UNIVERSITY OF GREENWICH

Alliance with FPT Education

UNIVERSITY OF GREENWICH

COMP1649– Human Computer and Interaction Design

Coursework

Student name	Phan Chi Bao
ID number	001272664
Lecturer/Tutor name	Bui Dang Ha Phuong
Student submission date	25/11/2022

Table of Contents

Table of figure

Table of table

1. Introduction

This report introduces ski tracking and weather forecasting systems. The report includes the following sections: introduction, background, design process, prototype, research study and conclusion.

2. Background

Some key terms and how it works in Human Computer and Interaction Design (HCI) will be presented as follows:

2.1 Interaction Design Research

After research and analyzing from a number of applications that support skiers, it is necessary to ensure the following functions: the most important function is ski tracking that allows users to record real data economy during skiing. Then you can review the saved data. The weather forecast function needs to display data such as temperature, visibility, snow thickness, snow direction... Next, the report briefly introduces some of the applications to support skiing below:

a. [1]Ski Tracks

Figure 1 Ski tracks

A relatively popular app for skiers is the Ski Trails app. This application provides skiers with information such as: maximum speed, ski distance, ski vertical, maximum altitude, running track, slope and duration so it is very popular with skiers. .

[1] https://courchevel.vip/best-ski-apps/

b. [2]4riders

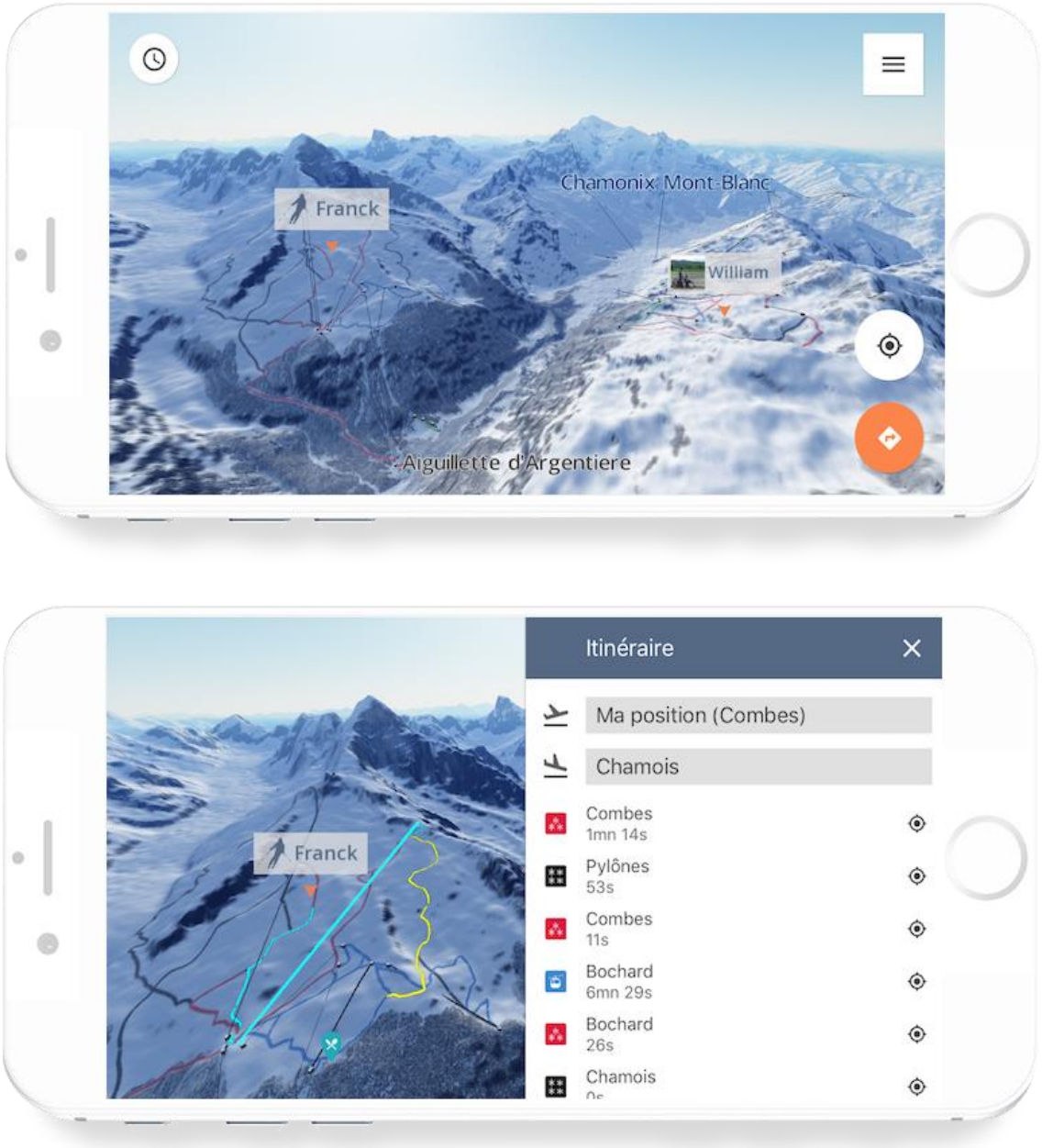


Figure 2 4riders

The application is very nice when it allows users to connect with each other on the slide through this 4riders app. This social skiing app has been around for a few years, but it offers plenty of benefits to skiers.

[2] http://www.4riders.ski/

c. Cairn [3]

