

## UNDERGRADUATE PROJECT REPORT

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## **Abstract**

In the wake of the 2022 novel corona virus, it has had a negative impact on people's health practices and health-related habits. In particular, the frequent isolation of people at home has led to a decline in people's exercise capacity and mental health. Chronic diseases and obesity have also entered most people's lives, so people are eager to change their lifestyle and become more active. In addition, after the epidemic, people are more and more concerned about their health indicators, such as the number of steps they take every day, the number of calories they consume every day, the amount of water they consume, and so on. People are also eager to customize exercise in their own homes, starting with basic and simple exercises to regain their fitness levels.

Therefore, the aim of this project is to provide a platform for people to set up and track their exercise training program, health data calculation, and so on, such as step counting, daily water intake reminder, and so on. This is to satisfy the growing demand for health and wellness.

As a result, an Android health and exercise app was developed containing step counting, water intake tracking, goal setting and progress tracking, reminders and alerts, notification, social sharing, calorie burn tacking, distance measurement, period and ovulation tracking, health calculator, register and log in functions.

Successfully integration of real-time health monitoring technologies, robust data protection led to accurate and precise function addressing accessibility and inclusivity at the same time.

***Keywords: Health and Fitness Application, Android Application, Kotlin, Step counts, Real-time monitoring***

## **Abbreviations**

- (1) FCM - Firebase Cloud Messaging
- (2) GDPR - General Data Protection Regulation
- (3) IPR - Intellectual Property Rights
- (4) SRS - System Requirement Specification
- (5) BMR - Basal Metabolic Rate
- (6) BAC - Blood Alcohol Concentration
- (7) ABV - Alcohol by Volume
- (8) TDEE - Total Daily Energy Expenditure
- (9) BDT - Blood Donation Time

## **Glossary**

- (1) Real-Time Health Monitoring: The use of technology to continuously collect and analyse health-related data as it occurs, without delay, allowing for immediate feedback and updates.
- (2) Data Privacy: The aspect of information technology that deals with the ability an organization or individual must determine what data in a computer system can be shared with third parties.
- (3) API (Application Programming Interface): A set of protocols and tools for building software applications. APIs specify how software components should interact and are used when programming graphical user interface (GUI) components, as well as linking different online services.
- (4) ADB (Android Debug Bridge): A command-line tool that allows developers to communicate with a device to perform device operations, such as installation and debugging of applications.
- (5) JIRA: JIRA is a popular project management tool developed by Atlassian that is widely used for issue tracking, project management, and agile software development.



## **Chapter 1 Introduction**

### **1.1 Background**

The COVID-19 pandemic and the ensuing public health measures have significantly altered lifestyles on a global scale, leading to adverse effects on health-related habits[1], [2], [3], [4], [4], [5]. According to numerous cross-sectional studies involving adults in Australia, the United States, and the United Kingdom the decline in positive health, practices and mental well-being amid the pandemic, notably a decrease in levels of physical activity, unhealthy eating habits and lower diet quality, wider alcohol consumption and higher prevalence of anxiety and depression symptoms have been proved[6]. Apart from self-reported shifts, research utilizing objective smart-phone-derived data has also demonstrated a global decrease in daily step counts [4]. People would likely to practice themselves more like jogging, swimming, basketball and so on when the COVID-19 pandemic finished to including but not limited changing their lifestyle, promoting their body fitness level, and altering their appearance by losing weight. However, there is no deny that quite some sports training have high physical condition, physical discomfort and fatigue will occur during the process, which cannot meet the training effect even cause a lot of health accidents [7]. The proliferation of the mobile internet has led to widespread adoption of mobile devices like smart-phones and tablets in our daily routines, becoming essential instruments for a multitude of activities. With the help of these devices' many user-friendly features and comprehensive data analysis services, people can pay more attention on their health level and personalize workout plan. Recently, the heart rate monitoring modules are equipped in a number of smart phones and tablets which track real-time heart rate, protecting them doing exercise within safe limits. [7]. Moreover, this technological progression has fostered the development of tailored health management solutions. By scrutinizing the data amassed, these apparatuses are capable of not only delivering instantaneous feedback on the user's current state of health, but also suggesting customized exercise regimens in accordance with the user's personal health objectives and inclinations. This bespoke strategy not only enhances the likelihood of users accomplishing their health and fitness aspirations, but also offers motivation and support throughout the process, particularly where persistent commitment and sustained endeavour is mandatory. Consequently, the creation of a comprehensive health and fitness tracking software capable of harnessing the advanced capabilities of smart devices is not merely a response to prevailing health trends, but also an innovative solution to the escalating demand for personal health management. The objective of such software is to provide users with a comprehensive, user-friendly, and

highly personalized platform to facilitate the adoption and preservation of healthy lifestyles to promote public health and well-being in the post-pandemic era.

## **1.2 Aim**

The aim of the project is to develop an Android health fitness application to track and calculate some data about physical condition like Blood Alcohol Content, Blood pressure, Blood sugar, Daily calories intake, Daily water intake and Heart rate and so on. as well as customize monthly training plan and track customers training progress using Kotlin.

## **1.3 Objectives**

The objectives are as follow:

- (1) Market Research the background for existed health and fitness application.
- (2) Analyse customer's requirements and make requirement specification document.
- (3) Confirm the problem planning to figure out and the function provided.
- (4) Design basic infrastructure include System design, user interface design and database design.
- (5) Coding with Android Studio in the priority order by Kotlin
- (6) Test and collect feedback from customers especially customer experience and function.
- (7) Develop software iteratively based on feedback and continuously optimize and improve.
- (8) Package into APK preparing it for release on app stores.
- (9) Develop a marketing strategy.
- (10) Maintenance and Upgrades

## **1.4 Project Overview**

### **1.4.1 Scope**

Fitness application offer users monthly customized workout schedule, suggested calorie intakes and relevant recommendation helping keep people healthy. As a start, user needs to create an account which contain some useful details and register the application. The program will monitor and record development in accordance with each user's unique preference.

It's easy to utilize fitness apps all users must do is log in and enter their health information to get personalized recommendations. After completing the registration and setup, the application manages personal goals, tracks users' activity, keep tabs on users' performance and create customized diet. It also easily connects with sensors to tell users about their calorie consumption and suggest actions.

#### **1.4.2 Audience**

(1) **Fitness Enthusiasts:** Active participants of physical fitness training, striving for enhanced personal wellbeing, shaping up, or maintaining a healthful lifestyle. They value precise fitness tracking tools like step count, heart rate monitoring and calorie calculation to boost workout effectiveness and enhance wellness.

(2) **Health Conscious:** Individuals with an intense interest in their health status, though they may not prioritize strenuous physical exercises. Instead, they're eager to keep track of fundamental health indicators such as pulse, rest patterns, and oxygen saturation for sustained wellness.

(3) **Rehabilitation Patients:** Individuals requiring meticulous monitoring of physical exertion and vital physiological metrics under the supervision of a medical practitioner or therapist, potentially necessitating a gradual reintegration into everyday routines and exercise subsequent to recuperation from an illness or surgical procedure.

(4) **Busy Workers:** Individuals labouring within high-stakes occupational settings who pursue optimal time management and stress mitigation, along with abbreviated yet potent physical exercises to maintain vitality and wellbeing.

(5) **Technology Enthusiasts and Data Trackers:** Individuals who maintain a high level of interest in the latest technology and enjoy using high-tech products to improve their quality of life.

## Chapter 2 Background Review

The section examines the existing health fitness application comparing them, importance, and influence of these software, indicating the main function of existing application and optimization according to compare five existing applications as well as the technology analysis used during the development.

In contemporary society, health and fitness software have emerged as essential tools for fostering personal health management and enhancing quality of life. With the swift evolution of technology and the surge in smart device adoption, this software are increasingly instrumental in daily living [8]. Health and fitness software offers a broad spectrum of applications ranging from daily activity monitoring to professional health administration. Users can use such software to track steps, monitor heart rate, record diet logs, customize personalized workout plans and track sleep quality. For instance, applications such as Flo Fitness and Keep offer caloric tracking and nutritional data to assist users in making healthier dietary decisions, while applications such as Sworkit and Keep proffer a diverse range of workout guides to inspire users to remain active. What's more, this software provides a convenient and effective strategy to enhance customers' awareness of health and the ability of self-manage. They make fitness data accessing easier and more understandable as well as reminding customer to self-manage them. Then the cultivation of optimal lifestyle habits can be facilitated by this application software through continuous health monitoring and feedback, which is crucial to prevent the chronic diseases and improve the quality of life. Furthermore, the software promotes interdisciplinary collaboration, enabling professionals in the disciplines of sports medicine, nutrition, and mental health to work more effectively together via a unified platform to deliver comprehensive health support to users. The table 1 shows the main function of 5 existing application.

Application	Main function
Sworkit	Customize exercise plan based on health target
	Provide different type of practice like yoga, stretch or other aerobic exercise
	Guide customer exercise safely by video

	Record exercise data like duration, burned calories and distance.
	Customer can communicate with each other in the community
Huawei health	Monitor health data like heart rate, the level of stress and oxyhaemoglobin saturation
	Provide multiple exercise mode like walking, running, or cycling
	Track sleeping indicator such as duration, sleeping cycle and quality
	Provide health suggestion and reminder for exercise
Keep	Customize exercise plan based on health target
	Provide different type of practice like yoga, stretch or other aerobic exercise
	Guide customer exercise safely by video
	Provide health and nutrition intake suggestion
Fio fitness	Customize exercise plan based on health target
	Monitor health data like heart rate, the level of stress and oxyhaemoglobin saturation
	Guide customer exercise safely by video
	Customer can communicate with each other in the community.

Apple health	Provide a platform to integrate data from Apple watch or Third-party application
	Record exercise data like duration, burned calories and distance.
	Monitor health data such as basic health indicator and women Menstrual and reproductive health
	Provide health and nutrition intake suggestion

Table 1. Main function of existing health fitness application

As depicted in Table 2, a cross-comparison of health and fitness tracker applications reveals the prevalence of step counting and calorie burning tracking, featured prominently by Sworkit, Huawei Health, Keep, Flo Fitness, and Apple Health. These features signify their critical role in the health tracking process. However, specialized functions such as heart rate monitoring, sleep tracking, and distance measurement are less consistently integrated, indicating a market gap[9]. Notably, sleep tracking—a vital aspect of health and training performance—is underrepresented, presenting an opportunity for innovative applications to fill this void. The inconsistent integration of these advanced features may reflect diverse user needs but underscores a market demand for more comprehensive health tracking solutions.

Function Application	Sworkit	Huawei health	Keep	Flo Fitness	Apple health
Step counting	√	√	√	√	√
Heart Rate Monitoring	N/A	√	√	N/A	√
Sleep Tracking	N/A	√	N/A	N/A	√
Calorie Burn Tracking	√	√	√	√	√
Distance Measurement	N/A	√	√	N/A	√

Table 2. Comparison between existing application

As for the technology used in existing application, Android Studio is official integrated development environment for android development which can not only write and adjust code but also provide a simulator to test the program. Both the development of Huawei health and Sworkit are use this IDE with Kotlin or Java language. XML are applied for user interface development. As for the back end, the Firebase and Node.js are commonly used to provide service and response the request from the API.

## **Chapter 3 Methodology**

### **3.1 Approach**

The software development approaches primarily include the software development model and requirement gathering methods.

