



COMP2043.GRP Final Group Report

Boulder Climbing System

Team - 201815

Member's Name	Student ID
Tianhao Li	16522042
Mingda Liu	16522047
Yiming Chen	16522026
Denis Stepanov	20027064
Masrur Sobirov	16519829
Cheong Nam Kwong Melanie Mee-Lin	20027069

Supervised by Paul Dempster and Sheung Hung Poon

School of Computer Science University of Nottingham

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1 Introduction

Over the last year, a team of six computer science students have developed a mobile application for boulder climbers at the UNNC gym. The team went through the process of software engineering, designing and implementation of the mobile application.

This report aims to explain the whole application development process from the software engineering team's point of view. It is divided into several chapters. The background described in **Chapter 2** and consists of the initial problem statement of the project. **Chapter 3** describes the design of the application and analysis of a survey questionnaire[1] that the team carried out for the market research. It also includes findings on current existing systems, an academic and a technical research for this project. **Chapter 4** contains the system initial and updated requirements with their evaluation. **Chapter 5** describes the use cases, activity diagrams, design of the user interface and back-end and database. **Chapter 6** is about the implementation of the application. The project management involving the time line, tools, software engineering method used and meetings are described in **Chapter 7**. **Chapter 8** contains the reflection on the project from the team's point of view. Finally, **Chapter 9** contains some future work the team would like to undertake.

2 Background

2.1 Initial Problem Statement

According to the project brief description, Team 15 was asked by their client, Paul Dempster, to create a system that supports indoor climbing sport at UNNC. The climbing gym for this project is the two bouldering walls located on the second floor inside the UNNC sports center.

The bouldering activity is a form of rock climbing without the use of ropes or harnesses. It is carried out indoors on artificial hand-holds attached to walls instead of natural rock and the climbers are provided with landing mats to ensure safety. Bouldering involves short climbing routes or problems close to the ground. Each route consists of a starting point, ending point and several hand-holds that can be touched in between. Although completing a climb is a solo accomplishment, climbing is an incredible social activity. According to the author of 'The Mountaineers Book' [2], a climber needs a partner to ensure his safety while climbing on a rope. To boulder without a rope near the ground, he also needs spotters to help control his fall. Whatever the type of climbing, his partners are at his side motivating him and making the activity even more enjoyable.

Currently, the UNNC climbing club uses a WeChat[3] page to share a few bouldering routes. Upon meeting with the stakeholder, more details on the requirements were revealed. The stakeholder asked for a system where the users will be provided with a list of routes and their details, communication channels and feedback sections.

3 Research

This chapter describes the academic, technical and market research carried out for this project. It includes the design and analysis of the survey questionnaire, research on three different current systems available on the market and a study from a book obtained at the UNNC library. The following technical research also defines the tools considered for this project.

3.1 Market Research

In the initial stages of the project, the team agreed on collecting the data from potential users in order to guide the project development in the right direction. During our fourth formal meeting, our supervisor conducted a fifteen minutes session on ethics and introduced some research methods that our team could use: survey questionnaire, face-to-face interview or focus group meetings. Each of the methods have their own advantages and disadvantages. Therefore, we have decided to do the survey questionnaire due to the efficiency of this method. The team then proceeded with the drafting of the survey questions and consent documentation for the participants.

Main aspects that the team was looking for:

- bouldering habits of climbers;
- likes and dislikes about current products on the market;
- useful functions in current products;
- function improvement areas;
- feedback on initial prototype of the user interface.

The ‘Survey Team’, consisting of 3 members who would work on the questionnaire, used Qualtrics, a subscription software tool to design the online survey, **See Appendix**. The questionnaire included 16 questions in which there were 5 open-ended ones based on the bullet points stated above. The first four multiple-choice questions aimed at getting a better understanding of bouldering sport itself from the target audience. For instance, how climbers usually select a route to climb or how long does it take them to finish a single route. The open-ended questions allowed respondents to freely reveal their thoughts on the difficulties they face during climbing, their opinions on the current products on the market and the missing features in our prototype. The survey also contained the Likert scale questions on

a 5-point scale with which respondents could choose the option that best supports their opinion on our current ideas. Lastly, the participants could also leave their email address if they wish to keep in touch during the project development.

The survey officially passed the ethics approval on December 6th, 2018 and the team distributed the link of the survey to the group of people who would most likely go indoor bouldering at the UNNC gym. The survey was accessible for one month. In total, 48 people consented in taking part of the survey. Although, the number of participants was low, we have learnt several interesting and significant elements on how our software could be improved. The next subsection describes the survey analysis. See **Appendix** for detailed feedback statistics.

3.1.1 Survey Analysis

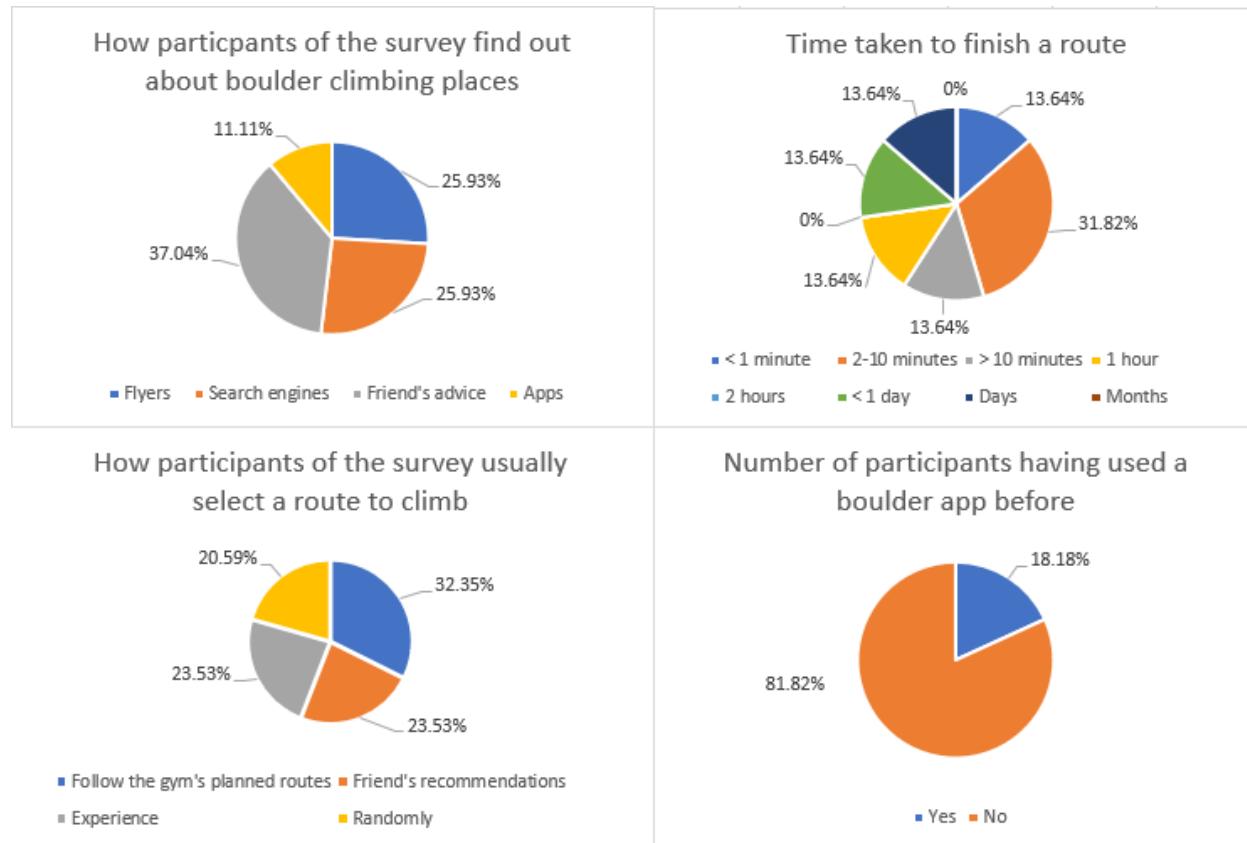


Figure 1: Survey results of some questions

According to the results, only 11% of the participants find out about boulder climbing places from related applications, while most of the participants (37%) find it out from friends' advises. It means that when our application will be published and people will be informed, it

could serve as a system to improve climbing sport and make it more accessible. Additionally, around 32% of the climbers simply follow the gym's planned routes to climb.

Our team did not know how to track the time the climber would take to finish a route. Results showed that climbers usually need at least a minute and at most few days to finish. Using these results, we can display the time taken to finish climbing a route. Moreover, we found out that 82% of the participants have never used a bouldering application before.

One of the questions was about what kind of difficulties climbers have during climbing a route. Although only nine answers were useful, three participants mentioned that they could not distinguish a route clearly and it is hard for them to remember the route if it is not of one colored hand-holds. The remaining six were unable to climb due to their lack of physical strength. From the start of the development, our team had thought on how to show and display a route on the wall so it could help the climbers on choosing and visualizing it. The result of the questions shows that displaying a route clearly is important and can help the users of our application.

The survey had three pictures of our application's initial prototype user interface and questions asking the participants on how they find it. More than 83% of participants agreed it is user friendly and gives them a better understanding of the routes. In addition, 75% of users agreed that the software will help them decide the routes more easily. Overall, our team understands from the results that our initial user interface satisfies the target audience, but it could still be greatly improved.

To conclude, the survey was beneficial for the team even though the number of participants was low. The data collected helped in designing a software which suits the needs of the target audience.

3.1.2 Current Systems Available

1. CANN WeChat Page

CANN is the official WeChat account [4] of the UNNC climbing club. Users share the bouldering routes by using an external social tool called "Weibo" [5] as an interface. In the homepage of their Weibo account, users upload pictures of routes periodically. For a clearer view of the specific routes, they highlight their start point, the hand-holds and the end-point while covering the rest of the wall picture with a translucent colored shadow.

2. Moon Climbing

Moon Climbing is a mobile application designed to support the Moon Board [6] invented by Ben Moon. It is a standardized 40-degree bouldering training wall that can be found in private and commercial facilities.

The app provides a picture of the wall with several grips and a specific route is highlighted by the hand-holds circled in different colors. The green circles represent the starting point(s), red is the ending point(s) and blue is the hand-holds that can be touched in between. Figure 2 shows an example.

Another interesting feature is that the Moon Board supports an LED system to identify the problems. The user needs to connect to the board via Bluetooth and selects a route in the application. The holds that make up that route will then be illuminated by their corresponding LED lights.

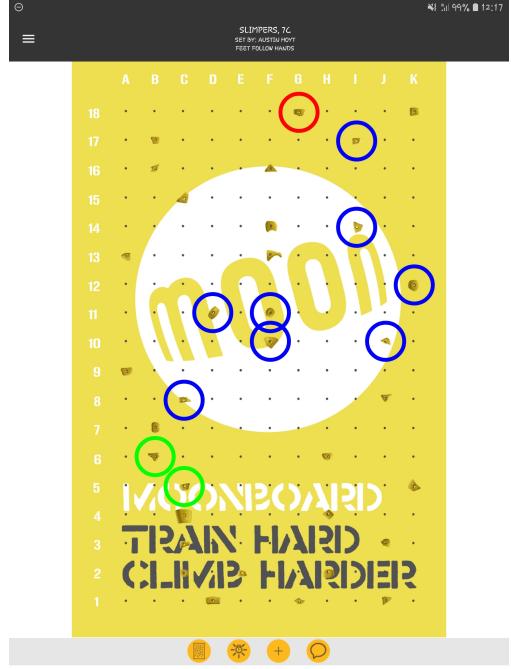


Figure 2: Moon Board App

3. theCrag

theCrag.com [7] is one of the largest rock climbing and bouldering platform for passionate climbers. It is a website providing all the climbing areas over the world ranging from Australia, Asia, North America, Europe and all the way to Antarctica. It has an online community forum where climbers can have a discussion and share the routes they have climbed over the world with videos and pictures. The climbers share the route name in the Logbook [8] with a grade and a description. Other climbers can also 'tick' a route to indicate they have climbed it and leave a feedback. An example is shown in Figure 3.

3.2 Academic Research

Our team also carried out an academic research. Our intention was to increase our knowledge on this activity. Therefore, a couple of team members used the NUSearch [9] and went to the UNNC campus library to search for books, articles or magazines related to boulder climbing.

Liang fen liangfen 19

Grades: AU Height: 12m Ascents: 6

TRAD




ACTIVITY

Check out what is happening on Liang fen liangfen (note there is an unresolved system issue where ascents logged before 2010 are not displayed in the stream below). If you just want to see beta then click on [view ascents with beta](#).

ticks updates discussions

Thu 14 Feb	 Andrew Baird red pointed a route at Maungarei Springs and mentioned Eric Horn. • ↗ 2103 • 5 weeks ago
Mon 4 Feb	 Andrew Baird worked a route at Maungarei Springs and mentioned Gianna Evans. • ↗ 1063 • 6 weeks ago
Sun 3 Feb	 siva-blaize faalavaau ticked a route at Maungarei Springs. • ↗ 2003 • 6 weeks ago
Sat 2 Feb	 ✓ 19 ★ Liang fen liangfen — Good — with Gianna Evans.

DESCRIPTION

Follow the crack over a small roof then finish at the anchor of Morning Coffee.

SEASONALITY



Figure 3: Example of a route named Liang fen liangfen located in Maungarei Springs

Unfortunately, very few sources were found. The team members got only two bouldering handbooks. Only one was taken and studied as it had more significant information.

The book our team studied was by Jerry Cinnamon – “The Complete Climber’s Handbook”[10]. It mentions that Jerry has been climbing for more than 30 years. From the book, we found many useful suggestions or tips on how to improve in boulder climbing from his and other climbers’ accumulated experience. It also discusses on the differences between indoor and outdoor climbing, equipment used, movement and grips techniques as well as other parts of climbing. The explanations of techniques in the book are very clear and it uses simple pictures to demonstrate the different grips climbers can incorporate in their climbing.

We noted down some interesting discoveries from the book, such as the types of handholds and finger holds. It is explained that climbers can use different type of grips such as cling or vertical grips when needed, as well as their effects. Additionally, the book has suggestions on how to move properly during climbing; how to change or switch feet in difficult situations to advance higher.

3.3 Market and Academic Research Conclusion

From the research on previously mentioned three currently existing systems, the team came to realize how and what type of information the boulder climbing systems are present today. We gathered valuable information from the climbers on our university campus via survey. From the book we studied, our team had realized that we need to include a feature for the users that will ensure their safety and make climbing more accessible. Overall, our team recognized the amount of research and the knowledge that we gained was very helpful in developing our software during the project.

3.4 Technical Research

3.4.1 Operating System

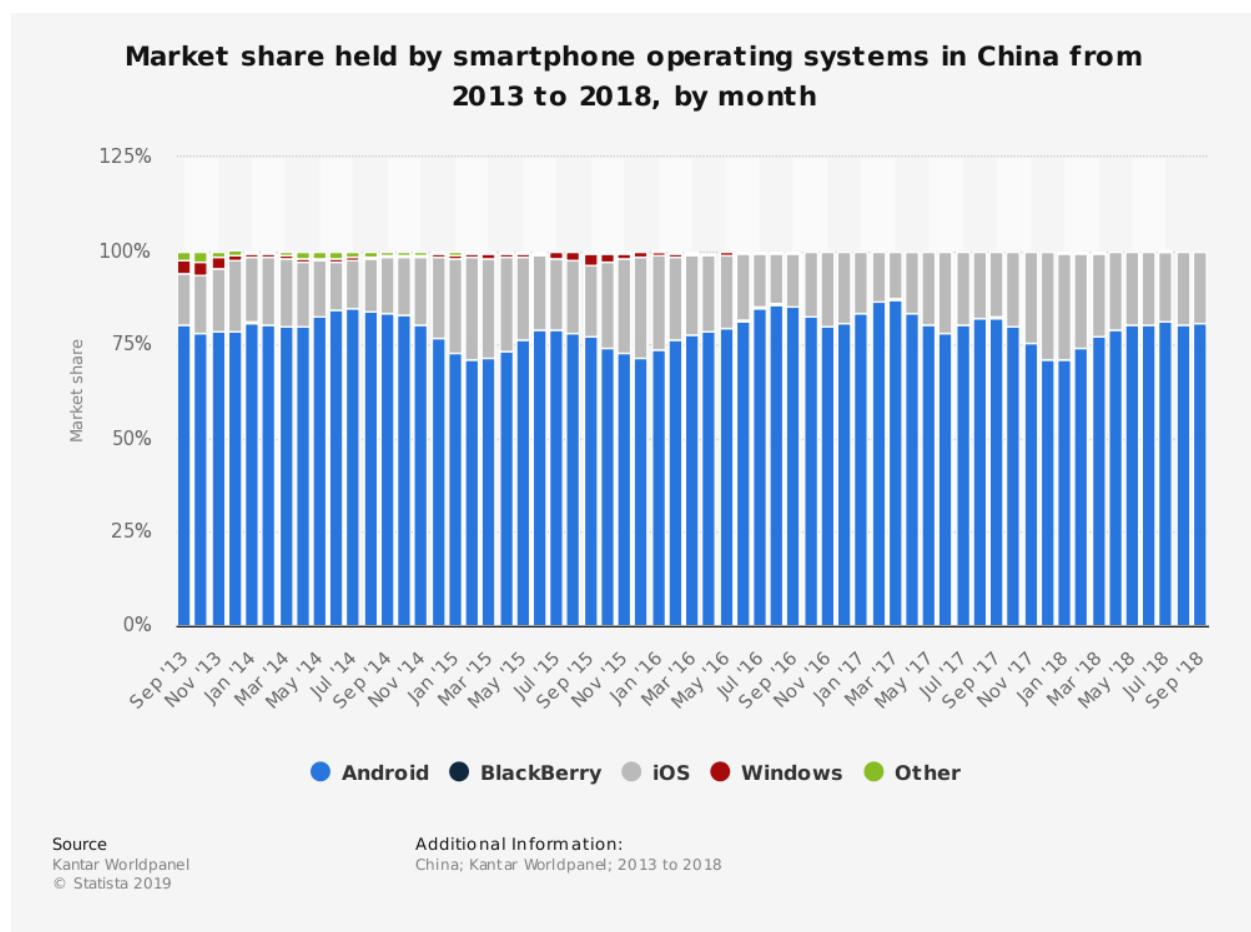


Figure 4: market share in China held by OS from 2013 to 2018 [11]

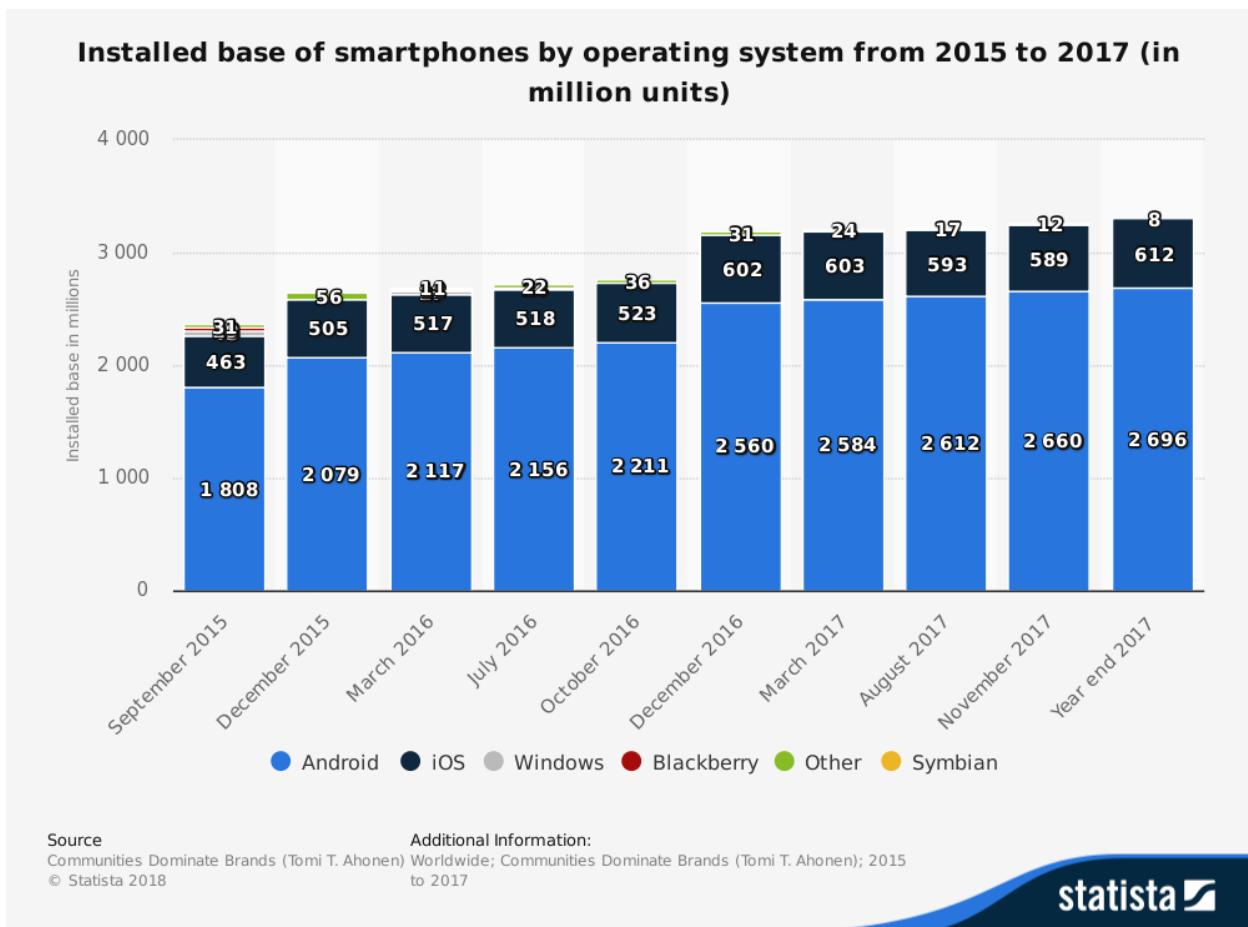


Figure 5: app installed global in different OS from 2015 to 2017 [12]

Android

Android is a mobile operating system developed by Google. It is based on the Linux kernel and other open-source software, and is mainly used on touch-screen mobile devices such as smart phones and tablets.

iOS

iOS is a mobile operating system created and maintained by Apple, specifically for its proprietary hardware. It is an operating system that provides motives to many mobile devices in different corporations. It is the second most popular mobile operating system in the world.

OS	Advantage	Disadvantage
Android	Massive user base[13]	Slower response than IOS when opening the same application[14]
	Open source framework	Processor gets heat after long time using
	Can be developed on Windows, Mac and Linux	Connects to Internet , personal privacy may be disclosed
	Easier for testing because of various simulators	Becomes slower after installing many applications
	Free for development	
	Java supported	
	Can connect to hardware easily to achieve more functionality	
IOS	Excellent security	Not open source
	Official support	Not as many users as Android
		Not easy to develop on Windows
		Apple restricted the connectivity with iTunes
		Applications are larger compared with other mobile platforms
		Expensive

Table 1: Operation System Comparison

3.4.2 Integrated Development Environment (IDE)

Android Studio

Android Studio is the official IDE for Android programming and built purposely for Android operating system to construct the appropriate environment for every device. It offers dedicated features and plug-in for developers, such as debugging, testing and analysis tools.[15]

Advantages of Android Studio: [16]

1. Gradle-based build system: Gradle is an open source project construction build tool, which can help you organize the library and projects automatically. It also has strong dependency management and supports multi-project construction, reducing the complicated building procedure and configuration. It is completely integrated into Android Studio, making the project building portable and providing maximum convenience to build the project.
2. Various developer-friendly built-in accessibility: Intelligent prompt completion, built-in terminal, powerful UI editor, real time application layout rendering, multiple APK

generation and so on can significantly reduce unnecessary effort when coding for the developers.

3. JAVA support: JAVA is a popular programming language, supported by abundant reasons. One of the most crucial account is memory manageable, which means programmer does not need to worry about the memory leaks or free memory all the time. Since Android is a memory management environment, the choose of JAVA becomes a trend by many companies and frame development, leading to the decrease in errors and increase in application efficiency.
4. Version control systems (git): Git is an open source distributed version control system that can efficiently control the project version management. Android Studio has implemented Git as a full functional, integrated source control tool with user-friendly interface, which will make developers can work more efficient as a group without any specific background experience on Git.

Disadvantages of Android Studio:

1. Complex installation and SDK version controls: it is difficult for the new user to install the complete and workable Android Studio at the beginning.
2. Low start speed and responding time: the compiling, synchronization and running on the virtual machine always take plenty of time.
3. Hard to employ the customized framework: this feature is explicitly not allowed by Gradle, which dramatically decreases the scalability of the project when developers want to employ their own framework.

Eclipse

Advantages of Eclipse

1. Creating projects is simpler and less time consuming.
2. Small project size: All files are required without redundant configuration files. Limited to few megabytes.
3. Low updated frequency of profile: Compared with Android Studio, the low updated frequency ensures to avoid the unnecessary error due to the low version profile and update failure.
4. Convenient multi-project management.

Disadvantages of Eclipse:

1. High response time and require high performance of CPU and memory: Such situations will occur when dealing with big project or using various plug-ins.
2. Strict plug-in installation and version requirement: It is perplex for Some plug-ins to fix and update. Additionally, The plugin has strict requirements on the eclipse version, and the plugin update speed cannot keep up with the eclipse update speed.

3.4.3 Database Connection

MySQL

It is a small relational database management system, which support the query language, with high portable, simple and compact installation. It also has good operational efficiency and rich information network support. However, based on the database size our software requires, the performance is not excellent compared with some other lightweight databases.

PHP

It is a general open source scripting language. Its' mature architecture, stable performance, embedded development method and simple syntax make the system develop rapidly. Increased safety and flexibility features are another good reasons to make it popular among other scripting languages. While the phone is not a appropriate platform for PHP to be employed, there are several examples that exist.

JSON

It is a lightweight data exchange format which database connection can employ. The data format is simple, easy to read and write. Furthermore, Simplified code development for both server and client. However, the promotion is not deeply rooted and widely used, and is not as versatile. In addition, it cannot be analyzed in JAVA language, so that the third-party library must be imported.

jdbc

It is an external library which support JAVA to connect to database. It reduces the workload on the sever by transferring the connection code from server to the client component. JDBC has very simple syntax which is a huge advantage over other external libraries for server/client

connections. However, the poor performance and increasing cost of the source code in the client side are drawbacks.

3.4.4 Technical Research Conclusion

From the research results, it has been found out that the Android mobile OS has a larger user base than IOS in China. Android applications can also be developed using any of the current major operating systems which is very convenient. Therefore, Android was chosen according to these advantages and from the suggestions of the supervisor. Under Android environment, the Android Studio was selected based on the JAVA and Git support, and various convenient functions for developers. Because the application is mainly based on the data from the database and intra-group cooperation, the memory management and version control should be considered significantly. Additionally, Android Studio has more robust and convenient features for developer to use. For the choice of database and corresponding language, MySQL with PHP was chosen since this combination is popular with almost every modern project structure and generally accepted among many developers.

4 Requirements Specification

This chapter describes the main requirements for the project. There are two types of the requirements: functional and non-functional. Functional requirements define what the system should do, while non-functional requirements display how the system works. The requirements for this project were collected from the supervisor, as he stated primary functions of the application that need to be implemented during formal meetings. As the project progressed on, some of the requirements were modified, removed or replaced by other features.

4.1 Functional Requirements

1. Anybody can start the application and use it right away.
2. The application is required to give user various routes selected by favorite filter.
3. The application must have the choice of different walls.
4. The user must be logged in with valid credentials in system to start climbing.
5. Managers must have additional features, such as adding/removing comments, adding/removing/editing routes
6. The application must have various type of feedback available for users, such as rating system for any route to show for other users, commentary section, etc).
7. Every user has their own account and settings page with various features, such as the choice of the last route or finding most favorite (climbed most) routes.
8. The application must allow the user to delete/edit a comment.
9. The application must check for updates if any of the holds were changed on physical wall.
10. The application must display all the information about every route, such as average climbing time, difficulty and rating with comments (if any of them exist).
11. The application must have communication between climbers as chat services.
12. The application must have a menu navigation bar for quick responses on user requests.

4.2 Non Functional Requirements

- Usability

The user interface should be intuitive, easy to use and understand. Any user should comprehend the meaning of each button, text field, or figure we used in the application without any confusion. All the functions in the application should be interactive and have an attractive design.

- Performance

The application should load within 2 seconds of clicking the icon in the offline mode. The selection of any button or feature in the application should take at most 1 second to load.

- Connectivity

Some of the features which require internet connection are not estimated in time completion because of the dependency on connection speed.

- Operating Environment

The application should work on Android operating system.

- Security

All the information provided by users during registration and later usage of the application should be stored on the database servers and not accessible by any other user.

4.3 Priority & Risk

All the functional requirements are sorted in priority order from highest to lowest. Moreover, all the requirements have their risks - the expectation of loss (probability) during development, and impact, the degree on which the project will be affected if any of functionality loss reaches one hundred percent.[17].

For simplicity, below is the summary table of functional requirements with their priority levels and risks. Priorities are rated from 1 to 4, where 1 is most important and 4 is at least importance. Risks are rated on impact from 1 to 4, where 1 is rated most important (catastrophic) and 4 is at least importance (negligible)[17].

ID	Name	Priority	Risk	
			Probability	Impact
1	Application Start	1	5%	1
2	Walls	2	20%	1
3	Routes	2	10%	1
4	Log In	2	20%	2
5	Feedback	2	40%	2
6	Manager	3	60%	3
7	Updates	3	70%	3
8	Comments	4	70%	4
9	Preferences	4	30%	4
10	Route Information	4	10%	4
11	Chat	4	75%	4
12	Navigation Bar	4	20%	4

Table 2: Priorities and risks of functional requirements

4.4 Modified Requirements

As project progressed over, many of the functional requirements have been changed. As of today, there is no managers feature available (**requirement 5**) because there was no confirmation with the UNNC stuff members about managing the routes and walls for the application and also time constraints. Additionally, **requirement 7** was changed. Users have three main choices to go from the start page: Favourite, Recommended and Popular. The idea of using those came from research on other applications, survey[1] and testing of the software. More on the features of the application is described in later Implementation and Design section. **Requirement 10** was modified to show only difficulty and rating (removing average time display), as it was analyzed from the conducted survey recommendation. **Requirement 11** was removed as it was not implemented on time of application publishing due to time constraints.

Our team had no change in non-functional requirements section as it was a standard for us to follow through all the project development since day one.

5 Design

This chapter includes the use case and activity diagrams, the design of the user interface, database and architecture of our application.