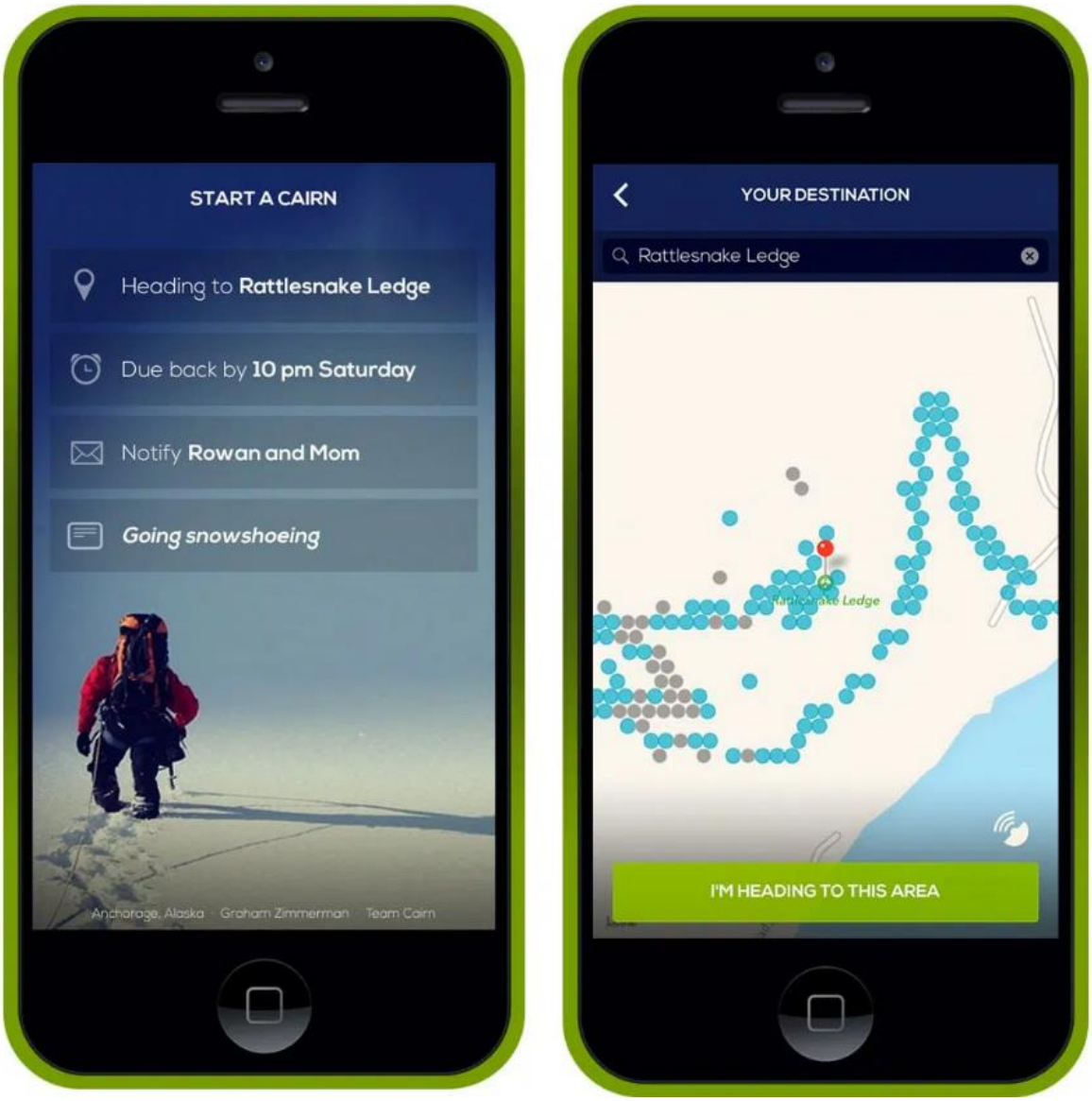


Figure 3 Cairn

The cairn app helps skiers return home with safety features such as recording your tracks, identifying areas where there is no cell coverage, and downloading maps...