#### **3.1.1 Software development model**

In this project, the chosen software development model is Waterfall model. It is a linear and sequential approach suited for projects with unambiguous objectives and unchanging requirements[10]. Each Waterfall model development life cycle can be divided into six phases including gathering and analysing requirements, system design, system implementation and coding, functional testing, deployment, and maintenance, as showed in Figure 1. The initial phase needs to gather requirements comprehensively through the survey, interviews, and review of existing literature on health and fitness applications. It is critical to ensure that the software is customized to address the specific demands of customer. After requirement collection, the second phase focused on software's architecture, user interface and database model design which create a blueprint that harmoniously aligns with the previous requirements, ensuring that the final product address the requirements and user-friendly. Following system design, the third function involves system implementation and coding transferring the requirements into the code, the feature of application consist of step counting, water intake reminder, calories burned calculator etc. After that, the fourth phase engages in the execution of functional, performance, and acceptance tests, assessing the outcomes for evaluation. Upon successful testing, the fifth phase focus on the deployment of the development and running environment. The last phase is mainly focus on the maintenance and operation of application to solve problem probably occurring in the future.



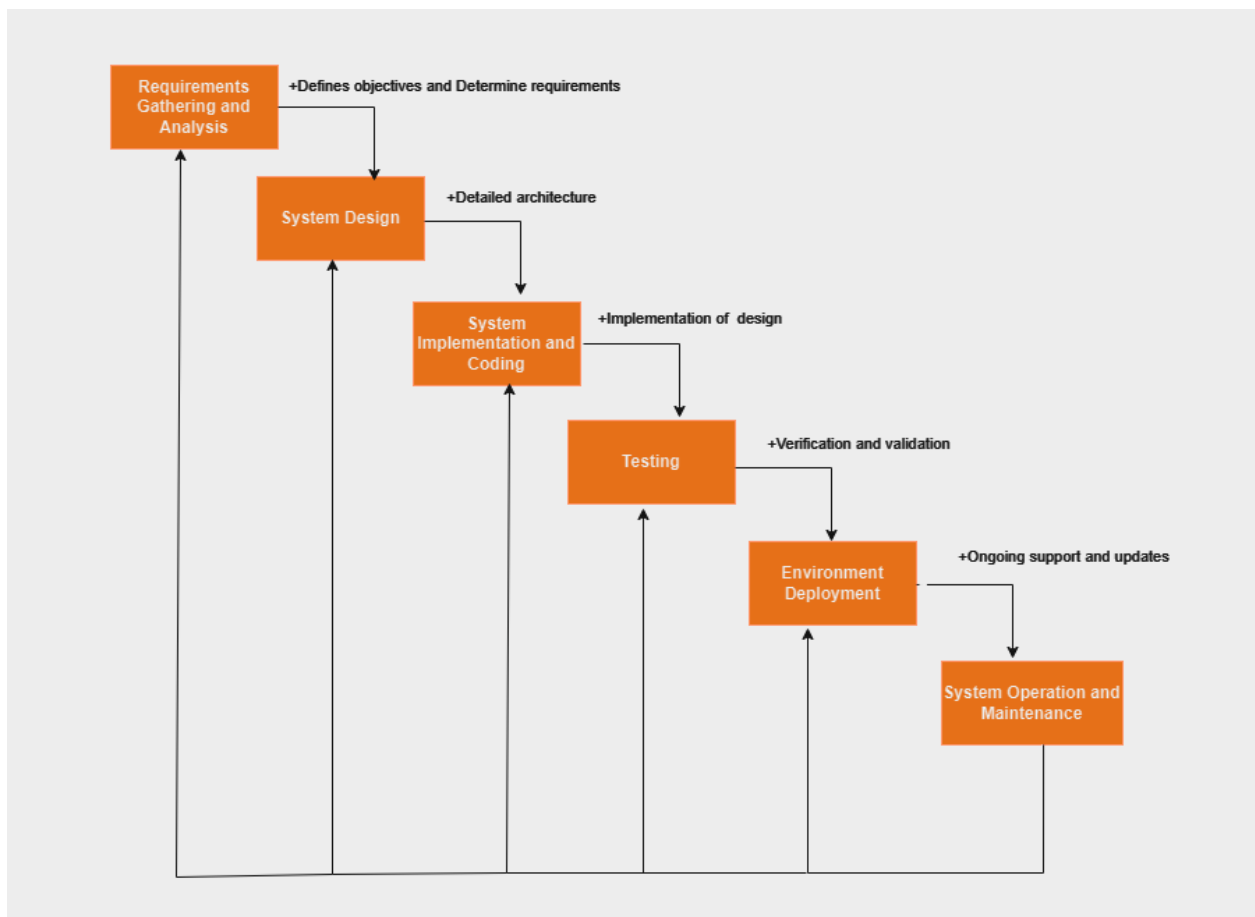


Figure 1. Waterfall Model

### 3.1.2 Requirement-gathering methods

For the development of our health and fitness tracker application, this project will execute an exhaustive requirement gathering strategy that encompasses four key methodologies. Firstly, individual and group consultations with stakeholders and clients will be facilitated. These personalized interactions are tailored to extract thorough insights into the precise needs and features desired by users, providing valuable qualitative data that will inform the core functionalities of our software[11]. Secondly, disseminate surveys and questionnaires will be sent to a broader demographic, reaching out to potential users across various age groups, fitness levels, and technological proficiency. This methodology aims to capture a wide range of preferences and expectations, ensuring that our application caters to a diverse clientele. Thirdly, observational research will be employed to gain a more lucid understanding of how client's interface with existing systems. By studying user engagement with current products, the areas for enhancement and innovation can identified. Lastly, feedback from users of existing systems to pinpoint common issues related to current regulations and the constraints of legacy systems will

be solicited. By amalgamating the insights gained from these four methodologies, a user-centric application will be developed that not only fulfils but also anticipates the needs of our target audience.

### 3.1.3 Function analysis

Fitness and health application is a comprehensive and complex application with a range of function such as distance measurement, water intake tracking and reminder, calories burn tracking, step counting and so on which offer customer good fitness experience and better to care about their health indicators. Functions are showed in Figure 2.

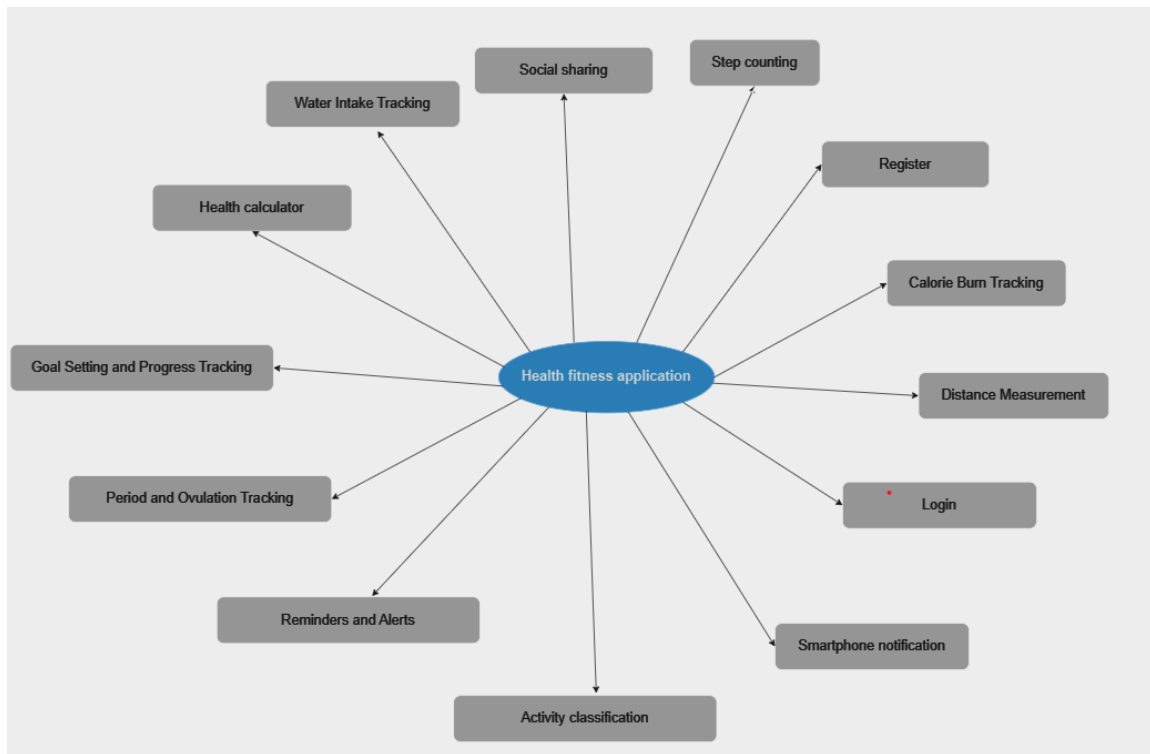


Figure 2. Function of Health Fitness Application

## 3.2 Technology

- Hardware requirements used in project are as follows:

- (1) Computer: Lenovo y7000p
- (2) Graphics card: NVIDIA GeForce RTX 2060
- (3) Operating system: Windows 11
- (4) Random Access memory: 16GB
- (5) Processor: Intel(R) Core (TM) i7-10875H CPU @ 2.30GHz

- Software used in project are as follows:

- (1) Integrated Development Environment (IDE): Android Studio (The officially recommended IDE for Android development)
- (2) Programming Languages: Java and Kotlin
- (3) Version Control Tools: Git
- (4) Database Technology: SQLite
- (5) Graphic Design Tools: Android Studio XML, Adobe XD, Sketch or Figma
- (6) Testing Tools: JUnit for unit testing, Android Profiler for performance testing
- (7) Documentation Tools: Microsoft Word
- (8) Release Tools: Google Play Developer Console
- (9) Communication Tools: Gitee, Feishu or Wechat group

### **3.3 Project Version Management**

As each version of the code is complete, the project code will be uploaded to the Gitee repository as a version management system.

Here is URL: <https://gitee.com/liang-ximeng/health-and-fitness-tracker>

- a) Sign up for an account on Gitee.com.
- b) Create a new repository for the project by clicking on the "New repository" button.
- c) Give the repository a name, select "Public" or "Private" for the visibility, add a brief description of the project. it to the remote repository on Gitee.
- d) Use Git command-line tools to initialize a local repository on the computer and link it to the remote repository on Gitee.
- e) Add the project source code files to the local repository using the Git command line tools, and then use the command to push the code to the remote repository on Gitee.
- f) Clone the repository to computer and push code changes back to the remote repository on Gitee.
- g) Use Gitee's built-in issue tracking and pull request features to manage and review code changes.

