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Introduce:

This app is a hospital intelligent navigation system created by Android, which can provide medical guidance to patients through graphic text.

Address: SCNU

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June 16

Catalog

1　Introduction

Welcome to our innovative Medical Guided Navigation System, a state-of-the-art mobile application designed to connect hospitals, medical professionals, and users in a seamless and convenient manner. Our app provides a comprehensive platform for medical guidance, empowering hospitals and users to share valuable insights, strategies, and resources for the benefit of the entire community.

2　Requirements specification

2.1　User requirements

1、Need to know the newest information about relevant hospital. For example, they need to know which hospital can support the laser eye surgery, which hospital can park and which door they can enter the hospital with a car.

2、Requirement information that the process of see a doctor in a strange hospital without the hospital guide. Furthermore, they want to know where about the relevant section and how can they reach there. （**main requirement**）

3、Need to communicate with patients to get some information about medicine or others.

2.2　Functional requirements

1、APP need to construct relationship with vicinal hospitals. Cooperate with them to issue necessary up-to-date information.

2、APP need to create a really great positive connection with relevant employees in the hospital to let them release processes of all diseases.

3、APP need to guide patients where they should go in every step and how can they reach there. （**main function**）

4、On the one hand, APP can collaborate with hospital to release some article in our app to guide. On the other hand, APP can use VR technique to guide users where they need to go.

5、Set a region to support communication between patients. To let them talk with each other and know some relative information.

3　Overall Design

3.1　General Design Overview

The medical intelligent guidance App aims to **provide convenient patient guidance and registration services**, and promote the communication and information sharing between patients. By uploading hospital location and registration information, patients can browse relevant information on the mobile phone, including hospital location navigation, precautions, and patient comments and communication. The App uses the Android Studio development tool, written in the Kotlin language, and combines some Kotlin grammar and basics, as well as related plug-ins to implement the required functions.

3.2　Main functional modules

1、　User login and registration module: Allows users to create accounts and log in to use the functions of the App.

2、　Hospital information presentation module: Display the basic information of the hospital, including the name, location, contact information, etc. Provide hospital location

navigation function to help patients find medical places quickly and accurately.

3、 Registration service module: Doctors can upload the registration information, including the department, the doctor's name, the treatment time, etc. Patients can view the available registration information and conduct the registration operation.

4 、Clinic Note module: Provide patients' precautions before medical treatment, such as medication requirements, fasting and smoking ban, etc. Provide relevant medical knowledge and FAQ to help patients better understand the treatment process and precautions.

5、 Patient comment communication module: Patient review and rating functions are provided, allowing patients to evaluate and share experiences with doctors, hospitals, etc. Support the communication and interaction between patients, and provide comments like, reply and other functions.

6、 User setting module: Allows users to manage their personal information, including changing their passwords, updating their personal data, etc.

4   User Interface Design

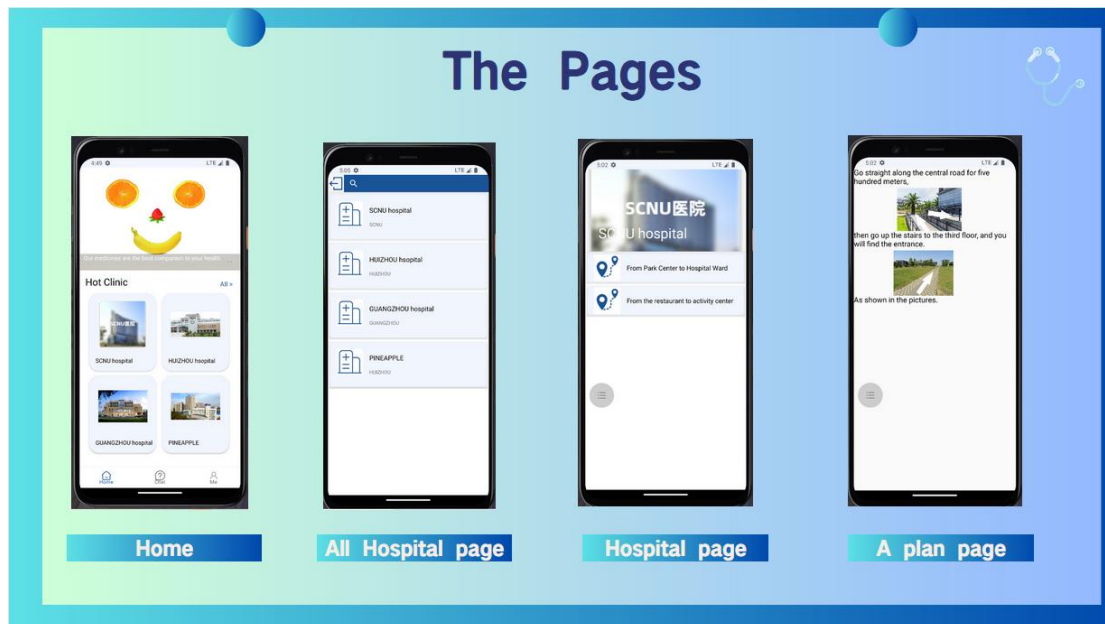## 4.1   The first version (what we have realized):