5.1 Use Case Diagrams

Initial Use Case

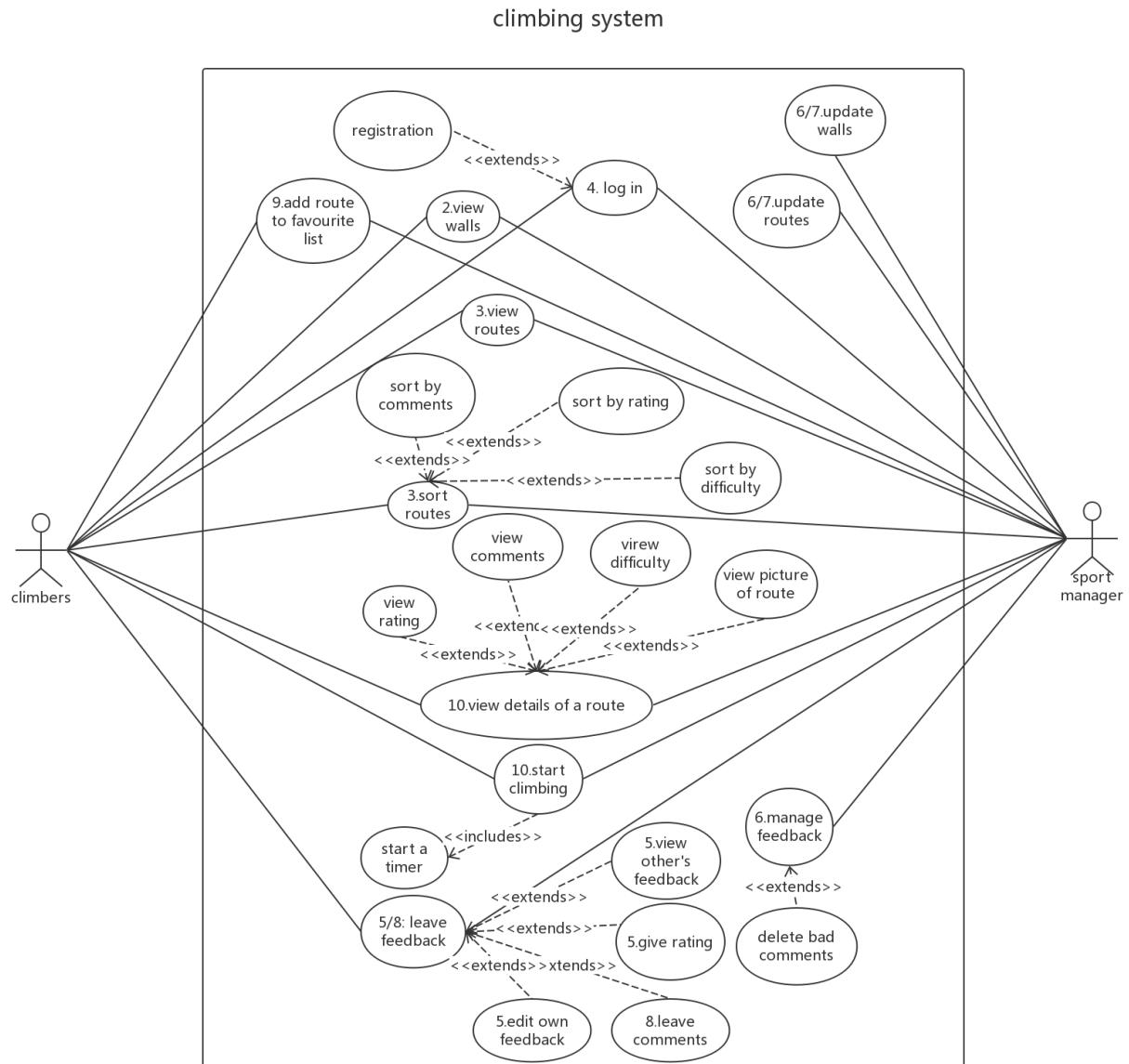


Figure 6

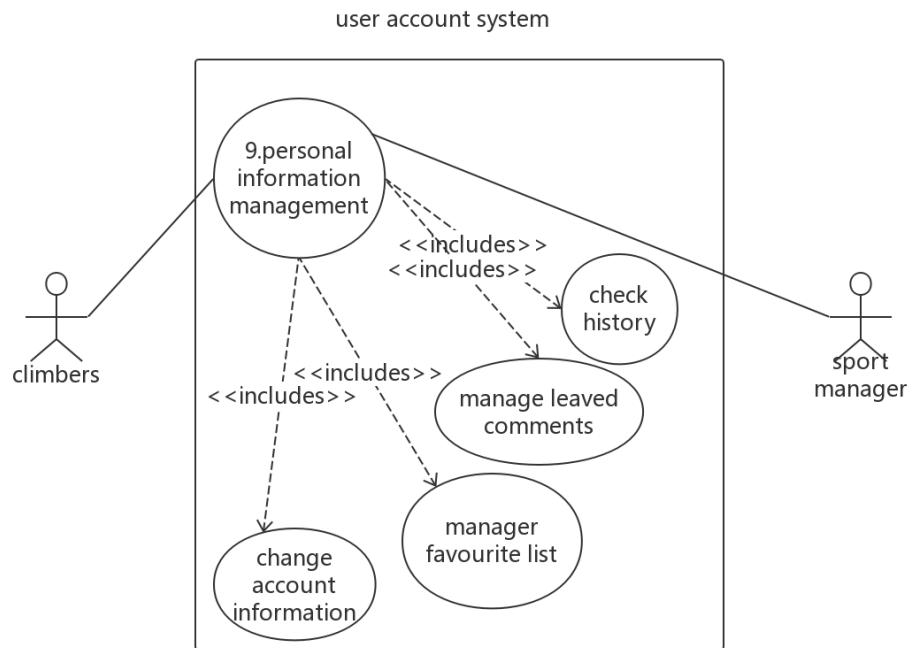


Figure 7: user account system

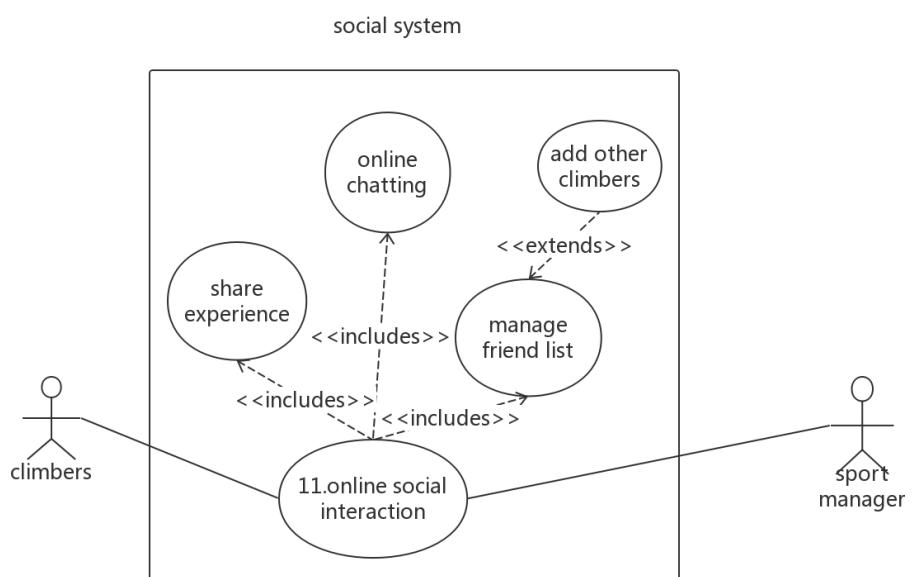


Figure 8: social system

The use case above describes the interaction between the two different users and the systems. There are three systems cooperating with each other in our application, which are climbing system, user account system and social system. The use case in the diagrams are designed based on the functional requirements analysis, referring to the **Section 4 Requirements Specification**.

The climbing system is the most important part of the application, where the basic climbing features which the user needs to finish an integrated procedure of climbing a route are all included in this system. The main functions are: log in, register, select walls and routes, view details, browse feedback and leave comments. Moreover, sport managers can also participate into our application. Related actions consist of the belonged walls, routes information maintenance and commentary management.

For the user account system, it aims to supply a complete functionality for users to manage their personal information, where account information, history checking, feedback management and the favorite routes lists are involved.

The social system is designed as an independent subsystem for users to serve a communication feature which allows climbers to interact with each other and share own experience and technology online.

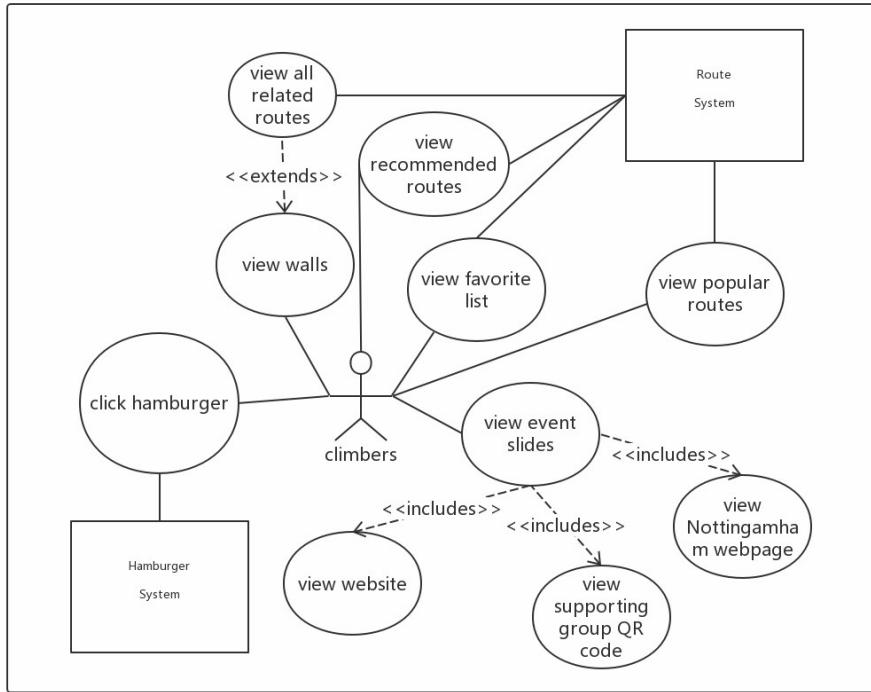


Figure 9: main system

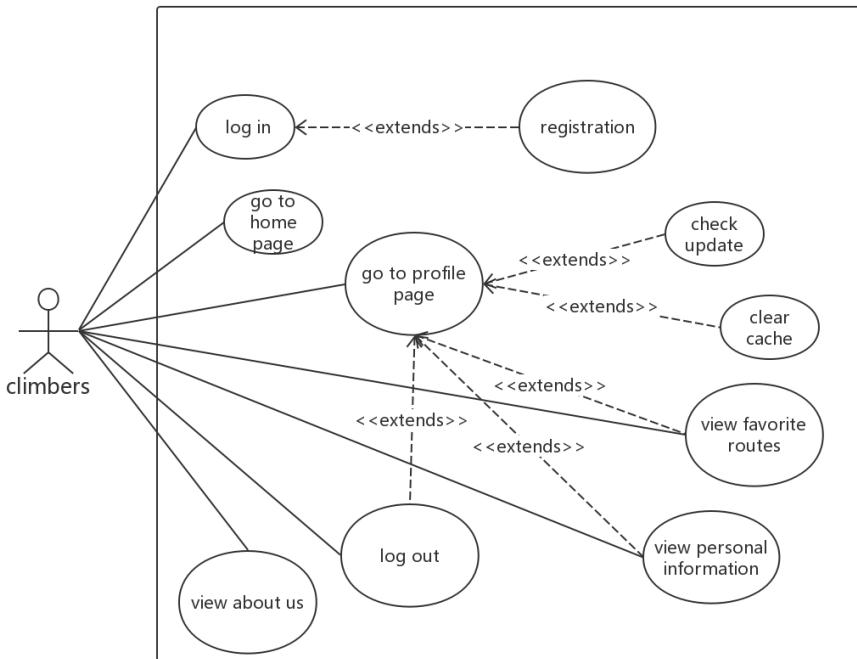


Figure 10: Navigation drawer system

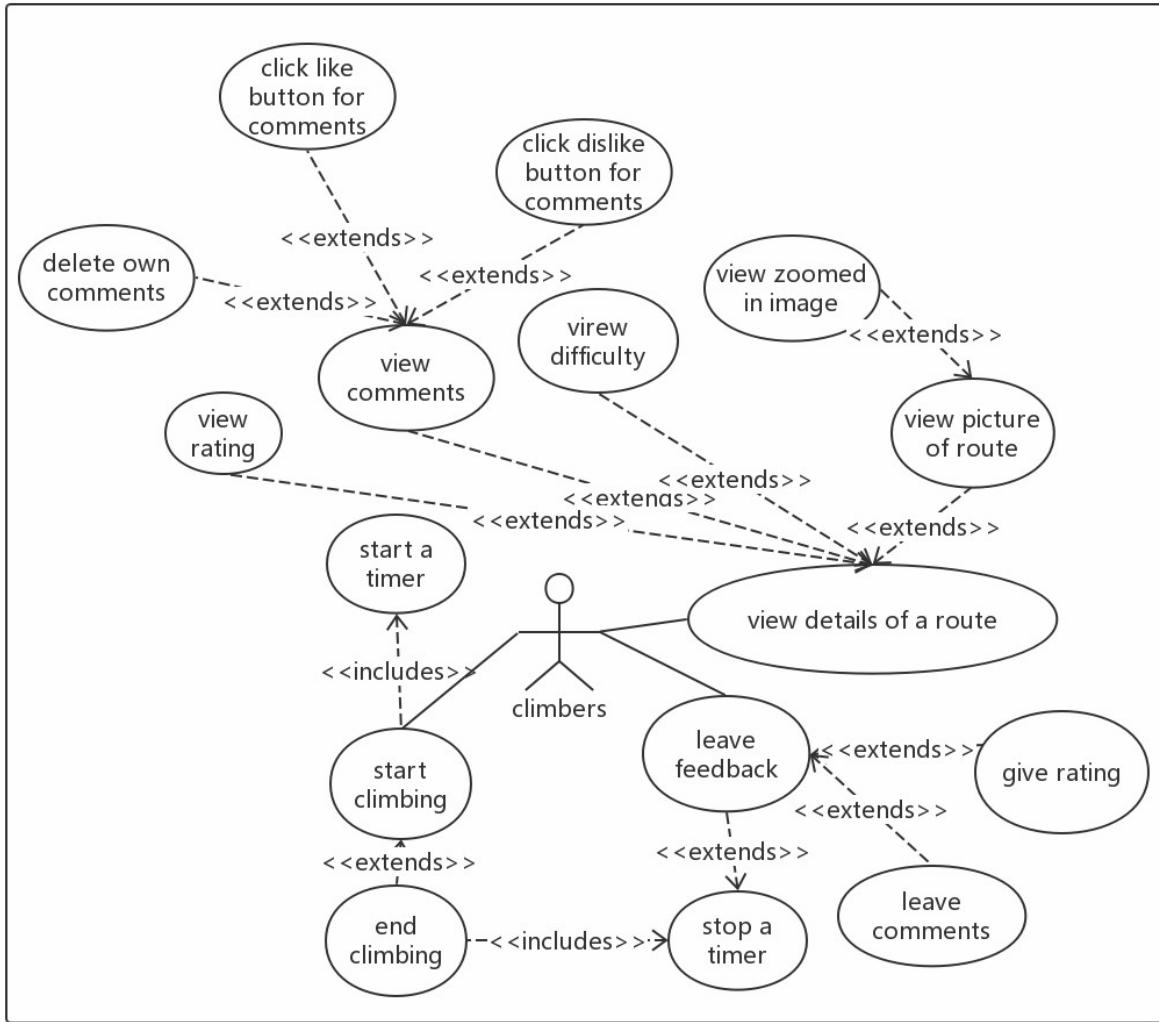


Figure 11: route system

5.2 Use Case Modifications

Our application is re-parted into another three systems, which are main system, route system and navigation system, communicating with each other. Most of functionality are kept as the initial requirement specification. However, because of some reasons like complicated implementation and low priority, we omit some unnecessary features to keep our application simple and useful. Some of the new requirements are added into our to-do list to accomplish a better user-friendly software.

The manager role and manager mode are removed since the insufficient communication with

the sport manager in the gym, the necessary support and information are not accessible. Additionally, the switching between double modes are also complex and prone to errors, the uploading and management features of manage mode involve various changes of database and back-end implementation. Therefore, this manager mode is discarded and put to future work instead.

The hamburger system, or navigation drawer menu, [18] is a new designed system which includes integrated shortcuts for user to access some functions effectively, like log in, log out, Home, favourite routes list and about us page. It is added as new requirement in order to provide convenience to user rather than using enormous buttons located in different pages to confuse them.

5.3 Activity Diagram

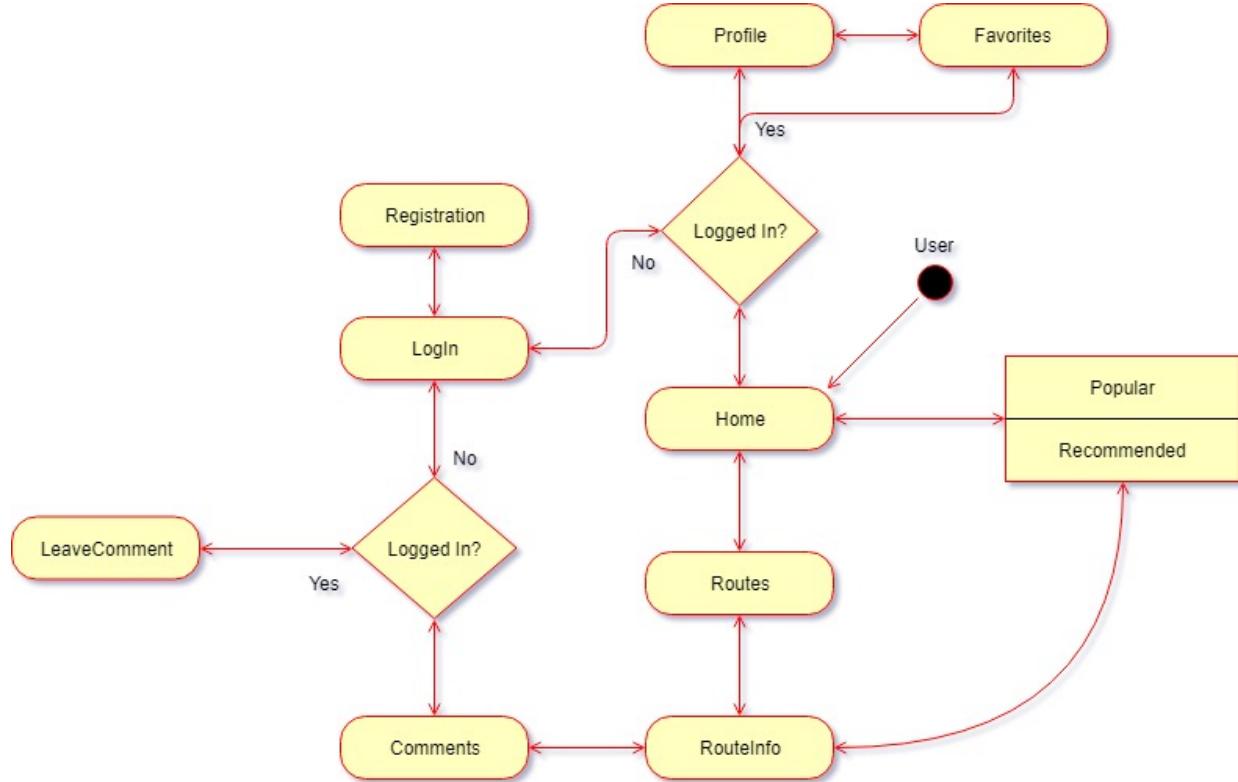


Figure 12: Activity diagram

The activity diagram [19] shown in Figure 12 is used to help in the visualization of how the Android's activities interact with each other in our application. Each activity has a function

or use which satisfies the requirements of the software. For instance, from the diagram it can be seen that the first page user sees is Home page. This fulfills the first functional requirement of the software, anyone should be able use the app from the start.

The following table in Figure 5.3 briefly describes the activities.

Activities	Description
Home	Recommended, popular and favorite routes or walls.
Routes	List of routes of chosen wall from the Home page.
RouteInfo	Information of specific chosen route like difficulty and rating.
Comments	Page with comments users left on specific route.
LeaveComment	If user logged in to their account, they can leave a feedback. Otherwise, the user will be redirected to login page.
Login	Credentials check for use of additional features.
Registration	Registration page where user creates an account with their credentials.
Profile	Profile page with the user's information if user is logged in.
Favorites	List of favorite routes of the user.

Table 3: Activities description

5.4 User Interface

5.4.1 Low Fidelity Prototype 1

After our team got the initial requirements of the application from the stakeholder, the paper-based prototype was used to have a visual representation of how the app would look like and what basic functions it would have. The low fidelity prototype as shown in Figure 13 was presented to the stakeholder/supervisor.

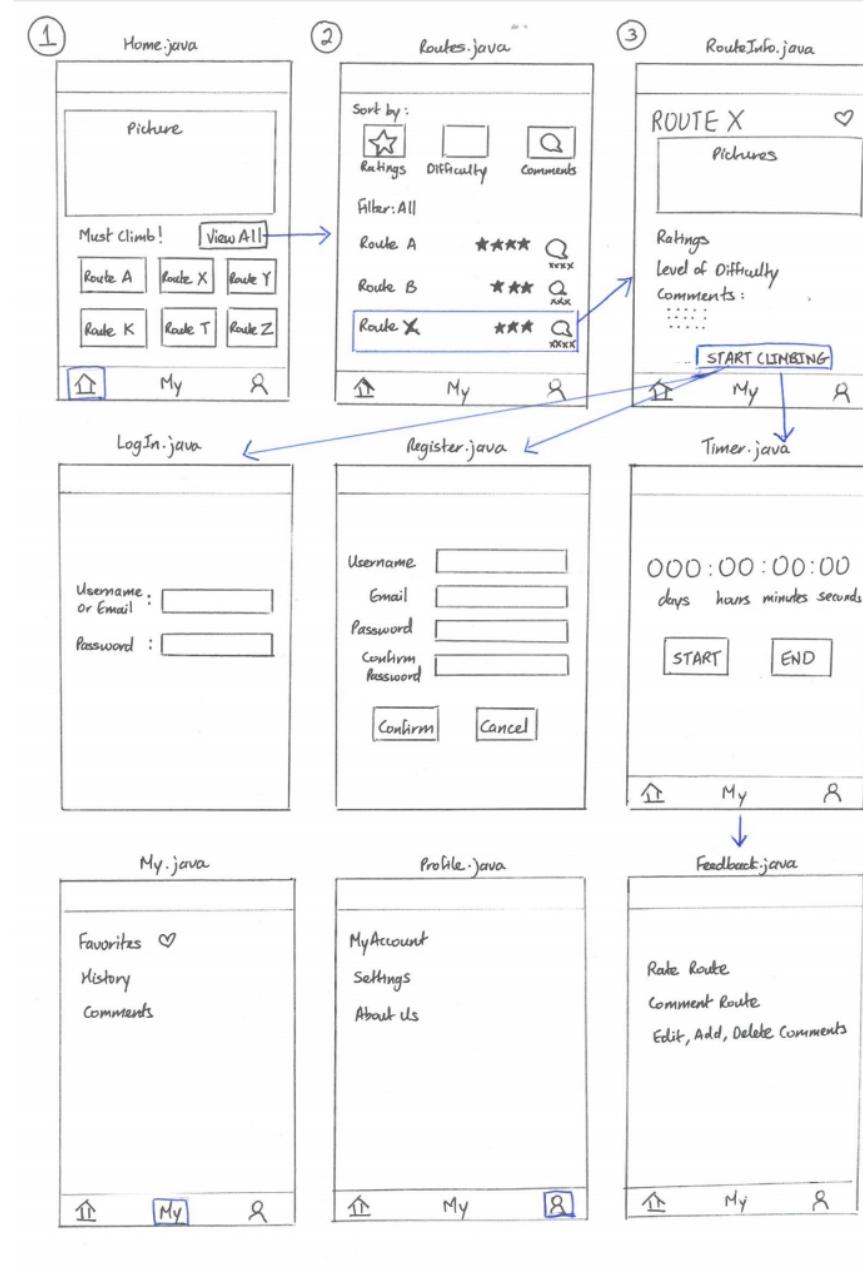


Figure 13: Low Fidelity Prototype 1

Suggestions from the supervisor:

Suggestion 1: Combine My.java and Profile.java because they generally have the same role.

Suggestion 2: Include 'Most popular' and 'Favorites' in the Home activity. It would be convenient for the user to access them at the launch of the app.

Suggestion 3: Have the rating and commenting buttons placed in the route information page. Users should be able to rate and comment a specific route and not the whole wall.

Our team took notes on these advises and reflected them in the prototypes which follows below.

5.4.2 Low Fidelity Prototype 2

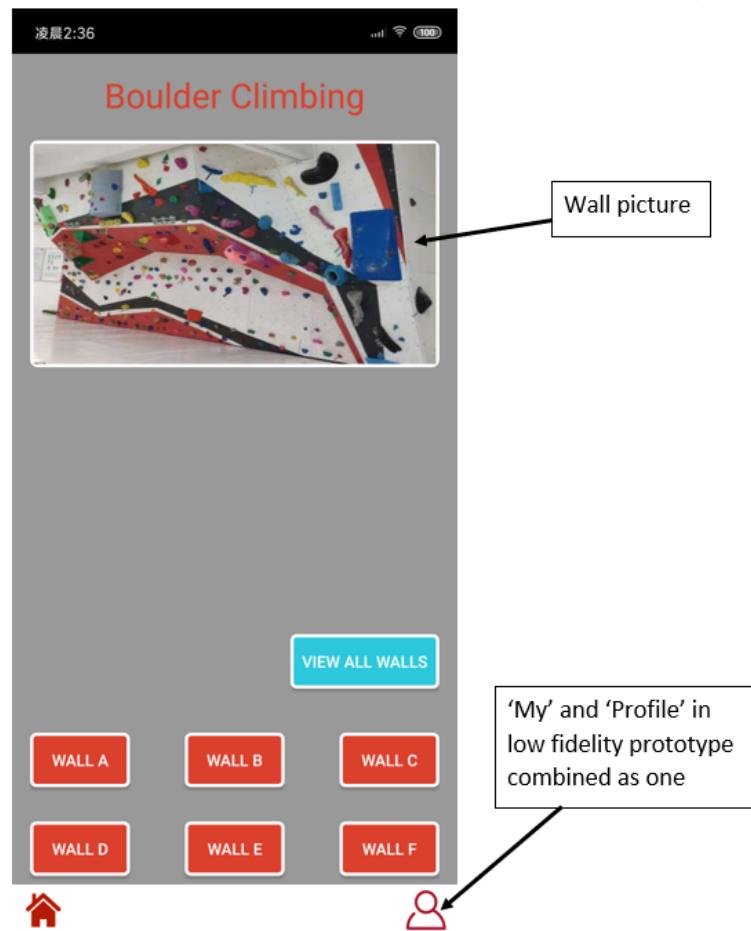


Figure 14: Home user interface prototype 2

After the discussion and analysis of the low-fidelity prototype, another prototype has been generated using the Android Studio as shown in Figure 14.

In the footer of the Home interface, 'My' and 'Profile' from the low fidelity prototype Figure 13 have been combined into one as per the supervisor's **Suggestion 1** mentioned previously in **Section 5.3.1**.

5.4.3 High Fidelity Prototype

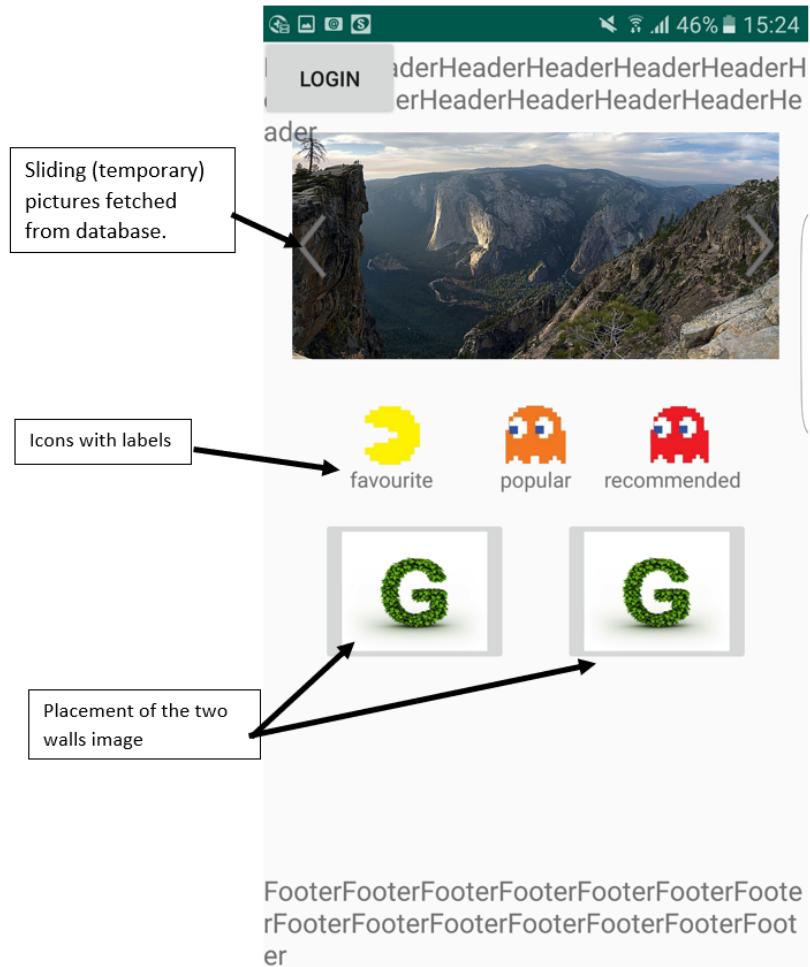


Figure 15: Home user interface prototype 3

At the time of developing latest prototype Figure 15, the database connection was established and the user could log in, if an account has been created before. To test out the image fetching from the database, a random picture of a mountain was stored. It is then fetched and displayed on the home screen. In the later development of the application, the sliding

pictures would be replaced by informative pictures, such as a QR code to the bouldering group chat and our project website.

The placement of the icons and some features are added according to the supervisor's **Suggestion 2**. Three shortcut icons with a text label each, namely 'Favorite', 'Popular' and 'Recommended', are included in the Home screen to provide easy and quick access on the first launch of the app to the user.

The use of the application title bar and bottom navigation as the footer are reconsidered in this design.