## Chapter 4 Implementation and Results

### 4.1 Development Details

#### 4.1.1 System Modelling

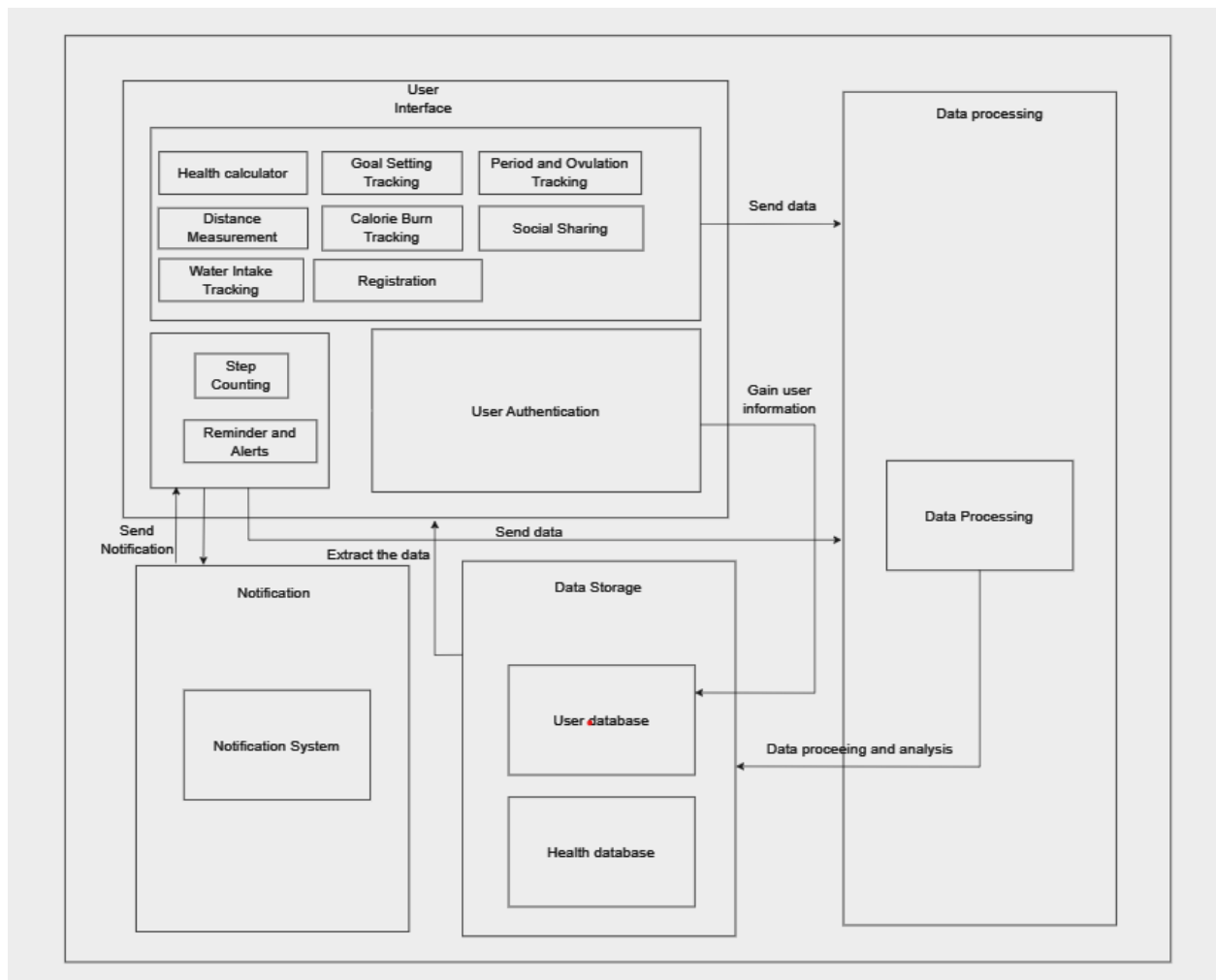
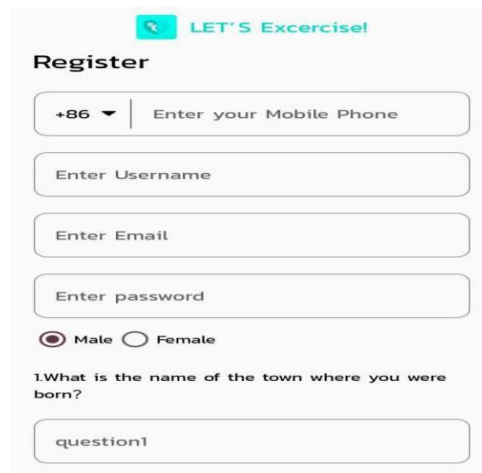


Figure 3. The Health and Fitness Application Model

#### 4.1.2 System Function Development

##### (1) Register

The purpose of the registration is that users can create their own accounts to use the application as well as specific functions. The user is required to enter a mobile phone number, username, phone number, email address, password, and a list of secret security questions to verify their identity when retrieving their password. The listener for the register button clicks event first gets the input values and validates them such as null values, phone length and email format. The application uses 'LitePal' to query the database to see whether the phone number has been registered. The register page is shown below.



LET'S Exercise!

### Register

+86 ▼ | Enter your Mobile Phone

Enter Username

Enter Email

Enter password

☒ Male ☐ Female

1.What is the name of the town where you were born?

question1

Figure 4. Register Page

## (2) Login

The purpose of the login is to allow the user to access the application by inputting phone number and password. In addition to this the application provides the user with a forgotten password option in the bottom right corner to change or retrieve the password. The phone number must exist, and the new password cannot be same as the previous one. Additionally, the user must be authenticated with a list of secret questions. Then, the user can change their password successfully after clicking 'Reset Password' button. Figures 5 and 6 show them.



LET'S Exercise!

### Log in

+86 ▼ | Enter your Mobile Phone

Enter password

Log in

Register      Forgot Password?

Figure 5. Login Page



LET'S Exercise!

### Forgot Password

+86 ▼ | Enter your Mobile Phone

Enter New password

Enter New password again

1.What is the name of the town where you were born?

question1

Figure 6. Forgot Password Page

## (3) Step Counting

The step counting function will be activated by turning on the internal Accelerometer sensor when the application setting is initialized. The Accelerometer detects motion in all directions, recognizing the acceleration pattern caused by walking. It captures these changes in acceleration and continuously transfer the data to the processor, effectively count the steps. The app will monitor and record the steps continuously with accurate discrimination between exact step movement and non-step action, displaying the step count on the home page. As a result, users can immediately see their total steps for the day and monitor their activity progress directly from the home screen. The step count displaying widget showed on screen will be updated dynamically as long as step changes, providing user with instant feedback. What's more, users can also view the number of steps in the history time including daily step counts, monthly step counts and weekly counts by clicking step count displaying widget shown in Figure 6. Users can analyse the trend of the number of steps over time in this way. It should also be noted that the step counting function continues to operate in the background even when the app is not being used on screen.



Figure 6. Total Step Counting Display Widget

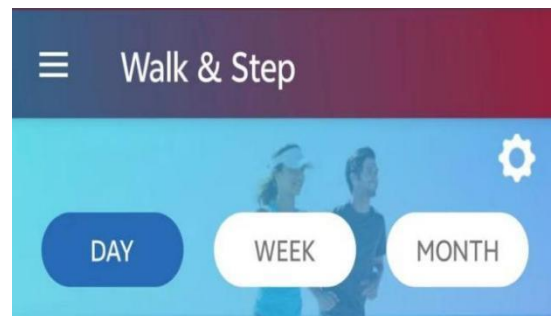


Figure 7. Step Counting Option Bar

User can select the way to look through their step counts, the application presents three options for displaying step counts: daily, weekly, and monthly. These options are depicted in Figure 7.

#### a. Daily step counting display

Users can view detailed information about their daily steps, distance covered, and calories burned after selecting the day button. What's more, users can review history data which is their step count from previous days by clicking the left arrow button. Additionally, the line chart below located at the bottom demonstrate a 24-hours trend of steps throughout the day. The horizontal axis on the chart represents the 24 hours in a day, while the vertical axis measures the number of steps taken. The blue line depicted on the chart

indicates the established step goal. User can click the setting icon and enter the general part to set and customize their daily step goal. Figures 8 and 9 show this part.

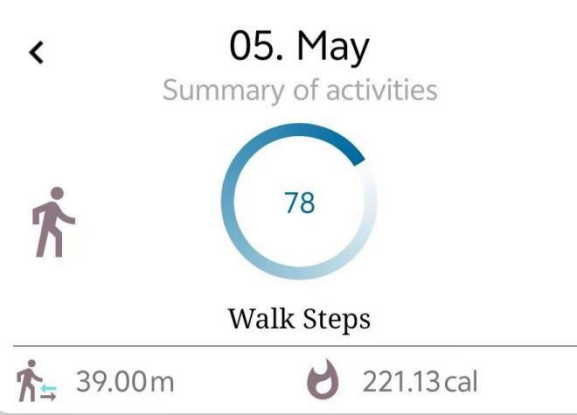


Figure 8. Daily Display Widget

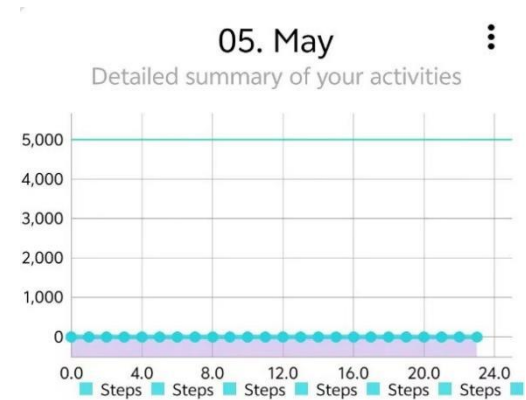


Figure 9. Daily Step Counting Line Chart

b. Weekly step counting display

For weekly step counting, the user can not only observe the steps taken, distance travelled, and calories burned during the whole week on the widget but also view a daily step from Monday to Sunday from a bar chart below the widget. Bar chart allows user to compare their daily activity level simply. Additionally, it is convenient for user to adjust their training plan based on the history steps taken, distance travelled, and calories burned when users set an exercise goal, enhancing the effectiveness of their exercise. In bar chart, the horizontal axis on the graph denotes the days of the week, while the vertical axis represents the number of steps taken. The blue line on the chart illustrates the predetermined step goal. User can click the setting icon and enter the general part to set and customize their daily step goal. Figures 10, 11 and 12 show this part.

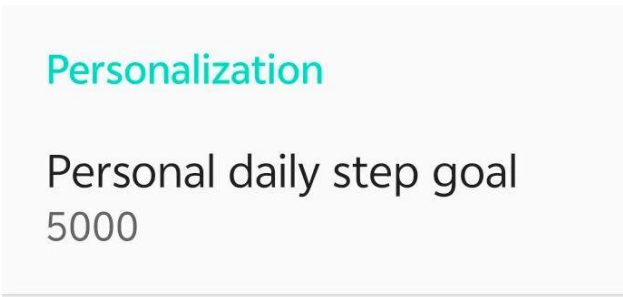


Figure 10. Customize Step Goal Page



Figure 11. Weekly Display Widget

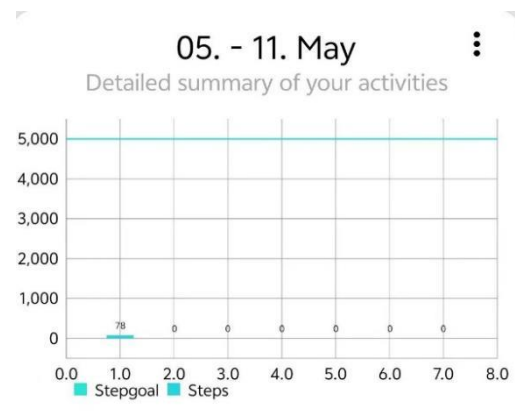


Figure 12. Weekly Step Counting Bar Chart

#### c. Monthly step counting display

For monthly step counting, user can not only observe the steps taken, distance traveled, and calories burned during the whole month on the widget but also view a daily step from the first day of the month to the last day from a bar chart. The horizontal axis on the graph denotes the days of the month, while the vertical axis represents the number of steps taken. The blue line on the chart illustrates the predetermined step goal. Figures 13 and 14 show this part.