Figure 1: About home page

In the home page, we set carousel images at the top while there are some clinics at the below. Clicking the "ALL" button, all of the hospitals will occur, and we can choose one of them to click. All articles will show in the lower section of the screen and the higher section of the screen is the hospital we are clicking in. In the specific plan page, some pictures and script will lead patients to the destination.
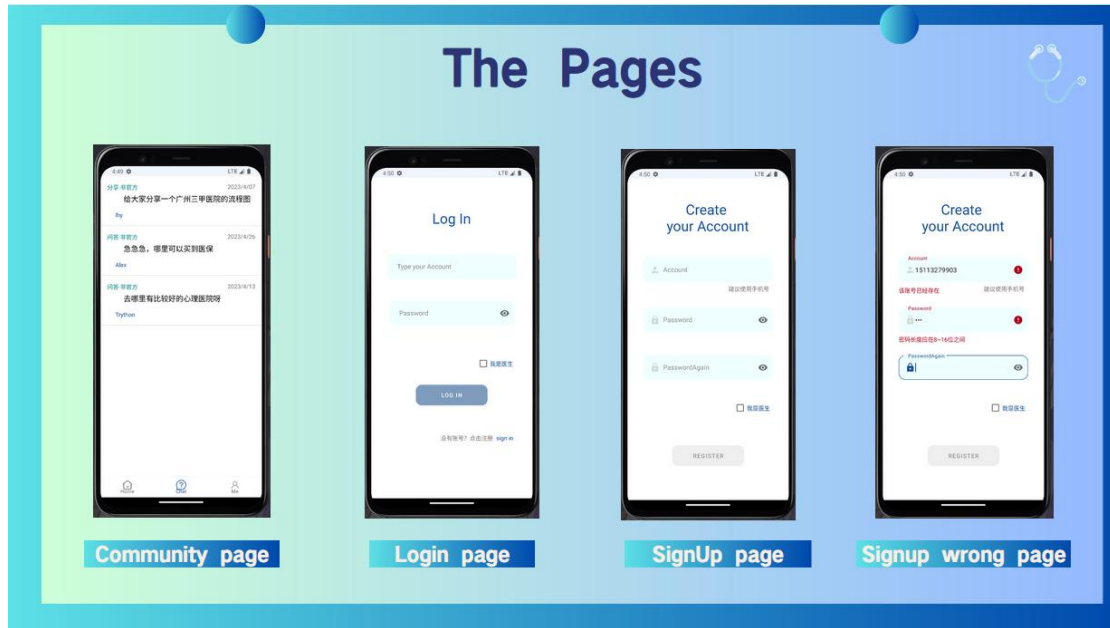
Figure 2: The Login and Sign in page

The first picture supports an area to communicate between patients. The other pictures simply describe two pages: Login page and Sign in page(seen in Figure 2).
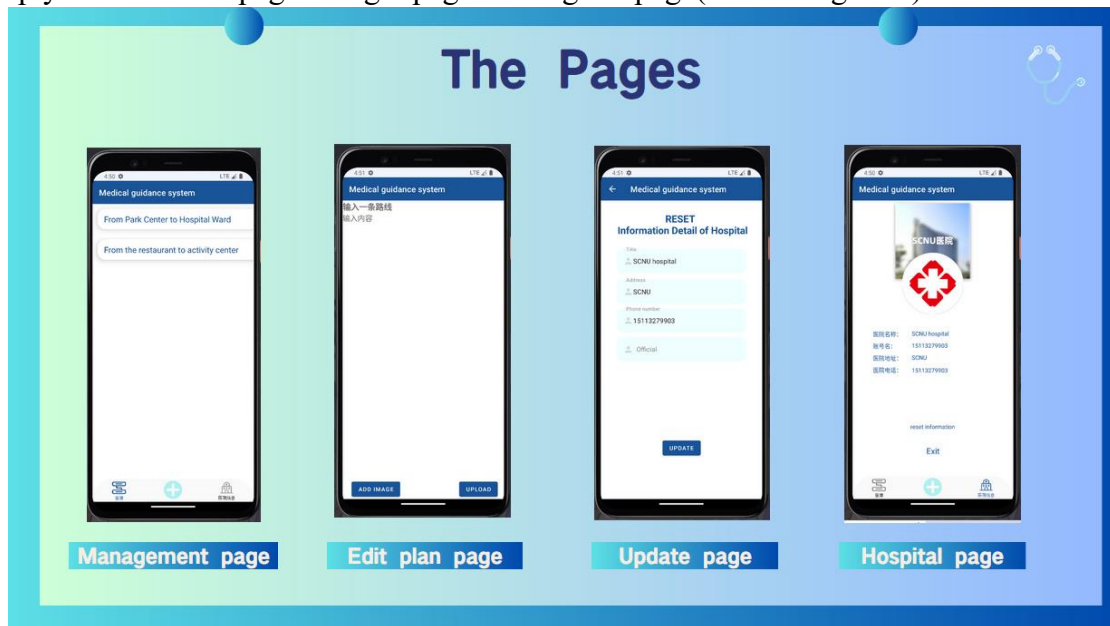

Figure 3: Management page and update page

This is then management page only for doctors(Figure 3). They can edit the guidance to patients and doctors need to log in by using their specific account. Patients barely can read this article and can not edit it. The third page shows how to reset detail information about the hospital. Identically, it can just edit by the doctor in this hospital.