5.4.4 Final User Interface

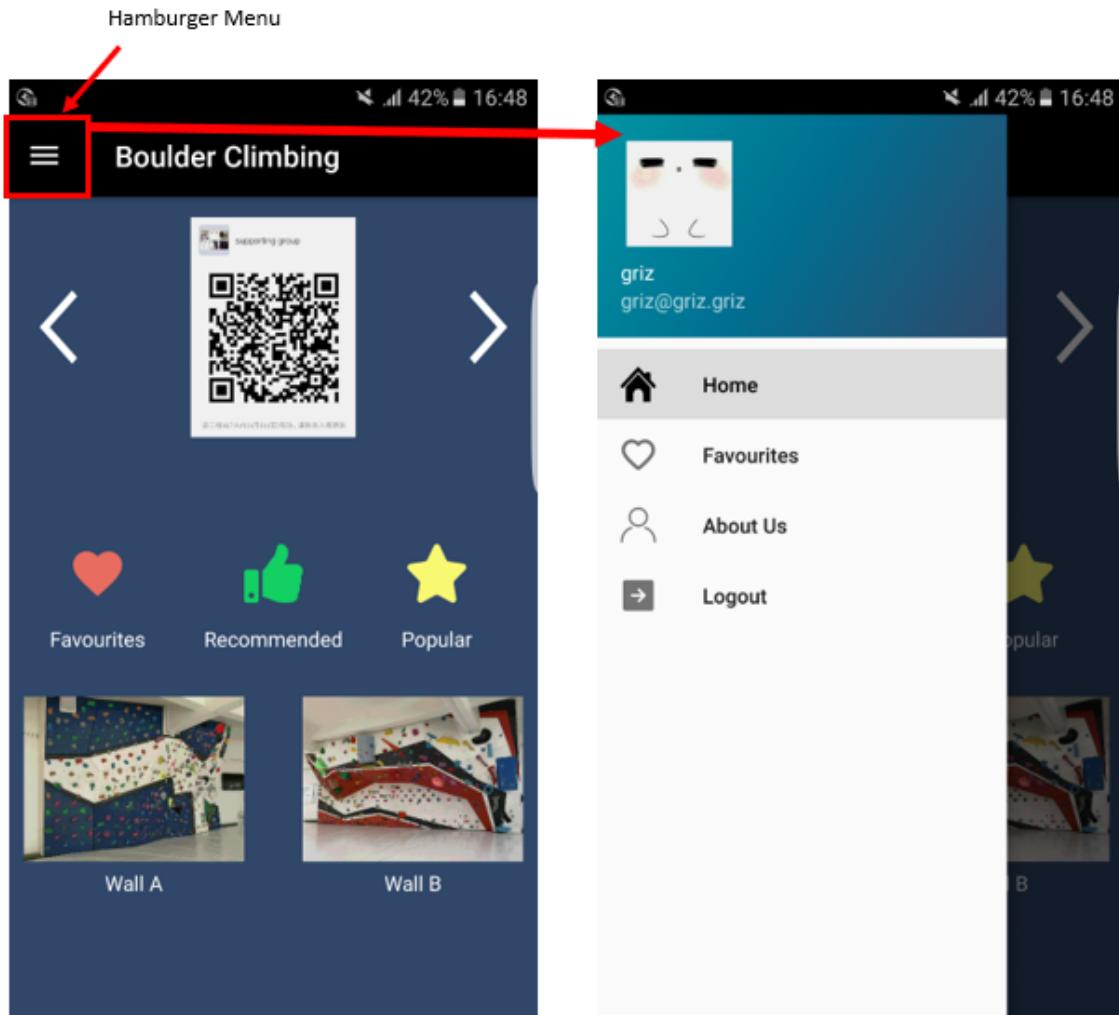


Figure 16: Final Home page user interface

In the final Home user interface of the application as shown in Figure 16, real data

(pictures) are used. At this stage, the pictures of the walls and routes have been stored in the database. In the top part of the screen, there are two sliding pictures: QR code of the support group chat and a picture link to the team's project website. The placement of the icons 'Favorite', 'Recommended' and 'Popular' was changed to the middle of the screen. A text label is added under each icon to further enhance the recognition of the icons.

The user will primarily use the lower half of the home screen to access the other pages. If the user is logged in, they can access favorite lists by clicking on the Favorites icon. 'Recommended' displays a list of routes based on the lowest difficulty. On the other hand, 'Popular' icon displays the list of routes which has the most likes from the users. Wall A and Wall B are clickable images where each will direct the user to the list of routes the wall contain. As mentioned in the previous prototype, the bottom bar navigation has been reconsidered. The home interface already consists of all the primary destinations of the entire application. To reduce clutter on the screen by the addition of a footer, a navigation drawer menu has been used. The user can either click on the three bars in the top left corner or slide the screen to the right to see more options like 'About Us' or 'Log out' of his account.



Figure 17: Route Information Display

The Figure 17 displays the UI of Route Information page. This page shows the layout, rating and difficulty of a chosen route from the list of routes. A picture can be seen which illustrates a route's layout of handholds. If the user wants to try a given route, they can press on "Start Climbing" and climb it as shown on the picture. In addition, a timer starts when the button is pressed, which records the time of climbing. When the user finishes climbing a route, the same button can be pressed and the time elapsed is displayed on the screen. The average rating of a route is calculated from users' feedback and shown to user on this page. Next, the difficulty shown on this page is fixed and gives an idea of how hard this route is. Finally, the two buttons on top are "Discussion Room" and "Favorite" buttons. When the former button is pressed, user is moved to Discussion Room which is described further. The Favorite button saves the route in Favorite Routes page if user likes it and presses on the button.

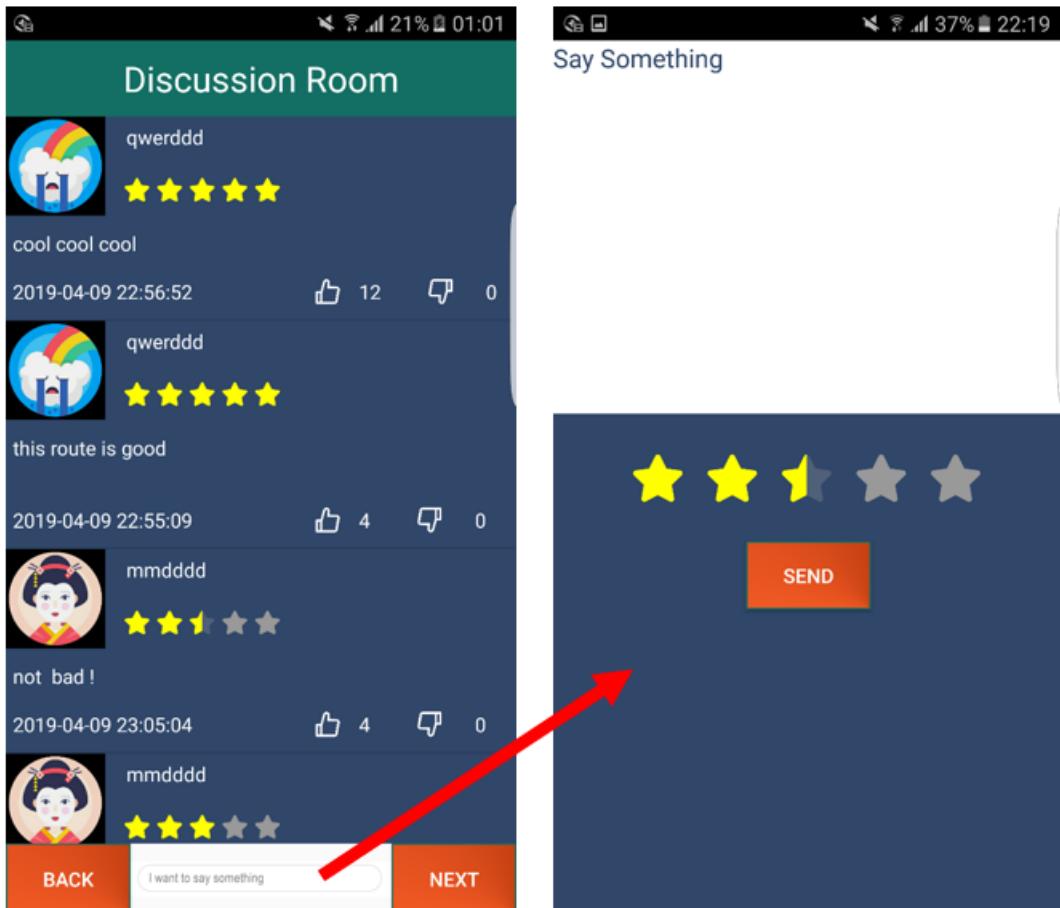


Figure 18: Discussion Room

The page on the left of Figure 18 displays the Discussion Room of specific chosen route of a

wall. Here user can see the comments other users had left, and their ratings of the route. User can also agree or disagree with a comment, and they have ability to like or dislike a comment. The Discussion Room shows at most 10 comments at a time, user can go through pages of comments by pressing on "Back" and "Next" buttons. If the user wants to leave their own feedback on the route, they can press on "I want to say something" button on the bottom of the page and a feedback page will show up like on the right of Figure 18. The function of the this page is to allow users write their opinions on the text box and rate the route on 5-scale rating. Next, when user presses on "Send" button, the feedback will be submitted and they can see it in Discussion Room.

User Manual

For the complete step by step walk through of the application, please refer to the User Manual [20] included in the **Appendix**.

5.5 Back-end Design

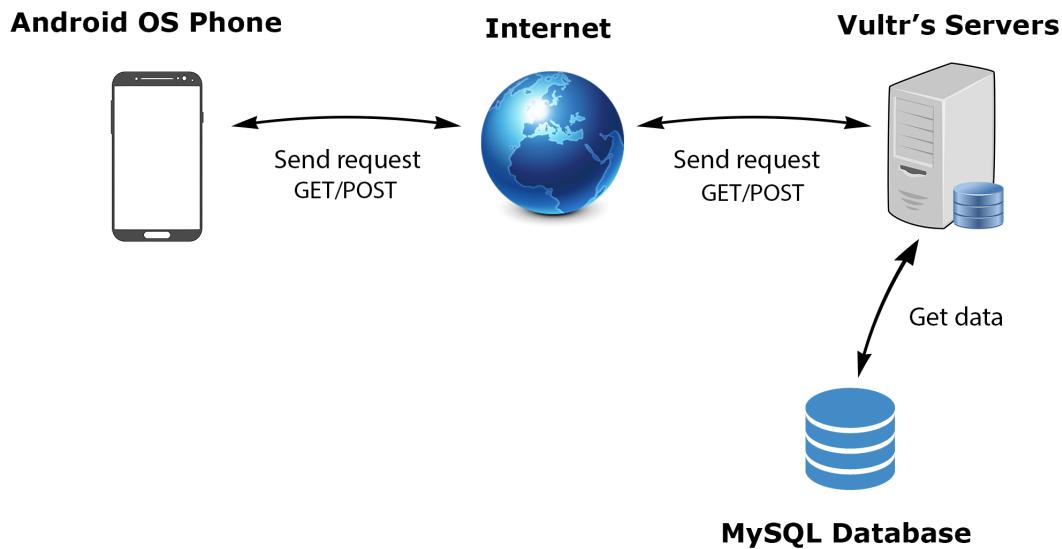


Figure 19: Database connection overview

Figure 19 above illustrates the general idea of how our app is connected to database

The LAMP[21] model is employed in our back end design, which represents the Linux, Apache, MySQL, PHP. There are sets of free software that is usually used together to run dynamic websites or servers. They are operation system, web page server, database management system and scripting language separately. First, Virtual Private Server (VPS) was purchased and applied into our project from VULTR [22], a website which provides a various number of servers. Then, MySQL database is created on that server with corresponding tables and attributes set **referring to the 5.6 section Database Design**. A new user default account was created in our application for testing purposes with the appropriate privileges. The most essential component in the model is the PHP files which controls all of the data transmission using GET or POST, connection creation and information authentication. Three different types of classes are devised to execute these features. Finally, the android application connects to database under internet connection by accessing those PHP files to call the interfaces and functions to achieve the data fetching and updates. Hence, Android OS device can get all route images and information.

In addition, shared preferences, a feature that can help phone to store the fetched data locally on the phone, is also employed, so that user can assess all data shown on the phone without any delay after the first launch.

5.6 Database Design

As the ER diagram (Figure 20) and Referential Integrity Constraint diagram (Figure 21) show, there are six tables. Below is the explanation of each diagram:

1. Version table: it only has one attribute which stores the version of our application. A button can help the user to check whether the application he or she use is the newest one. At this time, the data in version table will be used.
2. User table: it contains each user's information such as user ID, user name, email, etc. One thing should be pointed out is that we use a password hash and salt to guarantee the safety of the password since we cannot directly save users' passwords into the database, which is not safety.
3. Wall table: In our project, we focused on two walls in UNNC gym. This table provides a room to save the description of these two walls.
4. Route table: First, the table has the route ID, name. And the 'BELONGTO' attribute contains the wall's ID. Besides these basic information attributes of routes, this table contains a special attribute called 'DIFF'. The data in this attribute stands for the difficulty extent of routes which was offered by the manager of the walls.

5. Favorite table: This table stores a specific user collected which routes. This table is necessary because if data in this table is stored into user or route table, there would be too much repetitive data. And based on the number of users who collect the same route into the favorite list, the application system picks the most popular routes and lists them in the popular interface.
6. Comment table: A comment has a corresponding owner and evaluates a single route, which means that there should be a foreign key from user table's primary key, and another foreign key from route table's primary key. And each comment could also be evaluated from other users through the like and dislike buttons. 'GOODNUM' and 'BADNUM' record how many users like or dislike one comment. Additionally, when user leaves feedback, he or she can give the route a mark from zero to five which represents how the user like this route. In route information page, users average mark is shown.

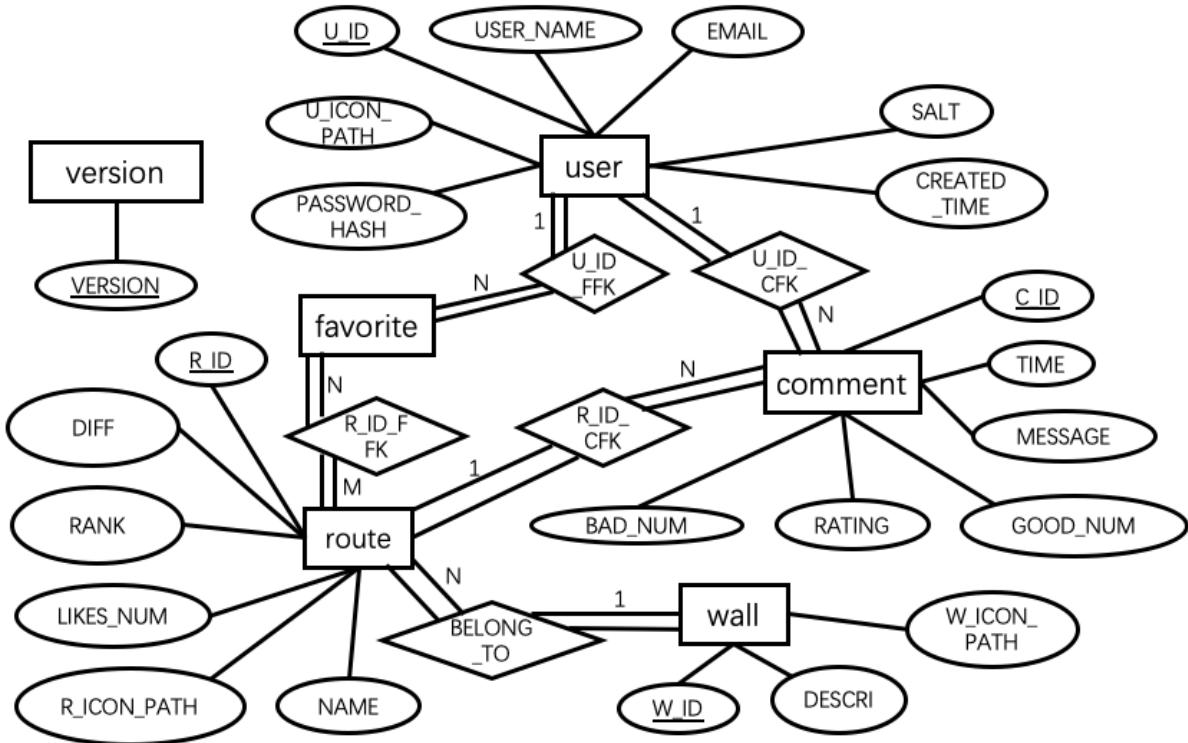


Figure 20: Entity Relationship Schema

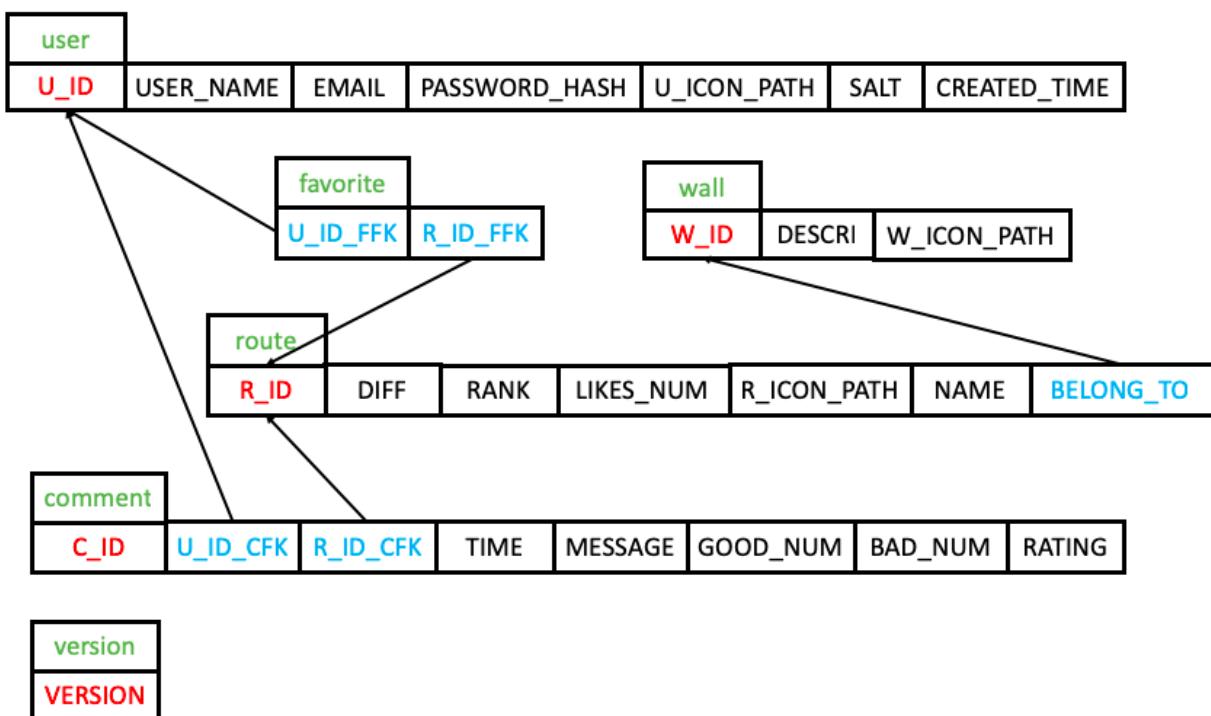


Figure 21: Referential Integrity Constraint Diagram

6 Implementation

This section will describe main implementation and testing classes of our application. How program behaves and steps of development to the final stage will be described in the sub-sections below. In order for our application to run correctly, our team had been implementing front-end and back-end designs from the system requirements specification, while running software tests at the same time and following team-set standards for android programming.

6.1 Android Development Standards

Before any implementation was started, our team has conducted a meeting that we must follow specific rules and format specifications for our application. It includes no hard coding for strings, colors, values and etc. Since we have not developed responsive design for all of the activities, it was decided to restrict the rotation of any application's window to landscape mode. As it was stated in design mode, following supervisor's advice to create landscape version for enlarging the route picture, the restrictions were taken off only for that activity. All of the files inside the project folder must be properly documented and packaged to different folders for simplicity of development for all the team members. Naming conventions were also used to ease the progress when merging the project files between team members. Establishing and following those rules since the beginning of our project made the software implementation part more efficient and effective in all the ways.

6.2 Front-end

Android application's front-end consists of the classes that are mainly present to the user. All the activities that were described in the Design section are written in Java language and use XML (Extensible Markup Language) as main tool for developing the layouts for each activity. We have used a design library to include several significant features, such as navigation menu with drop down buttons for user functionality.

Each activity's user interface follows the same protocol as to have user-friendly look and feel of the application. Our team has a consistent style management, so all of the application's windows are following the same format throughout the whole applications flow.

There are several packages that were created during the project implementation: Activity, Cache, Login, PHP and Adapter. Activity package is the only one that contains all the front-end classes and accessed by the user while using the application. For all other packages we use abstraction and encapsulation to hide all the sensitive data from the user.

All of the layouts use Responsive Layout type since our application is supported only in

portrait mode. All of the application's windows are fitting in one mobile size page and are assigned to each other to follow responsive design on different devices.

6.3 Back-end

A Virtual Private Server(VPS) is deployed for this project. An archetypal model of web service stacks LAMP is installed to get connection between application and database.

The back-end of this project is based on PHP scripting. There are three parts: configuration file, database connection file and functional files.

The configuration file stores the details of the database including MySQL server host, MySQL user name, MySQL password and MySQL database name. The purpose of creating this file is to make it easy to maintain. Changing the parameters in one file instead of change all files using these configurations is more efficient.

The database connection file consists of PHP connection and password encryption functions. It will be used when there is a request in Android application requiring connection to MySQL database, such as Login and Registration activities.

Functional files do most of the operations on MySQL database including GET and POST methods for Login and Registration. The get function takes field, table references, where conditions and values are taken as input parameters and return the corresponding data. The post function takes the whole MySQL query as input parameter and changes the corresponding data in database. The Login function takes user name or email and password as input parameters and return integer values represent different states. The Registration file takes username, email, password and path as input parameters and generate password to password hash for security and return integer value represents different states.

6.4 System Tests

During the testing part, we considered as many as possible situations. First, we tested the case that user has not logged in. We tested every button in each page and checked if the button worked as we expected. The test really helped our implementation since we cannot consider all cases at the beginning. Network connection tests and timeouts are present too with responsive messages. First ten cases are shown below for the Home page implementation. Green color means the test went successfully and produced expected outcome, and yellow states that there are some minor implementation errors present. All of the tests cases are attached as Excel file in the **Appendix** section or can be found in files section on our website[20].

Module	Number	Operation	Expected Output	Done	Actual Output (Problems)
Home page	1	First time opening the application	Every pictures load successfully, UI elements in correct position		Two wall pictures won't load until activity changes
Home page	2	Click on the UNNC logo picture in the image slider	The UNNC Official Website opens		
Home page	3	Click on the Group website picture in the image slider	Our team's website opens		
Home page	4	Click on the QR code picture in the image slider	Picture enlarges to full screen, allows user to scan to join the supporting Wechat group		
Home page	5	Click on Wall A picture	The routes of Wall A are listed		
Home page	6	Click on Wall B picture	The routes of Wall B are listed		
Home page	7	Click on Favorites icon	A toast message "Please log in" appears		
Home page	8	Click on Recommended icon	Displays five recommended routes to user		
Home page	9	Click on Popular icon	Displays five popular routes to user		
Home page	10	Click on the hamburger menu icon in the top left corner	The navigation drawer appears		

Table 4: Test examples

7 Project Management

7.1 Timeline

Figure 22 shows a Gantt chart for the timeline of our project. The green bars represent the initial allocated time frame that a specific task was going to take and the blue bars indicate that we were unable to stick within the planned time. If a task was finished in time, the bar of this task will be a completely green. As can be observed from the chart, most tasks planned for the holiday took more time than expected since the server and database connection problems had perplexed us for a long time. And after we tackled with these problems, the waiting tasks were also quickly done. Next time the timeline will give members more sufficient time to avoid any accident. To sum up, although the efficiency was not ideal, our group successfully achieve all expected tasks on time.

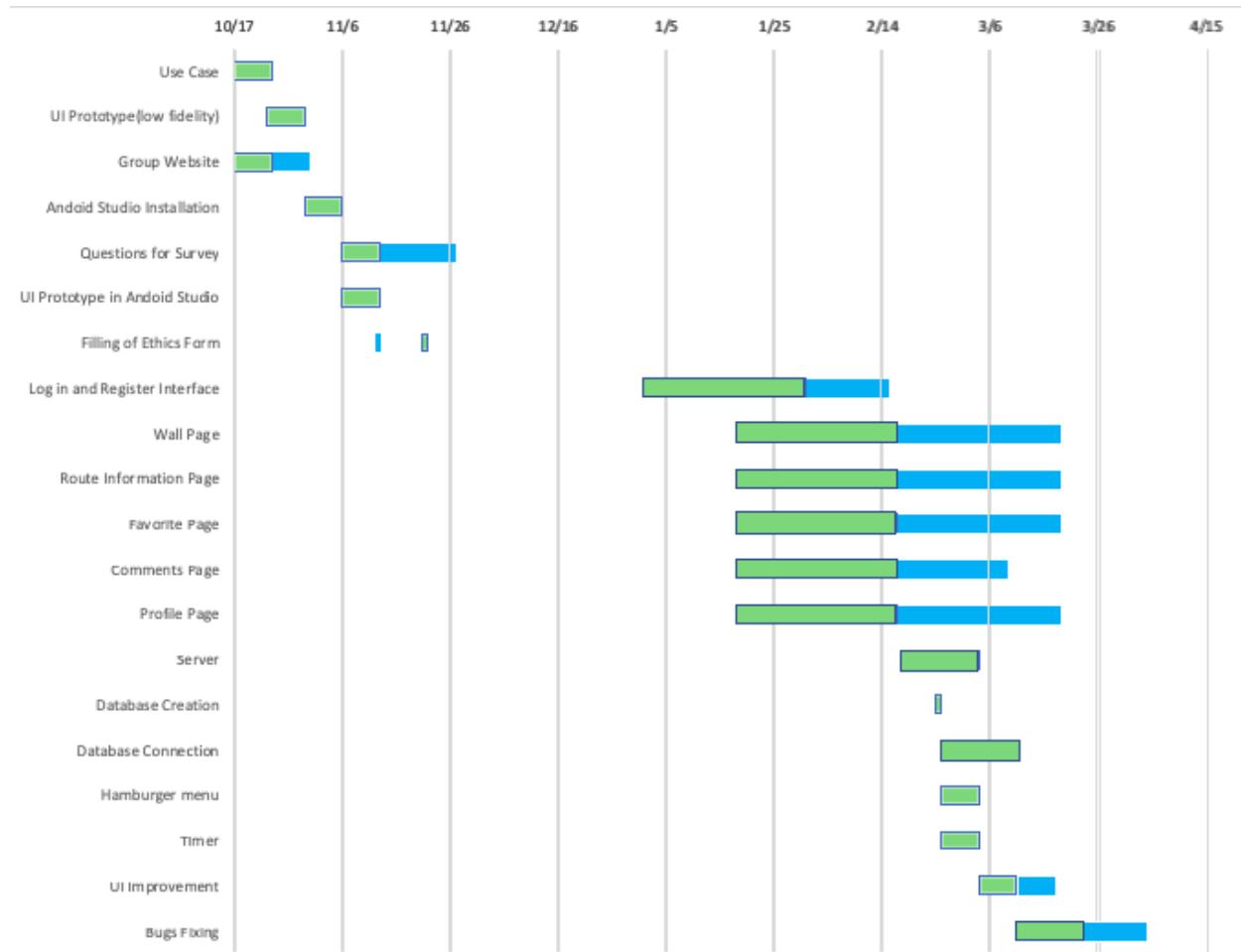


Figure 22: Timeline

7.2 Tools

Gitlab

GitLab [23] is a project management service which can be used to manage a project files by every developer in the team. Our team created a project for our application in GitLab and tried to use the service for some time. However, we ran into prototyping too fast since the early days without completely setting up GitLab accounts completely. Therefore, we have encountered a problem with merging later and have decided to not use GitLab services at all which slowed down our project development process.

WeChat

WeChat[3] is the messaging application that was mainly used by our team for remote communication, sharing different files and images or documents teammates needed. We created a group chat with all of our team members and always planned our next meetings time in there. Frequently, we asked questions to clear up misunderstandings or asked for help with a problem in the chat. All of the code merging and files sharing was done here instead of using planned GitLab features and it was not convenient at all.

Overleaf

Overleaf [24] is a web-based document sharing environment based on LaTeX. It was used by our team to write the reports, and it was very helpful and convenient for many reasons. First, the real-time sharing and changing of documents saved plenty of time. Our editors could write and make changes with more flexibility than a local document and others could see the modifications almost instantly. In general, it increased our cooperativeness when writing the reports because we could work on them together. Everyone could write separately if they wanted to during their free time. Next, the file system was user-friendly when we wanted to add images and diagrams to the document. We could upload the diagrams or images of app to the document's project and edit how we wanted it to be placed in the report without any difficulties.

7.3 Software Engineering Method

Our group adopted Agile method for our application development. In our belief, collaboration with customers and interactions in the group between team members is the highest priority during the development of the project. Following agile principles and relating to Agile Manifesto[25], we have created a set of rules and habits that help us to achieve results faster and in more efficient way. Considering the initial plan and the actual time line of the

team work, it is safe to say that our team's agility has changed over the time. We have encountered a lot of modifications in the software requirements since the early days of the project, conducted regular formal and informal meetings and communicated with the customers; all of these principles shaped our approach in developing a group project and made a big impact on our work flow.

7.4 Meetings

Informal

Over the course of the project our team had one or two informal meetings per week, apart from the formal meetings. In every meeting we either met to discuss the finished tasks or to work together on particular problems. Former meetings were usually about minor issues or tasks and lasted approximately one hour. We would update our team members on the given tasks and discuss what was finished, what problems occurred and how to solve them. Most of the time these tasks were given to two or three group team members to work on the problem together. Occasionally every team member had individual task to do and would report back during the informal meetings.

Furthermore, several times we got together to work on major issues of the project which cannot be discussed remotely. In this type of meetings all team members would work on one issue or decide what to do next in the development of the project. For instance, we occasionally worked together on both of the reports, discussed how we wanted our UI to look like or what functions are of a higher priority. These meetings lasted more than two hours with breaks in between.

Formal

Team strictly had one formal meeting per week with supervisors who were very helpful in guiding our project's development. In every meeting we assigned one chairman and one note taker who wrote the minutes after the meetings. Chairman would start the meetings and usually state an agenda of problems or questions we had and then brought them up to supervisor. Every meeting we changed chairman and note taker so that every team member got comfortable talking in formal meetings. These meetings almost always lasted for one hour.

We would regularly meet one day before the formal meeting to discuss the questions we were going to ask or progress we made during the week and noted them down in agenda.

Our supervisors usually gave us suggestions, checked if progress is going well and guided how to fix our problems without providing solutions. As customers, they would state the requirements and their preferences on the application while we noted them down. Team members also prepared different personal questions they wanted to ask to clear up misunderstandings about the project.

Challenges occurred on the second half of the project when our supervisor changed affecting our progress and formal meetings. We were forced to describe our project and problems we had to the new supervisor when we were already deep in the development and deadline was approximately in one month. As a result, our development slowed down slightly because we were not getting guidance and suggestions as we did before. Perhaps, we got too comfortable and relied too much on previous supervisor's help and now needed to adjust to new type of supervision. Fortunately, after a short time we got used to it and received several important advises from our new supervisor.

8 Reflection

This chapter highlights the overall experience and reflection of the team throughout the project.

Software Engineering Experience

The project allowed the team to gain first-hand experience on the software engineering project development. Most of the team members had no previous experience on working on a project of such scale. Throughout the year, the team have had to adapt to different situations, work together and achieve agreement as a team. Furthermore, team members also overcame Tuckman's stages of team evolution [26], namely, *forming*, *storming*, *norming* and *performing*. The first stage involved meetings while getting to know each other and understanding what role each member could play. As the name suggests, the team then went into a storming phase where each member no longer remained reserved and started voicing out their opinions especially during meetings and decisions making. Discussions would get tense but with good leadership and patience from each member, major conflicts were avoided. The members even grew closer. Norming and performing then followed where roles were established, trust was built and cooperation with each other to accomplish common goals were set.