[3] https://courchevel.vip/best-ski-apps/

d. [4]Snow Report Ski App

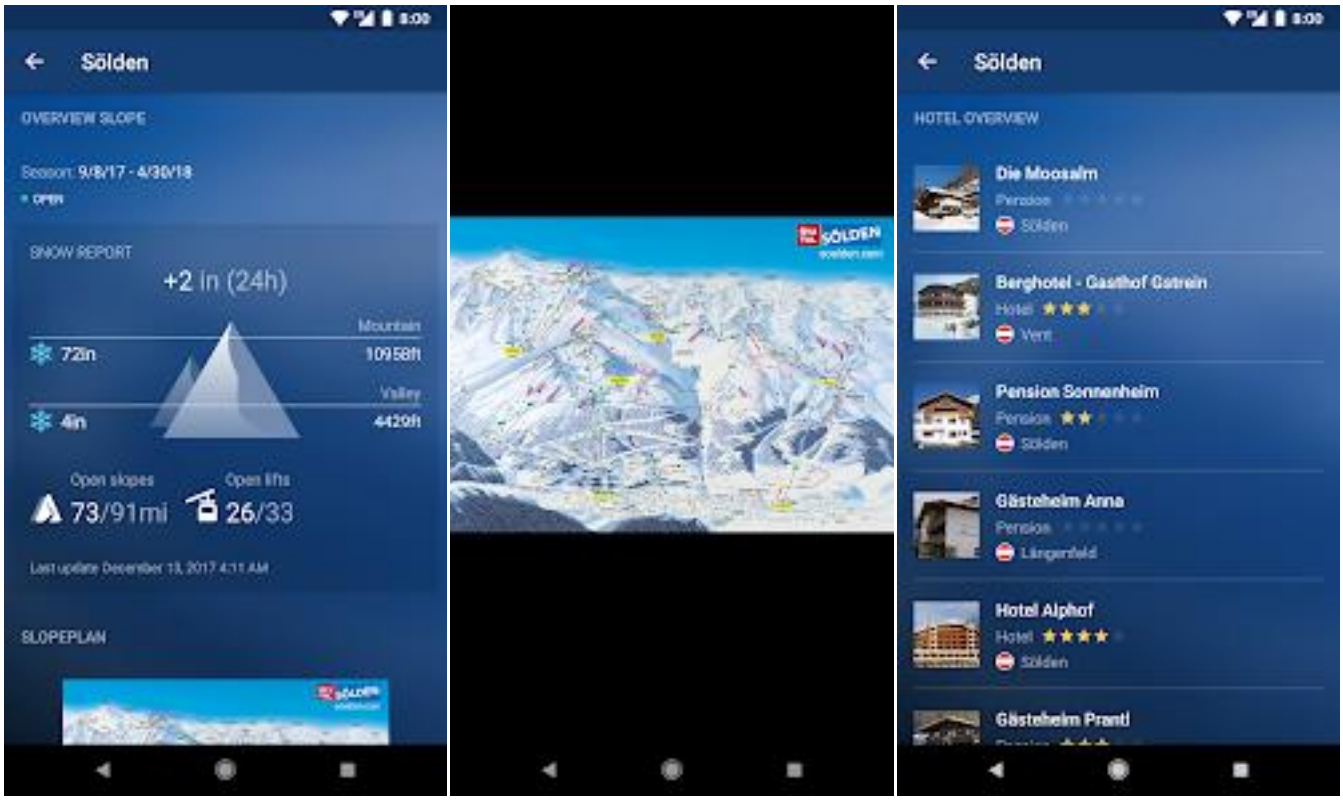


Figure 4 Snow Report Ski App

The Snow Report Ski App allows users to view snow conditions in ski areas, and allows users to see which ski areas are open. It helps skiers save time choosing where to ski.

Currently on the market there is no application that has both skiing and weather forecasting functions at the same time. Therefore, this report proposes the application of Ski tracking and weather forecasting which is very useful for skiers. In addition to the proposal, the report also shows the design prototype of the Ski tracking and weather forecasting application. The app will include the following functions important to skiers: first, a ski tracking function, which will display real-time skiing parameters including speed, distance, and slope, time and altitude. After completing the monitoring process, the user can review the recorded data. Next is the weather forecast function, this function will display weather related information such as: weather, visibility, snow dept, snow falling speed, direction of snowfall, last date of snowfall and a brief forecast of the weather for the next few days.

2.2 Interaction Design Theory

2.2.1 Interaction design principles and interaction design patterns

The application of interaction design principles and design patterns greatly benefits our design interface. The next section presents the following design principles and design patterns:

a. Interaction Design

Design interactive products aimed at assisting people in their daily lives. As Winograd (1997) describes it as "the design of spaces for human

[4] https://play.google.com/store/apps/details?id=de.schneehoehen&hl=en_US&gl=US

communication and interaction." According to the above saying, it is the designer looking for ways to minimize the relationship between man and machine. In a nutshell, interaction design is about defining behavior in interactive systems. This makes it easy for people to achieve their goals(Preece et al., 1994)

b. Interaction design principles

The principles of interaction design make it possible to infer patterns of human-computer interaction. The designer will easily compare the generated design with the principles of interaction design. Thereby creating a great experience for users. In short, the original design is the standard, guide and consideration for designers to apply to their ideas(Chao, 2009). The principles of interaction design are formed by the combination of knowledge, experience, experience and common sense based on theory. Common interaction design principles are: Visibility,Feedback,Predictability,Learnability,Constraints and Consistency (Jenny Preece, Yvonne Rogers and Helen Sharp, 2015)

