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Introduce:

This app is a health monitoring platform created by DevEco, which can provide personalized health reports to patients through graphic text.

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## 1 Introduction

Welcome to our innovative LifePulse medical app, which provides an intelligent and convenient lifestyle assistant service through the Huawei HarmonyOS platform, helping users efficiently manage their daily tasks. It supports real-time data synchronization and seamless collaboration between devices, allowing users to view and manage their personal information anytime. Push notifications ensure users receive important reminders on time. The simple and intuitive interface, combined with powerful backend technology, ensures a smooth experience. Personalized settings and smart analytics help users optimize their daily decisions.

## 2 Requirements specification

### 2.1 User requirements

1、 For individual users, the system provides convenient at-home blood sample collection and quick health reports, helping users easily manage health issues at home while ensuring data privacy. **(main requirement)**

2、 The system responds to the post-pandemic demand for telemedicine, supporting convenient online health management and report generation, catering to the modern user's need for remote healthcare services.

3、 For healthcare institutions, the system addresses staffing shortages and inefficiencies in traditional testing processes by providing automated workflows, real-time patient data access, and advanced analytical tools, improving operational efficiency and patient care quality.

4、 The system offers healthcare institutions opportunities to improve data sharing and collaboration, optimize testing workflows, and provide actionable insights, ultimately enhancing patient outcomes and service quality.

### 2.2 Functional requirements

1、 The system should allow users to collect blood samples at home and quickly generate health reports, ensuring privacy and accuracy.

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 、 The system should automate testing and data processing for healthcare institutions, providing real-time access to patient data. **(main function)**

4 、 The system should enable secure data sharing between institutions and provide tools for data analysis to improve patient care.

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**

This app is designed to address the growing need for convenient, remote healthcare solutions in the post-pandemic era. By leveraging the Huawei HarmonyOS platform, the app provides seamless, cross-device functionality that supports both individual users and healthcare institutions. The system is built with two key user groups in mind: individual users seeking to manage their health from home, and healthcare institutions aiming to improve operational efficiency and patient care.

The app's architecture follows a modular design, with separate layers for user interface, backend logic, and data management, ensuring scalability, flexibility, and ease of maintenance. The app integrates essential features such as real-time data synchronization, secure data storage, automated workflows, and advanced analytics tools, all while prioritizing user privacy and data security.

The system architecture is designed to be user-centric, with an intuitive, easy-to-navigate interface that minimizes complexity for users of all ages. The app's core functionality is accessible through a simple, streamlined process, enhancing both individual health management and institutional workflows. As part of the design, the app also supports the integration of telemedicine services and remote health tracking, making it ideal for modern healthcare needs.

#### **3.2 Main functional modules**

1 、 **User login and registration module:** Allows users to create accounts, log in, and manage their profiles securely. Includes support for social media login and password recovery.

2、 **Health report generation module:** Automatically generates detailed health reports based on user-submitted blood samples and health data, allowing users to track their health progress over time.

3 、 **Remote consultation module:** Enables online consultations with healthcare professionals through video calls or messaging, supporting remote diagnosis and personalized health advice.

4 、 **Notification and reminders module:** Sends timely notifications and reminders to users for upcoming consultations, health anomalies, and report availability.

5、 **Patient data management module:** Allows users to view and update their health data securely, ensuring privacy and accuracy.

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 Login interface**

On the personal homepage of the LifePulse app, users can access login options by clicking on their profile picture. The login process offers two methods: password login and verification code login. For password login, users are required to enter the phone number and password they used during registration. For verification code login, users need to receive and input a code sent to their phone. If users are not logged in, they can still browse various pages; however, certain features will be unavailable, and the system will prompt them to log in to unlock these features.