Communication

Since the early stages of the project development, all of the team members were too uncomfortable or closed in on any communication and conversation. It was difficult to schedule a meeting with everybody at the same time and nobody knew each other. After several formal and informal meeting, most of the team members developed a habit of meeting at the same place and same time using social communications tools. All of the team members started to participate more in general conversation, proposed ideas and defend their own if they were disproved functional for the project. Our main source of communication was WeChat as we have used it to schedule all the meeting and for general conversation of what we should do next. At the end of the project implementation it is safe to say that our communication skills have been greatly improved and we have a bigger sense of support and team work around each one of us.

Lack of Experience

In the beginning of the project, we have found out that most of us are not experienced in the field that we are aiming to build our project on. Most of us haven't written Software Reports before or built Android based software. However, the lack of experience did not

raise any panic in our team. It only has given us the motivation to learn and grow more as a team to help each other. As the time passed, we have branched out in the fields of developing which is most suitable for every member. Some of the team members got really strong in Android Programming, others developed the report writing skills during the interim report phase.

Conflicts Management

As any team in project development, ours was no different and we had our own conflicts. There were usually simple misunderstandings or disagreements upon some of features in our implementations. During the early days it has been difficult top main constructive criticism because many of us could not view others opinion properly and work as a whole team. However, with the progress ongoing, we have understood that listening to other team members and accepting different approaches is actually more significant than ignoring them and standing only at your own point. Without those conflicts, our project would never have been progressed to the last stages. Therefore, all of our team members are strongly appreciative of each others efforts and support any ideas given out for discussion.

Leadership

Since the day of team allocation, our team has signed one team leader for the position. The leader of the team would have to encourage all the ideas any of team members might have and help approve or disapprove any new changes during the application development. Leader would usually propose the informal meeting time and date and initiate the conversation with supervisors for the formal meetings. However, strict leadership was never needed during the project development. By the end of the first month, all of the team members developed a skill for strong communication and knew what to do when a leader gave them a task. Almost all of the time the task that were given by the leader were finished on time so we moved on with the next one.

Well-Defined Roles

As the day of the project briefs introduction passed, there was a proposition to divide the roles between the team members. As it was stated in sections above, many of us did not have a good experience in any of the fields so we would have to choose our task at random since the early development days or assigned by the team leader. As the project progressed, we have established well defined roles for each team member (stated below in Figure 8) and followed them until the last days of the project development. Following those conventions and given proper task to the team members whose strong suits are on those fields improved

out team work and efficiency in project development itself.

Name	Role	Description
Tianhao	Technical lead	Lead programmer
	Server specialist	Researched, configured and maintained the server.
	Back-end developer	Handled connection with database.
Mingda	Implementer	Turn ideas into code
	Completer Finisher	Searches out errors, polishes and perfects.
	Back-end developer	Designed and established connection to database.
Yiming	Tester	Test the application, detect the database connection, write database related documents
	Researcher	Background research and in charge of survey.
Denis	Team leader	Manage team actions and ensure quality of reports.
	Front-end developer	In charge of UI.
	Specialist	Provides knowledge and skills
Masrur	Researcher	Background research and in charge of survey.
	Editor	In charge of writing documents and ensuring quality of reports.
Melanie	Researcher	Background research and in charge of survey.
	Editor	In charge of writing documents and ensuring quality of reports.

Table 5: According to Belbin Team Roles

9 Future Work

Even though our Android Application was finished on time fulfilling most of the requirements, there are still some features that we would like to implement as continuation of our project development. Furthermore, as it was stated in **Section 4 Requirements Specification**, there was a number of requirements that were changed or not finished on time. This section will describe which additional functionality we would like to implement in the future.

9.1 Social Chat System

The current application has a discussion room for each route where the users can share their feedback. However, if the social chat system was implemented, the users would have been able to communicate with each other by direct messaging. Chat systems are common in most mobile application as embedded feature. Therefore our next step would be creating a chat room for two users who are logged in the system and can share messages. Additional feature can be implemented as adding media sharing (pictures, videos), QR code scanning and route suggestions.

9.2 Climbing Hints

One of the features that we wanted to implement from the start was to help new users understand how to climb properly and more effectively. As this functionality was scratched off at early stages because of low priority, our team did not pay much attention to it. Considering safety of the climbers, we would like to create simple chart or list of rules/hints for people who are accessing routes for the first time. It would help to raise awareness about safety as there are usually no supervisors at the routes during the time of climbing and provide helpful hints on how to finish any route efficiently.

9.3 3D model of the wall and route

The 3D model which is aim to visualize the wall and the route is the initial plan at the beginning of our project; while, when discussing the workload and the benefits it can bring, it is considered as out of our application objective scope and put into low priority list which we would abandon if time is limited. However, it will be a creative and attractive idea if it can be added in. Considering each wall has a corresponding 3D model, where the rocks/holds are adhered flexibly, which can be reset as the change of the real wall, displaying the route by connection line. Instead of the 2D image of that route, the interest and enthusiasm will

be considerably promoted. Furthermore, the flexibility of 3D model allows user to view the wall and routes in all aspects, offering a better visual feeling and a superior cognition of difficult part.

9.4 Manager Mode

Referring back to **Section 4 Requirements Specification**, our team removed Manager functionality because of lack in agreement with boulder climbing managers and due to time constraints. Manager system would be important addition to our application as it would allow to revise and manage the contents of application, such as routes information, feedback section and others. Manager would have higher access to the different functionality of the application than any user. For example, any manager can create or modify a route, delete unpopular (rated by likes/dislikes) comment or add more routes/walls to the application. Such feature would be really effective in our application because it would allow new features to be added and secure the community's safety by monitoring feedback section.

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11 Appendix

Formal Meeting 1 on the 17 October 2018 13:00-14:00

Agenda 1

1. Opening of the meeting.
2. Apologies from absent members.
3. Introduction of team members to the Supervisor/Client.
4. Requirements Gathering from Client
 - 4.1: What does he want the app to do?
 - 4.2: Who will be using the software?
 - 4.3: Where will the app be used?
 - 4.4: Why does he want the app?
 - 4.5: How did he come up with this idea?
5. Seek advice from Supervisor
 - 5.1: Ask about the website
 - 5.2: What kind of feedback and the frequency of them?
 - 5.3: What is the next step?
6. Any other questions.
7. Next meeting details
8. Closing of the meeting

Minutes 1

Participants: Paul Dempster (supervisor/client) Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A. Introduction

Brief introduction and review of the bid. Supervisor commented on too ambitious ideas which are out of scope. Advises us to break down the ideas and get the core down first before going on with implementation.

B. User stories

The client

1. noticed the gap in the market about a lack of a system that can create the routes automatically rather than manually by a expert and came up with the idea of an app that manages the routes of a gym.
2. Android? Web app? Needs it to be a mobile app for convenience
3. Want it to be like google searching but for routes instead

4. Can scroll through the lists of routes and select interested one
5. Can view the comments and the highlights of the routes of interest
6. Can give feedback and ratings after climbing trial
7. Can suggest removing or adding a new handhold to the route based on his experience
8. Can see the possible routes of one handhold

C. Important questions asked

1. A need for promotion of the system online through website?

Not really the purpose.

2. Actually make changes in the wall?

Out of scope for this level of degree project. Consider the wall with the handholds to be fixed. However, can consider the gym changing their boulder walls maybe once a year and the implications of the admin to manage/update their walls.

3. Use WeChat as interface?

Other technical platforms are also available.

D. Focus points of specifications

Specification Point 1: User accounts for each user

1. to create, find, add, modify, delete and rate a route
2. to view, leave, edit comments or give feedback – needs a threading system or generic one? Who is going to manage the comments/feedbacks?

Specification Point 5 & 6:

1. 3D model of the bouldering wall and automated routes finding system using AI algorithms would be out of scope for this project.

Specification Point 8:

1. Voice instructions through earphones are not appropriate.

E. New ideas Achievement awards for climbing challenges.

(record time taken for each route in minutes, hours, days or weeks)

F. Action points

1. Make an agenda for the next meeting so that each participant talks/asks about one topic.
2. Make use cases of the ideas in the specification. Order them by priority and feasibility.
3. Think about the risk management of the ideas.

Formal Meeting 2 on the 23 October 2018 15:15-15:45

Agenda 2

1. Opening of the meeting.
2. Apologies from absent members.

3. Recap of the last meeting's important topics
 - 3.1: The change of the wall is out of scope.
 - 3.2: The WeChat interface is not the only choice, others are also available.
 - 3.3: The brief flow of this application's functionalities (compare with the use cases).
 - 3.4: 3D modelling and voice instructions can currently be set to the lowest priority.
4. Problems we have
 - 4.1: Website setup problem.
 - 4.2: Wall problem (is it an application which can deal with any different walls or just concerns the UNNC campus' boulder walls? If so, which wall should we take into consideration: first floor one, second floor one or both?)
 - 4.3: Do we need to update our wall in the software (rank them to give advice for sports managers)?
5. Review of the progress since last meeting
 - 5.1: The use case (shown in paper or doc).
 - 5.2: The website.
6. Feedback and improvement of present progress
7. Discussion about next week's action points
 - 7.1: Related resource research
 8. Summary of the decisions we made and who is responsible.
 - 9: Any other questions.
9. Next meeting details.
10. Closing of the meeting.

Minutes 2

Participants:

Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A. Wall Problem

1. The wall may be updated;
2. The app better be an interface which can handle different walls;
3. No need to hard code the wall;
4. In our project, just focus on the small wall in the gym.

B. Use case

1. The guest mode is over designed;
2. Let anyone be able to leave comments, because the comment can be good or bad. The manager can delete the bad ones;

3. No need for the ‘log in’ or ‘registration’ page to be first. We can grab the interest of the user by making him or she use the app first and get interrupted later to register to use some functions;
4. ‘Remember me’ is not a use case but can be a non-functional requirement. The software should never log out if possible(or have a time limitation) unless user do that, so that user don’t need to log in every time they use the application;
5. Change priority ‘start climbing’ from 2 to 1;
6. Change the technology to describe the use case;
7. Keep the balance between the complex/detail(like angle, height or width and how to show them) of walls and the time consumed.

C. Website

1. How to link to the supervisor? It’s better not to use the third-part website, if use, then need to consider the privacy and the usability.

D. Next Steps

1. Focus on the UI and prototype, as well as website construction.

Formal Meeting 3 on 30th of October, 2018, 15:15-15:45

Agenda 3

1. Opening of the meeting.
2. Apologies from absent members.
3. Recap of the last meeting’s important topics
 - 3.1: No ‘Guest Mode’
 - 3.2: Tip given: Grab the interest of the user by making him use the app first then interrupted to register
 - 3.3: Aim to make an app which can adapt to various walls
 - 3.4: Focus on Android for now
4. Problems we have
 - 4.1: How to identify if the climber has climbed the wall or not?
 - 4.2: Which wall exactly? (choose from the pictures taken, which will also be used for the website)
5. Review of progress since last meeting
 - 5.1: UI prototype (low fidelity)
 - 5.2: Website construction
6. Feedback and improvement of present progress
7. Discussion about next week’s action points
8. Any other questions.

9. Next meeting details.
10. Closing of the meeting

Minutes 3

Participants:

Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A. Introduction

1. Introduction of first draft of UI prototype. Brief explanation of how all web pages work with each other.

B. Identifying if the climber finished the wall

1. Bouldering is series of sessions. So, recording the date on which climb started and finished is better than having a timer, because the climb could take many days to finish and having a timer on those days is not comfortable.
2. No need to control if someone really finished climbing the wall and comments which are not true.

C. Bouldering walls in Sports Center

1. Bouldering is focused more on climbing a big boulder or rock with specific routes or approaches without ropes and the goal is not to climb higher. Thus, the bouldering walls in Sports Center are the ones which are on second floor and not the high main wall.

D. Prototype

1. The home page Home.java could be a page with the most popular walls shown.
2. Combine My.java and Profile.java because they have same roles.
3. Rating and commenting a wall buttons should be placed in route information page.

E. Feedback

1. Don't force the user to finish the wall first to give a feedback and rate it.
2. Allow users to edit the comments.

F. Development

1. It is easier and more flexible to develop on Android Studio.
2. Developing a cross-platformed software can be very complicated.
3. Better not to use paid services like databases.

G. Website

1. Attribute all the copyrighted images down in the footer.

H. Tasks

1. Develop the UI draft prototype to high-fidelity prototype.
2. Set up the Linux database and server.

Formal Meeting 4 on 6th November 2018, 15:15-15:45

Agenda 4

1. Opening of the meeting.
2. Apologies from absent members.
3. Recap of the last meeting's important topics
 - 3.1: Discussion of the low fidelity prototype of the boulder system app
 - 3.2: Development to be done on Android Studio
4. Progress since last meeting
 - 4.1: Website maintenance;
 - 4.2: Report discussion;
 - 4.3: Android studio installation;
5. Problems we have
 - 5.1: Android Studio setup;
 - 5.2: Time constraint in producing high fidelity prototype;
6. Questions about
 - 6.1: Interim report outline
 - 6.2: Survey (WeChat) - Any advice for the types of questions to be asked? Some suggestions: What do you want to help you in your climbing activity? Any application currently using for bouldering? What do you seek for in a boulder system application?
7. Feedback and improvement of present progress
8. Discussion about next week's action points
8. Any other questions.
9. Next meeting details.

Minutes 4

Participants:

Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A. Introduction and recap of the progress

1. The website maintenance: the background has been changed, the agenda and minutes

files can be browsed and downloaded directly from the webpage.

2. Talk about the problems we encountered during Android Studio (AS) installation.
3. The report outlines.

B. Problem and discussion about the Android Studio

1. We met with problems about the SDK, Proxy, VPN and different versions of AS, but most of them have been solved. Almost all team members can run it successfully.
2. Supervisor suggested that the use of a concrete Android phone may be better than the simulator in AS. Some difficulties may occur when using the simulator: the sensor and camera are not easy to use.
3. Lab computers may have AS installed which could be helpful if available.
4. We may borrow some android devices from the IT/Library if possible.

C. Interim report

1. The background research on bouldering is required in the interim report.

D. Research methods

1. Some research methods: survey (static), face-to-face (interview) and focus group meeting (dynamic), to find what we need and can add in our software.
2. Preferable to consider the use of Qualtrics.
3. We should consider the ethics aspect.
4. It is important to decide which method to use before getting the ethics approval.
5. Between the two questions: What do you think of this idea? Or What do you want? The former is better.
6. Type of response: by selection, text box or free form writing.
7. The different research methods have their own pros and cons: survey is static, not much information can be gathered. Focus groups is dynamic, but time consuming and should be careful about the content consistency.
8. We can add scenario or comments to help interviewees to better understand our questions.
9. Evaluation of the research is important.

E. Ethics

1. No matter what kind of research method chosen, if there is the involvement of human participants, animals and datasets relating to people, we should get the ethics approval.
2. The related Ethics lecture slides from the supervisor will be sent to us to read.
3. Book for reference: Research Methods in Human-Computer Interaction, Joathan Lazar and Jinjuan Heidi Feng and Harry Hochheiesr, 2010, Wiley

F. Other

1. The rope for the big (high) wall in the UNNC gym is to guarantee the safety. It does

not make much difference for climbing (but maybe help). But now, we should only consider the small walls.

2. The rope is not the only differentiation between bouldering walls. it's the type, position, frequency of holds for a different style of climbing.

G. Tasks

1. To read the ethics materials, and finish the ethics form for next meeting.
2. To decide on the research methods and survey questions.
3. Continue to design prototypes on AS.

H. Next meeting time

1. Monday 12th at 14:15-14:45 in office.

Formal Meeting 5 on 12th November 2018, 14:15-14:45 Agenda 5

1. Opening of the meeting.
2. Apologies from absent members.
3. Recap of the last meeting's important topics
 - 3.1: Research methods;
 - 3.2: Ethics;
 - 3.3: Survey questions.
4. Progress since last meeting
 - 4.1: Draft questions for survey;
 - 4.2: Filling of ethics forms;
 - 4.3: ShareLaTex setup and interim report layout.
5. Questions about
 - 5.1: Interim report outline;
 - 5.2: Checklist;
 - 5.3: Sample survey.
6. Feedback and improvement of present progress
7. Discussion about next week's action points
8. Any other questions.
9. Next meeting details.

Minutes 5

Participants:

Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur

Sobirov

Absentees: None

A. Introduction and recap of the progress

1. Ethic forms: revision of formal documents for the research process
2. Survey: introducing first draft of the questionnaire
3. Interim Report: presenting first draft of the outline and cover page for group report

B. Problem and discussion about the Questionnaire

1. We have asked for advice from the supervisor on different questions in our survey:
 - (a) Question 1 about the routes should be revised because gym already has planned/labeled routes.
 - (b) More time ranges
 - (c) Improve scale-type answers to have 5 at minimum
 - (d) Revise the question about the application idea to force people to answer on scale (not just yes/no)
 - (e) Aim to have about 20 questions in total
 - (f) Ask more specific questions related to app in “Scenario” section
2. Supervisor mentioned that we may collect contact information at the end of the survey for future contact with volunteers (optional choice). Although our questionnaire is anonymous, contact information would help us to conduct meetings in more efficient way later in the process with people who are interested in our application.
3. Supervisor advised the team on specific order of questions in section 1 (to be revised with total number of questions later).

C. Interim report

1. Supervisor said that all the report is based only on our decisions and we have to decide on number of major topics and divide the workload by ourselves.
2. Supervisor also stated that we can submit the draft report no later than December 3rd, 2018 to be revised. It would take approximately a week for supervisor to review the draft and return to us on time to add changes.

3. Relate to Handbook outline

D. Checklist and Other forms for Ethics Submission

1. Checklist questions reviewed (Section 2 & 4)
2. All the forms were presented but not on time manner (accident with format of the files sent by email).

E. Other

1. Since we have decided to use Qualtrics.com for main site of the survey, we had additional questions during the meeting:

- (a) Advisor stated it would be a good idea to add all the forms online before the start of the survey. Doing so would prevent anybody to access the form to submit random/fake data.
- (b) Example:
 - i. Information sheet
 - ii. Consent form for volunteers
 - iii. Survey Questionnaire
- 2. When submitting the forms next week, we should attach the screenshots of the survey pages from the website.

F. Tasks

1. Finish the ethics forms to submit completely on the next meeting (including the questionnaire).
2. Divide tasks between team members to research/prototype.

G. Next meeting time

16:00 – 16:30 on Tuesday, November 20th, 2018

Formal Meeting 6 on 21st November 2018, 16:00-16:30 Agenda 6

1. Opening of the meeting.
2. Apologies from absent members.
3. Recap of the last meeting's important topics
 - 3.1: Ethics form;
 - 3.2: Survey questions;
 - 3.3: Interim report.
4. Progress since last meeting
 - 4.1: High fidelity prototype in Android Studio;
 - 4.2: Finalized survey questions (use of Qualtrics);
5. Questions about
 - 5.1: Use the predefined routes or come up with new routes?
 - 5.2: Approximately how many routes?
 - 5.3: Dynamic memory allocation in the app.
6. Feedback and improvement of present progress
7. Discussion about next week's action points
8. Any other questions.
9. Next meeting details.

Minutes 6

Participants:

Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A.Show Prototype:

1. Database
 - i. The app should be able to connect to database to get information of walls and routes;
 - ii. There should be a local copy of database on the phone;
 - iii. Internet is required for update;
2. Climber vs Manager
 - i. Extra buttons for manager, e.g. ‘add route’ button
 - ii. Become a manager by adding a wall
3. ‘Favourite’ function

Above the list of walls, having the 3 most favourite routes in the main interface.

B. Survey: Approval of survey.

C. Meetings left: 4 more meetings during teaching time, 1 meeting before exam.

D. Goal for next week:

Finishing the survey and focus more on internal report, also adding functionalities and setting database.

Formal Meeting 7 on 27th November 2018, 14:15-14:45

Agenda 7

1. Opening of the meeting.
2. Apologies from absent members.
3. Recap of the last meeting’s important topics
 - 3.1: The details of the survey;
 - 3.2: Inappropriate design of prototypes;
 - 3.3: Database questions;
 - 3.4: Functionalities only for manager;
 - 3.5: Some extra functionalities used to improve the convenience;
4. Progress since last meeting
 - 4.1: Revised the survey and submitted it to supervisor;

- 4.2: Outline, distribution of tasks and draft of the interim report;
- 5. Questions about
 - 5.1: Survey approval;
 - 5.2: Interim report questions;
- 6. Feedback and improvement of present progress
- 7. Discussion about next week's action points
- 8. Any other questions.
- 9. Next meeting details.

Minutes 7

Participants:

Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A. Discussion about

a. Database

Email Joseph Zhang for change of password in Linux database MySQL.

b. Interim Report Outline

1. Introduction

2. Background

In market research: can write that survey is still in progress and about existing apps if relevant.

3. Requirements specifications

Include a table with the requirements, their priority and risk scores.

4. Design

Can include pictures.

5. Implementation

6. Project management

Write about the initial design, problems encountered and solutions to them.

the software engineering methodology we used should be included.

7. Future work

Write about how the team is going to proceed with the project till next semester.

8. Appendix

Include minutes (word count in appendix is excluded from report's final word count.)

Add another section called 'Reflection' to write about the team's collaboration and

communication throughout this project.

Formal Meeting 8 on 4th December 2018, 14:15-14:45

Agenda 8

1. Opening of the meeting.
2. Apologies from absent members.
3. Recap of the last meeting's important topics
 - 3.1: Interim Report Questions;
 - 3.2: Database Password;
4. Progress since last meeting
 - 4.1: Draft Interim Report Submitted;
5. Questions about
 - 5.1: Survey approval;
 - 5.2: Interim report questions;
6. Feedback and improvement of present progress
7. Discussion about next week's action points
8. Any other questions.
9. Next meeting details.

Minutes 8

Participants: Paul Dempster (supervisor/client)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

Interim report draft quick feedback:

1. Reference citation
 - Follow the instruction of Dave said. Prefer [number] format in body.
 - Cite format is incorrect.
 - Cite from the book rather than Internet for some references.
2. What type of corrections we will see after receiving the draft back
 - (a) Kind of corrections for grammar, missing content and inappropriate content.
3. Figures/meeting/minutes style and captions
 - (a) Line break between each appendix.
 - (b) Agenda and minutes should have the same style.
 - (c) Put the agenda and minutes of one meeting together.
 - (d) Remove the figures and tables.

4. Requirement table
 - (a) Add something else, like risk.
 - (b) Risk can be considered as three parts: scale, difficult and impact when changing.
 - (c) Check Latex for /document article.
 - (d) Requirement part has some duplicate things. Use tables rather than text.
 - (e) Add explanation about how to come up with these requirements.
5. Survey
 - (a) Get the approval tomorrow (5th December 2018).
 - (b) We can add something about survey.
6. Survey
 - (a) Write some explanations about what is in this figure. highlight some important actions.
 - (b) Reformat the diagram to avoid the cross lines and small texts.
 - (c) Add id for each action corresponding to requirement table.
7. Back-end
 - (a) Write more about the details of implementation: like database and protocol used for transfer.
8. Implementation
 - (a) List all available software and explain the advantages and disadvantages for select.
 - (b) MySQL database.
 - (c) Third party database is allowed. But it's not necessary to use database hosted by company.
9. Project management
 - (a) Tell what we are spending time on.
 - (b) Timeline
 - i. Actual time/plan time
 - ii. Change description of timeline
 - iii. Describe whether we overrun or how to keep on timeline, and reflection about this.
 - (c) Software engineering methodology
 - i. Reference to textbook about agile.
 - ii. Add more description, like explain why we use this, what does this mean when we are using agile.
 - (d) Reflection
 - i. Context confliction.
 - ii. Too many subheadings, merge them.

iii. Change the description about make decision randomly.

10. Future work

- (a) Rename to next step or next semester plan.
- (b) Write how will we do in the next semester more specifically. Not like a story.
- (c) About the researching and data collection, it's not necessary to go out to collect data. We can get related data from Internet database.
- (d) For the participation of sport manager part, the verification is not necessary and unrealistic.

11. Feedback for the whole report draft.

- (a) Inappropriate bold, subsection and capital words.
- (b) Start a new page when starting a new section.
- (c) consistent format.

Next meeting time: 11th December 2018, 14:15-14:45

Formal Meeting 9 on the 11 December 2018 14:15-14:45 SEB 438

Agenda 9

1. Opening of the meeting
2. Apologies from absent members
3. Recap of the last meeting's important topics
 - 3.1: Interim Report draft quick feedback.
4. Progress since last meeting
 - 4.1: Interim Report improvement
 - 4.2: Survey release and data collection
5. Questions about
 - 5.1: Interim report questions
6. Feedback and improvement of present progress
7. Discussion about next week's action points
8. Any other questions
9. Next meeting details

Formal Meeting 11 on 24 February 2019 11:00

Agenda 11

1. Opening of the meeting
2. Apologies from absent members
3. Overview of group project
 - 3.1: Current progress
 - 3.2: Work done during winter break
4. Challenges

- 4.1: Database
- 4.2: Combining the software together
- 5. Future work
- 6. Questions and next meeting details

Formal Meeting 13 on 4th March 2019 11:10 - 12:10

Agenda 13

Minutes 13

Participants: Sheung Hung Poon (supervisor)

Team 15 : Denis Stepanov, Melanie Cheong, Mingda Liu, Tianhao Li, Yiming Chen, Masrur Sobirov

Absentees: None

A. Review last week challenges and the corresponding solutions

- 1. DB connection: Figure out the server and the back-end using PHP. Now we can connect to DB successfully.
- 2. merging: Using gitlab to upload and share the individual work. But some members have problem in pushing, which we will resolve later

B. The discussion about DDL and time distribution

- 1. 4.11 for report and sw. We decided to cope with the final report and software concurrently by dividing into subgroups and use the rest of time to deal with presentation

C. Supervisor's proposed ideas

- 1. To come up with some extra functions about user interaction.
- 2. Think about the procedures and designs about the creative ideas in advance
- 3. Consider another method to show the routes

D. Next meeting

- 1. An information sharing meeting with Paul is possible (TBC)

Project 2018.P04: Boulder Climbing System

Requirement

To create a system that allows climbers and climbing gyms to create, share, and collect feedback on bouldering routes for indoor bouldering walls. The climbing gym for this project will be the bouldering walls in the UNNC sports centre. The client will be the project supervisor, acting as the CEO of a start-up software company that has spotted this gap in the market.

Background:

Bouldering [0] is an increasingly popular rock-climbing sport that involves climbing small but highly technical routes across or over large rocks. Indoor bouldering uses short climbing walls with a large number of many different types of hand-holds [1] attached to them. Bouldering routes are then designed by an experienced climber [2] selecting a start point, end point, and a small number of holds that the climber is allowed to touch in-between. A route is commonly marked with coloured holds, bits of coloured tape, numbers, or just a drawing beside the wall. A route is also assigned a difficulty by its designer. Climbers then try to climb the route, sharing feedback about how fun the route was and how accurate they thought the difficulty was. Climbers might also suggest modifications or entirely new routes to friends. The problem for the climbers and the climbing gym is that managing all these routes and updating the wall is time-consuming and error prone. A wall that doesn't change routes often enough, or has boring or inaccurate difficulties will soon become empty.

Currently, the UNNC climbing club shares a few bouldering routes via a WeChat page [3] and bits of tape on the wall, but it is rarely updated and hard to use when actually at the wall to climb. This project should improve that situation. The long-term aim is to take this project and combine it with a final year project tackling automatic route creation, to create a first-of-its-kind system and explore commercialisation opportunities in summer 2019.

(Note: you do not have to do any climbing yourself for this project! However, if you want to, you must join the UNNC climbing club for their mandatory safety training. DO NOT CLIMB, EVEN A LITTLE BIT, WITHOUT ATTENDING THE SAFETY TRAINING.)

Project Outline

The selected students will form a software engineering team, and work together to complete a full cycle (maybe several full cycles) of the software engineering process, resulting in delivery of a system (and accompanying artefacts), as requested by the client.

The SE team will need to go through a complete requirements engineering process to identify the exact SE project requirements. Part of this will involve applying an appropriate requirements elicitation methodology. It is likely that stakeholders such as climbers will need to be identified and involved in both the early stages and the evaluation of the system. The team will need to make informed decisions about which SE process approaches or methodologies to apply to this project.

Over the course of the project, the SE team will need to produce several artefacts, including (but not limited to): a report on the current situation, a system requirements specification, design documentation, team management and planning documentation, prototypes, progress reports, verification and validation plans, end-user evaluations, code, code documentation, and instructions manual.

The target goal of the SE project will be to deliver, on time, a system that can allow climbers to create, share, and collect feedback on bouldering routes for indoor bouldering walls in intuitive and easy ways.

References:

- [0] <https://en.wikipedia.org/wiki/Bouldering>
- [1] https://en.wikipedia.org/wiki/Climbing_hold
- [2] <https://en.wikipedia.org/wiki/Route.setter>
- [3] http://mp.weixin.qq.com/s/u_ARraCfk65XEuANkILQVQ

Some examples of climbing a route in gym:

- <https://www.youtube.com/watch?v=LWq53Gn07HY>
- http://commons.wikimedia.org/wiki/File:Indoor_Bouldering_V3_Rock_Spot.webm?embedplayer=yes
- <https://www.youtube.com/watch?v=fY2IeYSxY4U>

Professional bouldering; only one route is set up on the wall but the moves required are rather more difficult:

- <https://www.youtube.com/watch?v=nSjjpL1gI1Y>

Survey Questionnaire

Boulder Climbing System

PARTICIPANT INFORMATION FORM

Dear Participant,

Thank you for agreeing to participate in this questionnaire survey in connection with our Software Engineering Group Project at the University of Nottingham Ningbo. The project is a study of developing a boulder climbing software. This software aims to help climbers to find routes on bouldering walls of different difficulty at the Sports Center at UNNC. Users can also leave feedback, such as comments and rating for the routes.

Your participation in the survey is voluntary. You are able to withdraw from the survey at any time and to request that the information you have provided is not used in the project. Any information provided will be confidential. Your identity will not be disclosed in any use of the information you have supplied during the survey.

The research project has been reviewed according to the ethical review processes in place in the University of Nottingham Ningbo. These processes are governed by the University's Code of Research Conduct and Research Ethics. Should you have any question now or in the future, please contact me or my supervisor. Should you have concerns related to my conduct of the survey or research ethics, please contact my supervisor or the University's Ethics Committee.

Yours truly,
Yiming Chen

Contact details:

Student Researcher: Yiming Chen (zy22026@nottingham.edu.cn)

Supervisor: Paul Dempster (paul.dempster@nottingham.edu.cn)

University Research Ethics Committee Coordinator: Ms. Joanna Huang (Joanna.Huang@nottingham.edu.cn)

PARTICIPANT CONSENT FORM **Project title:** Boulder Climbing System

Researcher's name: Yiming Chen

Supervisor's name: Paul Dempster

I have read the Participant Information Sheet and the nature and purpose of the research project have been explained to me. I understand and agree to take part.