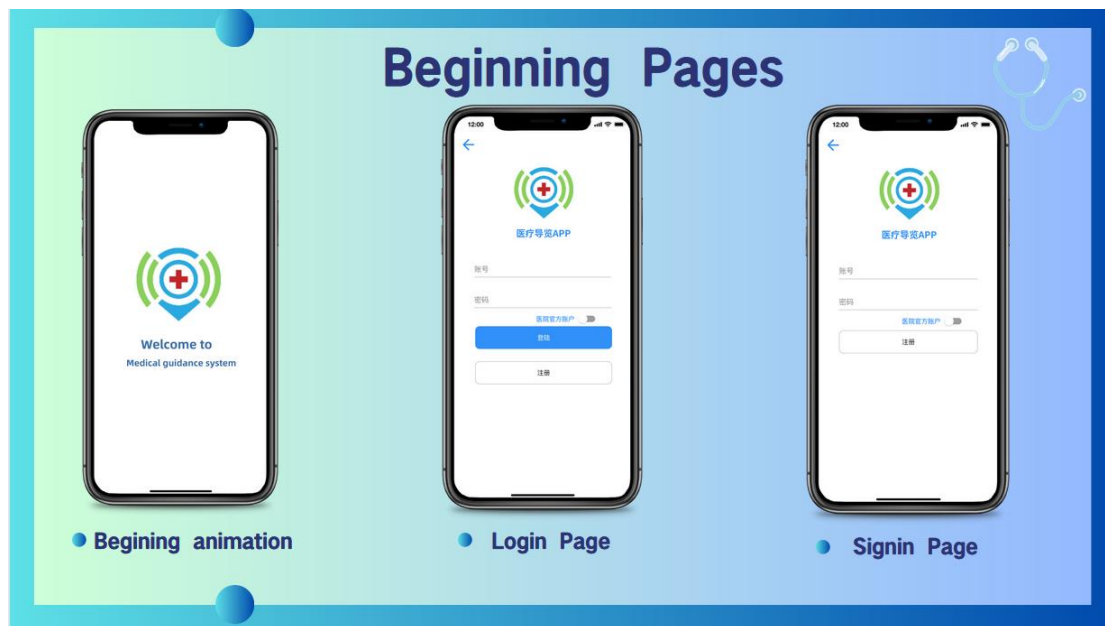## 4.2 The second version (To be realized in the future)

Figure 4: The beginning pages

This is the beginning pages(Figure 4). In this page, there will be an animation when we open the app. Other pages show the login page and the sign in page.
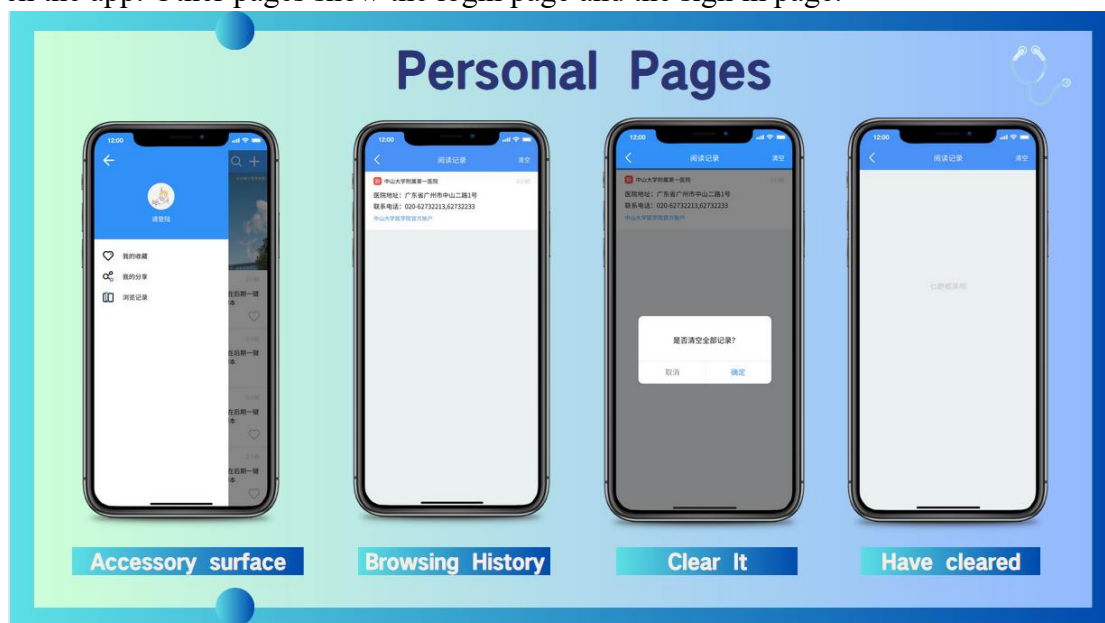

Figure 5: The personal pages

This is the personal pages(Figure 5). This part shows how to clear the browsing history. The main pages are shown in a style of blue and white.
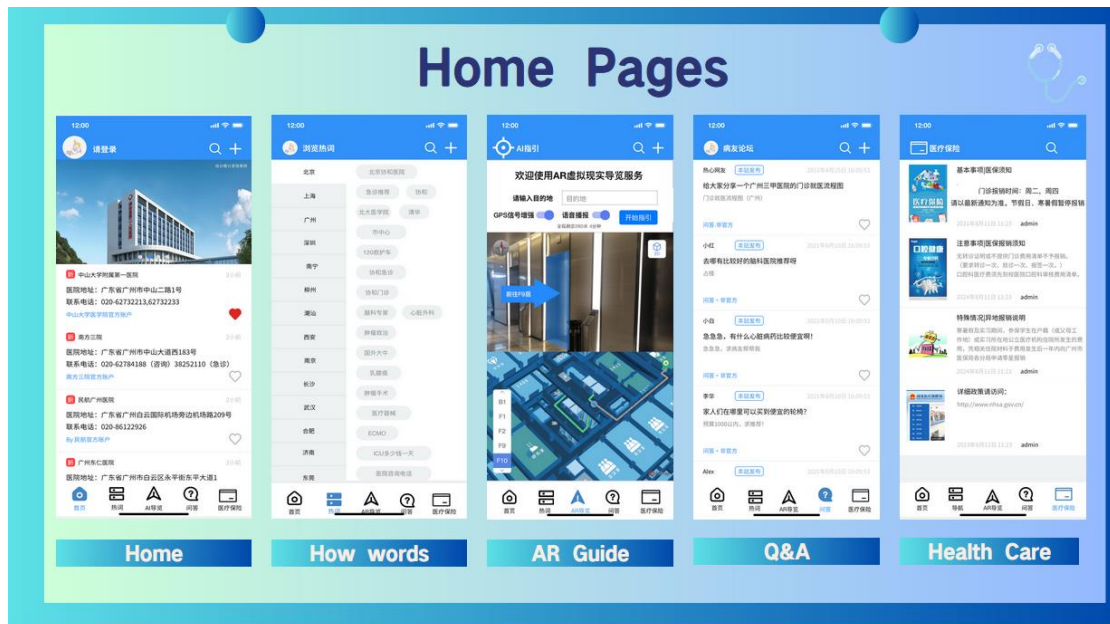
Figure 6: The Home pages