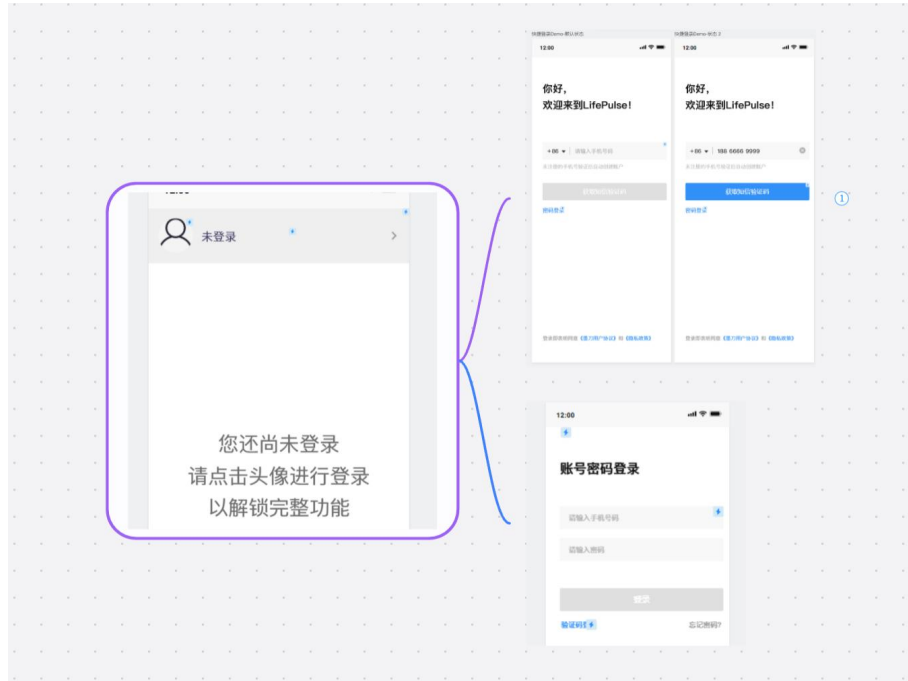


Figure 1: login page

## 4.2 Homepage

The homepage of the LifePulse app features an information search bar at the top, allowing users to search for information of interest. Below the search bar is a scrolling image window that displays announcements and advertisements, providing users with the latest updates and promotional content. Further down, there are various health data display panels, which users can click to view more detailed and comprehensive information. For example, the blood pressure data panel by default shows blood pressure information from the past week, presented in chart form to give users a clear and intuitive view of their health status. Additionally, users can select and query historical data for long-term trend analysis and health management. This design enables users to easily access and analyze their health information, facilitating better personal health management.



Figure 2: homepage

### 4.3 Discovery Page

This module is divided into two parts: the post page and the course page:

#### 1. Post Page

The Post Page module in LifePulse APP is designed with a layout inspired by the popular platform Xiaohongshu. It features post covers that are visually engaging, drawing users in to explore further. Users can easily click on a post to access detailed information, where they can interact by commenting and liking, fostering a sense of community. For those inspired to share their own experiences or insights, a plus sign located centrally at the bottom of the page provides a quick and convenient method to create a new post. This design not only enhances user experience but also encourages active participation and interaction among the user base.

#### 2. Course Page

The Course Page module is thoughtfully divided into two sections to cater to different user needs. The upper half of the page showcases a selection of popular courses, highlighting trending topics and appealing to a broad audience. The lower half of the page offers a personalized touch by presenting courses that are recommended based on the user's data and preferences. This tailored approach aims to provide users with relevant and interesting course options. When a user clicks on a course display panel, they are directed to a detailed page where they can learn more about the course content and structure. If they

decide to enroll, a simple click on the purchase button completes the process, making it easy for users to access the educational resources they desire.

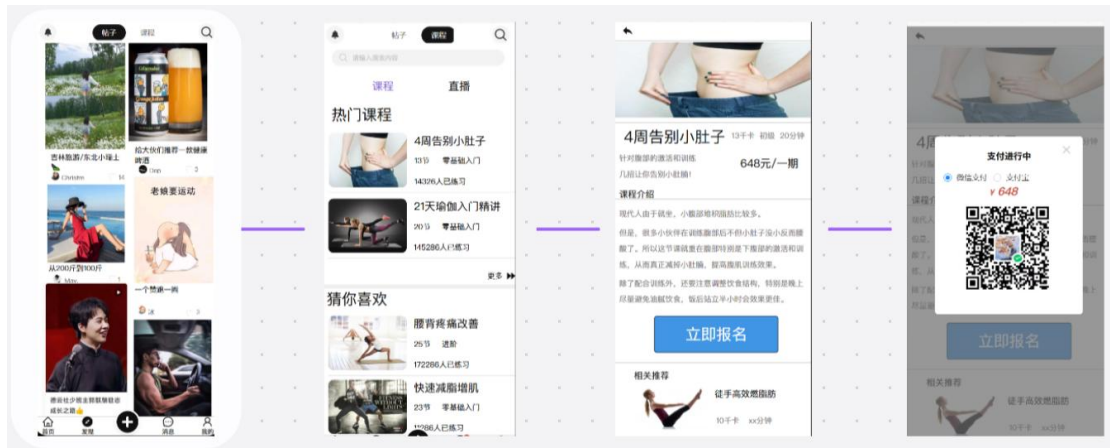


Figure 3: discover page

#### 4.4 Chat Page

At the very top of the messaging page in the LifePulse APP, there is a search bar that allows users to quickly search for contacts and message records. The page features a clear layout that displays the conversation status between the user and each contact. Each contact is allocated a separate column, stacked one on top of the other, with each layer representing a different person. Contacts with earlier messages are positioned at the top layer. Unread messages are indicated by a small red circle on the far right of each contact's column, with a number in the middle showing the count of unread messages. The time of the last conversation is also displayed. Clicking on a contact's avatar allows users to view their information, and clicking on the corresponding column enables chatting with that contact. This design facilitates easy access to contacts and conversations, with unread message alerts enhancing the convenience of communication.