I understand the purpose of the research project and my involvement in it.

I understand that I may withdraw from the research project at any stage and that this will not affect my status now or in the future.

I understand that while information gained during the study may be published, I will not be identified and my personal results will remain confidential.

I understand that data will be stored in accordance with data protection laws.

I understand that I may contact the researcher or supervisor if I require more information about the research and that I may contact the Research Ethics Sub-Committee of the University of Nottingham, Ningbo if I wish to make a complaint related to my involvement in the research.

Contact details:

Researcher: Yiming Chen (zy22026@nottingham.edu.cn)

Supervisor: Paul Dempster (paul.dempster@nottingham.edu.cn)

UNNC Research Ethics Sub-Committee Coordinator: Ms. Joanna Huang (Joanna.Huang@nottingham.edu.cn)

Q Do you consent to take part in this survey?

[Please select one of the following.]

Yes I do.

No I do not.

Skip To: End of Survey If Q = No I do not.

Q1 How do you find out about boulder climbing places?

[Please select one or more of the following.]

- From flyers
- From search engines
- From friend's advice
- From apps

Q2 How often do you go boulder climbing?

[Please select one of the following.]

- Every day
- 2-3 days a week
- Once a week
- 2-3 times a month
- Once a month
- Once every 1-2 months
- Rarely

Q3 How do you usually select a route to climb?

[Please select one or more of the following.]

- I just follow one of the gym's planned routes
- From friends' recommendations
- From experience
- Randomly

Q4

On average how long does it take for you to finish a route?

[Please select one of the following.]

- < 1 minute
- 2 - 10 minutes
- > 10 minutes
- 1 hour
- 2 hours
- < 1 day
- Days
- Months

Q5 What kind of difficulties do you have during climbing?

[Please fill in the text box below.]

Q6 What will make your climbing easier?

[Please fill in the text box below.]

Q7 Have you ever used an app related to bouldering before?

[Please select one of the following.]

- Yes
- No

Display This Question:

If Q7 = Yes

Q7.1 Which app(s) did you use?

[Please fill in the text box below.]

Display This Question:

If Q7 = Yes

Q7.2 Which feature(s) did you like the most?

[Please fill in the text box below.]

Display This Question:

If Q7 = Yes

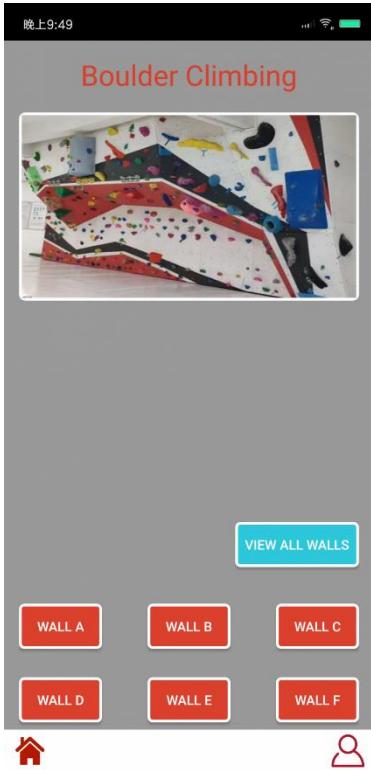
Q7.3 In what way(s) did you find using the app(s) you mentioned difficult?

[Please fill in the text box below.]

SCENARIO

Our boulder climbing mobile application will let you view the walls available and the list of routes with their details, such as ratings, layout and level of difficulty. Additionally, it will have features which will let you leave feedback on walls and record the time you spent on finishing climbing a route. You can show it to your friends or challenge them on who will finish a route faster. On the next page, you can find the screenshots of our app's user interface. Your answers will help us on improving it.

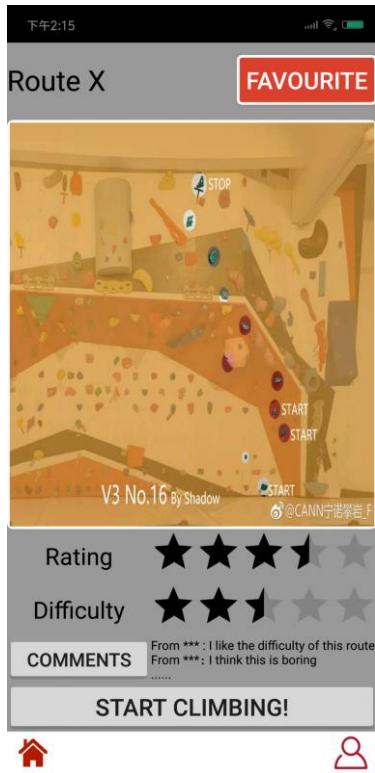
This is the Home page which shows the most popular walls for climbing and a button to view all the walls available.



This is the Route page which shows the list of routes of the specific wall chosen previously. You can have a list of the routes through filters by rating, difficulty or chat.



The page below shows information about the route chosen by user. This information can help you understand the difficulty and layout of a route, and if you want to climb it later you can save it and access it quickly when needed. Additionally, you can rate and leave your opinion on this route.



By answering the following questions, you will help us greatly in achieving a useful application.
[For each question, select one option only or fill in the text box.]

Q8 Having seen the app's interface, I find that it:

[Please select one of the following.]

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Is user-friendly	<input type="radio"/>				
Will give me a better understanding of the routes	<input type="radio"/>				
Will help me decide on routes more easily	<input type="radio"/>				

Q9 I want to know:

[Please select one of the following.]

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The height and difficulty of the wall beforehand	<input type="radio"/>				
The types and number of handholds for a route	<input type="radio"/>				
The time I took to finish climbing a route	<input type="radio"/>				

Q10 I like:

[Please select one of the following.]

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The feedback and comments system	<input type="radio"/>				
To access to my favorites routes quickly	<input type="radio"/>				

Q11 I feel that:

[Please select one of the following.]

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The app will be helpful to me	<input type="radio"/>				

Q12 I find the following features or information about the walls or routes missing...

[Please fill in the text box below.]

Q13

As part of our project, we would like to contact you later to get more of your opinion. Do you consent in leaving your email address? It is not compulsory.

[Please select one of the following.]

- Yes I consent
- No I do not consent

Display This Question:

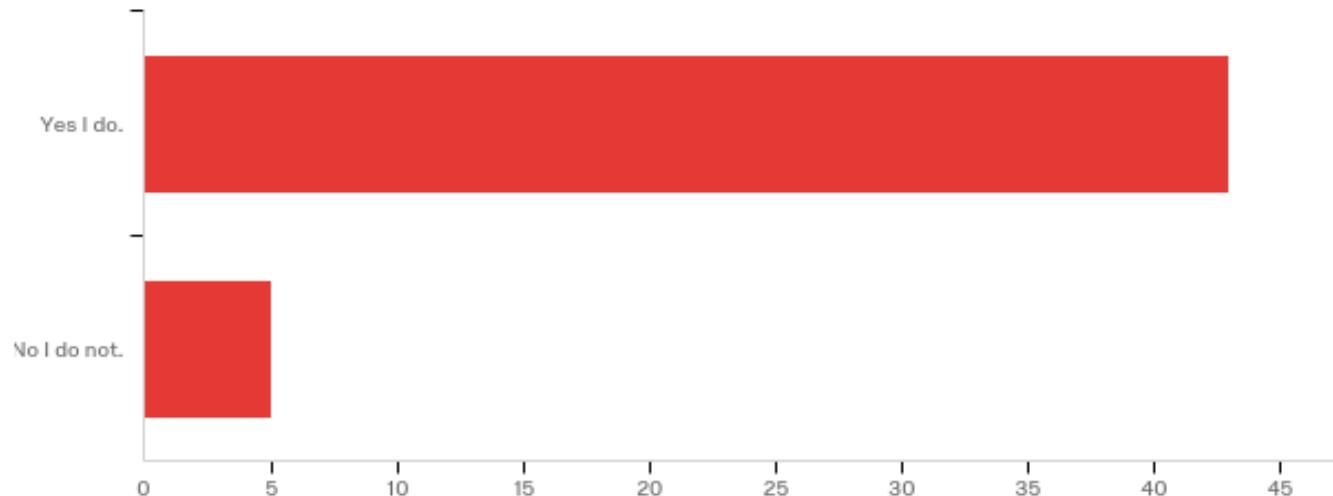
If Q13 = Yes I consent

Q13.1 Please write your email down below:

Survey Report

Boulder Climbing System

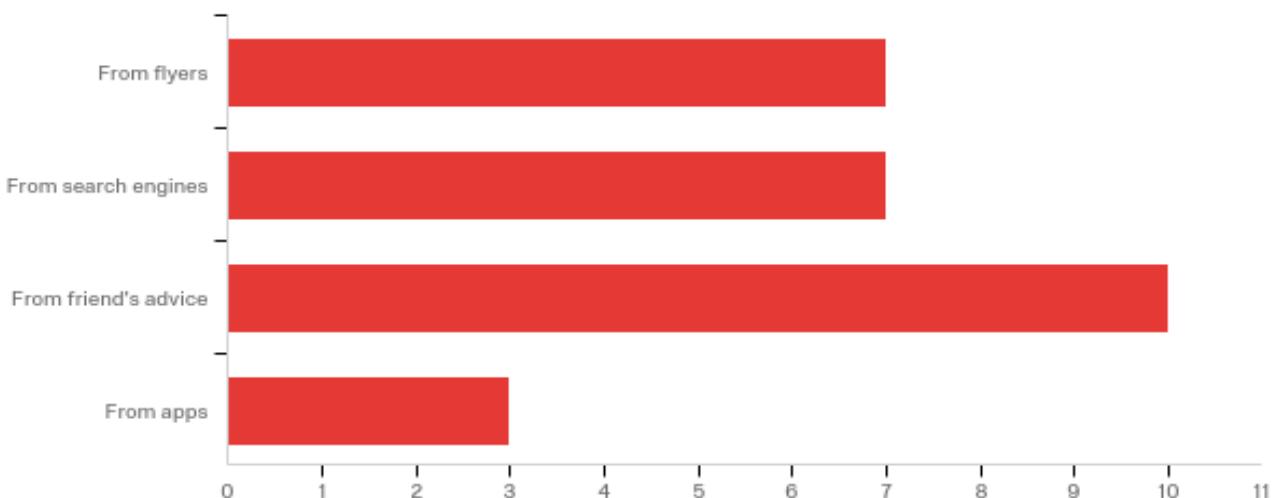
Q - Do you consent to take part in this survey? [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you consent to take part in this survey? [Please select one of the following.]	1.00	2.00	1.10	0.31	0.09	48

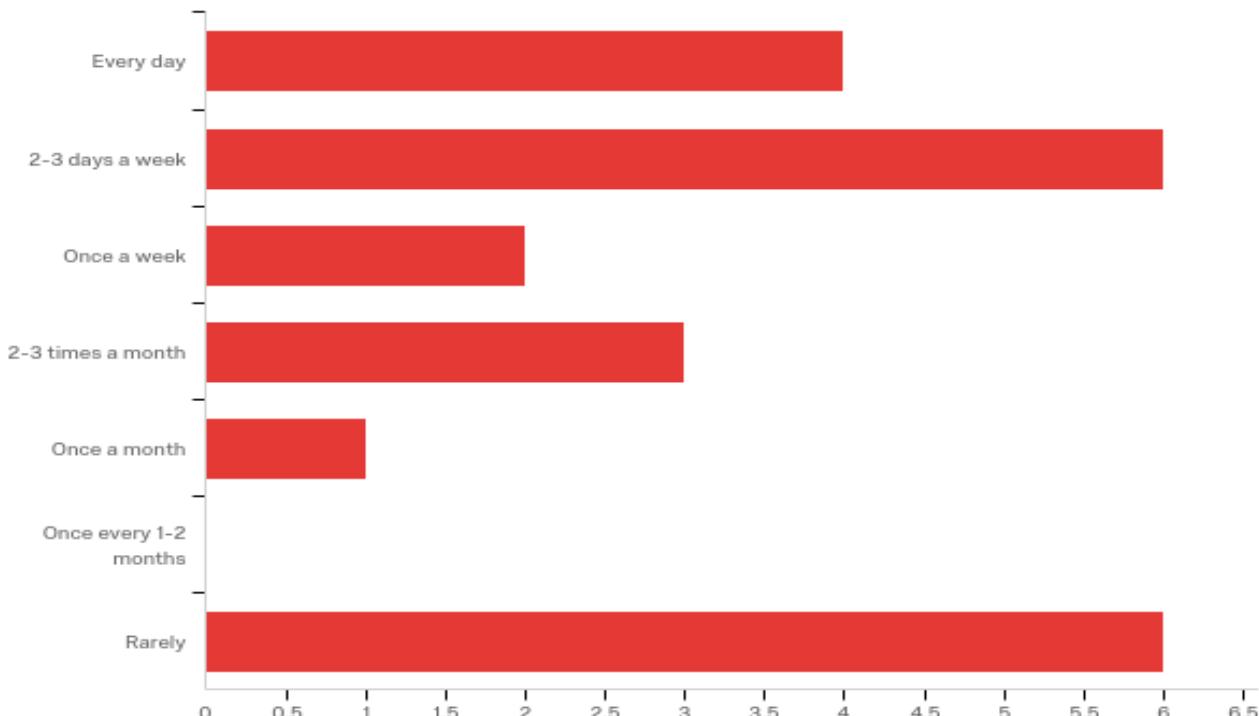
#	Answer	%	Count
1	Yes I do.	89.58%	43
2	No I do not.	10.42%	5
	Total	100%	48

Q1 - How do you find out about boulder climbing places? [Please select one or more of the following.]



#	Answer	%	Count
1	From flyers	25.93%	7
2	From search engines	25.93%	7
3	From friend's advice	37.04%	10
4	From apps	11.11%	3
	Total	100%	27

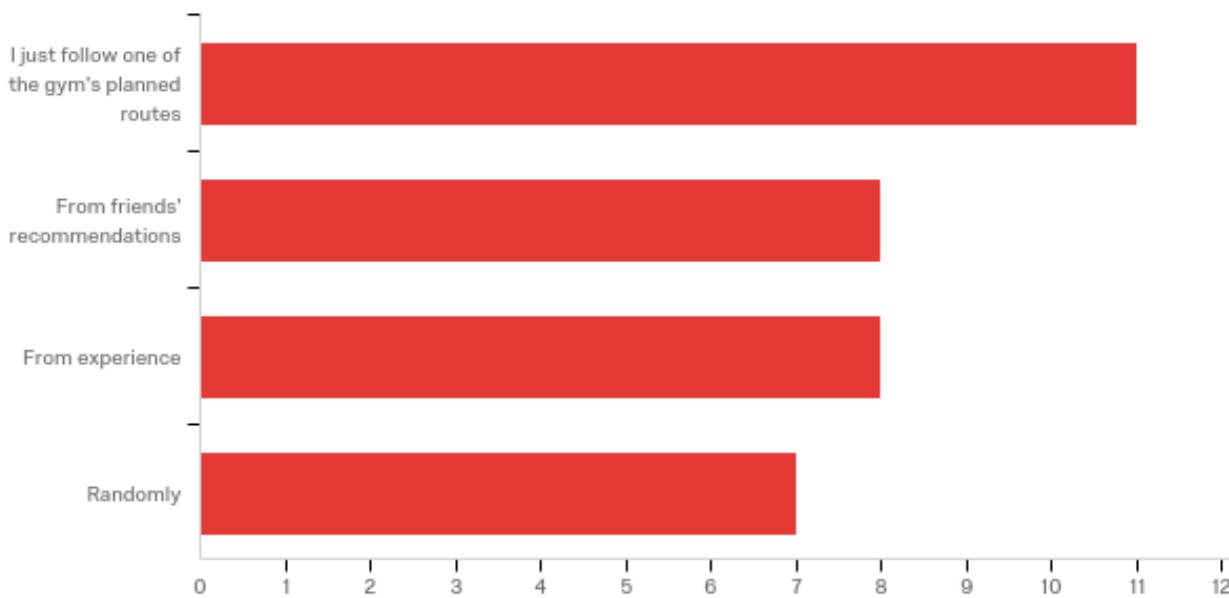
Q2 - How often do you go boulder climbing? [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How often do you go boulder climbing? [Please select one of the following.]	1.00	8.00	3.77	2.29	5.27	22

#	Answer	%	Count
1	Every day	18.18%	4
2	2-3 days a week	27.27%	6
8	Once a week	9.09%	2
4	2-3 times a month	13.64%	3
3	Once a month	4.55%	1
5	Once every 1-2 months	0.00%	0
6	Rarely	27.27%	6
	Total	100%	22

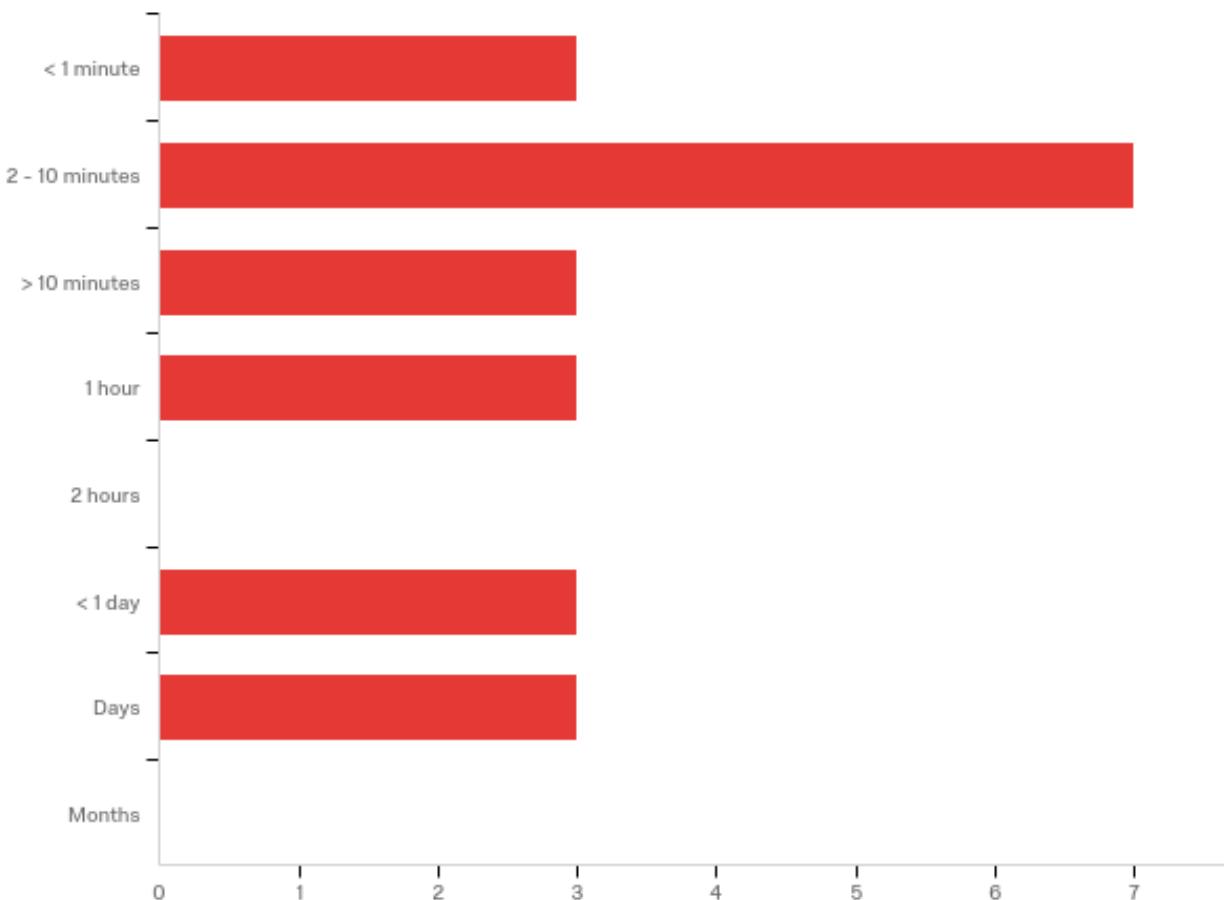
Q3 - How do you usually select a route to climb? [Please select one or more of the following.]



#	Answer	%	Count
1	I just follow one of the gym's planned routes	32.35%	11
2	From friends' recommendations	23.53%	8

3	From experience	23.53%	8
4	Randomly	20.59%	7
	Total	100%	34

Q4 - On average how long does it take for you to finish a route? [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	On average how long does it take for you to finish a route?[Please select one of the following.]	1.00	9.00	4.05	2.72	7.41	22

#	Answer	%	Count
1	< 1 minute	13.64%	3
2	2 - 10 minutes	31.82%	7
3	> 10 minutes	13.64%	3

5	1 hour	13.64%	3
6	2 hours	0.00%	0
7	< 1 day	13.64%	3
9	Days	13.64%	3
10	Months	0.00%	0
	Total	100%	22

Q5 - What kind of difficulties do you have during climbing? [Please fill in the text box below.]

What kind of difficulties do you have during climbing? [Please fill in the text box below.]

weak arm can't lift my body

dyno 跨度太大

Finding routes clearly

Lack of stamina and incorrect position

hard to remember the route if its not one color route.

j

qqq

Just because I am a climber with poor techniques and body height.

I am not strong enough

I barely manage to grab of the rocks

weak physical strength

Only my lack of techniques and body height. Sometimes I forgot where's the next hold.

Q6 - What will make your climbing easier?[Please fill in the text box below.]

What will make your climbing easier?[Please fill in the text box below.]

more excercises

增强力量

More training for staff aimed at supporting children

More practice

Able to look at someone to demo the route I want to climb , so I can illuminated the position, how to balance your body, how can we use least energy to get that pint and the way to grab the point .

the indicate during climbing would be helpful

j

qqq

... climbing with a better climber maybe, but I prefer climbing alone. A comment area for every routes will be very helpful. On the other hand, it must be optional, or it will spoil the plan of some climbers (they might hate to know any information about how to solve a new bouldering problem). So maybe a 'spoiler alert' could help?

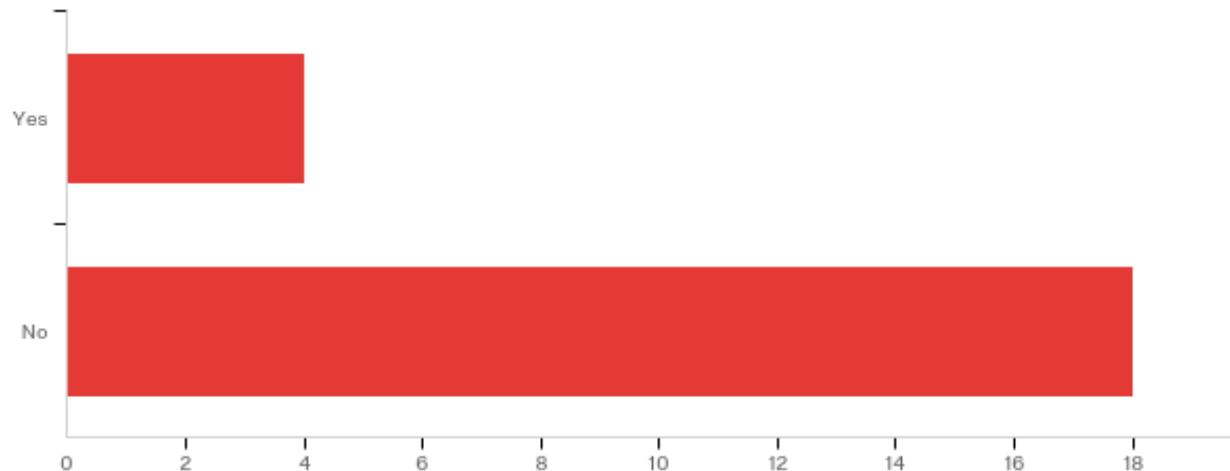
Climbing more so that I can build more muscles

Easier steps around and better fitness

good climbing shoes

Some better climbers together? But I prefer climbing alone, so a comment section for routes will help. On the other hand, pay attention to the special requires of some hard core climbers. Some of them hate to know any information except the route itself before they start to solve a problem(that's how we call a bouldering route). Maybe 'spoiler alert' for those comments which might give the clue of solving problems.

Q7 - Have you ever used an app related to bouldering before? [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Have you ever used an app related to bouldering before? [Please select one of the following.]	1.00	2.00	1.82	0.39	0.15	22

#	Answer	%	Count
1	Yes	18.18%	4
2	No	81.82%	18
	Total	100%	22

Q7.1 - Which app(s) did you use? [Please fill in the text box below.]

Which app(s) did you use? [Please fill in the text box below.]

q

moon climbing

...forgot the name, just provides information of most climbing gyms in China. Not actually a bouldering route app.

Q7.2 - Which feature(s) did you like the most? [Please fill in the text box below.]

Which feature(s) did you like the most?[Please fill in the text box below.]

can share on the world

none, so I deleted it.

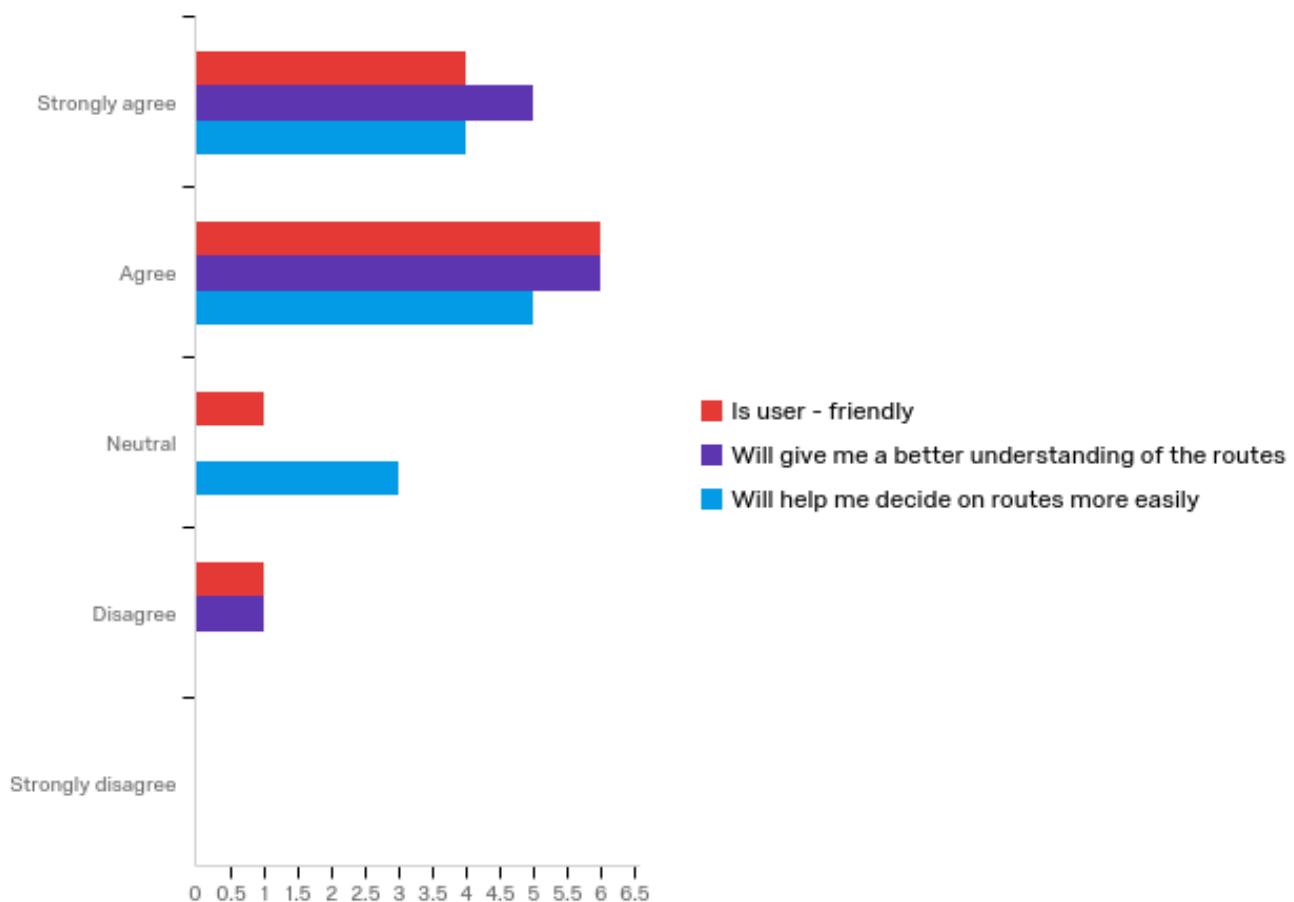
Q7.3 - In what way(s) did you find using the app(s) you mentioned difficult?[Please fill in the text box below.]

In what way(s) did you find using the app(s) you mentioned difficult?[Please fill in the text box below.]

english...

no.