This is the home pages(Figure 6). We adopt some interesting icons.
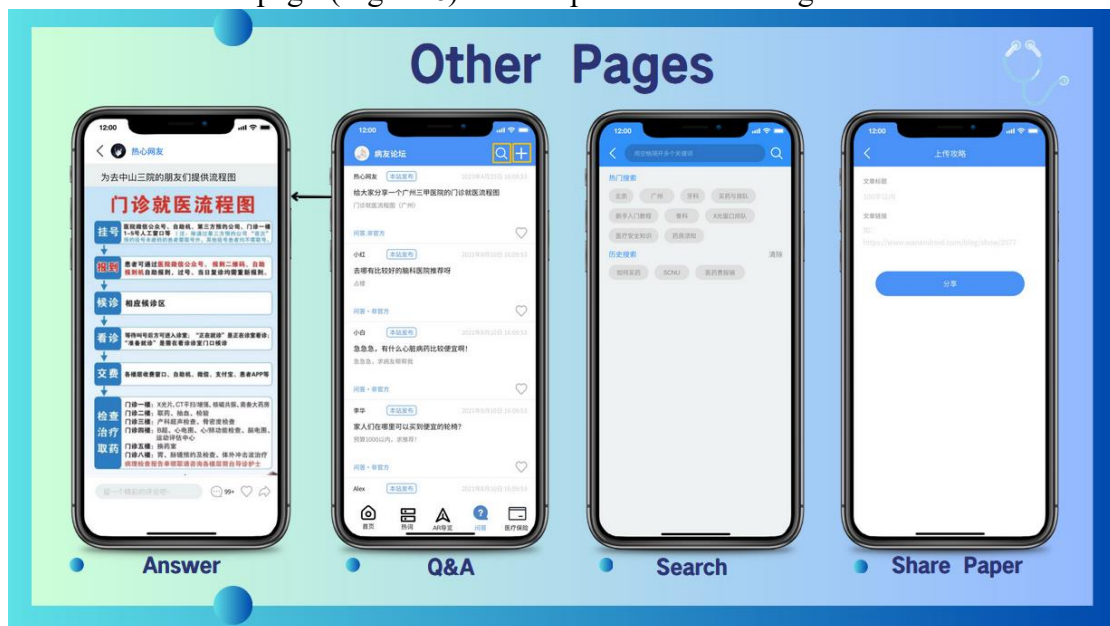
Figure 8: Other pages

This series of pages show some other pages which support an area to communicate between users.

5   Key Technologies

5.1   Sha256 encryption

Sha256 encryption is a cryptographic hash function that generates a fixed-size output (256 bits) from any given input. It is widely used for data integrity and security purposes. Sha256 is considered a secure algorithm and is commonly used in various applications, including password hashing, digital signatures, and data validation.

Sha256, which stands for Secure Hash Algorithm 256-bit, offers several advantages compared to other encoding methods. Here are the key benefits:

1、Security: Sha256 is a secure cryptographic hash function that is resistant to various attacks. It produces a fixed-size 256-bit hash value that is highly unlikely to be reverse-engineered or tampered with, ensuring data integrity and security.

2、Uniqueness: Sha256 generates unique hash values for different inputs. Even a slight change in the input data will result in a significantly different hash value, making it ideal for verifying data integrity and detecting any modifications or data corruption.

4、Efficiency: Sha256 is designed for efficient computation and performs well across different platforms and devices. It can handle large amounts of data quickly and is suitable for applications with performance constraints.

5、Wide support: Sha256 is a standardized hash algorithm supported by various programming languages, frameworks, and operating systems. This wide support ensures compatibility and interoperability across different software environments.

Here is the function that we use to achieve Sha256 encryption(Figure 9)

```kotlin
private fun getSha256(str: String): String {
    val messageDigest: MessageDigest
    var encodeStr = ""
    try {
        messageDigest = MessageDigest.getInstance( algorithm: "SHA-256")
        messageDigest.update(str.toByteArray(StandardCharsets.UTF_8))
        encodeStr = byte2Hex(messageDigest.digest())
    } catch (e: NoSuchAlgorithmException) {
        e.printStackTrace()
    }
    return encodeStr
}
```

Figure 9: Function of Sha256

5.2   SpannableStringBuilder+SQLite

SpannableStringBuilder is a class in Android that allows you to create and manipulate text with different formatting styles within a single TextView. It provides methods to apply different styles such as bold, italic, underline, and more to specific parts of the text.

SQLite is a lightweight and embedded relational database management system commonly used in Android applications. It provides a simple and efficient way to store, retrieve, and manipulate structured data. By using SpannableStringBuilder with SQLite, you can store formatted text data in the database and retrieve it with its formatting intact.