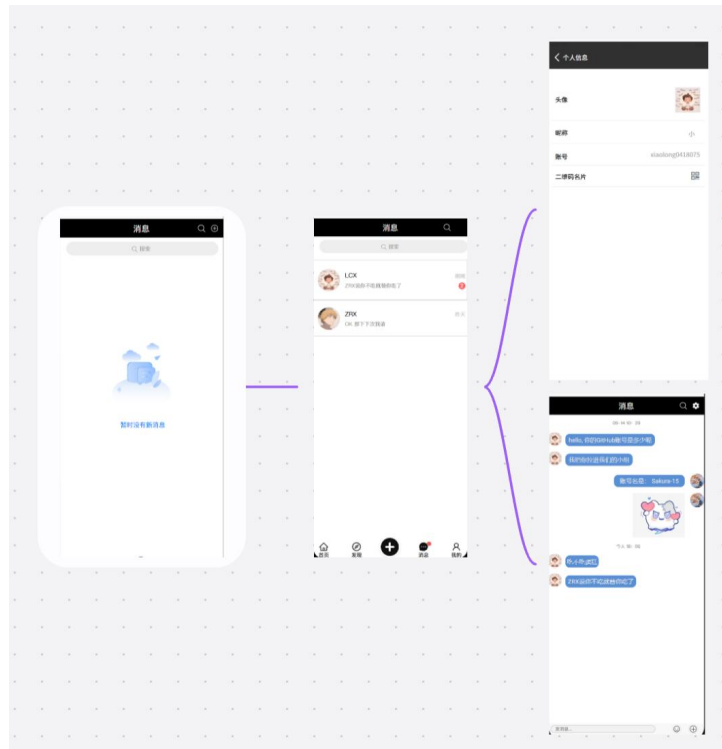


Figure 4: chat page

## 4.5 Personal Page

At the top of the user profile page in LifePulse APP, you'll find the user's avatar and username prominently displayed. The avatar is interactive, allowing users to click on it and change their profile picture with ease. Similarly, clicking on other areas of this top bar enables users to modify their username and personal signature, offering a seamless and personalized experience. Just below this bar, the page showcases social statistics, including the number of other users the user is following, their fan count, and the number of posts they've made, providing a quick overview of their social presence. Further down, the page is organized with various functional sections such as data import, browsing history, and account management, making it easy for users to handle their account settings and customize their profile. This layout ensures that all user profile elements are easily editable and that essential account functions are readily accessible, enhancing the overall user experience.

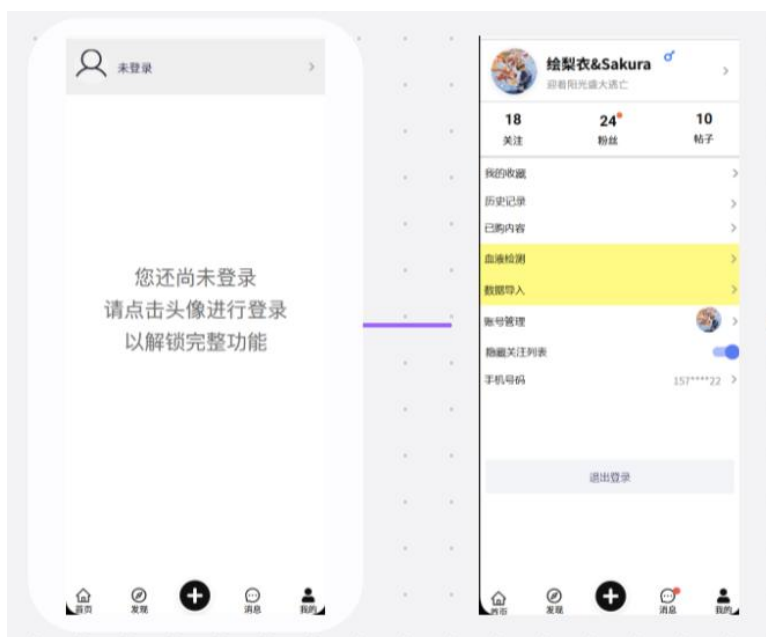


Figure 5: personal page

## 5 Key Technologies

### 5.1 Core technologies

- 1、 Mobile Application Development Environment: As our primary development platform, DevEco Studio is chosen for its robust support for HarmonyOS applications, providing a comprehensive set of tools for efficient app development.
- 2、 Data Security and Privacy: Vital for safeguarding sensitive health data, ensuring compliance with healthcare regulations and building user trust.
- 3、 User-Friendly Interface Design: To simplify sample submission, results viewing, and access to personalized health advice.
- 4、 APIs and Databases: For data processing, user authentication, and supporting the app's functionalities.