c. Interaction design patterns

The interaction design pattern is to help designers reduce time by allowing solution iteration when solving a common usability problem that often occurs in interaction design. The interaction design pattern includes the following components: problem, use when, principle, solution and why(Eelke Folmer, 2015).Design patterns have become a successful solution to the problem of repetitive design and are hierarchically organized into a pattern language(Borchers and Thomas, 2001)

In this coursework, I apply all the principles of interaction design to my products. To provide a better user experience when using the product and to be able to meet all the needs and desires of the user.

2.2.2 Investigation in cognitive psychology

Cognitive psychology is a field within psychology. There are different types such as: thinking, perceiving, remembering, problem solving, seeing, reading, writing and learning. Norman (1993) separates them into two general modes: experiential and reflective cognition. Every day people will apply each mode for each different job. Designers need to predict user behaviors and design based on those predictions, in order to create an intuitive and easy-to-use interface(Jenny Preece, Yvonne Rogers and Helen Sharp, 2015)

a. Attention

It involves audio and the visual sense. Interface design has a huge influence on focus. Focused and divided attention allows the volume of stimuli from the environment to be moderated(Jenny Preece, Yvonne Rogers and Helen Sharp, 2015).

b. Perception and recognition

Information presented should be designed to be perceptible and recognizable by the user. Icons or illustrations must allow users to easily recognize its meaning. Icons or illustrations must allow users to easily recognize its meaning. This improves the efficiency of the design interface and helps users get the necessary information easily(Jenny Preece, Yvonne Rogers and Helen Sharp, 2015).

c. Memory

Memory is the recall of knowledge that has been met, heard or known. From there, appropriate decisions can be made. Memory is very useful and versatile(Jenny Preece, Yvonne Rogers and Helen Sharp, 2015)

I have applied most of the cognitive psychology in this subject. Because it is a useful tool in interface design. They help design interfaces to be efficient and deliver great user experiences.