Figure 13. Monthly Display Widget

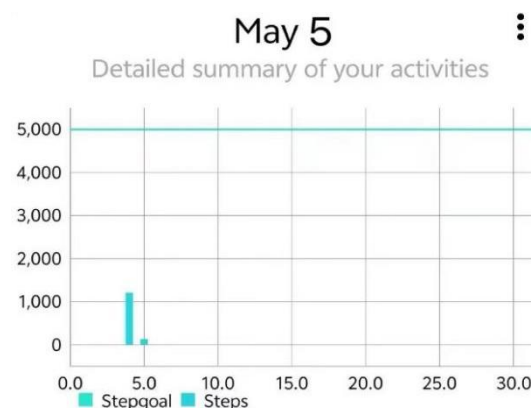


Figure 14. Monthly Step Counting Bar Chart

#### (4) Water Intake Tracking

The water intake tracking function encourage users to stay hydrated and achieve the recommended daily water consumption to maintain the normal physiological functions of the body as well as logging water consumption. Moreover, staying adequate-hydrated can boost the body's metabolic rate, enhancing energy level and promoting a sense of vitality. Users can access this function by clicking on the water intake display widget on the homepage shown in Figure 15.





Figure 15. Water Intake Tracking Display

After clicking that, users are prompted to input some personal details including their weight in kilograms, daily work out time in min per day, and both wake and sleep time when they first access this function. This information is utilized to determine the recommended daily water intake for each user. The formula to calculate the daily water intake is shown in Figure 6.

$$\text{Intake} = \left( \frac{\text{weight} \times 100}{3} \right) + \left( \frac{\text{workTime}}{6} \times 7 \right)$$

Figure 16. The Formula to Calculate Daily Water Intake

Supposing a user weighing 75kg, exercising for 90 minutes daily, the user is navigated to the water intake tracking page. This page displays the recommended water intake and already consumed water quantities shown in Figure 17. Users logs each consumption with options to record different amounts such as 50ml, 100ml, 150ml, 200ml, and 250ml, or entering a customized volume. By clicking the plus icon, the water was recorded with the notification 'your water intake was saved...!'. After each successful recorded, the system will notify feedback via 'Snackbar' to confirm that the water volume has been successfully saved. What's more, users could access the water intake report by clicking the computer icon in the page's bottom right, showing the percentage of the target water intake achieved and amount of water remaining which is demonstrated in Figure 18. The notification icon in the bottom left corner of the page is used to control whether notifications are sent.



Figure 17. Water Intake Progress Bar



Figure 18. Water Intake Option

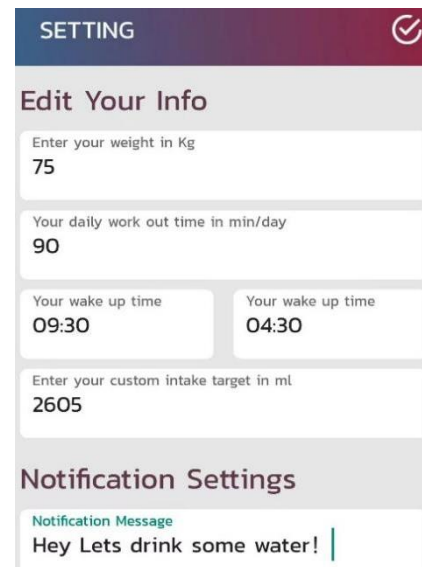


Figure 19. Water Intake Setting

If user want to edit their information, users can click the setting button and edit the weight, the daily work time, wake and sleep time, water intake target and notification content. After editing the content, user click the pick button to save them. Figure 19 shows this part.

Additionally, the function includes a notification system that periodically reminds users to drink water, ensuring users stay hydrated. It is showed in Figure 20.

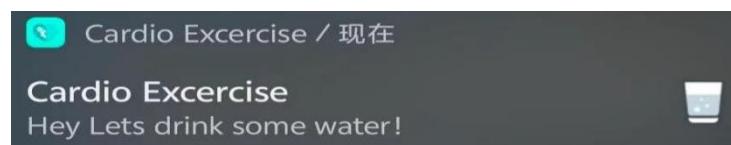


Figure 20. Water Intake Notification

#### (5) Goal Setting and Progress Tracking

The Goal Setting and Progress Tracking function is aimed to allow users to tailor their fitness plan based on individual physical conditions, fitness levels, and objectives. It also tracks goal progress and provides visual feedback to motivate ongoing training efforts.

Users can access this function by clicking the exercises progress report widget on the home page showed in the Figure 21 or workouts button on the function bar at the bottom of the application showed in the Figure 22. Users can customize a 30-day exercise plan, structured in three-day active cycles followed by a rest day on the fourth. The cycle is beneficial for both mental and physical health—it supports muscle recovery, prevents injuries due to over-training, and helps maintain mental engagement by refreshing the training routine.



Figure 21. Progress Report Widget



Figure 22. Workouts Button

The software offers users a comprehensive range of whole-body training exercises. Therefore, users can customize intensity and difficulty of their daily training by adjusting the quantities of each fitness movement based on individual needs. When the user is navigated into workout page, they can see 30 days. After clicking the day button, the user will see a page containing an array of different fitness movements with their quantity on the right side shown in the Figure 24. After the user clicking the movement or the quantity button, they can edit the quantity of the movement and see the movement description shown in Figure 23. Additionally, users will be able to see a demonstration of the movement after starting the workout. It is crucial to highlight that each exercise movement in the software includes both a visual demonstration and a textual description, making it exceptionally accessible and safe for fitness novices or individuals who infrequently engage in physical activities.

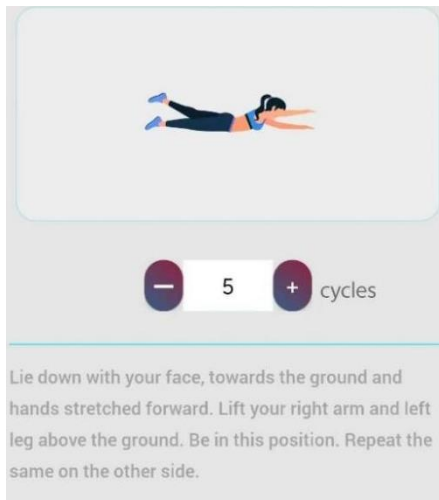


Figure 23. Movement Description and Setting

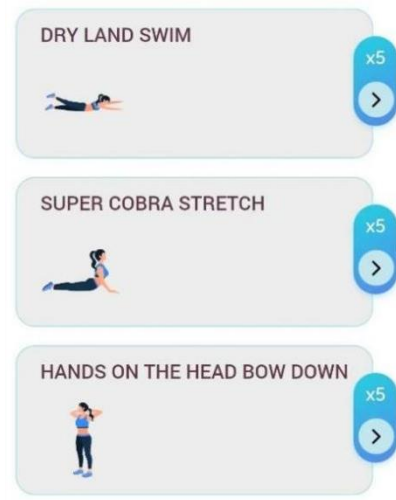


Figure 24. Array of Movement

After the user has customized the training plan, the user clicks the start button to begin training. There is an 8-second preparation time before the workout commences, which can be bypassed by pressing the skip button. Each movement is followed by a rest period showed in the Figure 26 which contain a visual and auditory preview of the name, quantity of next activity. In this period the application will report what the next movement will be, allowing the user to prepare for next movement in advance. User can also skip it by clicking the skip button. There is a progress bar displayed underneath each movement to encourage and motivate the user to continue through the training, showing how many have completed and remain which is showed in Figure 25.

When the daily training finished, the user could know both how many exercises they have done and the duration of the exercise. And they can share their achievement by clicking the share button. As shown in the Figure 27.



Figure 25. Progress Bar

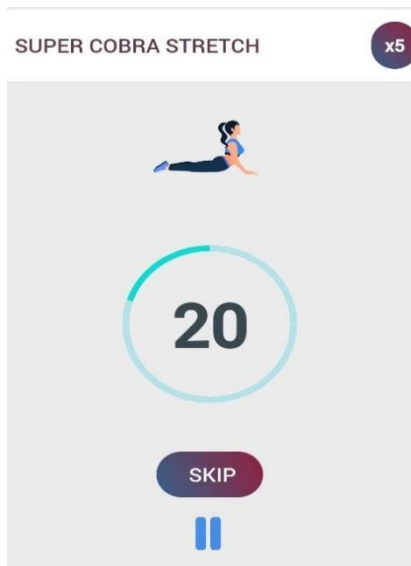


Figure 26. Rest between Movements



Figure 27. Exercise Finished

#### (6) Reminders and Alerts

Reminders and alerts promote the habit of regular drinking water and remind patients to take medication timely, ensuring patients avoid missing doses. This function is crucial for enhancing long-term health outcomes and facilitating effective chronic disease management. It uses the phone's built-in time management system to set and view trigger conditions for reminder notifications.

The user is navigated to the reminder page by clicking on the 'Reminders' icon on the function bar showed in the Figure 28. Reminder offers two functions; one is a water reminder, and the other is a medication reminder showed in the Figure 29. The water reminder reminds the user to replenish water, whereas user can customize the content of the water reminder.



Figure 28. Function Bar

If users want to add a medication reminder, click the plus button at the bottom right corner of the medication reminder to create a medication reminder. Users need to fill in the details including the name of the medication, the date and time of the reminder, as well as whether the reminder is repeated, the interval of the reminder, and the type of repetition

like minutes, hour, day, week, and month. After completing the information collection, click the tick button in the upper right corner to save. The medication reminder is added successfully. In addition to this, the user can click the bell button to turn off the notification and click the trash bin button to delete the medication reminder. As shown in the Figure 30.

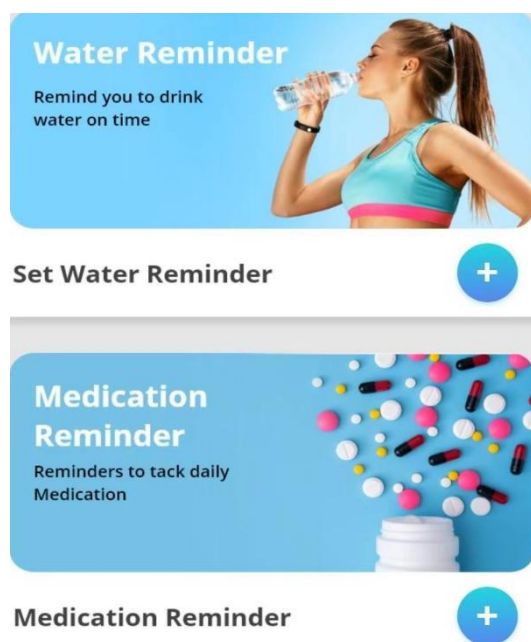


Figure 29. Reminder Types

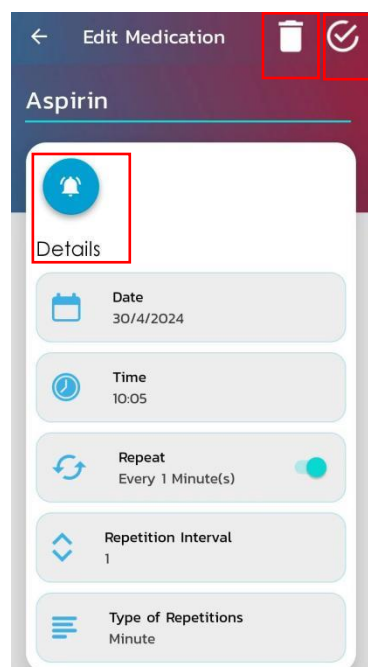


Figure 30. Medication Reminder Setting

Then the user receives a notification message to take the medication at the specific set time. As shown in Figure 31.