### 5.2 Technical challenge

During the development of this project, the main technical challenges we faced were

- 1、 Transition to DevEco Studio
- 2、 Complexity of Backend Setup
- 3、 Building Efficient Communication Channels
- 4、 Accuracy and Reliability of Health Data Tracking

During the development of the LifePulse app, our team faced the significant challenge of migrating from Android Studio to DevEco Studio. This transition was not easy, as it required us to adapt to an entirely new development environment from scratch. We invested considerable time in learning HarmonyOS-specific APIs and development patterns, which included mastering new syntax and programming paradigms to ensure our application fully leveraged the HarmonyOS ecosystem.

On the backend, we had to rethink how to utilize HarmonyOS's distributed capabilities to build our services. This meant learning new frameworks and tools and redesigning backend services to interact effectively with HarmonyOS's distributed system. Additionally, database selection and migration added extra workload. We had to evaluate HarmonyOS's database support and decide whether to migrate to a new database system, a process that involved the complexity of data migration and redesigning data models in the new system.

During the testing and debugging phase, we had to familiarize ourselves with the new emulator environment and testing tools provided by DevEco Studio. This required relearning how to use these tools to conduct application testing and ensure performance and compatibility on HarmonyOS devices. Migrating project configurations also proved challenging, as we had to reconfigure the build system, dependency management, and project structure to ensure smooth builds and runs in the new environment.

Moreover, as DevEco Studio is a relatively new platform, we encountered difficulties in obtaining community support and resources. We had to rely heavily on official documentation and limited community resources to address issues encountered during development. Finally, to ensure optimal performance of our app on HarmonyOS devices, we conducted compatibility tests and performance tuning to adapt to the new system's characteristics.

Although these challenges added extra workload and pressure to our project, we viewed them as a valuable opportunity to enhance our skills and adapt to new technologies. By overcoming these difficulties, we are confident that the LifePulse app will provide users with a more stable and efficient platform for health monitoring and disease screening.

## 6 Testing and User experience Analysis

We use the **Testin cloud testing platform** to conduct all the tests for our software. Testin is a comprehensive cloud-based testing platform designed to enhance software testing processes and improve overall quality assurance. It offers a professional and user-friendly

interface, supporting various testing methodologies such as manual testing, automated testing, and performance testing. Testers can create and manage test cases, execute tests across different environments, and track results and defects in real time. Testin also provides powerful automation capabilities, allowing testers to design and execute automated test scripts. The platform integrates seamlessly with other development and testing tools, offering insightful reports and detailed analytics to help identify issues early. Testin stands out for its scalability, flexibility, and the ability to perform testing across a wide range of devices and networks, ensuring high-quality performance across diverse platforms. By using Testin, we benefit from enhanced collaboration, increased productivity, and improved software quality, making it a key tool for professional-grade software testing.

6.1 Standard compatibility test

Since the version of our development platform, DevEco Studio, is 3.1, it only supports devices with API level 9, which corresponds to **HarmonyOS 3.1**. Therefore, we initially selected four HarmonyOS 3.1-supported devices for testing: HUAWEI MATE 40, HUAWEI MATE 30, HUAWEI P40, and nova 11 Pro. The results obtained are as follows:

设备ID	设备品牌	设备型号	设备名称	频率耗电量	内存 (GB)	分辨率	CPU核数	CPU名称	CPU核频率	CPU架构	结果	设备信息
5217	HUAWEI	NOH-AN00	HUAWEI MATE 40	10	128	2376×1080	8	麒麟9000E	2.05	ARM Mali-G78 MP24	通过	41206/device/5217
5231	HUAWEI	LIO-AL00	HUAWEI MATE 30	10	128	2400×1176	8	麒麟990	1.86	ARM Mali-G76	通过	41206/device/5231
5214	HUAWEI	ANA-AL00	HUAWEI P40	10	128	2340×1080	8	麒麟990	2.28	Mali-G76 MP16	通过	41206/device/5214
5249	HUAWEI	GLA-AL00	nova 11 Pro	10	256	2652×1200	8	高通 骁龙7785 4G	2.42	Adreno 642L	通过	41206/device/5249