In the program, the complexity of the graph database and the loss of mobile phone performance are considered. We have adopted the method of converting pictures into byte streams and text content into strings for storage. The following is a corresponding schematic diagram(Figure 10). Realizing data storage, modification and reading by combining SQLite and SQL statements
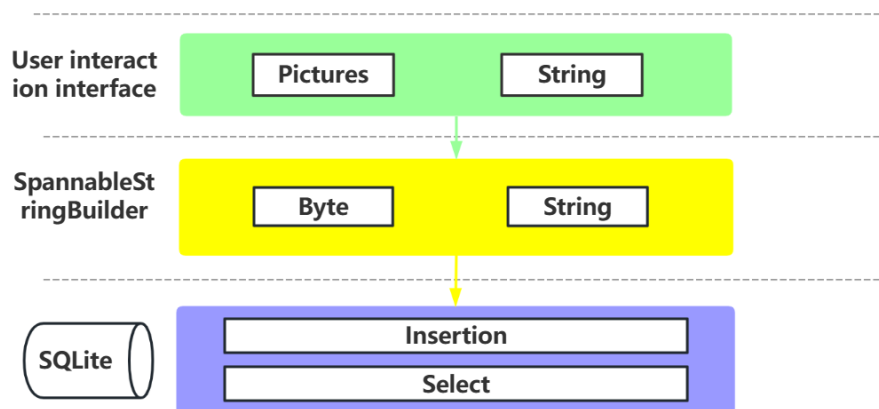
Figure 10:Data storage in SQLite

5.3 TextInputLayout+EditText

TextInputLayout is a component in the Android Support Library that enhances the functionality of EditText by providing a floating label and other features. It acts as a container for EditText and adds extra functionality such as error handling, character count, and floating label animation.

EditText is a user interface component in Android used for capturing user input. TextInputEditText is a subclass of EditText that is specifically designed to be used within a TextInputLayout. It inherits all the features of EditText and can be used with TextInputLayout to create a material design-inspired text input field with a floating label.

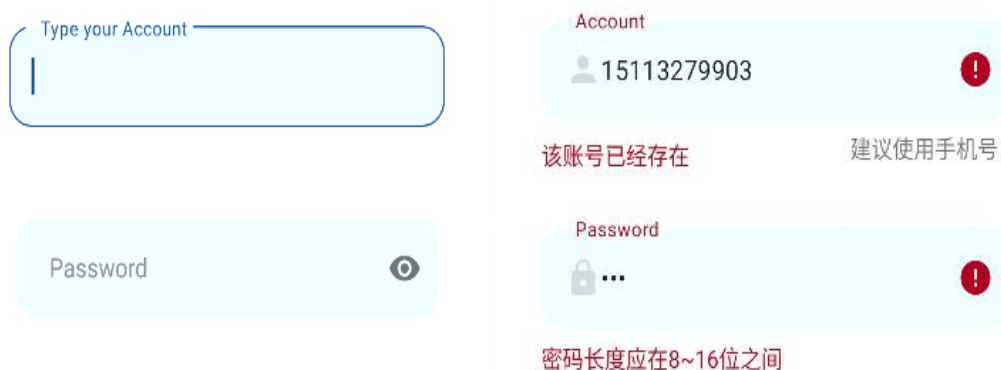We use them to provide boxes for login and register (seen in Figure 11).

Figure 11: EditText that we use

5.4 RecycleView

RecyclerView is a more flexible and advanced version of ListView in Android. It is a powerful and efficient container for displaying large sets of data in a scrolling list. RecyclerView uses a flexible and modular approach to manage and display data items, allowing for better performance and customization compared to ListView. It provides features like item animations, item decoration, and multiple layout managers for arranging items in various ways.

We utilize RecyclerView as the dynamic rendering component of the page, construct adapter objects, and interact with the SQLite database to achieve dynamic data display and management. (The rendering picture is as Figure 12, the relevant adapters that we use are in

Figure 13)

We write different styles of adapters based on different requirements to display different types of data.
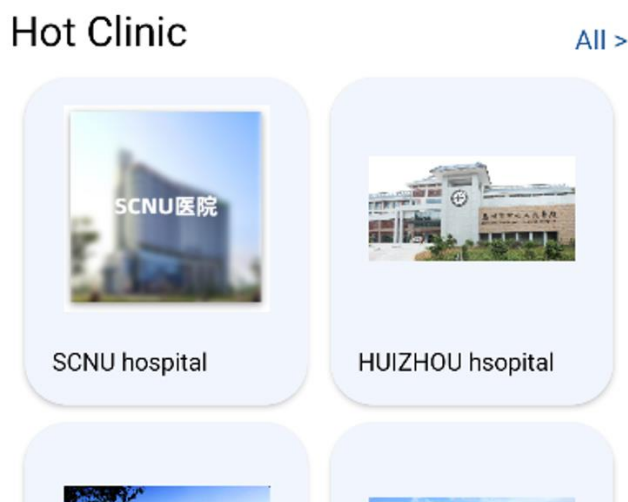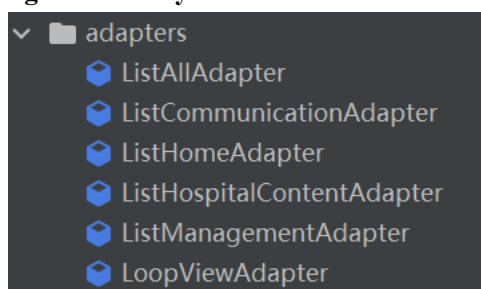

Figure 12: RecycleView that we used

Figure 13:The adapters that we use in the pages

5.5 BottomNavigationView

BottomNavigationView is a user interface component introduced in the Android Design Support Library. It provides a navigation bar at the bottom of the screen, typically used for navigating between different sections or views in an app. It supports displaying icons and text labels for each navigation item, and allows users to switch between them with a single tap(Seen in Figure 14).