2.2.3 Interaction design theory

The next part of the report will present some interaction theory theories as follows:

a. Conceptual models

Conceptual models are terms used to describe abstract models that represent how tasks are performed and how a system is organized and operated. Create design interfaces and iteratively apply conceptual models so that users can easily learn how to use new products(Johnson and Henderson, 2002)

b. Metaphors

Metaphors is the use of an object that is familiar to the user to map onto an unfamiliar object, and also serves as a platform for the user to familiarize themselves with an unknown concept through the mapping process(Nardi and Zarmer, 1993)

c. Prototype

Prototype is a sketch of a product that allows stakeholders to interact and see if it fits and meets the needs of the user. In fact, prototypes can be anything that can be used to simulate product interactions(McElroy, 2016). Prototypes are divided into three types as follows:

Low-Fide

A low-fide prototype is a prototype that is not the same as the final product. It is used to predict possible risks. It can be a drawing, a paper model... It is used because it is cheap and its completion is simple, no high skill is required(McElroy, 2016)

Mid-Fide

A mid-fide prototype starts to resemble the product. Mid-fide prototype started to be designed with intuitive, interactive design and integrated functionality. Mid-fide prototype is a prototype that balances cost and value(McElroy, 2016)

High-Fide

High-Fide prototype is a detailed and functional prototype with the most detailed and functional final product. High-Fide prototype allows usability testing and evaluation to draw conclusions for the final product(McElroy, 2016)

In this coursework I apply two types of archetypes: low-fide and mid-fide to my product.

2.2.4 Types of interaction and modes of interaction

Next, the report will talk about the type of interaction and the mode of interaction presented as follows:

a. Types of interaction

Instructing is where users issue instructions to a system. Giving instructions can be a good way to help any activity succeed.

Conversing is where users have a dialog with a system. Conversing is very suitable for customers who are children, people with disabilities and those who have difficulty interacting with products manually.

Manipulation is where the user interacts with objects in virtual or physical space. Through interaction, users will acquire a lot of knowledge.

Explore how users interact with objects in a virtual or physical environment, thereby improving their familiarity(Jenny Preece, Yvonne Rogers and Helen Sharp, 2015)

b. The modes of interaction

Touch is the type of interaction with the product through a sensitive screen where all information is controlled. Hands-on interaction and eye-feeding are intuitive and easy to use for beginners(Albinsson and Zhai, 2003)

Voice is an audio communication medium that carries sound-based information from the speaker to one or more receivers(Seaborn et al., 2021)

I apply Instructing interaction type to make it easy for users to achieve their requirements.

3. Design Process

Next the coursework will present the design process.

3.1 Conceptual design

Concept design is about transforming requirements into conceptual models to fulfill those requirements(Jenny Preece, Yvonne Rogers and Helen Sharp, 2015)

3.1.1 User requirements

I recommend Ski tracking and weather forecasting system to meet user requirements. The system includes important functions such as: Tracking, weather forecasting.

The tracking function will display real-time parameters such as speed, distance, altitude, slope, time and tracking map. The weather forecast function will provide information about temperature, visibility, snow thickness, wind speed, direction and last date of snowfall. Finally, the setting function, users can set information such as: unit, gradient unit, battery saving mode, language and screen mode.

3.1.2 Problem statement and design solutions

After talking to the skiers about the prototype, I received suggestions to improve the quality and efficiency of the final product. Here are the solutions to fix those problems:

The skier wants to review the data of the previous records, so I added a history function so that the user can review all the saved records and the last one will be displayed in the tracking. The second problem is that users want to search for their current location and old records, so I designed the search bar above to solve this problem.