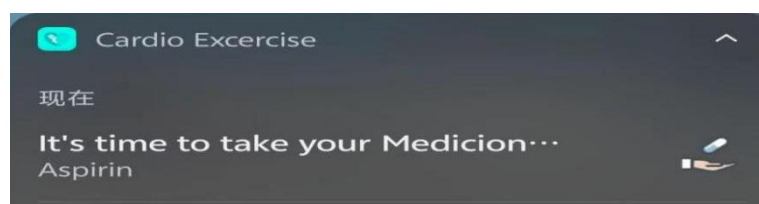


Figure 31. Medication Reminder Notification

## (7) Smartphone Notifications

Smartphone notifications send real-time notifications via the user's mobile device. This function ensures that the user's steps are visual and reminds the user to stay hydrated and take their medication on time. It helps users to focus on their daily health with timely notifications and feedback. The software utilizes Google's Firebase Cloud Messaging service to deliver notifications. Firstly, a project is created in the Firebase console and add it to the project, then configure the 'google-services. Json' file to the project. Once the app

is installed on devices, the FCM SDK generates a unique token, different for each device, for sending messages. The app passes the token to the server, and the server uses the token to send messages to the device via FCM. In addition to this, FCM is very secure and reliable because it uses secure links (HTTPS). It can be delivered to the target device despite poor network conditions.

Users can not only customize the content of the notification in water reminder and medication reminder, but also control whether notifications are turned on or not via the notification button. Thus, the user will receive a notification from the app when it comes to a specific time for water reminders and medication reminders. As for the steps notification, the notification bar continuously displays and updates today's total number of steps even the application only runs in the background shown in the Figure 32.

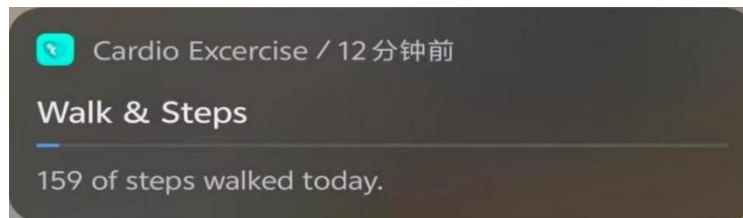


Figure 32. Steps Notification

#### (8) Social Sharing

The social sharing allows users to share their training achievement and software with friends, family, or other contacts after finishing their target goal showed in Figures 27 and 34. This increases interaction and competition, while recognition from friends or family can increase the user's sense of achievement and motivation. When users finish their daily training or whole training plan, they can choose to share and recommend their friends to use this application.

The principle of this function is as follows. Firstly, an Android predefined action 'Intent' is set, here indicating an intent to share. Then assign text to a key, the text includes a message and a Google Play Store link. Finally, the system share menu is called and the user can choose which social media they want to share this text through app. This automatically adapts to the different apps the user has installed, eliminating the need to implement sharing functionality for each service separately. Figure 16 shows that.

Users click share button and choose the application they want to share. For instance, if a user opts to share content via WeChat, they will click on the WeChat icon, choose a contact, and then complete the sharing process.



Figure 33. System Shared Menu



Figure 34. Sharing with Friends Page

### (9) Calorie Burn Tracking

The function uses the quantity of steps obtained from the phone's Accelerometer sensor to calculate the calories burned. Calorie burn tracking enables users to monitor their energy expenditure during activities. Users can effectively tailor their exercise objectives and dietary strategies by understanding the amount of energy they consume. It is displayed with the quantity of step and distance. As shown in the Figures 35-39.

Additionally, the app includes a calorie burn calculator as assist. Users are required to input their weight, the distance covered, and select the type of exercise to use this function. Weight is available in lbs and kg, distance is available in km and m, and exercise mode is available in walking or running. Following the computation, the user can view the calories burned during the activity. Except running and walking, application provide a chart to demonstrate approximate calories burned of different exercise, which offer the user to choose their favourite exercise fulfilling the targeted calories burned.

**Calories Burned Calculator**

75 kg ▼

10 km ▼

Walking ▼

**Calculate Your Total Calorie Burn**

Figure 35. Calorie Burn Calculator (walking)



Figure 36. Calorie Result (walking)



**Calories Burned Calculator**

75 kg ▼

10 km ▼

Running ▼

**Calculate Your Total Calorie Burn**



Figure 37. Calories Burned Calculator(running)    Figure 38. Calories result(running)

Calories Burned Calculator	
Burn Calories	
Exercise	Approximate Calories Burned
Walking	100 calories burned per mile
Jogging	120 calories burned per mile
Swimming	100 calories burned in 20 min
Bicycling	100 calories burned in 20 min
Aerobic exercise	100 calories burned in 20 min
Gardening	100 calories burned in 30 min

Figure 39. Calorie Burn for Different Exercise

#### (10) Distance Measurement

This function not only integrates with step detail display, allowing users to view the distance travelled alongside step count, but it also includes a separate distance measurement tool for different Walking modes as assistance. Customer could customize their own walking modes by the learning functionality of the application. The separate Distance Measurement function provides the ability to start and stop the measurement of the distance and displays the real-time updated distance in the user interface for different walking modes.

The principles of function are as follows: firstly, the accelerometer sensor runs persistently in the background to monitor step count. Additionally, a receiver tracks updates from the step count service to refresh the step data continuously. The total distance is calculated by the step counting service. The step length would be adjusted for different walking modes such as running, walking, and jogging and so on.

##### a. Distance Measurement Display

There are two ways to choose walking modes when using this separated distance calculating tool to calculate distance. One is the option in the upper right corner to make the selection showed in Figure 40. The other way is to make the walking mode to be activated in the settings of the walking mode showed in Figure 41.

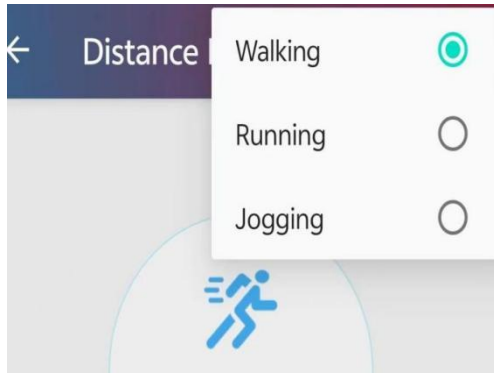


Figure 40. Walking Mode Selection Bar

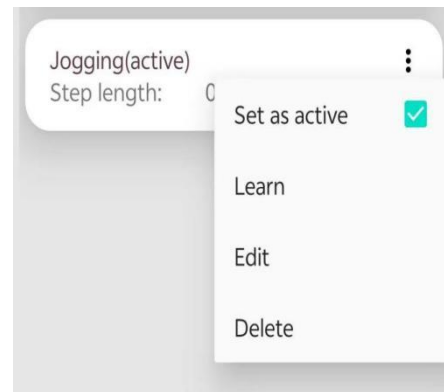


Figure 41. Walking Mode Activation

## b. Walking Modes

When the user is navigated into the Walking Mode setting page, the user can view and add walking modes with different step distances. The defaults are Walking and Running. People need to input the name of walking mode and the step length while they customize the walking mode shown in Figure 42. The settings button on the right side of each walking mode allow user to activate the mode, learn, edit, and delete the mode showed in Figure 41.

### Walking mode

Set your custom walking mode:

Name

Step length (Meters)

**CANCEL** **SAVE**

Figure 42. Walking Mode Add

### ← Walking modes

The application can learn the distance per step. Please walk the given distance and press end if you finished.

Distance to walk: 100.0 meters

Steps walked: 0

**END LEARNING MODE**

Figure 43. Learn Walking Mode

Additionally, if users are unsure of their step length, the app provide an auto-learning capability shown in the Figure 43. By walking 100 meters, the app activates its pedometer

function to automatically determine the number of steps taken and subsequently calculates the average distance per step. User only need to walk 100 meters and click end button; the customized walking mode will be generated automatically.

#### (11) Period and Ovulation Tracking

Period and Ovulation Tracking function is designed to help users predict their menstrual cycle and ovulation. Female users can use it to raise awareness of their health such as adjusting diet and mood to alleviate menstrual discomforts. Furthermore, the function helps a lot in both pregnancy preparation and contraception. It provides the time of ovulation to increase the likelihood of pregnancy for those who are preparing for pregnancy. It reminds them to use contraception during ovulation for users who do not want to get pregnant.

The application applies the 'SNPCalendarView' control, which is a calendar view allowing users to interact and select data. It retrieves the cycle length from the user's input in a 'TextView' and calculate the predicted date. It stores the number of cycle days and the date of the last menstrual period in 'SharedPreferences'. This persistent storage ensures that data remains intact despite device shutdowns or reboots.

The user opens the Menstrual and Ovulation Calculator function and clicks on the "Select cycle days" selection bar, prompts a range of cycle days (21 to 45) for selection. After choosing the cycle days, the user then picks the start date of the last menstrual period using the calendar. The app predicts and displays the estimated start date of the next menstrual period and two possible ovulation dates after clicking the calculate button. Users can modify these predictions by adjusting the number of cycle days and the start date. Figures 44 and 45 shows this part.



Figure 44. Menstrual Ovulation Predictor

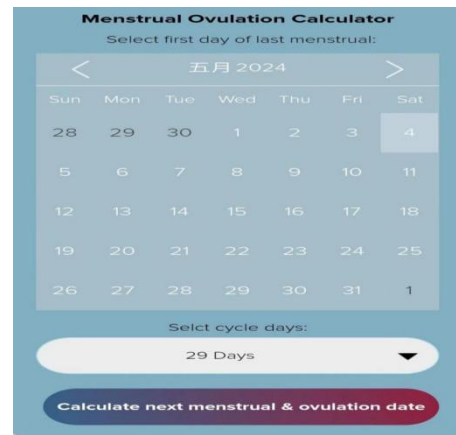


Figure 45. Prediction Result

## (12) Health Calculator

### a. BMR Calculator

The BMR Calculator offers a simple and efficient method for determining the minimal daily energy requirement for a user at rest. It enables users to strategically plan their diets to match their energy consumption with their body's demands, which is particularly vital for those aiming to lose weight.

The user activates the BMR calculator, inputs their age, weight, and height, selects their gender and measurement units in the 'TextView', then clicks the 'Calculate' button to display the results. The different units are automatically converted into the units required by the formula.

The calculation formula follows:

**Male:  $BMR = 66 + (6.23 \times \text{weight}(\text{lbs})) + (12.7 \times \text{height}(\text{inches})) - (6.8 \times \text{age})$**

**Female:  $BMR = 655 + (4.35 \times \text{weight}(\text{lbs})) + (4.7 \times \text{height}(\text{inches})) - (4.7 \times \text{age})$**

Figures 46 and 47 show the BMR calculator page and the result with inputting 22 male, 180 cm, 75kg.