We Combine Fragment and BottomNavigationView to implement the rendering of the bottom navigation bar, page switching, and animated effects upon clicking.

By clicking on different options in the bottom navigation bar, render the corresponding Fragment page.
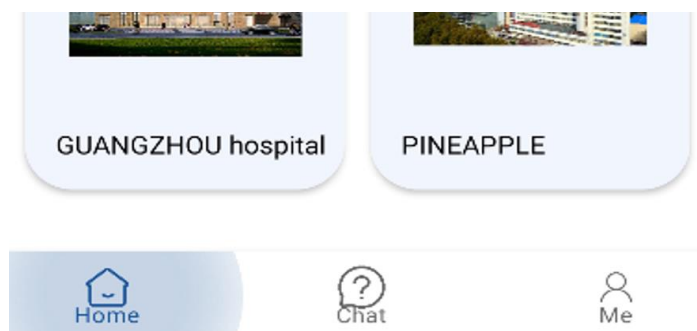

Figure 14 :BottomNavigationBar that we use

5.6   Lottie

Lottie is a library for Android that allows developers to easily integrate and animate vector graphics in their applications. It supports rendering animations created with Adobe After Effects in the form of JSON files. With Lottie, developers can add visually appealing and interactive animations to their user interfaces without the need for complex coding or heavy graphic resources.

We utilize LottieAnimationView to load JSON animation files and use the component's translation effect to display the splash screen animation(Figure 15).

Figure 15: The jump animation that we use

5.7   ViewPager

ViewPager is a user interface component in Android that allows users to swipe horizontally between multiple pages or fragments. It provides a smooth and interactive way to navigate through different screens or content sections within an app. ViewPager is often used in conjunction with FragmentPagerAdapter or FragmentStatePagerAdapter to manage the content of each page or fragment.

We use ViewPaper to implement the carousel function(Seen in Figure 16).

Figure 16: The ViewPaper that we use

5.8   CircleMenu

CircleMenu is a custom user interface component in Android that presents a circular menu with multiple options arranged around a central button. When the central button is tapped or swiped, the menu expands to reveal the available options. CircleMenu provides a visually appealing way to present a set of actions or choices to the user in a compact and intuitive manner.

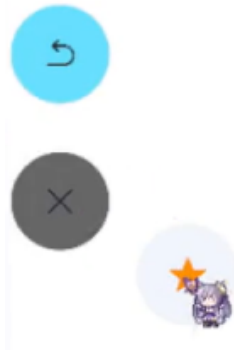We use it to achieve some navigation bar in Software.(Figure 17)

Figure 17: CircleMenu that we use

6 Testing and User experience Analysis

We use **Wetest** to do all the tests for our software. Wetest is a testing platform designed to streamline software testing processes and improve quality assurance. It offers a user-friendly interface and supports various testing methodologies, including manual testing, automated testing, and performance testing. Testers can create and manage test cases, execute tests across different environments, and track results and defects. Wetest also provides automation capabilities, allowing testers to create and execute automated test scripts. It integrates smoothly with other development and testing tools and offers insightful reporting and analytics features. Wetest aims to enhance collaboration, productivity, and overall software quality.

6.1 Standard compatibility test

We used **20 mobile phones** to carry out the standard compatibility test. Among the 20 mobile phones, we selected mobile phones from different versions of the Android system, and we also selected several brands that occupy a large market share on the market. Mobile phone, system distribution ratio and brand distribution ratio are shown in the figure below(Seen in Figure 18).

We hope that by covering as many test brands and as many test versions as possible, we can ensure that software testing is as universal and practical as possible.
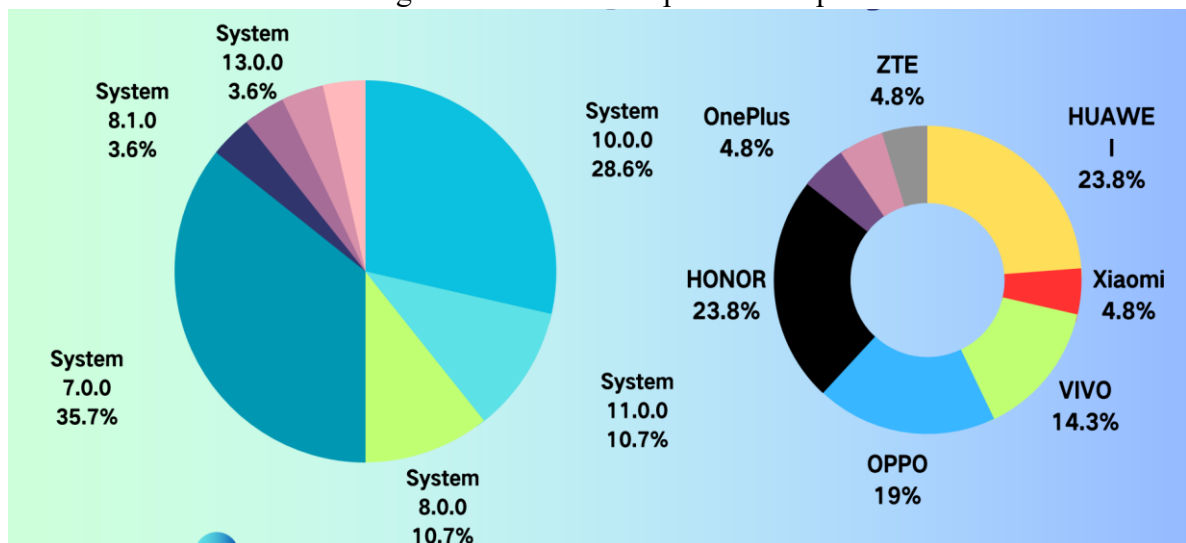

