment, if no skin care products are used, what will happen to your facial skin?

It feels very dry or tingling B. It feels tight C. It feels normal D. It starts to shine E. I don't know

Q5: Looking in a mirror, which parts of your face have enlarged pores?

Not at all. B. There are some in the T area (forehead and nose). C. There are also
D. Around the T area

2. Sensitivity / tolerance test

Q1: Does your face often have redness and allergies (burning, itching, tingling)?

Never B. Rarely C. Appear at least once a month D. Appear at least once a week

Q2: Do skin care products cause flushing, flushing or tingling on your face?

Never B. Rarely C. Often D. Always

Q3: Has the face been diagnosed with acne?

No B. I have n'

t been to the doctor, but my friend or family member said that I have acne
on my face C. Yes, but not serious D. Yes, and the symptoms are serious

Q4: Are you allergic to metal jewelry?

A. Never allergic B. Occasionally allergic C. Allergic to most D. Allergic to all E. Not sure

Q5: Do sunscreen products make your skin itchy, tingling, and red?

Never B. Rarely C. Frequently D. Always E. I always use sunscreen

3. Pigment / non-pigment test

Q1: Will the acne or acne on my face leave a dark acne mark?

A. Never B. sometimes C. often D. always like this

Q2: After being cut, how long will the brown mark (not the pink scar on the new healing)
remain:

A. left no mark or paid attention B. 1 week C. several weeks D. months

Q3: Have you ever had dark spots or patches on your face? No B. I'm not sure C. Yes,
but not sure D. Yes, and very obvious

Q6. No exposure for a few months When you are exposed for the first time, your skin
feels:

A. Burning but not tanned B. Burning and darkening of the skin C. Just darkening
directly D. My skin is already deep, and I can't tell if it will get deeper

Q5: Your facial skin has been diagnosed with pigmentation or light / dark brown / grey spots:

- A. No
- B. Once, but then disappeared
- C. Yes
- D. Yes, and the situation is very serious

4. Wrinkle / Firming test

Q1. Are there any wrinkles on your face?

- A. No, there are no wrinkles even when smiling, frowning, raising eyebrows
- B. Wrinkles only appear when I smile, frown, and raise my eyebrows
- C. Yes, there are wrinkles when I do expressions, and some wrinkles when I do not
- D. Even if there is no expression, there are many wrinkles

Q2: How old is your mother's facial skin?

- A. 1-5 years younger than their peers
- B. Like other people of the same age
- C. 5 years older than his peers
- D. Look older than 5 years old

Q3: How old is your father's facial skin?

- A. 1-5 years younger than their peers
- B. Like other people of the same age
- C. 5 years older than his peers
- D. Look older than 5 years old

Q4: How much sunshine do you receive in the area where you live?

- A. Dominated by cloudy days
- B. Some, not very strong
- C. Moderate sunshine
- D. Tropical, southern or places with long sunshine

Q5: How old do you think you look?

- A is 1-5 years younger than his peers
- B is the same as other people of the same age
- C is 1-5 years older than peers
- D over 5 years old