3.1.3 Hierarchical model

The picture below is the hierarchical model of the Ski tracking app

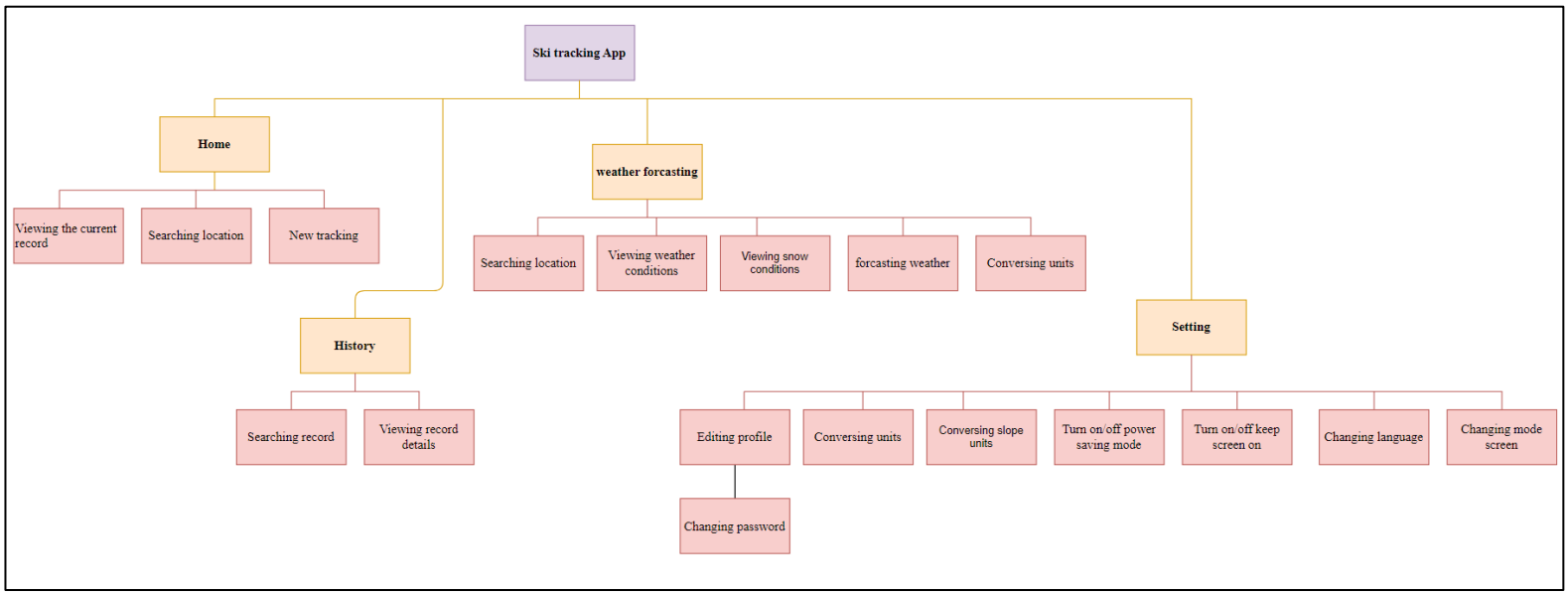


Figure 5 Hierarchical model

Based on Figure 5 above, the Ski tracking application will have 4 main functions as follows: home, history, weather forecasting and setting.

The home page includes other functions such as location search that allows users to search for the desired location. The current record review function allows the user to review the data of the last recording. And new tracking function so users can start recording new process.

The history page, there is a record search function that allows users to search for the necessary records and finally a function to review the saved records will display the data.

The weather forecasting has the following functions: search the location to see the weather allows the user to see the weather in other places. Next is the unit conversion, this function allows the user to convert the unit from degrees Celsius to degrees Fahrenheit. Next is the weather condition view function that will display things like temperature and visibility. Viewing snow condition's provides data such as speed, direction, snow dept and the last date of snowfall. Finally, the snow weather forecast function for the next six days.

Setting function, including functions such as setting units from meters to feet, slope units from degrees to percent, toggle functions such as power saving mode and keep screen on, switch languages, and changing screen modes. Finally, the profile editing function allows users to change personal information.

3.1.4 Conceptual model

In this part of the report, the conceptual model will be presented.