Figure 18: System and Tester Brand Distribution

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Of the **20** models tested, **19 passed the compatibility test** and **1 failed(Seen in Figure 19)**. It can be seen that our software has good device compatibility. The only device that failed the test failed because the software could not be installed.
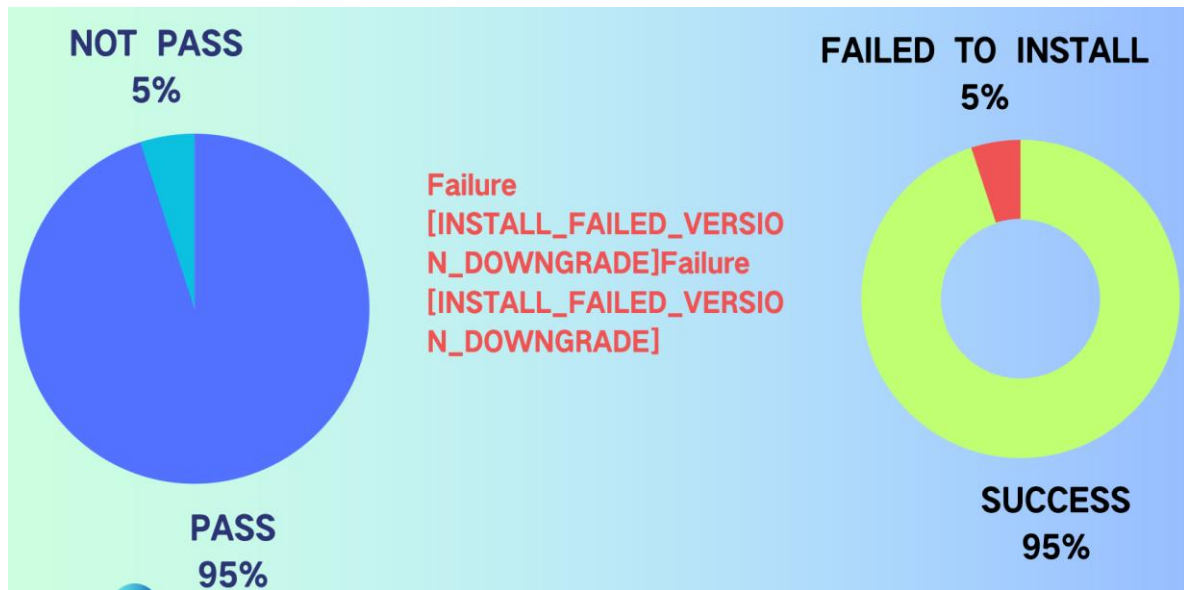

Figure 19: Distribution of test results

In addition, our software will not take up too much memory space and CPU overhead of the mobile phone. According to our test data, when running the software, the overall temperature of the CPU is within the normal range, and the memory consumption is also kept at a low level. Details can be shown in the figure below(Figure 20).

CPU占用(%)	cpuTemp2	内存占用(MB)	流量消耗(KB)
1.36	35.23	76.86	0.00
1.37	34.07	68.46	0.00
1.35	37.89	94.94	0.00
1.36	37.79	99.93	0.00
3.61	68.40	135.83	0.00
3.07	42.74	87.73	0.00
1.23	40.64	93.06	0.00
0.92	36.44	65.90	0.00
1.60	36.15	68.29	0.00
1.47	/	72.52	0.00

Figure 20:Data of CPU overhead

6.2   Security scan test

In addition to standard compatibility testing, we also checked the overall security of the software. On the whole, the software has a relatively **high security factor**, with only **two low-risk vulnerabilities and one potential risk**. In the follow-up development and design, we will optimize the above problems(Seen in Figure 21).

扫描结果

共发现漏洞 **2** 个,风险 **1** 个 免费加固 更多解决方案>>

检测项 共检测8项 ⓘ

安全风险 本应用存在风险,请尽快修复。

风险

漏洞详情

高危漏洞	中危漏洞	低危漏洞	安全风险
0↑	0↑	2↑	1↑

Figure 21:Results of Security scan test

6.3   User test

Considering the target audience of the software, our program development team and the South China Normal University Growth Camp, a non-profit organization of the School of Psychology of South China Normal University, distributed more than 20 questionnaires at the Guangdong Cancer Hospital. After desensitization, 20 valid questionnaires were obtained. Questionnaire, the target population participating in this questionnaire survey is **5 doctors, 5 nurses, 4 students and 6 patients(Seen in Figure 22)**
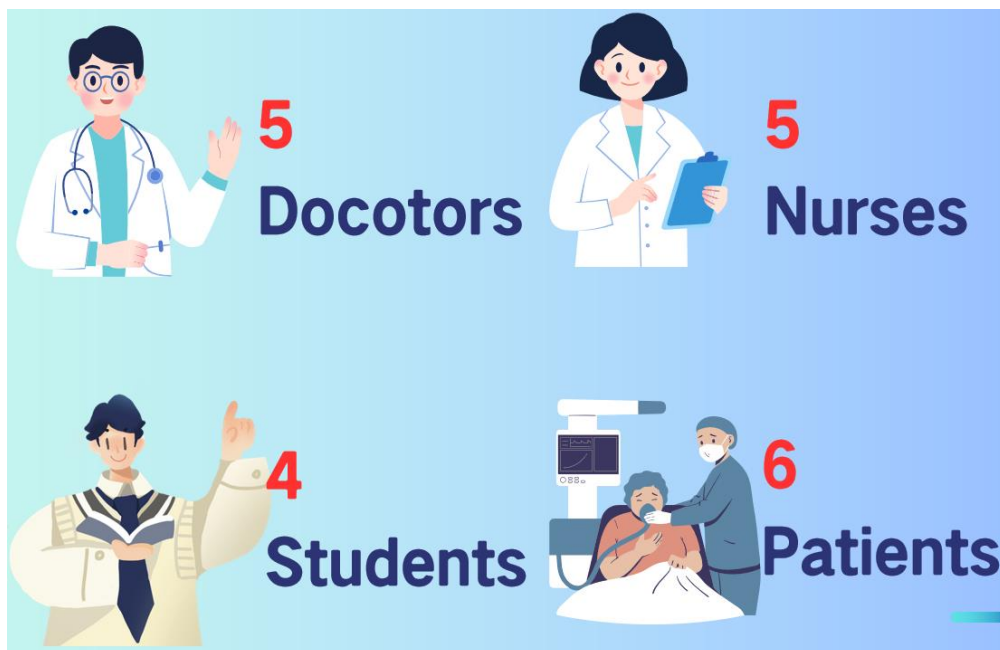