Figure 6: overall api 9 supported devices test

测试基本信息				
	测试应用	RedGuard	测试通过率	100.00%
	系统平台	HarmonyOS		
	机型数	1		
	未执行机型数	0		
	测试结果	测试终端数		测试结果百分比
	安装失败	1		100.00%
	启动失败	1		100.00%
	monkey失败	1		100.00%
	卸载失败	1		100.00%
	运行失败	1		100.00%
	通过	1		100.00%

Figure 7: Huawei Mate 40 test

Later, we tried to see if we could install the packaged .hap file on a device running HarmonyOS 4.0 for testing, but we found that the installation package could not be opened, as shown in the image below.

测试基本信息				
	测试应用	RedGuard	测试通过率	0.0%
	系统平台	HarmonyOS		
	机型数	1		
	未执行机型数	1		
	测试结果	测试终端数	测试结果百分比	
	安装失败	0	0.0%	
	启动失败	0	0.0%	
	monkey失败	0	0.0%	
	卸载失败	0	0.0%	
	运行失败	0	0.0%	
	通过	0	0.0%	
未执行(1)款				
华为 Mate 50				

Figure 8: Huawei Mate 50 test

6.2 User test

We collected the user experience and feedback from 20 users using Wenjuanxing (SurveyStar). We extracted keywords from their responses and created a word cloud based on them.



Figure 9: user experience



Figure 10: users' suggestion

From the word cloud generated from user feedback, we learned that the LifePulse app received positive reviews regarding user experience, particularly for its smooth operation and simple interface design. Users were able to clearly understand and access health data, which indicates that our data visualization has met the expected goals. However, there are areas that need improvement, such as the slow app startup speed and the high frequency of notifications, which could affect user satisfaction. To enhance the user experience, users suggested adding personalized themes, such as dark mode, and providing an option to adjust notification frequency according to personal preferences.

Additionally, users expressed a desire for more features to enhance the experience, such as health trend predictions, eye protection mode, or customizable color schemes. These suggestions highlight users' further demand for personalization and health monitoring. Some users also pointed out that certain feature entry points were not prominent enough, which indicates a need for redesigning the layout to ensure all functions are easily accessible. The addition of a tutorial or onboarding guide was also suggested to help new users quickly familiarize themselves with the app.

Performance optimization is another key focus for users, who expect improved app fluidity and reduced loading times. This requires optimization of backend processing and frontend display. Finally, some users raised concerns about data import, which may involve the need for importing health data from other devices or apps. This is a feature we need to consider for future versions.

While the LifePulse app has been recognized by users in many areas, there is still room for improvement. We will continue to work hard to optimize and enhance the app based on user feedback and suggestions, aiming to provide higher-quality health monitoring and disease screening services.

Additionally, we collected feedback from 20 users regarding their satisfaction with our app. From the chart, it is clear that our app received mostly positive reviews.

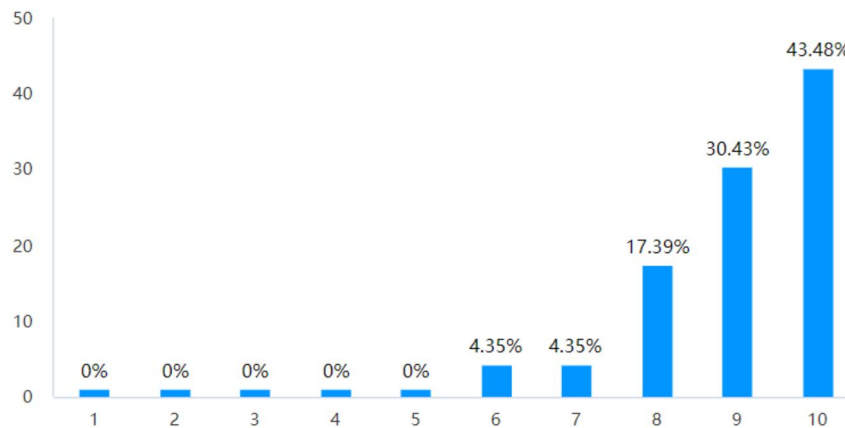


Figure 11: User Satisfaction Chart

## 7 Conclusion

On the whole, LifePulse app has demonstrated great potential in providing remote health monitoring and disease screening services. We will continue to listen to user feedback, constantly optimize the product, and provide more personalized and efficient health solutions to meet users' needs. Through our relentless efforts, we believe that the LifePulse app will become a valuable tool for users' health management, helping them better understand and manage their health status.