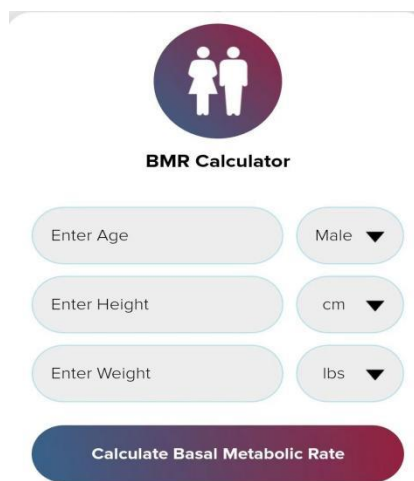


Figure 46. BMR Calculator



Figure 47. BMR Calculator Result

#### b. BAC Calculator

BAC Calculator is designed to estimate users' blood alcohol concentration (BAC). The information is displayed and adjusted through the 'TextView' control. Additionally, 'listView' and 'PopupWindow' are utilized to choose the user's gender, time unit including hour, minute, day, and weight unit including lbs and kg.

The user open Blood Alcohol Calculator, input the amount of alcohol consumed, the alcohol concentration, the elapsed time since consumption, and their weight, select their gender. Then clicks the 'Calculate Blood Alcohol Content' button to view the results. As shown in the Figures 48 and 49.

After knowing the blood alcohol concentration, the app also provides the user with a table of drunkenness levels. User can match the result with the level and decide whether they can drive car especially in the morning after a hangover. The different units are automatically converted into the units required by the formula.

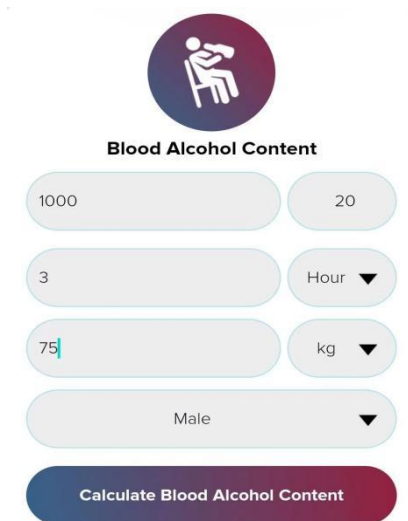
The calculation formula follows:

**Gender Ratio: Male-0.68 Female:0.55**

**$Alcohol(g) = Volume(ml) \times (ABV/100) \times 0.789$**

**$Weight(p) = Weight(kg) \times 2.20462$**

**$BAC = (Alcohol(g) \times 5.14 / Weight(p) \times Gender Ratio) - 0.015 \times Time Passed(hour)$**



**Blood Alcohol Content**

1000 20

3 Hour ▼

75 kg ▼

Male ▼

**Calculate Blood Alcohol Content**

Figure 48. BAC Calculator



✕



Your Blood Alcohol Content level is : 0.11

**View Chart**

Figure 49. BAC Calculator

### c. BDT Calculator

The Blood Donation Time Calculator assists users in determining a safe date for their next blood donation to make sure user have sufficient time to recover. The application utilizes an 'Activity' to create the user interface and incorporates the 'SNPCalendarView' component, which allows users to select a date to calculate the next eligible blood donation date.

The user opens the Blood Donation Time Calculator, selects the date of the last blood donation, clicks on the Calculate button, and the application automatically calculates the next date on which it is safe to donate blood. As shown in the Figures 50 and 51.



**Blood Donation Time Calculator**

Select date of last donation :

< 五月 2024 >

Sun	Mon	Tue	Wed	Thu	Fri	Sat
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

**Calculate Next Eligible Date**

Figure 50. BDT Calculator



✕



Date of Next donation :  
26 6月 2024

Date of last donation : 01 5月 2024

Figure 51. BDT Calculator Result

#### d. Daily Calories Intake Calculator

The Daily Calories Intake Calculator determines the user's daily caloric needs, aiding in weight management and supporting users with specific dietary plans. Users input their age, height, and weight via the 'EditText' component. The 'radioGroup' selection captures the user's activity level. The calculator then computes the recommended daily caloric intake by TDEE related to user's Basal Metabolic Rate (BMR) and activity level.

User opens the calorie intake calculator, enters age, height in cm or m and weight in kg or lbs and then selects different daily activity level and gender by radio buttons. The user confirms that all information is filled in clicking on the Calculate button and the application verifies the validity of the input. If the all the inputs are valid, the results displayed. And the different units are automatically converted into the units required by the formula. First, the BMR will be calculated according to the BMR calculation formula mentioned above. And then calculator will calculate TDEE.

The TDEE calculation formula according to activity level follows:

***Sedentary (Little or no exercise):  $BMR \times 1.2$***

***Lightly active (light exercise/sports 1-3 days/week):  $BMR \times 1.375$***

***Moderately active (moderate exercise/sports 3-5 days/week):  $BMR \times 1.55$***

***Very active (hard exercise/sports 6-7 days a week):  $BMR \times 1.725$***

***Extra active (very hard exercise/physical job & exercise 2x a day):  $BMR \times 1.9$***

After calculating the TDEE, the app gives the user three recommendations. If the user is maintaining weight, the TDEE is used directly as the target calorie intake. If weight loss is the goal, the TDEE is usually reduced by 15-20% as the target calorie intake. If gaining weight is the goal, the TDEE is usually increased by 10-20% as the target calorie intake. The calorie intake for all three scenarios will be shown to the user for guidance.

#### e. Any Other Calculators

In addition to the calculators mentioned above, there are many other health calculators offered such as Blood Pressure Calculator, Blood Sugar Conversion Calculator, Blood Volume Calculator, Waist to Height Ratio Calculator, Waist to Hip Calculator, Cholesterol Ratio Calculator and so on. These are all set for those who have specific demand like chronic patients' cholesterol sufferer or models.

## 4.2 Testing and Evaluation

### 4.2.1 Functional Testing

(1) Test purpose: To test whether each function of the software application meets the user's requirements and to correct bugs to improve system reliability and user experience.

(2) Test method: Based on software design and development, manually enter application-related test cases, observe results, and verify correct functionality. The Test cases are shown in Table below.

ID	Function	Use case	Preconditions	Test case	Expected results	Actual results
1	Register	Valid Registration	App installed and launched	Phone: 01234567890, User: TestUser, Email: testuser@example.com, Password: test123, Security Questions: [Answer1, Answer2...]	"User registration successful, logged in automatically"	"User registration successful, logged in automatically"
2	Register	Empty Phone Number, Username, Email, or password	App installed and launched	Phone: (empty), User: (empty), Email: (empty), Password: (empty)	"The phone number, username, Email or password cannot be empty"	"The phone number, username, Email or password cannot be empty"
3	Register	Phone Number Not 11 Digits	App installed and launched	Phone: 12345	"The number of digits in the phone number length is not 11"	"The number of digits in the phone number"



						length is not 11"
4	Register	Duplicate Phone Number	App installed and launched	Phone: 01234567890 (already registered)	"User already exists"	"User already exists"
5	Register	Invalid Email Format	App installed and launched	Email: emailtest	"Invalid email format"	"Invalid email format"

Table 3. Functional testing of Registration

ID	Function	Use case	Preconditions	Test case	Expected results	Actual results
1	Login	Empty Phone Number	App installed and launched	Empty phone number	"The phone number cannot be empty"	""The phone number cannot be empty"
2	Login	Phone Number Not 11 Digits	App installed and launched	Phone: 12345	"The number of digits in the phone number length is not 11."	""The number of digits in the phone number length is not 11."
3	Login	Empty Password	App installed and launched	Phone: 01234567890 and empty password	"Password cannot be empty"	"Passwo rd cannot be empty"

4	Login	Incorrect Password	App installed and launched	Valid phone number, incorrect password	"The password is incorrect."	"The password is incorrect."
5	Forgot Password	Incorrect Security Questions	Forgot Password page loaded	Valid inputs, incorrect security question answers	"Your security question answer is not correct."	"Your security question answer is not correct."
6	Forgot Password	Mismatched Passwords	Forgot Password page loaded	Valid phone number, new password, different confirm password	"The passwords you entered twice do not match."	"The passwords you entered twice do not match."

Table 4. Functional testing of Login

ID	Function	Use case	Preconditions	Test case	Expected results	Status
1	Step counting	Verify Step Count Accuracy	App installed, User login	User walks 5 steps	App accurately counts steps 5-10	Passed
2	Step counting	Verify Background Functionality	App running in the background	User walks while app is not active on screen	Steps are counted accurately in background	Passed
	Step counting	Display Step Count on Widget	Widget added to	User walks with phone	Widget updates with new step count in real-time	Passed

3			home screen			
4	Step counting	Low Battery Operation	Battery level is low (<20%)	User walks with phone	App continues to count steps accurately	Passed

Table 5. Functional testing of Step counting

ID	Function	Use case	Preconditions	Test case	Expected results	Status
1	Water Intake Tracking	Verify Daily Water Intake Tracking	App installed; user logged in	App installed; user logged in	App accurately tracks and sums the daily intake	Passed
2	Water Intake Tracking	Verify Water Intake Goal Setting	Default goal is set	User sets a custom water intake goal	Custom goal is saved and displayed correctly	Passed
3	Water Intake Tracking	Display Step Count on Widget	Widget added to home screen	User walks with phone	Widget updates with new step count in real-time	Passed
4	Water Intake Tracking	Notifications for Water Intake	Notifications enabled	User does not log intake for several hours	App sends a reminder notification to drink water	Passed
5	Water Intake Tracking	Water Intake History and Trends	Data available for past use	Access water intake history view	Display historical data and trends accurately	Passed

Table 6. Functional testing of Water Intake Tracking

ID	Function	Use case	Preconditions	Test case	Expected results	Status
1	Goal Setting	Verify Goal Creation	User is logged in	User sets a new fitness goal	Goal is saved correctly	Passed
2	Goal Setting	Modify Existing Goal	Existing goal set	User modifies the target of an existing goal	Modified goal is updated and saved correctly	Passed
3	Progress Tracking	Daily Progress Update	Users finish a daily goal	User logs daily activities	Daily progress is updated and displayed	Passed

Table 7. Functional testing of Goal Setting and Progress Tracking

ID	Function	Use case	Preconditions	Test case	Expected results	Status
1	Reminder and Alerts	Create a New Reminder	User is logged in	Name: Aspirin Time: 19:00 Date:5/5/2024 Repeat: on Repeat interval:1 min	Reminder is saved correctly and visible in the app	Passed
2	Reminder and Alerts	Delete an Existing Reminder	At least one existing reminder	User deletes the 'Aspirin' reminder	Reminder is deleted and no longer triggers	Passed
3	Reminder and Alerts	Modify an Existing Reminder	Existing reminder set	Name: Aspirin Time: 19:20 Date:5/5/2024	Reminder is updated. And the user is reminded to	Passed

				Repeat: on Repeat interval:1 min	take medicine at 19:20 5/5/2024	
4	Reminder and Alerts	Receive a Notification	Reminder set for a specific time	Name: Aspirin Time: 19:20 Date:5/5/2024 Repeat: on Repeat interval:1 min	App sends a notification t at 19:20 5/5/2024.	Passed
5	Reminder and Alerts	Reminder repeat	User is logged in	Name: Aspirin Time: 19:20 Date:5/5/2024 Repeat: on Repeat interval:1 min	App sends a notification t at 19:20 5/5/2024. And repeat every 1 min	Passed

Table 8. Functional testing of Reminder and Alerts

ID	Function	Use case	Precondition s	Test case	Expected results	Status
1	Calorie Burn Tracking	Track Calorie Burn for Walking	User selects walking activity	Duration: 30 minutes	Correct calories burned are calculated and displayed	Passed
2	Calorie Burn Tracking	Track Calorie Burn for Running	User selects running activity	Duration: 15 minutes	Correct calories burned are calculated and displayed	Passed

Table 9. Functional testing of Calorie Burn Tracking

ID	Function	Use case	Preconditions	Test case	Expected results	Status
1	Distance Tracking	Start and Stop Distance Measurement	User starts measurement from rest	Start/Stop after walking 1 km	App correctly displays distance as 1 km	Passed
2	Distance Tracking	Continuous Measurement Accuracy	User use app	Walk 3 km without stopping	App accurately tracks and displays walked distance 3 km	Passed
3	Distance Tracking	Distance Measurement in Background	App is in the background	Walk 2 km with app in background	Display waking distance 2km	Passed
4	Distance Tracking	Reset Distance Measurement	Distance is being measured	Reset after 0.8 km	Distance resets to zero and restarts counting	Passed

Table 10. Functional testing of Distance Tracking

#### 4.2.2 Performance Testing

(1) Test purpose: To evaluate the application's speed, responsiveness and stability under different loads and analyse the system under various load levels to optimize performance[12].