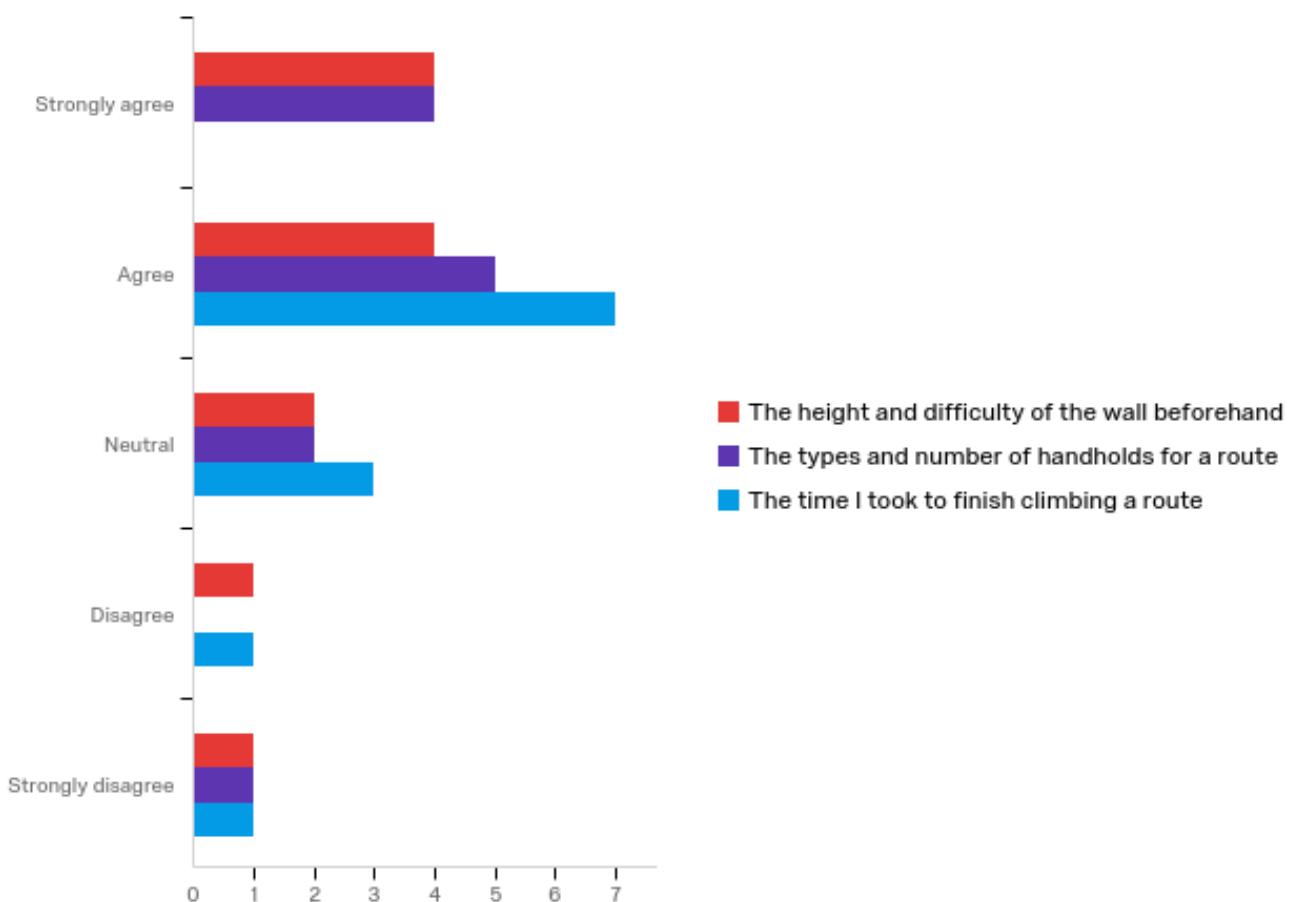
Q8 - Having seen the app's interface, I find that it:[Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Is user - friendly	1.00	4.00	1.92	0.86	0.74	12
2	Will give me a better understanding of the routes	1.00	4.00	1.75	0.83	0.69	12
3	Will help me decide on routes more easily	1.00	3.00	1.92	0.76	0.58	12

#	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total					
1	Is user - friendly	33.33%	4	50.00%	6	8.33%	1	8.33%	1	0.00%	0	12
2	Will give me a better understanding of the routes	41.67%	5	50.00%	6	0.00%	0	8.33%	1	0.00%	0	12
3	Will help me decide on routes more easily	33.33%	4	41.67%	5	25.00%	3	0.00%	0	0.00%	0	12

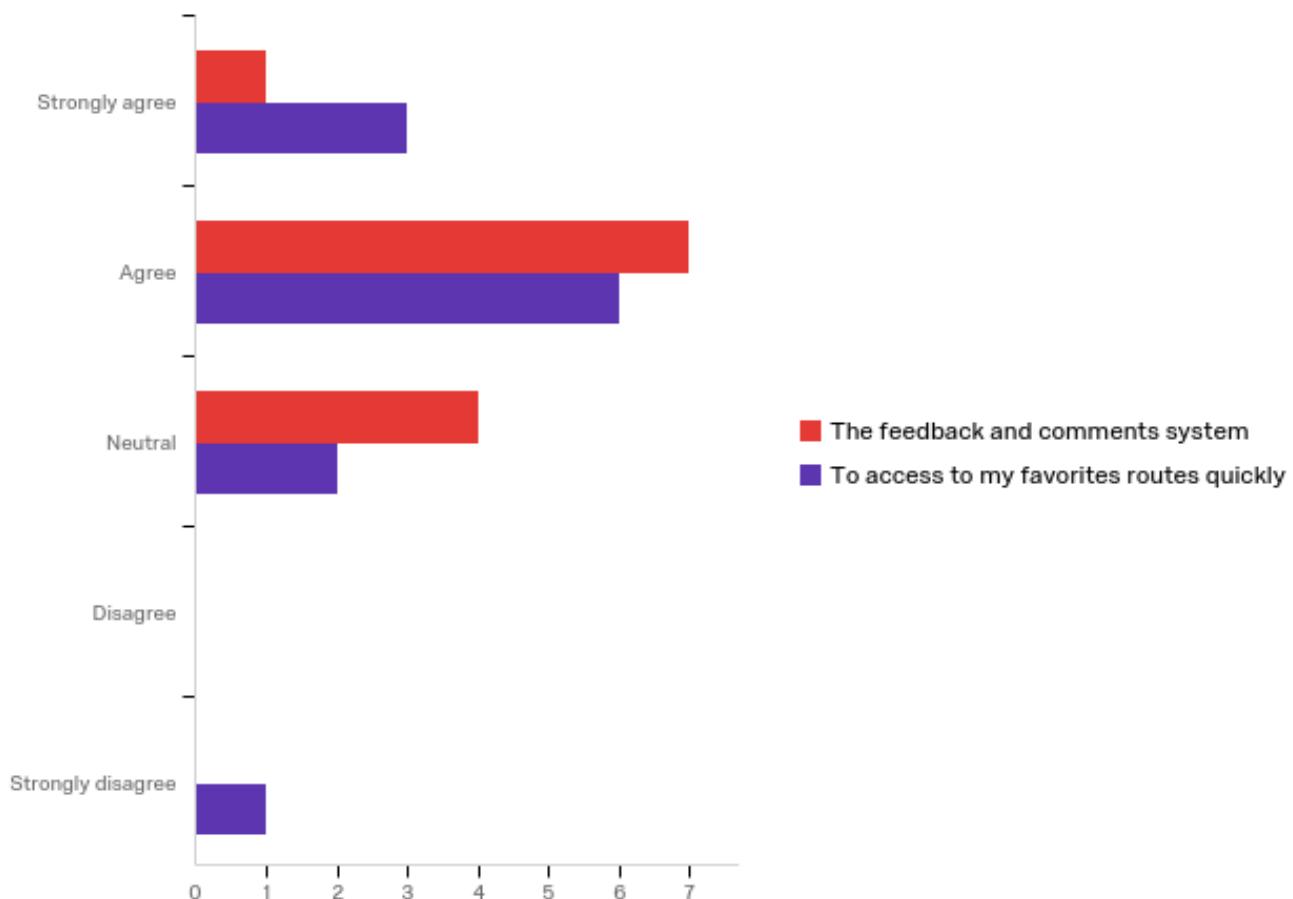
Q9 - I want to know: [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The height and difficulty of the wall beforehand	1.00	5.00	2.25	1.23	1.52	12
2	The types and number of handholds for a route	1.00	5.00	2.08	1.11	1.24	12
3	The time I took to finish climbing a route	2.00	5.00	2.67	0.94	0.89	12

#	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total
1	The height and difficulty of the wall beforehand	33.33%	4	33.33%	2	8.33%	1
2	The types and number of handholds for a route	33.33%	4	41.67%	2	0.00%	0
3	The time I took to finish climbing a route	0.00%	0	58.33%	3	8.33%	1

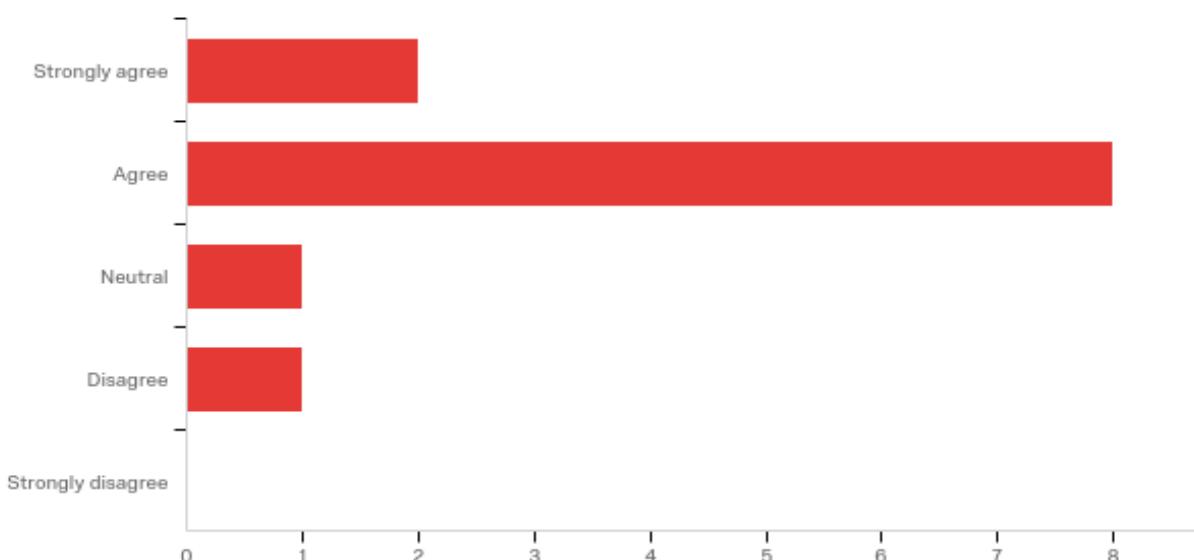
Q10 - I like: [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The feedback and comments system	1.00	3.00	2.25	0.60	0.35	12
2	To access to my favorites routes quickly	1.00	5.00	2.17	1.07	1.14	12

#	Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total
1	The feedback and comments system	8.33%	1	58.33%	7	33.33%	4
2	To access to my favorites routes quickly	25.00%	3	50.00%	6	16.67%	2

Q11 - I feel that: [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The app will be helpful to me	1.00	5.00	2.25	1.09	1.19	12

#	Answer	%	Count
1	Strongly agree	16.67%	2
2	Agree	66.67%	8
4	Neutral	8.33%	1
5	Disagree	8.33%	1
6	Strongly disagree	0.00%	0
	Total	100%	12

**Q12 - I find the following features or information about the walls or routes missing...
[Please fill in the text box below.]**

I find the following features or information about the walls or routes missing...[Please fill in the text box below.]

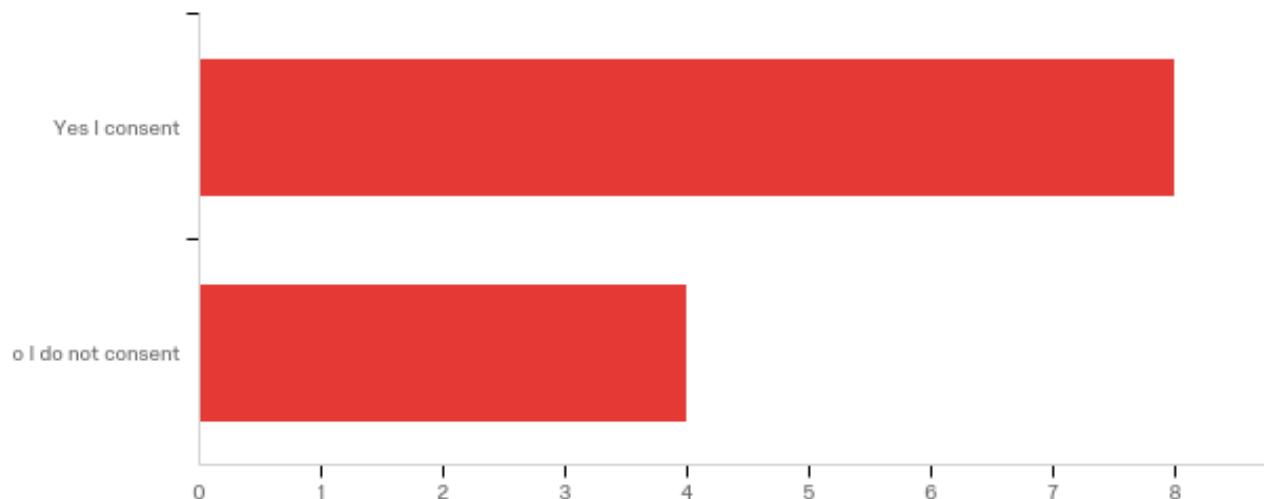
Standard difficulty of a route (V0, V1, etc.)

Sorry , I can't get what this sentence mean.

the app could show the standard gesture stimulation. the climbing way could be various for one route, but there could be a standard way, since for each type of handholds theres a special way to hold and move. with this function the climber can compare himself to the expert. see the difference.

It's not very professional. I don't even see the necessary information (except the comments section, it's nice) I need, like its grade and what are the holds specifically for this route, instead of a photo of the wall. And we are never care about how high a route is. As for the right way to grade a bouldering route, check with your friends who actually climb. Photos for problems you can meet the promotion group of climbing associasion. They will be definitely helpful.

Q13 - As part of our project, we would like to contact you later to get more of your opinion. Do you consent in leaving your email address? It is not compulsory. [Please select one of the following.]



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	As part of our project, we would like to contact you later to get more of your opinion. Do you consent in leaving your email address? It is not compulsory.[Please select one of the following.]	1.00	2.00	1.33	0.47	0.22	12

#	Answer	%	Count
1	Yes I consent	66.67%	8
2	No I do not consent	33.33%	4
	Total	100%	12

Q13.1 - Please write your email down below:

Please write your email down below:

yueli@nottingham.edu.cn

Sqyzt1@nottingham.edu.cn

zy18618@nottingham.edu.cn

seywh1@nottingham.edu.cn

Abdulboy2k6@yahoo.com

sgyyw3@nottingham.edu.cn

zy22182@nottingham.edu.cn

Boulder Climbing System

User Manual

By Team 15:

Denis Stepanov, 20027064

Masrur Sobirov, 16519829

Yiming Chen, 16522026

Mingda Liu, 16522047

Tianhao Li, 16522042

Cheong Nam Kwong Melanie Mee-Lin, 20027069

Installation



Figure 1: QR Code for Download

Scan the QR code or access <http://45.32.90.197/res/apk/BCS.apk> to download the android package and install it on an Android mobile device.

Installation

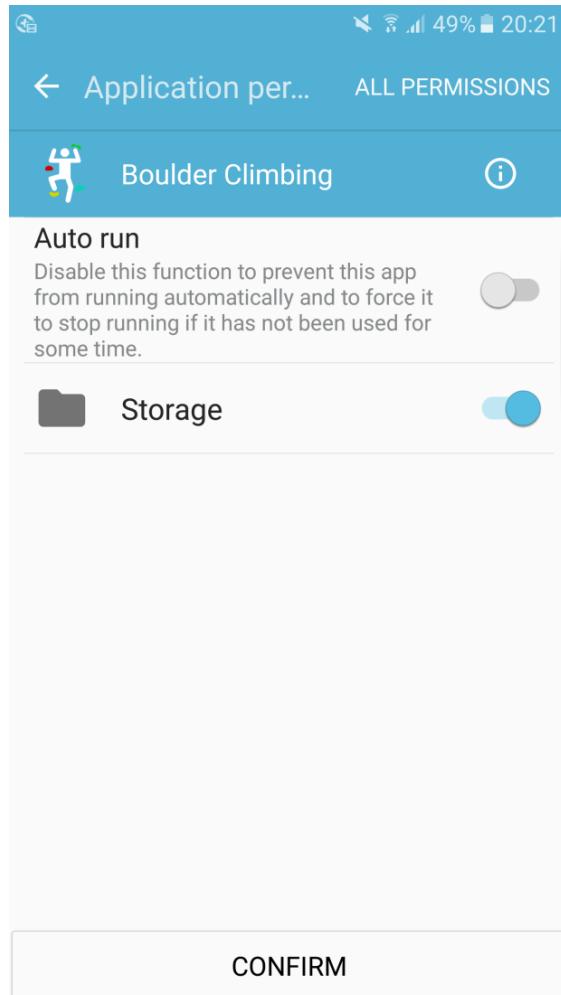


Figure 2: Grant permission

Install the android package and give it permission to use the storage. If application is not allowed to use the storage, it will load the pictures from the server every time when going over the pages in the application.

Home Page

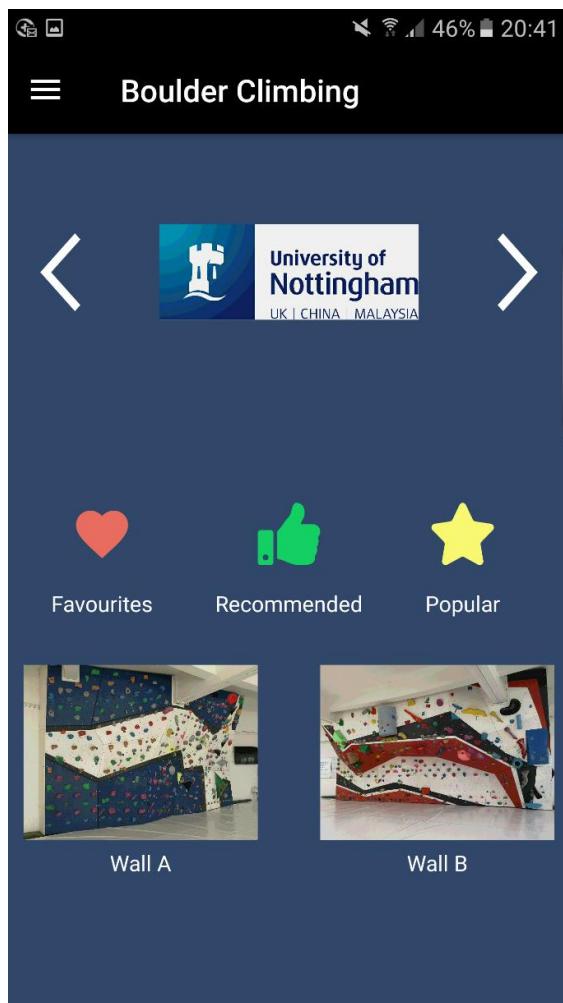


Figure 3: Overview of Home Page

Figure 3 displays the home page which shows Favourite, Recommended and Popular routes at the center. Furthermore, the navigation drawer button on top left corner, slides below the header, two buttons of main walls on the bottom. University of Nottingham's logo can be pressed to jump to the school's web-page.

Home Page

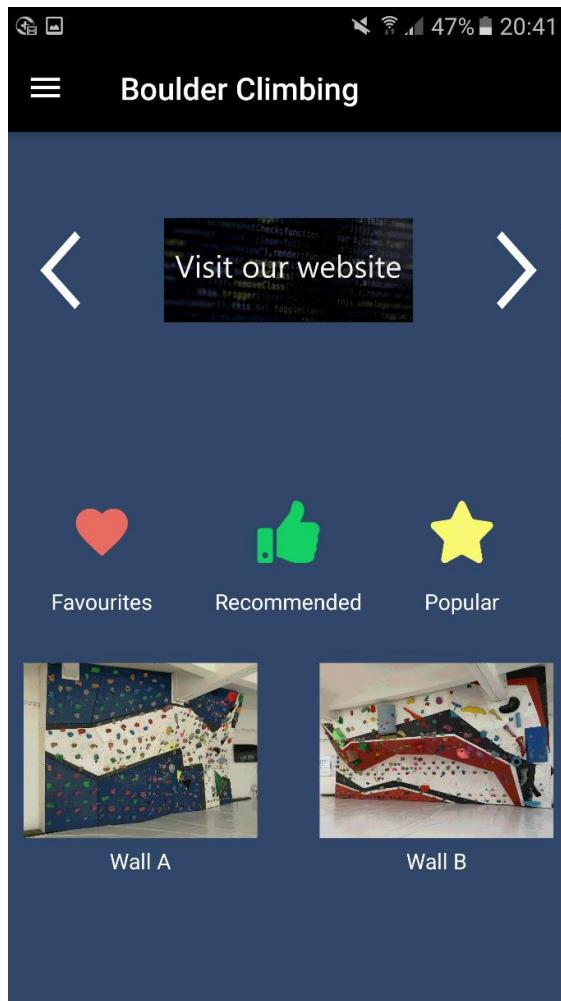


Figure 4: Slides

Press the slide with text “Visit our website” to jump to the website of our team’s project.

Home Page

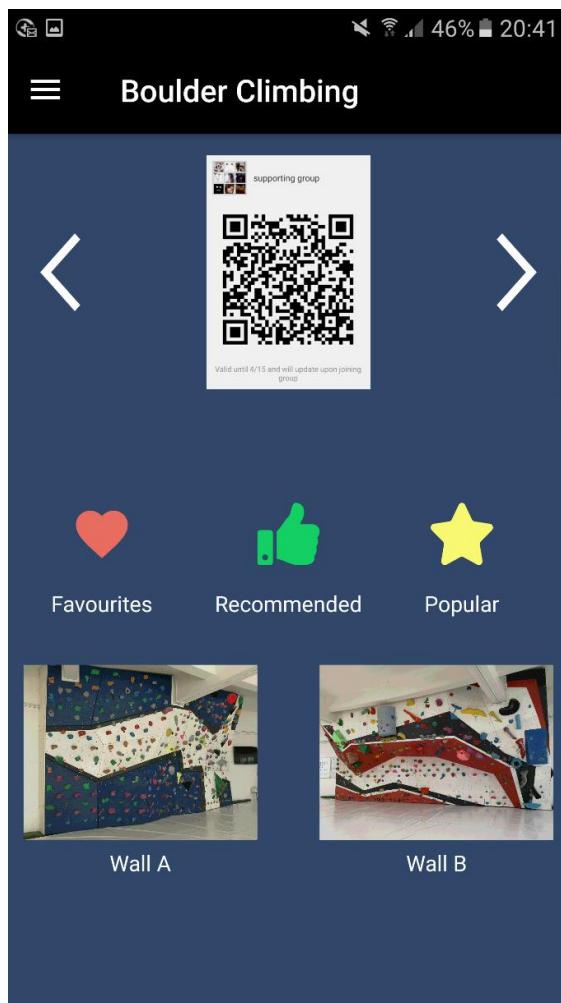


Figure 5: Slides

Slide shown on Figure 5 contains a QR code with link to team's support chat. Scan it to get help or share the suggestions in the chat.

“Hamburger” Menu

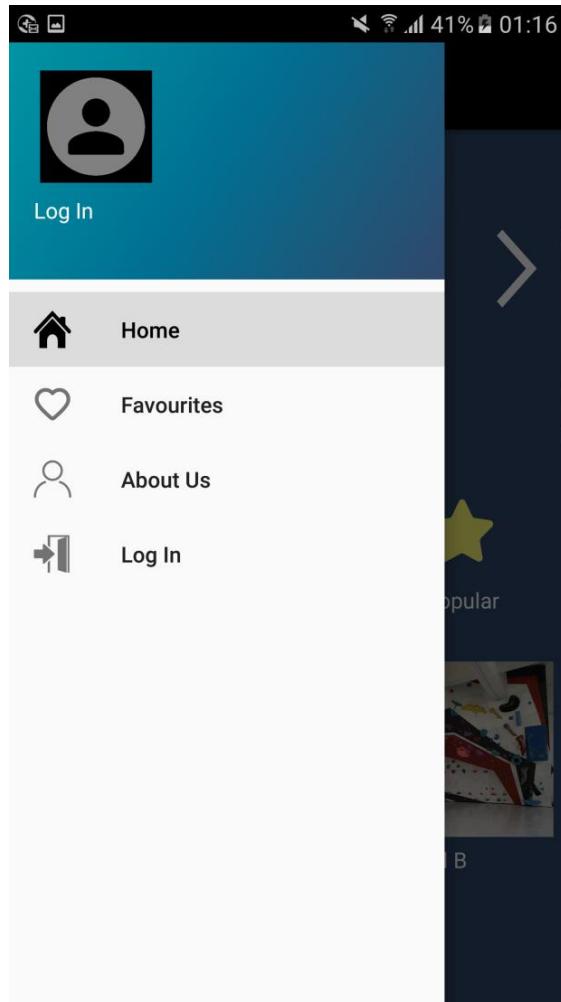


Figure 6: Navigation drawer

There are two parts in the menu shown in Figure 6. Upper part contains login information, which includes avatar, username and email. If not logged in: default avatar and “Log In” text. Lower part contains four buttons with different functions which are explained further.

About Us

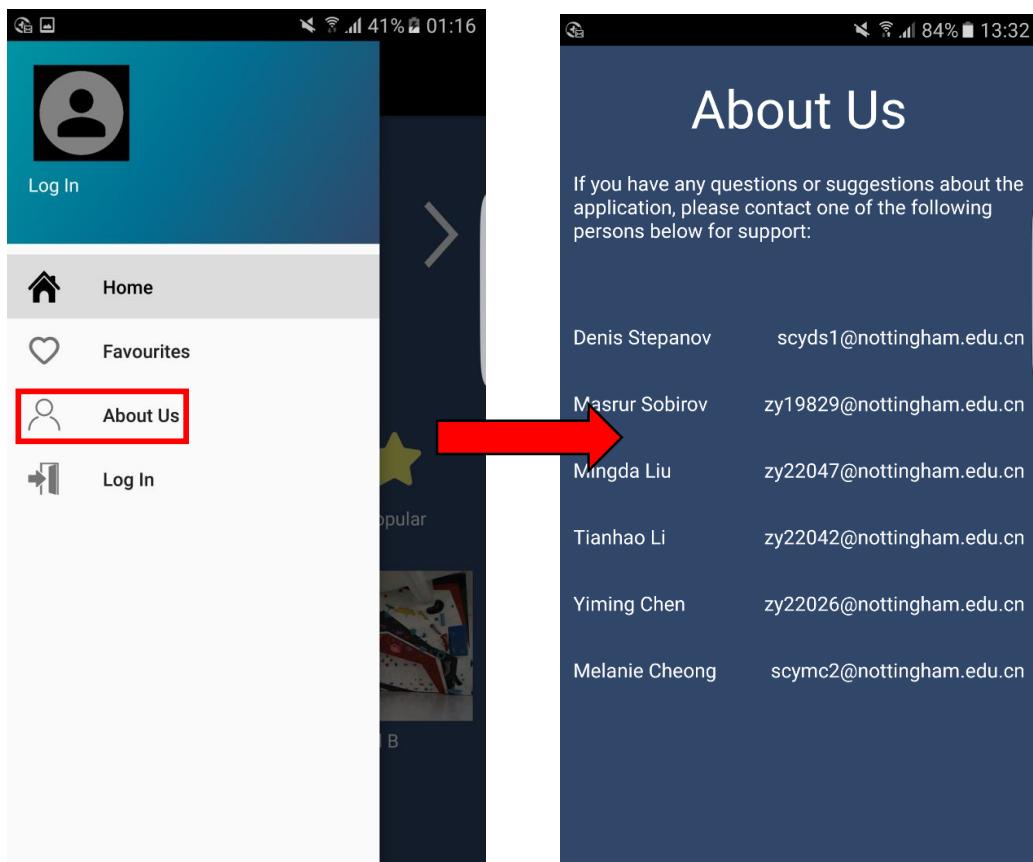


Figure 7: Hamburger – About Us

Press on “About Us” button to see a page with the team’s information.

Log In

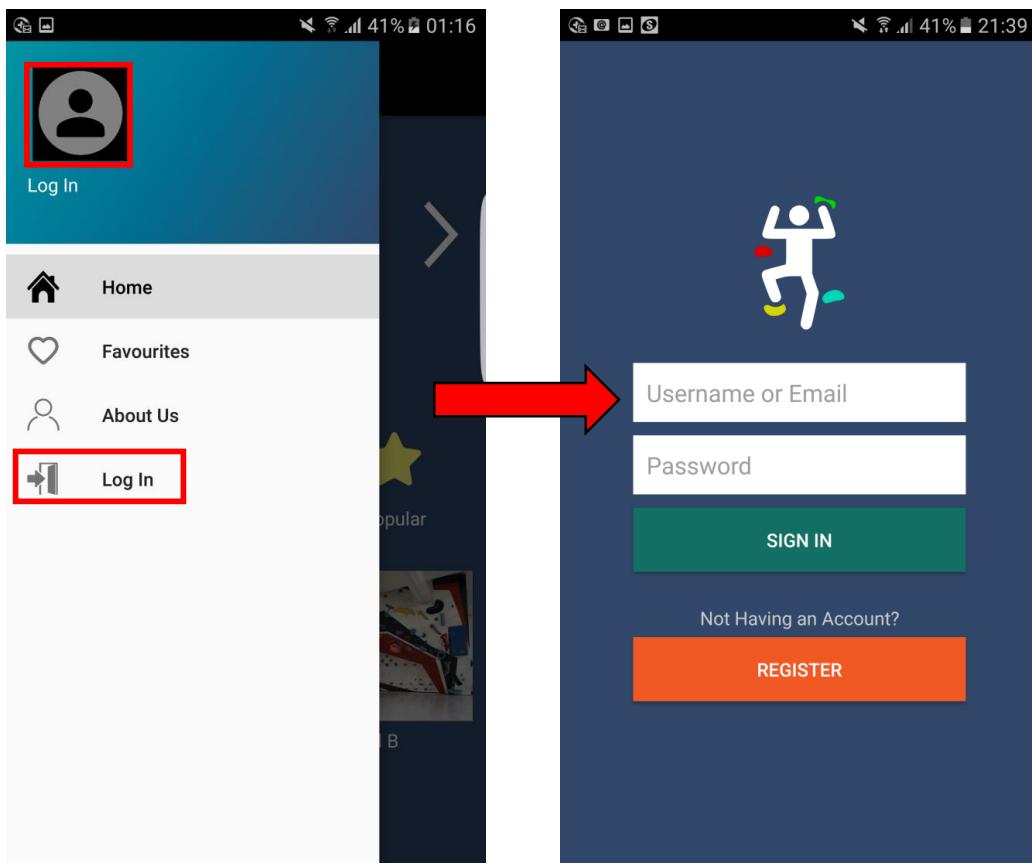


Figure 8: Hamburger – Log In

Press on the default avatar or the “Log In” button to go to the Log In page if not logged in.

Log In

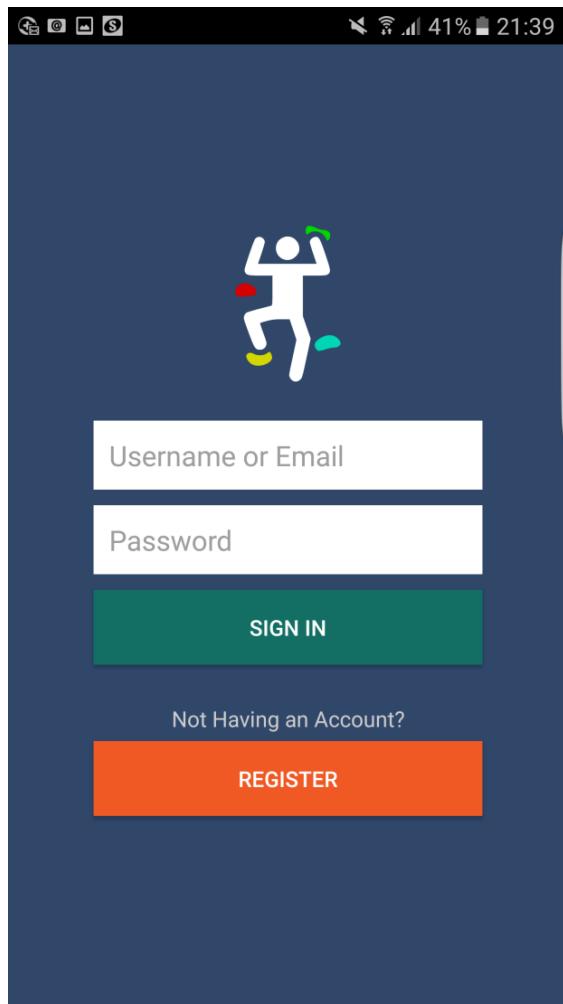


Figure 9: Log In

Log in using the existing account's username or email and password. To create an account press "Register" which will show Registration page.