Figure 22: Distribution of people participating in the survey

The overall evaluation of our project in the user group is very high, and users give us good feedback. We provide users with an evaluation scoring window, with 10 stars as a full score, and 0 stars as 0 points. We let users make comprehensive evaluations based on their personal Indicators rate our projects from a minimum of 6 stars to a maximum of 10 stars. The overall average score is 7.4 stars(Seen in Figure 23), which shows that the project has broad development prospects and has also been widely recognized by all sectors of society
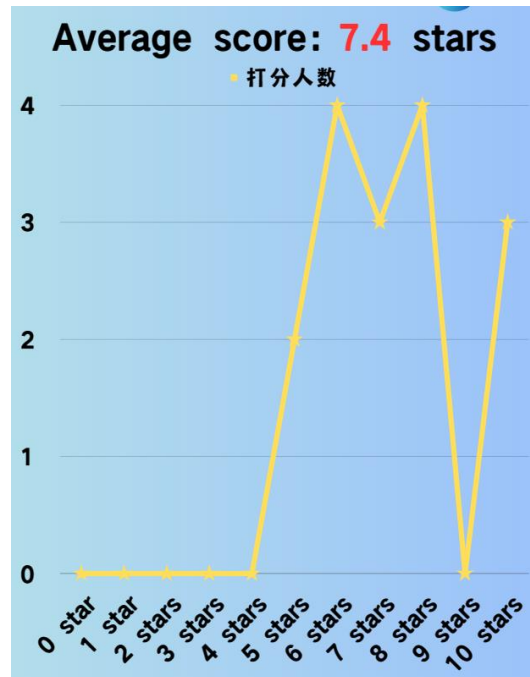
Figure 23: User rating star statistics

In order to further understand the customer's evaluation, we based on the specific evaluation of 20 users, and according to the user's feedback(Seen in Table 1), many users think that our software is suitable for the elderly, and the overall evaluation is good. But there are still some users who put forward many development suggestions for our software, such as improving data security, designing more interfaces to provide more functions, etc. We will discuss these suggestions and optimize them later.

Table 1:Users comments of our software

姓名	职业	打分	评价
陈先生	老年患者	5	可以提供更多功能，我很喜欢用
王医生	主治医师	10	很方便，可以更加方便老人
罗医生	实习医师	8	应用很不错，很适合老年人使用
李先生	实习医师	10	如果可以开发出具体的AR导览功能会更好
陈同学	网络安全专业学生	6	感觉如果要实现商业化，那么数据的安全性可以增强
罗同学	心理专业学生	8	软件的导航栏可以进行替换，看着更加舒服
陈同学	新闻专业学生	7	APP能实现很多功能，如果界面更加大气的话会更好
蔡先生	老年患者	9	很方便，很适合我使用
陈主任	医师	6	构思与想法很好，普及商用是难题
李女士	护士	7	感觉很不错，但仍然有提高空间
刘先生	实习护士	7	如果医院账户也可以查看攻略信息就更好了
李女士	护士	6	很方便，适合老人和小孩用
杨同学	老年患者	8	构思想法不错，如果更精美就最好啦
魏先生	患者	6	多提供点路线就更好了
林女士	患者	7	适合老人用
庞同学	心理专业学生	10	不错，这个软件的配色我很喜欢
邓医生	医师	8	很好，很有新意
牛医生	护士	7	不错，适合老人
周女士	护士	5	第一次见，还有很大的提升空间
杨女士	患者	8	还不错，多点功能就更好了

Regarding the improvement measures provided by users(Figure 24), after discussion, we decided to further optimize the following aspects in the future:

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1. Use the knowledge of cryptography to encrypt and store data to further improve the security of the software.
2. Provide more functions for hospital accounts, so that hospitals can check each other's strategies issued by different hospitals
3. Redesign and optimize part of the navigation bar to make the overall page design more beautiful

改进措施
无
无
无
增加AI大模型，使用CV辅助AR导航
选择合适的加密算法保存数据
看样子改
协调一点
无
仍需探讨
好看一点
增加个功能吧
无
无
增加点文章
无
无
无
无
多点功能
多点功能

Figure 24: User provided improvements

7   Conclusion

On the whole, the software has achieved the expected basic functions, but there are still some areas that can be improved, such as using a more powerful navigation system and introducing AI models for route guidance. The project has a good social reputation, but also has broad development prospects.

In future development, we will continue to optimize the project, strive to improve its commercial competitiveness, and then widely apply it to more social scenarios