(2) Test method: Android Profiler provided by Android studio are used to test the performance of application. Figure below shows the result.

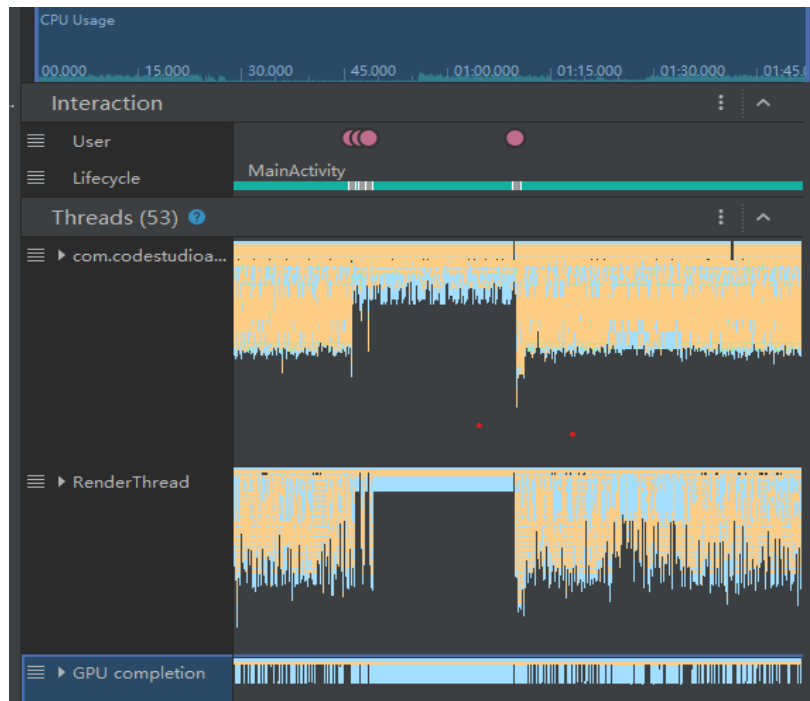


Figure 52. Performance Testing Result

com.codestudioa... Shown are the main working threads of the application. The yellow and orange patterns show CPU usage, the dense areas indicate high CPU usage during these times probably doing a lot of data processing. RenderThread for UI and graphics. It's clear that there are a few spikes, probably caused by the UI constantly updating. The pink dots represent interactions between the user and the application which is the operation on the phone and the green colour represents MainActivity's lifecycle events.

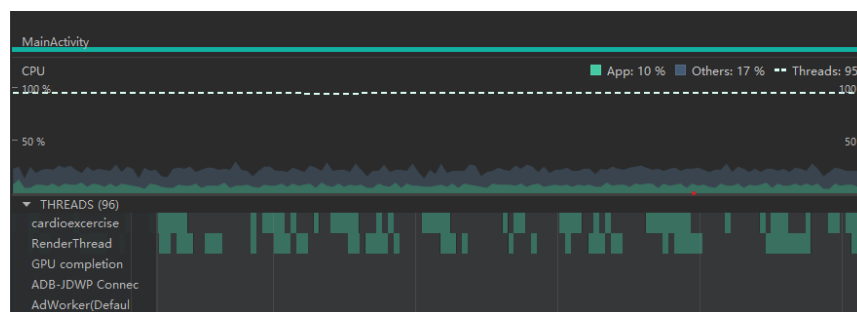


Figure 53. Performance Testing Result Under Low Load

Figure 53 describe the situation under low load and shows that the CPU usage is not very high, mostly stays around 10%. This means that the application does not performing a lot of computational operations. The low CPU and thread activity patterns indicate that the current threads are well managed without abuse. Developers should continually monitor

for sudden spikes in resource usage to avoid potential performance issues that may exist although current usage is low.

Frame #	Frame Duration
21838356	63.26 ms
21838792	25.33 ms
21838997	43.99 ms
21839085	17.59 ms
21839290	37.04 ms
21839532	2.66 ms
21839667	40.29 ms
21839798	62.22 ms
21839893	21.99 ms
21840163	14.14 ms
21840501	1.84 ms
21840712	880 $\mu$ s
21840783	239.09 ms
21840861	50.38 ms
21840861	46 ms
21840884	25.61 ms
21840937	7.44 ms
21840937	4.88 ms
21840957	4.98 ms
21840979	87.68 ms
21841484	24.38 ms
21841711	23.91 ms
21841937	15.03 ms
21841973	12.68 ms
21842121	19.52 ms

Figure 54. Frame Duration Analysis Data

As can be seen from this Figure 54, the time that frames continue to change can be indicative of the consistency of the application. Longer processing time will have significant delay and jitter in the visual output. There is only one place where the time is 239.09ms, which means the performance bottleneck is less frequent and the performance is superior.

### 4.2.3 Acceptance Testing

(1) Test purpose: To Ensure that the software is responsive and acceptable to the user's needs, as well as ensuring that the software system performs as expected in actual operation.

(2) Test method: Before conducting acceptance testing, the software requirements specification needs to be reviewed especially the requirements such as business logic and device compatibility. The application files are packaged as apk files for trialists to test, but at the same time they all need to be configured with all external dependencies, databases, APIs, etc. Use defect tracking tool (JIRA) to record the defects found. Analyse the data collected from the tests and evaluate the performance of the application to prepare a test report. Evaluate whether the application meets the quality standards by comparing the report with the requirements. Acceptance testing result table is below.



Functional Module	Test Scenario	Expected Result	Actual Result	Status
User Registration	User can successfully register a new account	Account is created successfully	Successful Register	Passed
User Login	User can log in using a valid username and password	Login successful, redirected to the main screen	Successful Login	Passed
Password Reset	User can reset a forgotten password	User answer secret questions and reset password	Successful Password Reset	Passed
Step Counting	App accurately records user steps	App displays the total number of steps for the day, matching manual count	Successful Step Counting	Passed
Water Intake Tracking	User can record daily water intake and track total	Correct total daily water intake displayed, reminders to drink water	Successful Water Intake Tracking	Passed
Goal Setting and Progress Tracking	User can set fitness goals and track progress	User can set fitness goals and track progress	Successful Goal Setting and Progress Tracking	Passed
Reminders and Alerts	App can set water and medication reminders	User receives reminders at set times	Successful Reminders and Alerts	Passed

Calorie Burn Tracking	Track calories burned during exercise	Accurately displays calories burned	Successful Calorie Burn Tracking	Passed
Distance Measurement	App track movement distance and activity distance	Distance measurement is accurate, matches actual distance	Successful Distance Measurement	Passed
Social Sharing	User can share their fitness achievements and the use of application	Success message after sharing, post visible on user's social media page	Successful Social Sharing	Passed
Notification	App sends notifications for step counts and reminders	Notifications are timely and accurate, according to set preferences	Successful Notification	Passed
Health Calculator	Users calculate their health indicators	Accurate and fast calculation	Successful Health Calculation	Passed
Period and Ovulation Tracking	App accurately predicts menstrual and ovulation dates	Accurate prediction of next menstrual and ovulation dates	Successful Period and Ovulation Tracking	Passed

Table 11. Acceptance Testing Result

#### 4.2.4 Evaluation

The health and fitness android application meets users' functional and non-functional requirements. In terms of accessibility, the software is clean and attractive at the same time, which all stems from the fine typography in the xml files. Thus, a wide range of users are catered for. For responsiveness, the program has a fast response time and there is no significant delay in user access. Users need to conduct security checks to verify their

identity, avoiding malicious password changes and account theft when retrieving passwords. However, there are also some limitations to this application, such as the lack of good integration with wearable devices. This because there are no wearable devices available for use during the development phase. While wearable technology such as fitness wristbands and smartwatches play a crucial role in modern health applications by providing continuous and real-time monitoring of physiological data such as heart rate, activity levels, sleep quality, and more. With the absence of wearable integration, it is difficult to provide precise and customized advises for users. Therefore, I will be focusing my development on the integration of wearables with the software in the future, allowing the data collected to be sourced from the wearable device. It will notably make the data more comprehensive and accurate.

## Chapter 5 Professional Issues

### 5.1 Project Management

#### 5.1.1 Activities

Objective	Activities
1. Conduct a comprehensive review of existing health and fitness applications	<ul style="list-style-type: none"><li>a. Review relevant literature on current health and fitness apps.</li><li>b. Conduct market research to identify popular features and user preferences.</li><li>c. Analyse competitor applications to understand industry standards.</li></ul>
2. Design and develop the user interface	<ul style="list-style-type: none"><li>a. Sketch initial wireframes for main screen.</li><li>b. Design a user-friendly interface with easy navigation and accessibility.</li><li>c. Develop interactive elements such as buttons and sliders for user input.</li></ul>
3. Implement core functionalities	<ul style="list-style-type: none"><li>a. Develop modules for step counting using the accelerometer, calorie burn tracking, and workout routines.</li><li>b. Code functionalities for real-time data processing and display.</li><li>c. Integrate sensors like accelerometer for activity tracking.</li></ul>
4. Enhance user engagement and motivation	<ul style="list-style-type: none"><li>a. Implement social sharing function using system shared menu.</li><li>b. Develop a system for setting and tracking fitness goals.</li><li>c. Create motivational notifications and rewards for achieving goals.</li></ul>
5. Ensure data security and privacy	<ul style="list-style-type: none"><li>a. Implement register and secure login.</li><li>b. Ensure all personal health data is stored securely and complies with privacy regulations (e.g., GDPR, HIPAA).</li><li>c. Develop robust authentication mechanisms to protect user accounts.</li></ul>
6. Optimize for different devices and operating systems	<ul style="list-style-type: none"><li>a. Ensure the app functions well on any Android devices.</li><li>b. Perform cross-device testing to check compatibility and performance.</li><li>c. Optimize battery usage and data handling for mobile devices.</li></ul>

7. Test and refine the application	<p>a. Conduct unit, integration, and system testing.</p> <p>b. Collect feedback from friends through beta testing and make necessary adjustments.</p> <p>c. Prepare the app for deployment and resolve any final issues.</p>
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Table 12. Objectives and Activities

### 5.1.2 Schedule

The project uses a Gantt chart for project progress management. This is shown in Figure 55.