Log In

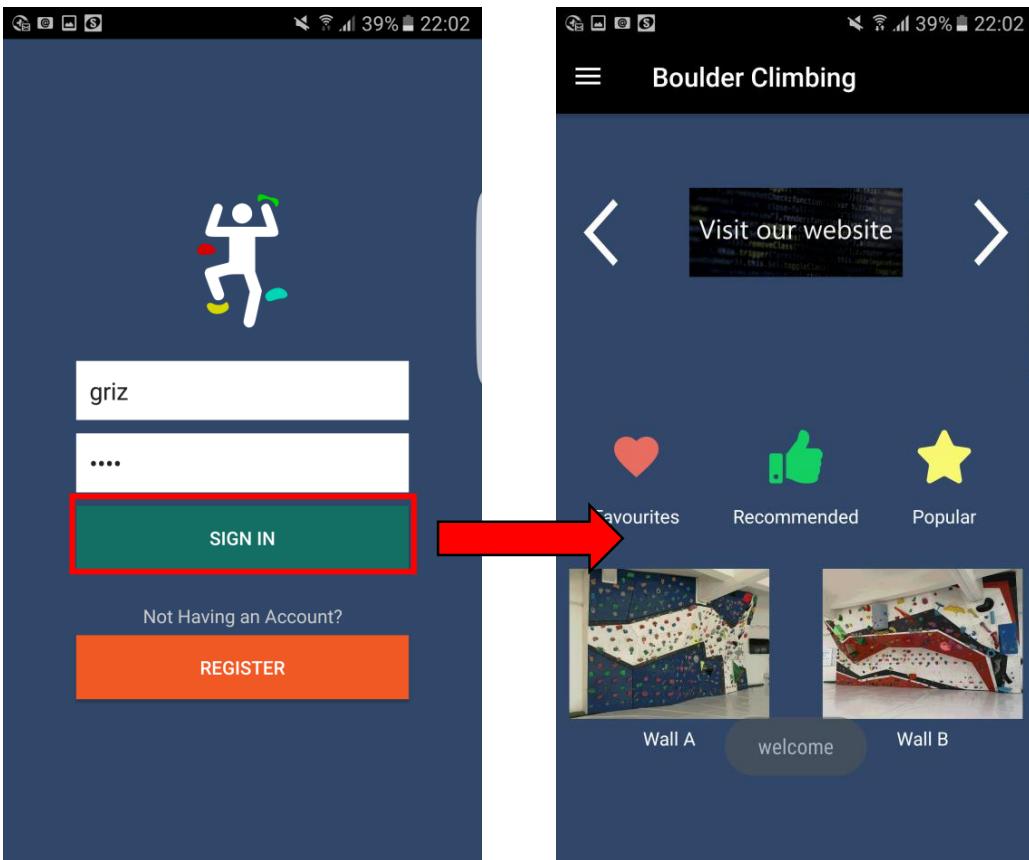


Figure 10: Log In – Home

Pressing on “SIGN IN” button, application displays the home page if login is valid.

Registration

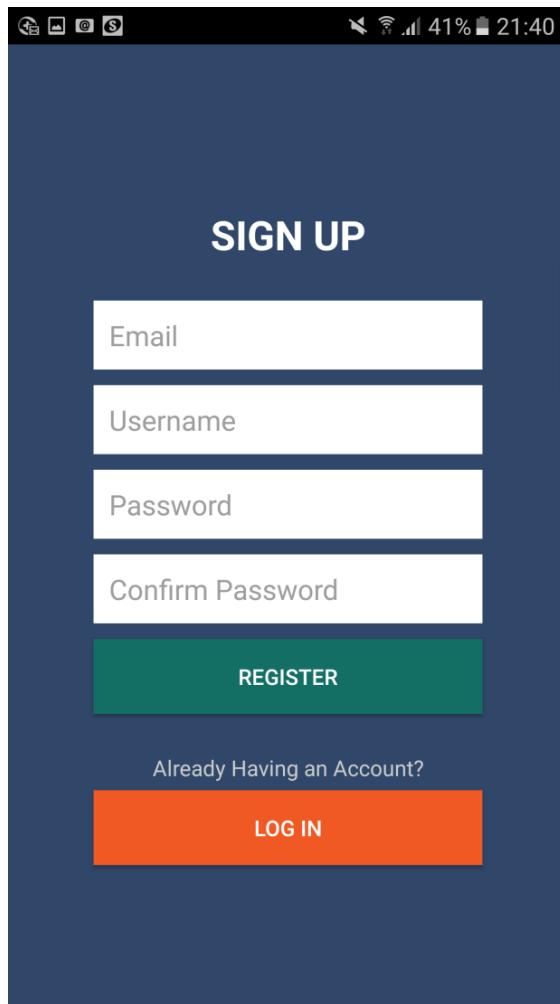


Figure 11: Registration

Register to access more functions of this application.

Registration

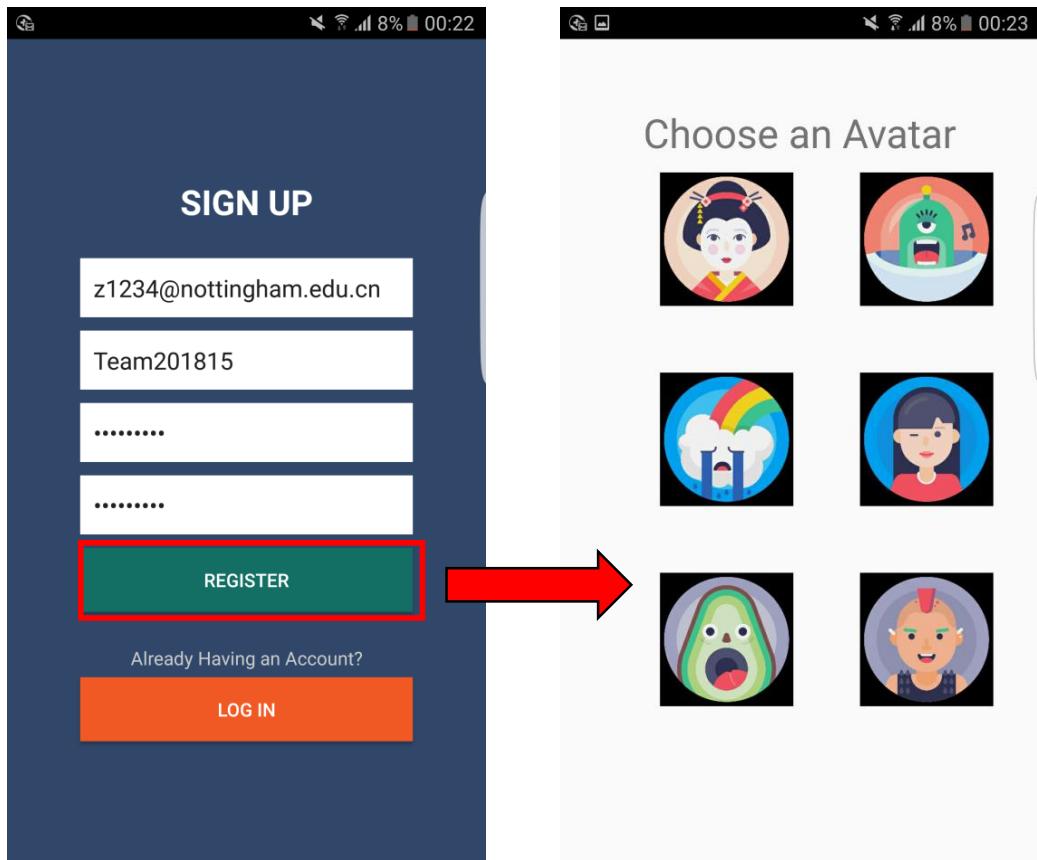


Figure 12: Register – Choose Avatar

When registration's input is valid, press on “REGISTER” to choose avatar for the account.

Valid email address: common email address format.

Valid name: consists of letters or numbers with the length between 6 and 20.

Valid password: at least 6 characters length, must have letters and numbers.

Home page is displayed after registration.

If no avatar chosen, the avatar will be set the first by default

Log In and Registration

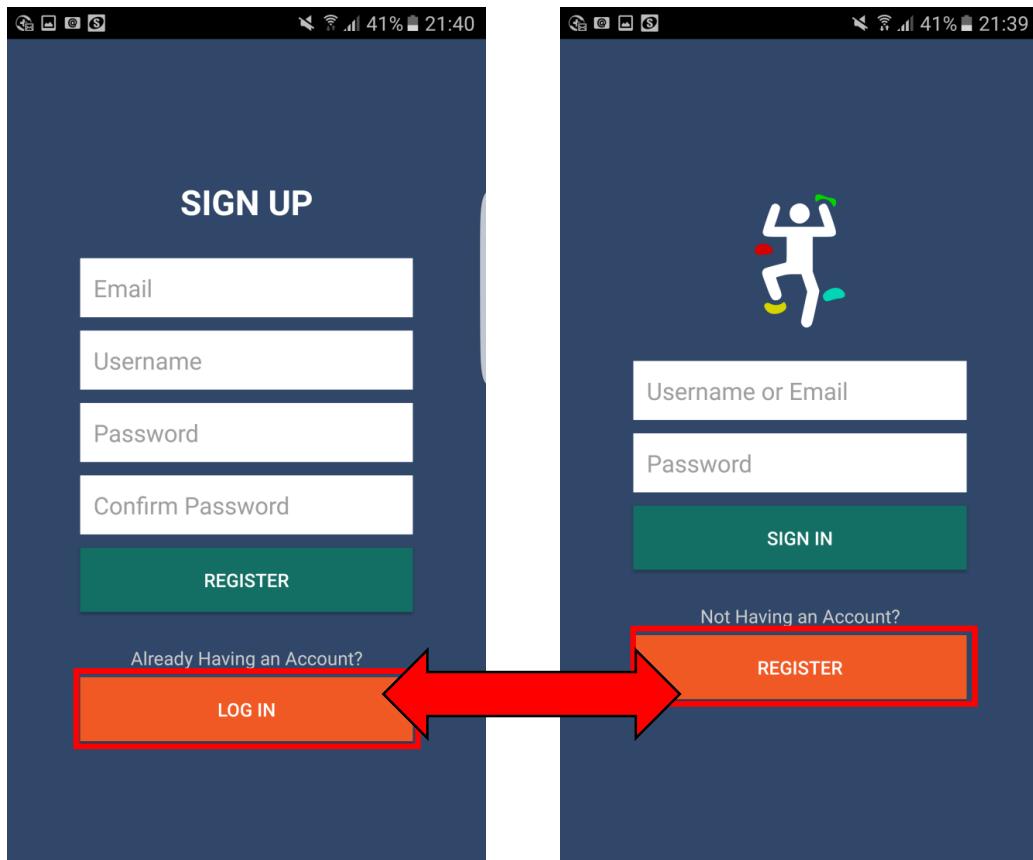


Figure 13: Log In - Registration

Switch between Log In and Registration pages by pressing the corresponding buttons.

Hamburger

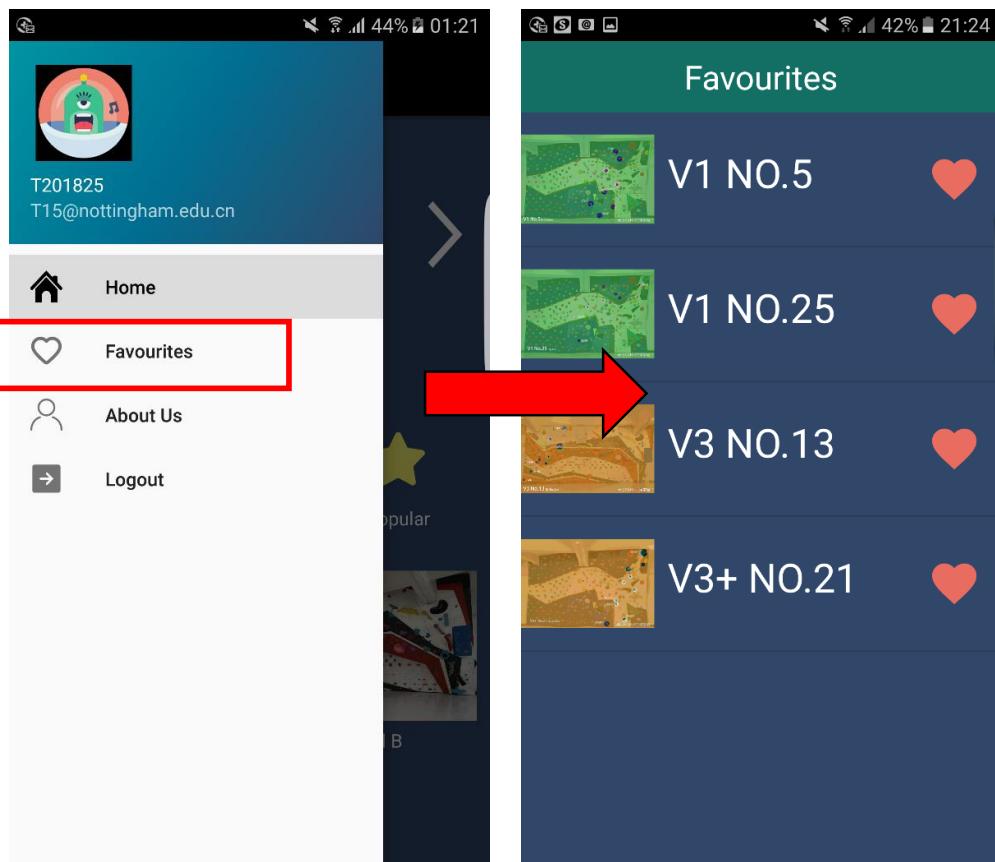


Figure 14: Favourites

If you are logged in, you can jump to favourite routes list by pressing on the “Favourites” button. Otherwise, a prompt window will pop up to remind you to log in.

Hamburger

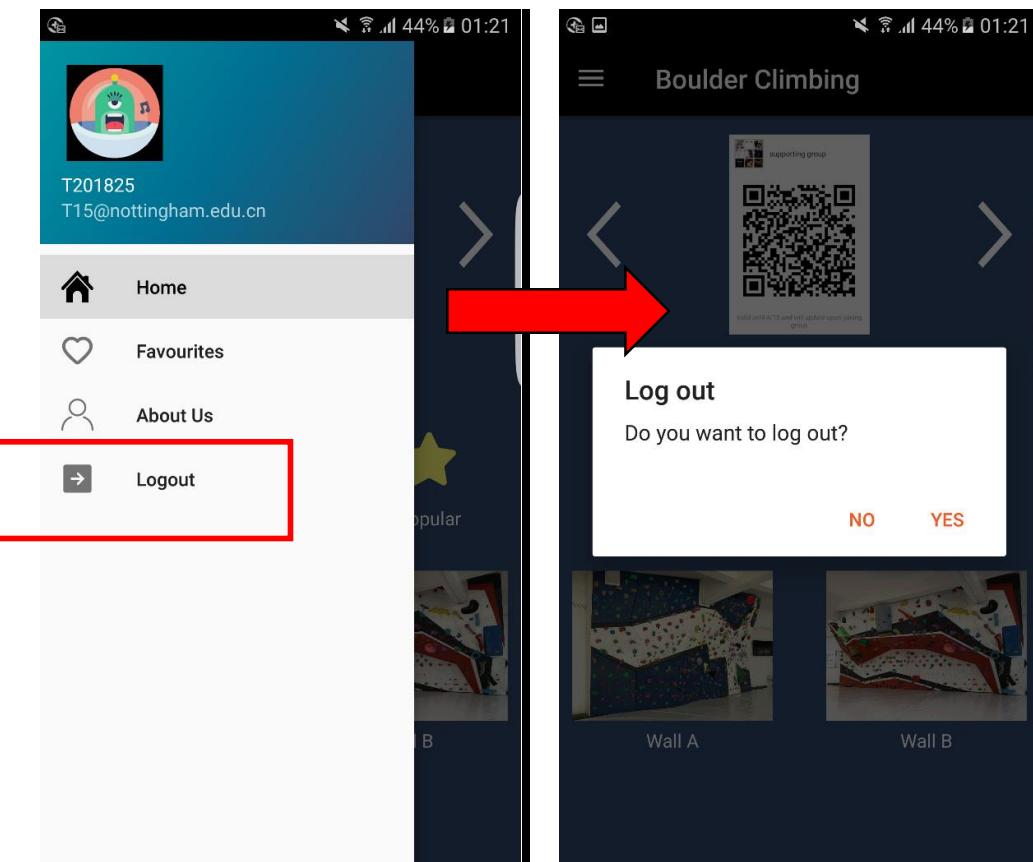


Figure 15: Log out

When you are logged in, you can log out by pressing on the “Log out” button. A window will pop up to prevent accidental triggering.

Hamburger

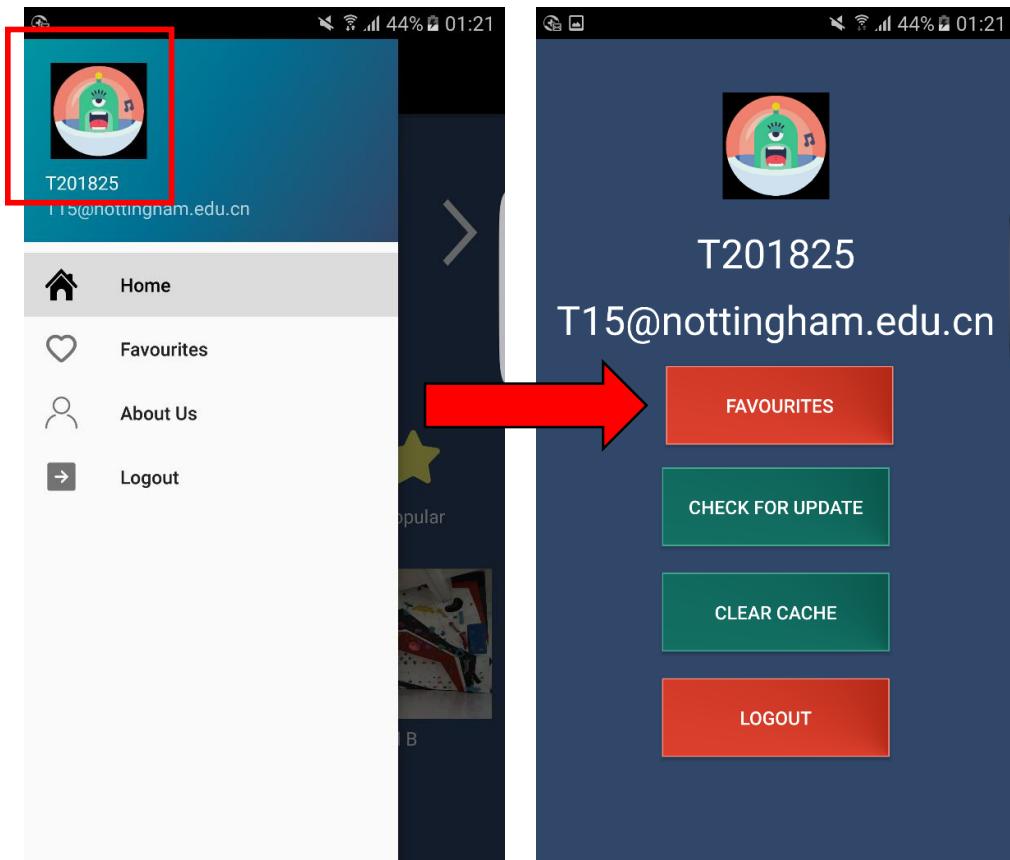


Figure 16: Profile

You can click your icon to jump to the profile page, where the personal information will be shown. In addition, you can go to favourite list, check the updated version of our application, clear the local cache or log out.

Home Page

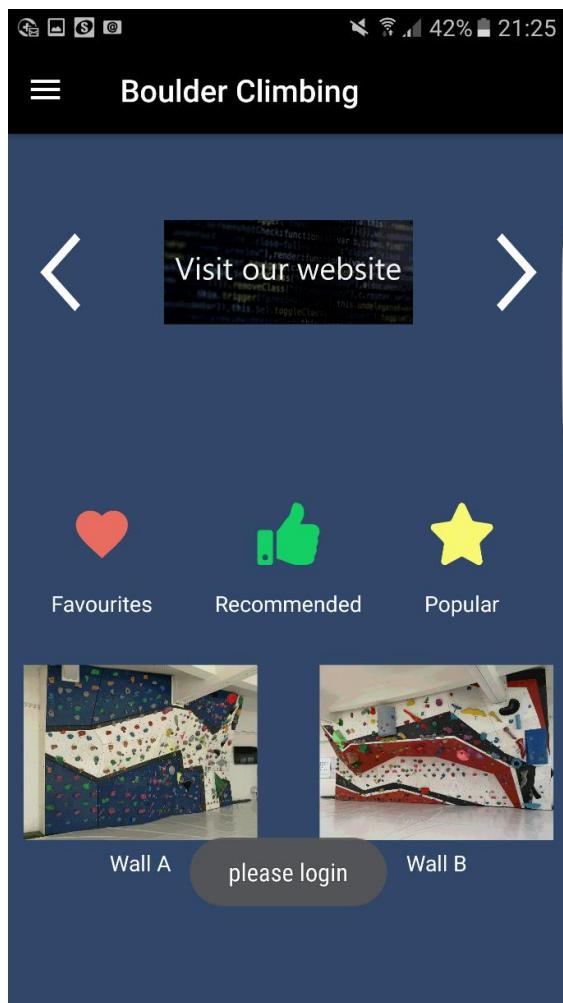


Figure 17: Favourites

Favourite list cannot be displayed if you are not logged in.
A prompt message will pop up.

Home Page

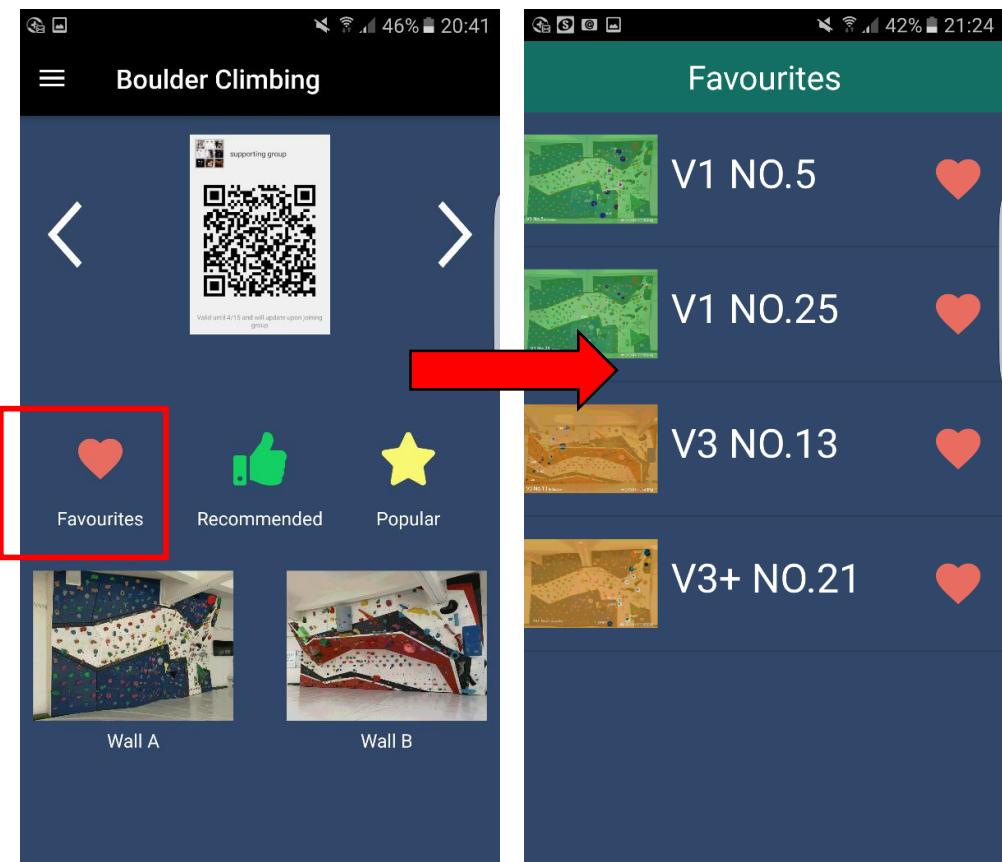


Figure 18: Favourite List

As long as you are logged in, “Favourite” button can be pressed to access the favourite routes.

Favourite Page

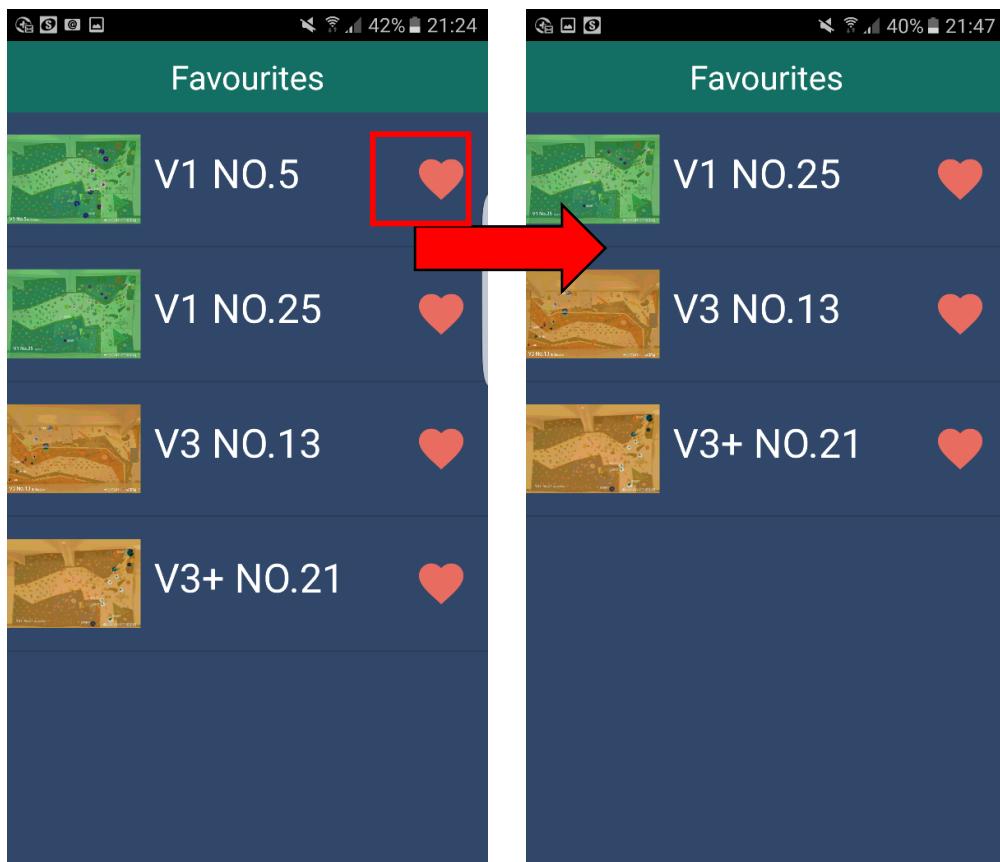


Figure 19: Remove Route

In the Favourites page, the routes are shown with their images and names. “Heart” buttons can be pressed to remove corresponding route from the Favourite list.

Recommended Page

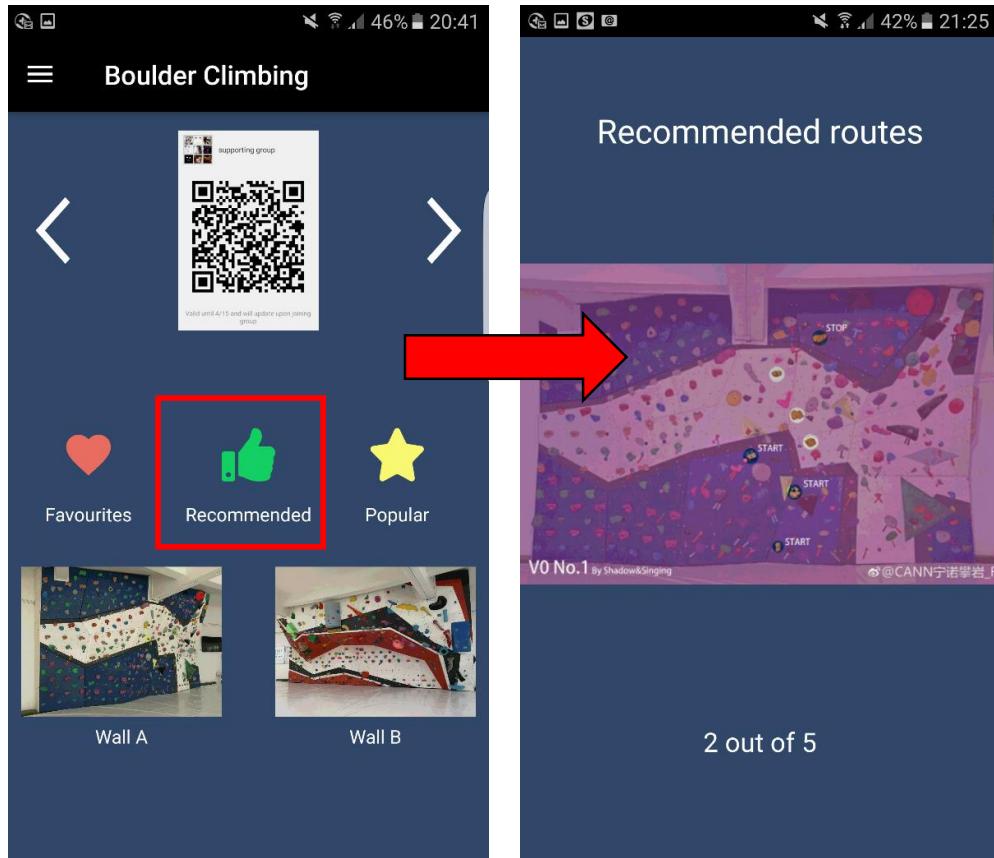


Figure 20: Recommended routes

You can go to the recommended routes page by pressing the “Recommended” button. It will display several routes recommended by our team, which are suitable for the new climbers. You can swap left or right to look through all routes.