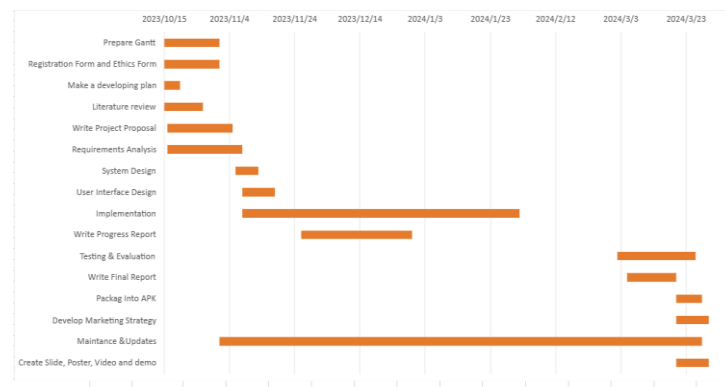


Figure 55. Project Gantt Chart

### 5.1.3 Project Data Management

Upload Weekly progress on Gitee with subfolders (As shown in Figure 55)

URL of full project source: <https://gitee.com/liang-ximeng/health-and-fitness-tracker>

URL of project code: <https://gitee.com/liang-ximeng/health-and-fitness-tracker/tree/master/Code>

Upload presentation-related ppt, videos and posters to Gitee later

Upload reports to the “Reports” folder

Upload different code version to the “Code” folder

Upload the weekly report to the “WeeklyReport” folder

Upload other project-related materials to the Gitee later

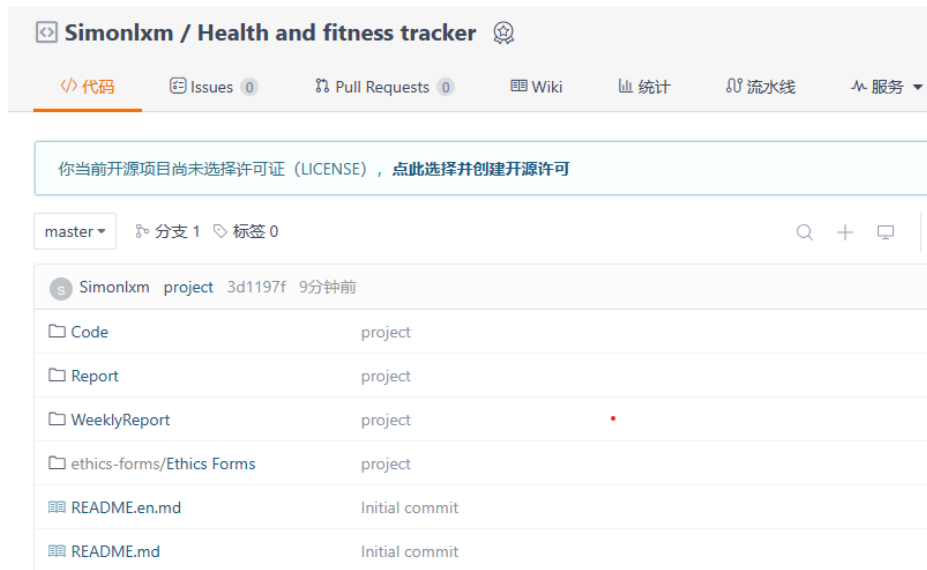


Figure 56. Data Management In Gitee

Using Zotero to manage useful literature. As shown in Figure 56.

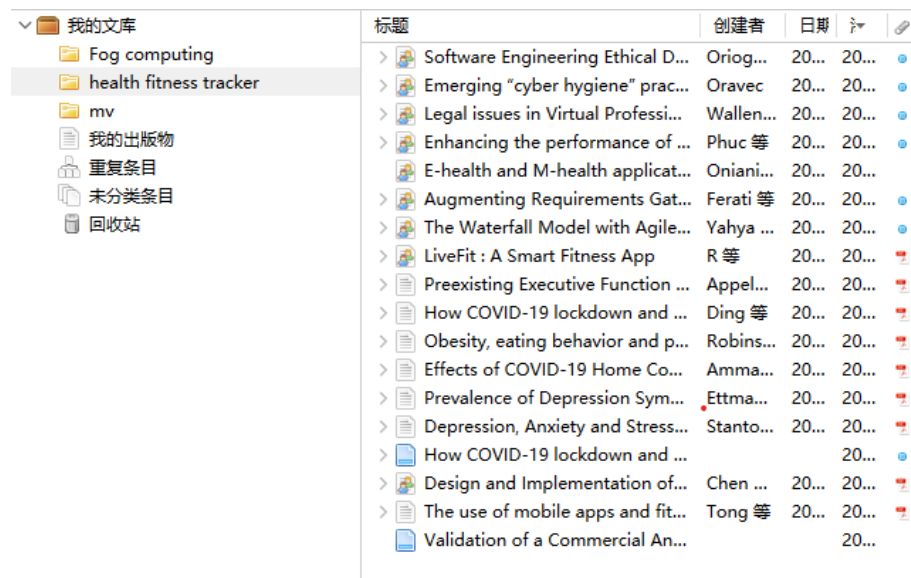


Figure 57. Literature Management with Zotero

#### 5.1.4 Project Deliverables

The following files would be submitted for assessment:

- (1) Project proposal
- (2) Progress Report
- (3) Final Project Report
- (4) Health and Fitness Android application Code
- (5) Presentation: Poster, PowerPoint, and Video

## 5.2 Risk Analysis

This section is used to assess and analyse the possible risks of the project, with the risk level expressed as a product of severity and likelihood as shown in the table.

Likelihood \ Severity		Very Unlikely	Not Likely	Possible	Probable	Very Likely
		1	2	3	4	5
Negligible	1	1	2	3	4	5
Minor	2	2	4	6	8	10
Moderate	3	3	6	9	12	15
Major	4	4	8	12	16	20
Catastrophic	5	5	10	15	20	25

Risk Level	
1-5	Acceptable
6-12	Tolerable
13-25	High

Table 13. Risk Severity Matrix and Risk Level

Risk analysis is crucial for developing fitness and health applications. Accurately identifying potential risks and implementing strategic mitigation measures can reduce these risks and enhance the likelihood of the application's market success.

The table outlined below delineates various prevalent risks encountered in development projects, categorizes them according to defined risk levels, and outlines corresponding causes and mitigation associated with each risk.

Risk ID	Potential Risk	Cause ID	Cause	Severity	Likelihood	Risk	Mitigation ID	Mitigation
R 1.1	Data leakage	C 1.1.1	Unauthorized access	2	2	4	M 1.1.1	Apply advanced encryption and strict access controls.
		C 1.1.2	Weak password	1	2	2	M 1.1.2	Enforce strong password policies and two-factor authentication.
		C 1.1.3	App vulnerabilities	3	1	3	M 1.1.3	Regular security audits and immediate

								patching of vulnerabilities.
R 1.2	Progress risks	C 1.2.1	Project outpace schedule	5	4	20	M 1.2.3	Manage the time well and task allocation
R 1.3	Software bugs	C 1.3.1	Non-modular design	1	3	3	M 1.3.1	Make a clear and advisable modular software design
		C 1.3.2	Inadequate test plan and techniques	4	3	12	M 1.3.2	Implement a variety of testing techniques
R 1.4	Reputation risks	C 1.4.1	Dissatisfaction and negative interaction	3	4	12	M 1.4.1	Pay more attention to the users' feedback.
R 1.5	Competitive risks	C 1.5.1	New competitors into the market	2	2	4	M 1.5.1	Updates requirements and keep the trend of the fitness and health application
R 1.6	Cyber crimes	C 1.6.1	User identity theft	4	3	12	M 1.6.1	Use strong authentication method and improve the security awareness
		C 1.6.2	User privacy sale	4	4	16	M 1.6.2	Use data anonymization, only collect the necessary data.

Table 14. Risk Analysis

### 5.2.1 Future Risks

#### (1) Technological Advancements

Technology develops rapidly, and soon, it will be able to outstrip the possibilities of the application. The threat of potential obsolescence is imminent, and it needs to be updated to reflect current trends.

#### (2) Regulatory Changes

Some specific laws and regulations may change in the future. Therefore, every change needs to meet the requirements of the latest laws. For instance, changes in data protection laws will demand changing data collection processes and methods.



### **5.3 Professional Issues**

#### **(1) Legal Issue:**

##### **a. Intellectual Property Rights (IPR):**

Icons and graphics are key in designing interfaces in the creation of the application. Most of these are available in online repositories. There will be a need to ensure that such visual assets are covered under licenses allowing commercial exploitation and requiring attribution to be made in accordance with specified rules. Additionally, for anything that is developed and considered the user's original code and content, copyrights should be deposited to protect the user's intellectual property[13]. This creates stiff penalties for infringers and ensures that the developers maintain control over the material created or get recognition or compensation.

##### **b. General Data Protection Regulation (GDPR):**

One of the critical areas in application development is Data Protection and GDPR Compliance. It compels developers to be subject to stringent rules on using personal data. Some of the underlying ethics in this sub-field include collecting and processing data only with users' credence, providing users with access to, correction, and deletion of personal data, safeguarding the data collected using methods such as encryption and access restriction. In case of data breach, the affected user and relevant authorities should also be informed within the 72 hours. Privacy by Design also ensures that the high privacy and data defence standards are followed right from the product's creation.

#### **(2) Social Issue:**

Social issues in projects often have implications for different stakeholders, including issues related to accessibility, the digital divide, user privacy and potential job substitution[14]. These issues underscore the need for inclusive design, equitable access to technology and the protection of personal data.

#### **(3) Ethical Issue:**

Ethical concerns in projects are broad especially those that involve technology. They range from the breach of data privacy to the misapplication of artificial intelligence, and from invisibility in algorithmic decision-making to inadvertent partiality through the handling or analysis of data. But they all point to ethics standards. Ensuring user autonomy, upholding fairness, and guaranteeing transparency is essential[15]. Projects should be able to anticipate these ethical challenges by ensuring a robust data governance framework, making AI systems transparent and accountable, and eliminating biases within their sphere, which helps build trust and ensure fairness on every project deliverable[15].

#### **(4) Environment Issue:**

The negative environmental issues related to technology projects consist of a high amount of energy required in their implementation as well as depletion of resources, e-waste generation, large carbon footprints, and high usage of water with effects on biodiversity. To address these challenges that impinge such project entails the adoption of sustainability practices throughout its life cycle: that is from production (use energy efficient technologies) and manufacturing (minimize resource use), proper disposal of e-waste, take action to minimize your overall ecological footprint. The approach towards environmental issues in technology projects primarily involves optimizing the use of energy and ensuring that resources are well managed.

## **Chapter 6 Conclusion**

This project successfully developed a comprehensive Android health and fitness application, aim to address the increased need for personal health management and activity tracking. The application contains a lot of functions including step counting, calorie burned tracking, water intake reminders, and personalized goal setting, all aimed at fostering healthier lifestyle choices. The project follows rigorous testing and feedback cycles to ensure usability and effectiveness, resulting in an application that supports users in their health and fitness journeys. Moving forward the work is mainly focused on incorporating wearable gadgets that help in improving data reliability and offer deeper level of understanding about health. Thus, the integration seeks to extract the significant data like those from fitness bands and smart watches, so the application may now give personal instructions and advice plus advanced tracking features. Additionally, if social sharing could be expended, more users would be willing to use the app and support each other on their fitness journeys. And in that way, they could be more motivated. These upgrades will help the app to be the benchmark for health tech and be a solution that is adaptable to the changing needs of the user's community.

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## Appendices

1. URL of my application code: <https://gitee.com/liang-ximeng/health-and-fitness-tracker/tree/master/Code>