Popular Page

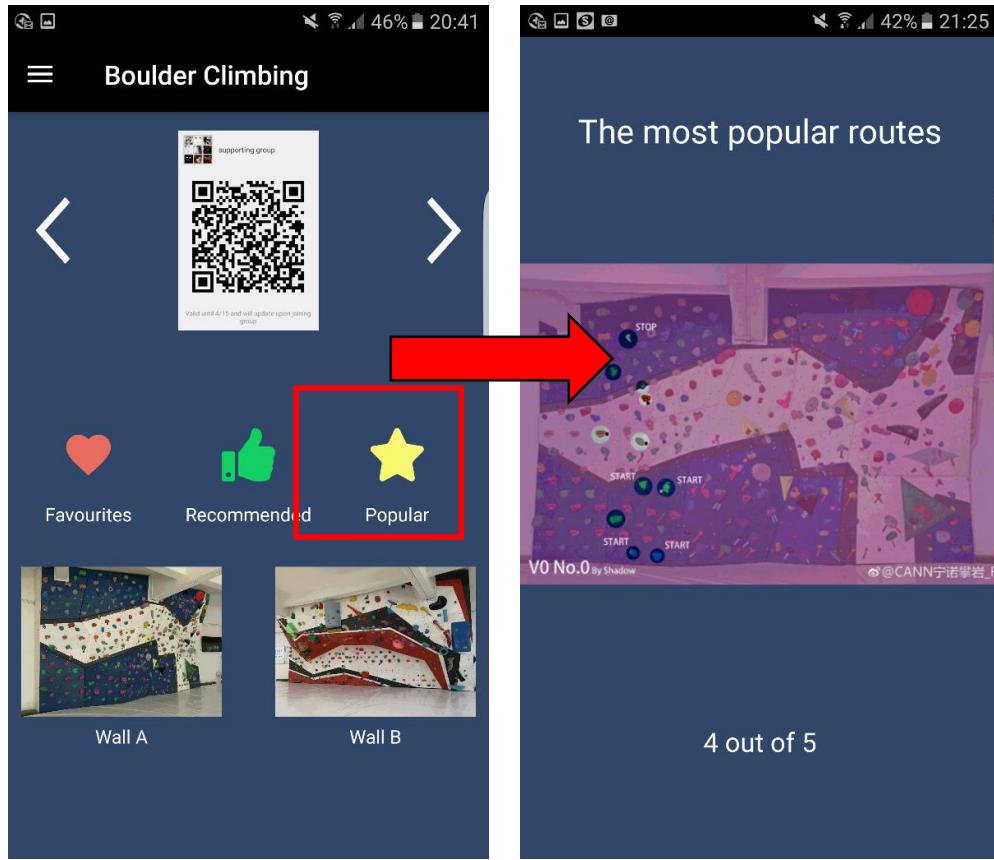


Figure 21: Popular Routes

You can go to the popular routes page by pressing on the “Popular” button. It will display the routes which are popular among the users according to number of climbers mark it as favourite. You can swap left or right to look through all routes.

Routes Activity

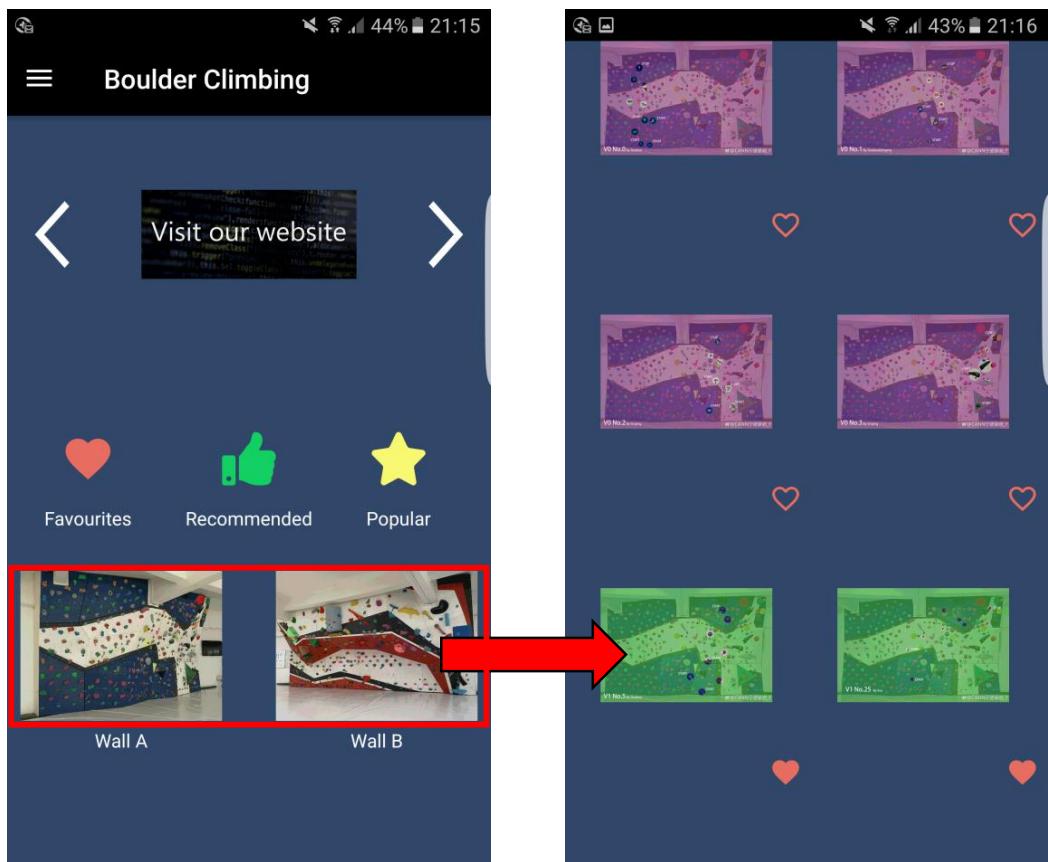


Figure 22: Walls - Routes

Press on an image of a wall to see all routes it has.

Route Infomation Page

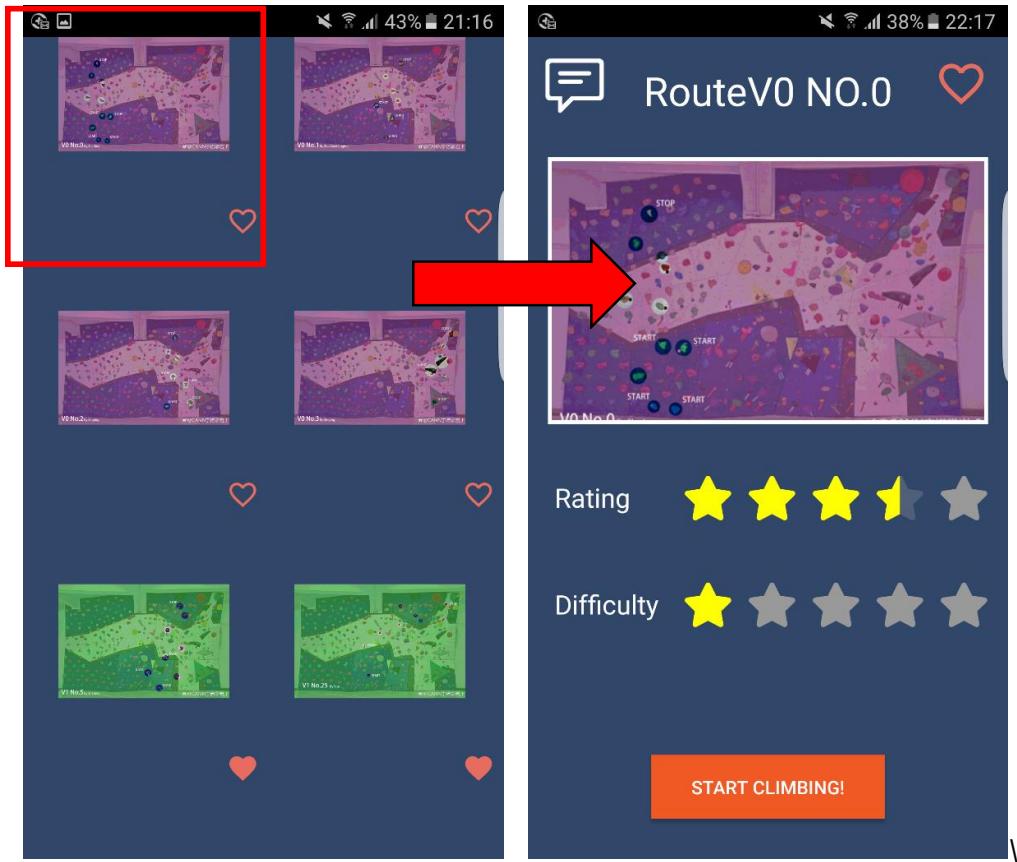


Figure 23: Routes-Route Information Page

Pressing on a specific route will redirect you to that corresponding route's information page. The details of that route, including name, picture, overall rating and difficulty are shown. On the top, the "V" in the name represents the standard difficulty, the number represents how hard it is.

Route infomation Page

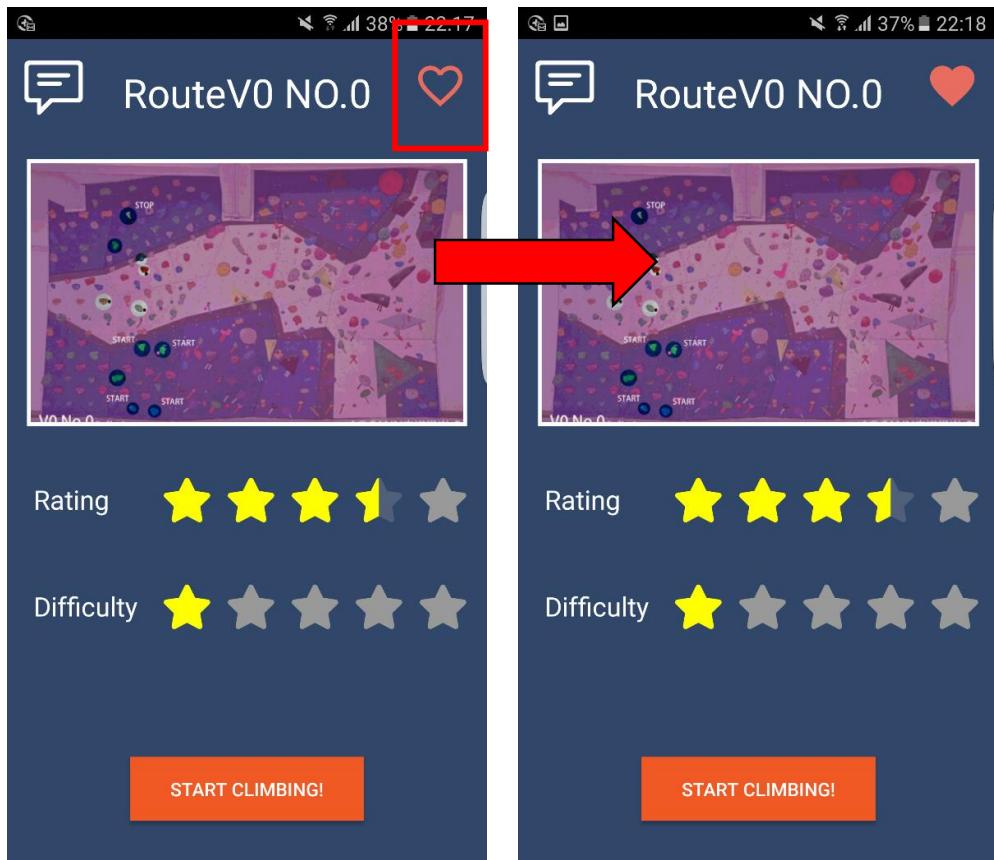


Figure 24: Favourite Button

The heart located in the top right corner shows if you have added this route into your favourite list. If it is not full, then it's not your favourite, you can press on the heart to add the current route to your favorite list. And vice versa, if you press the heart when it is full, you will remove it from the list.

Route infomation Page

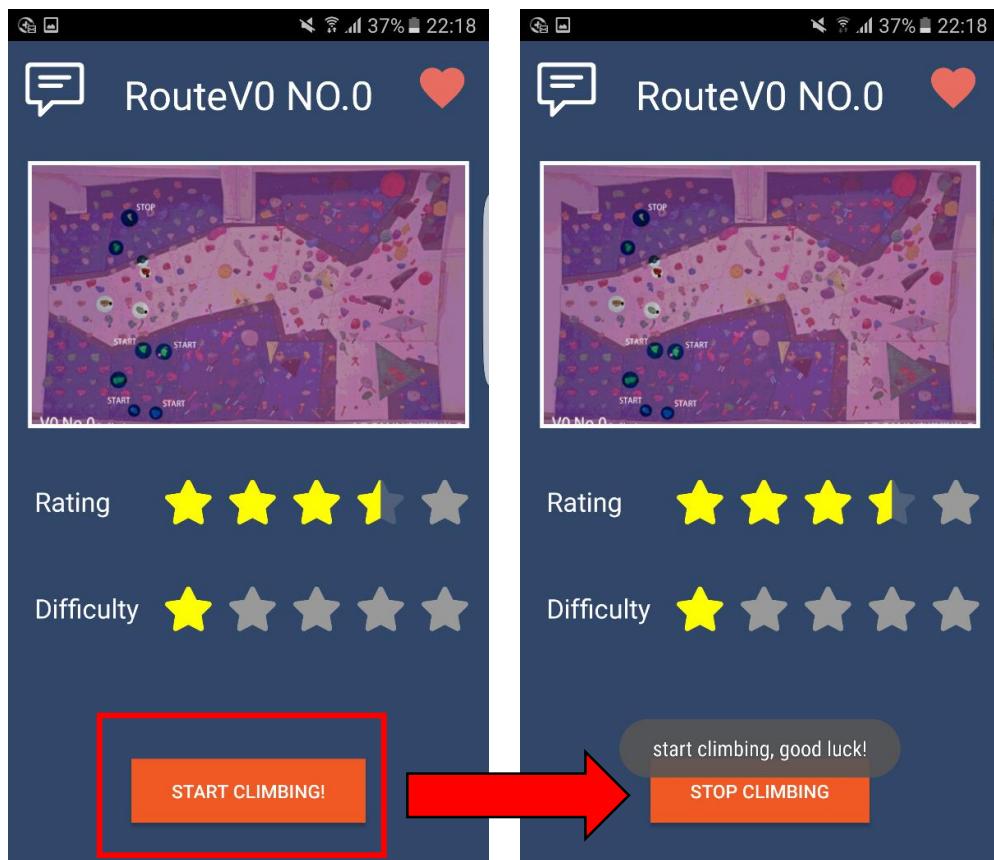


Figure 25: Start Climbing

When you want to start climbing a route, press the “start climbing” button to start a timer which records the climbing time.

Route infomation Page

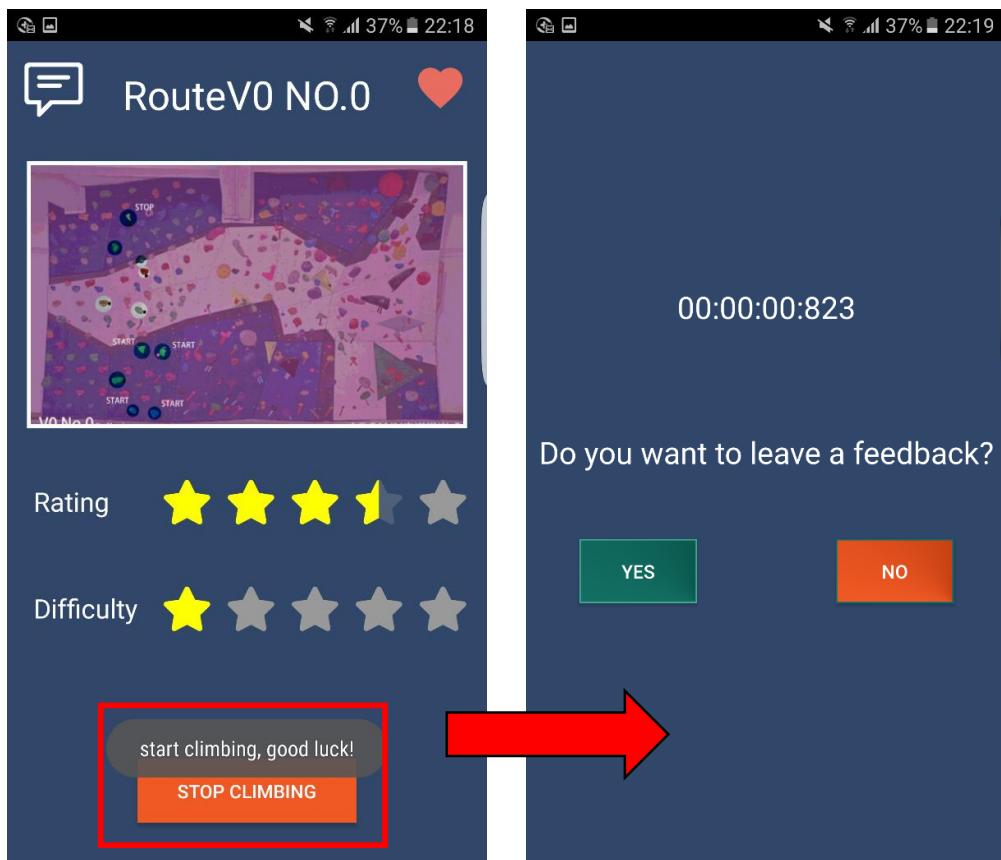


Figure 26: Stop Climbing

When you finish climbing, you can press “stop climbing” button to get your record.
You can also leave your feedback if you want.

Route infomation Page

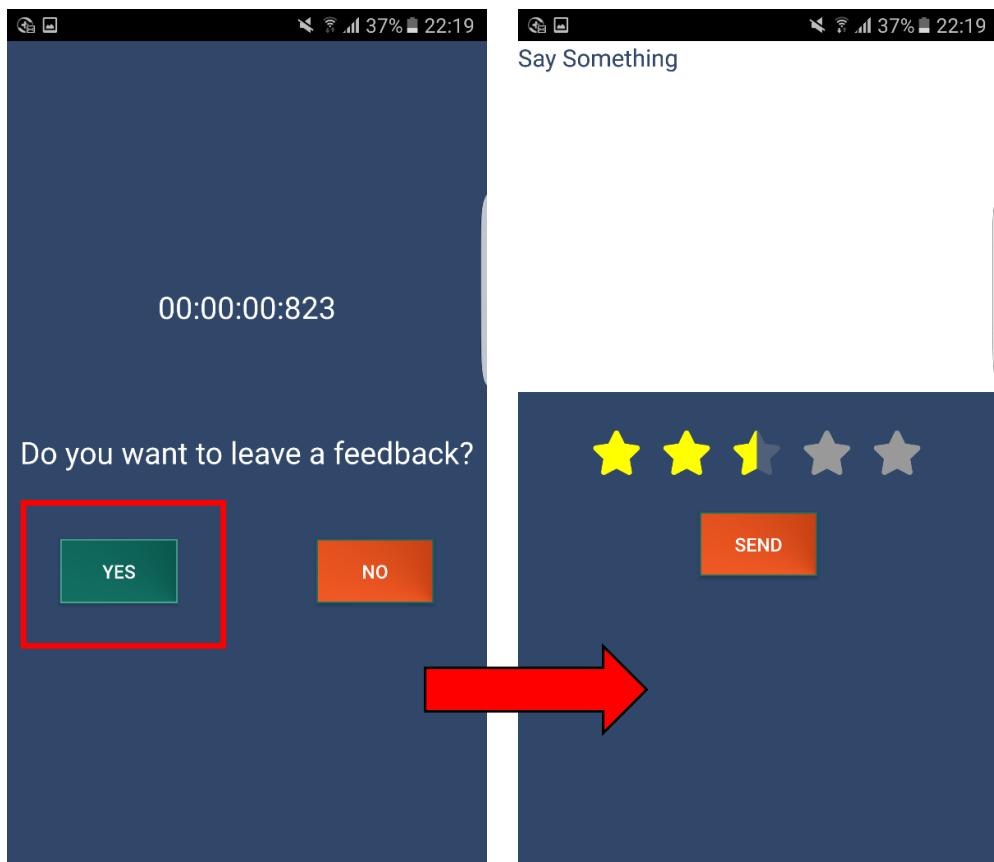


Figure 27: Leave a Comment

If you are logged in, you can press “YES” button to leave a comment and a rating on a route. Pressing on “NO” button, will return you to route information page

Route infomation Page

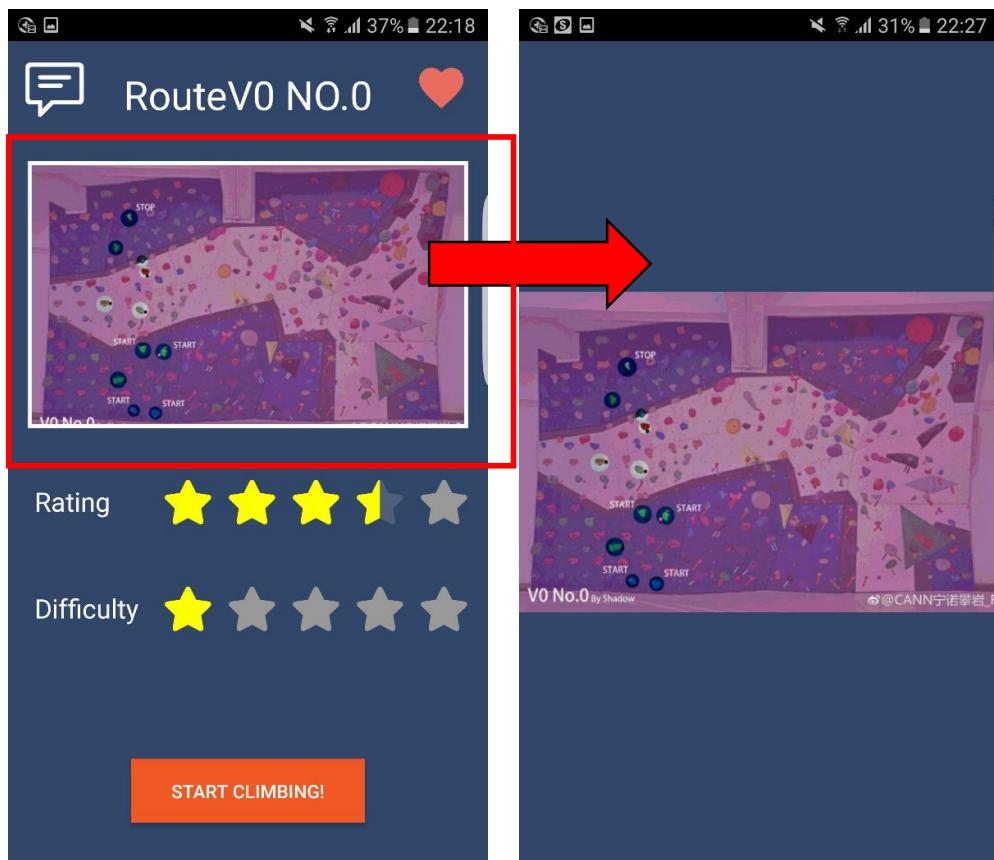


Figure 28: Larger Image

To view the zoomed in image of a route, you can press on the image. The larger picture will be shown in a new page.

Route infomation Page



Figure 29: Larger Image

You can also rotate your phone to view a larger route's image which fits your phone's size.

Comment Page

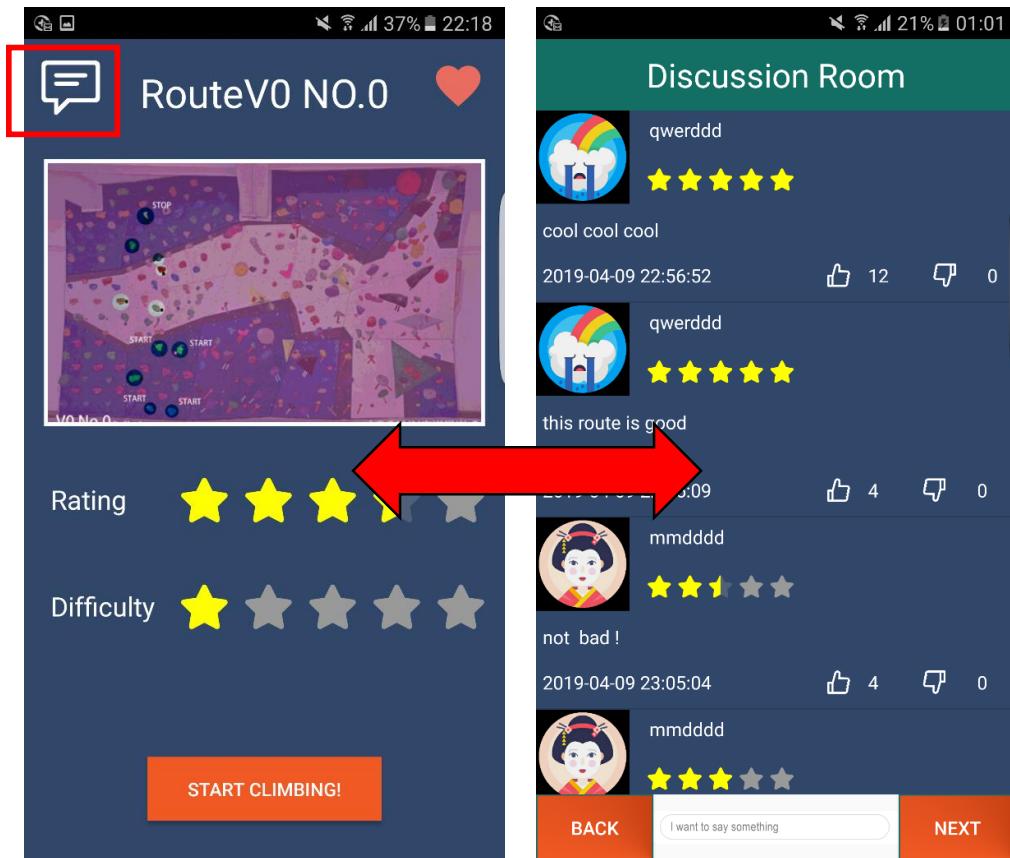


Figure 30: Route Information - Comment

The comment page can be accessed by pressing on the comment button located at the top left corner. Swiping on route information page can also redirect you to comments page. The avatar, user name, comment, time of comment, likes and dislikes of other users' comments will be shown. Comments in the first page are ordered by likes and other pages by time.

Comment Page

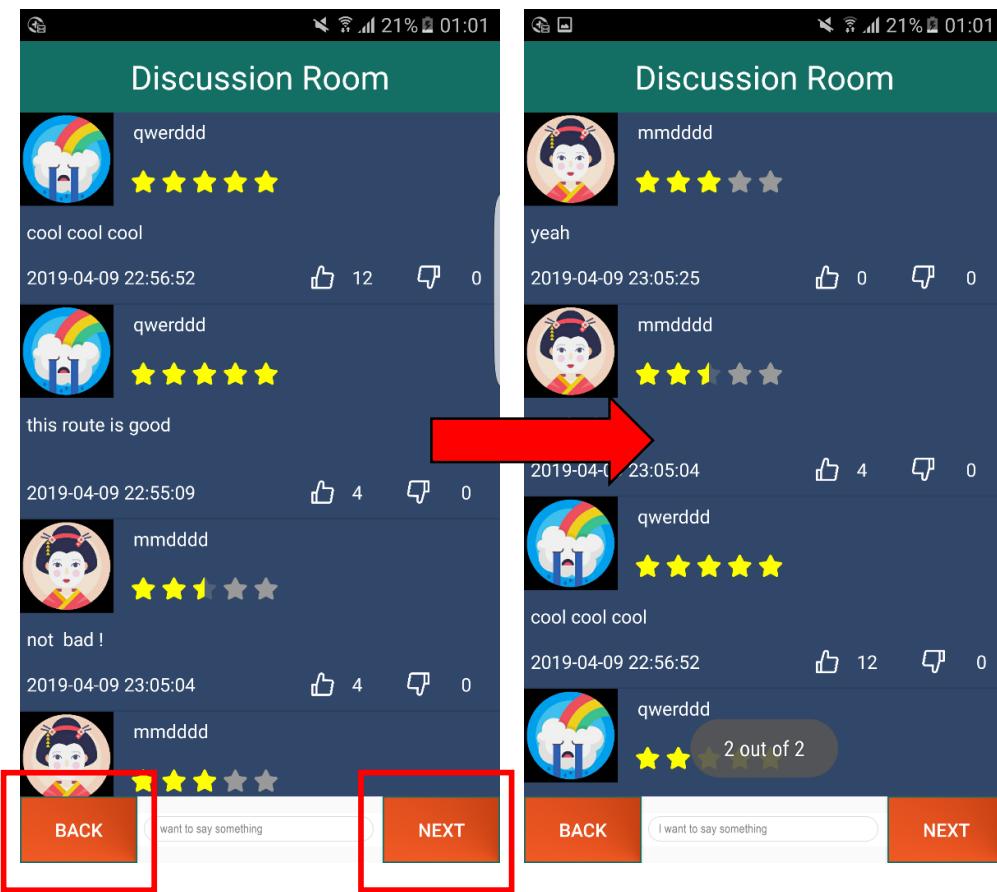


Figure 31: next and back page

You can go through the pages of comments by pressing “Next” and “Back” buttons.
The page number will also be displayed.

Feedback Page

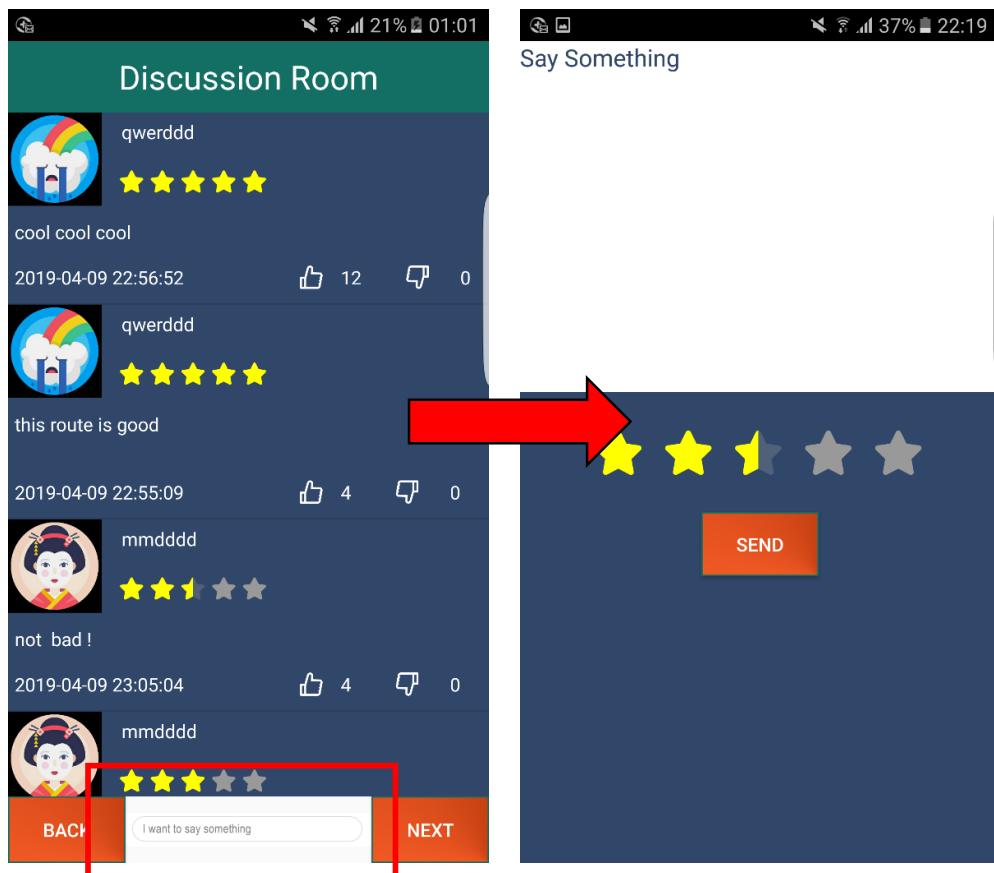


Figure 32: Leave feedback

You can leave a feedback and rate a route if you are logged in.