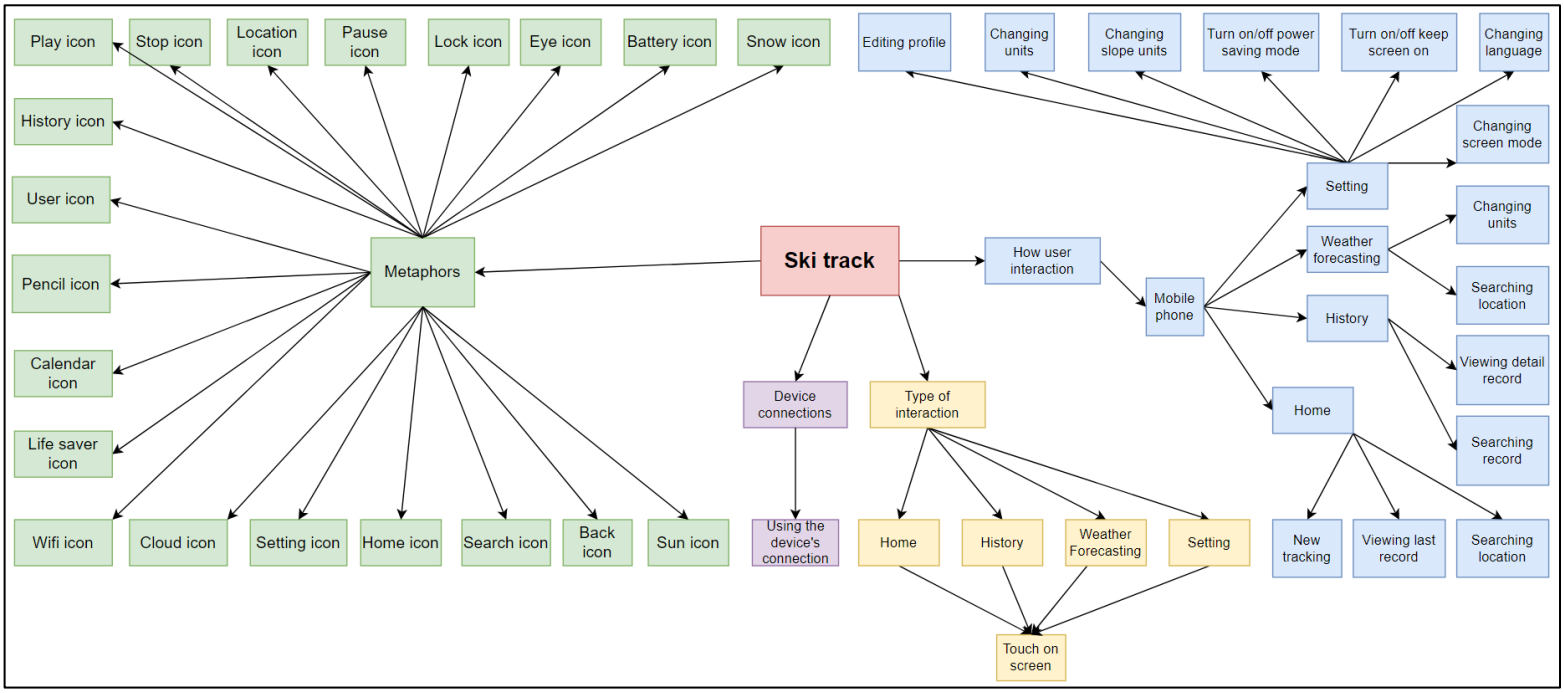


Figure 6 Conceptual model

Based on Figure 6 above, we can know the conceptual model components of Ski tracking application including metaphors, device connection, type of interaction and how user interaction. Regarding the connection, now mobile devices allow users to manage the connection, so the Ski tracking application does not need to design this connection management section. The type of interaction of all functions is to touch the screen. The icons used in metaphors are explained in more detail in table 1 below.

The metaphors used in the device's interfaces

Table 1 Icon used in the device's interface

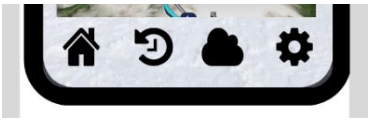
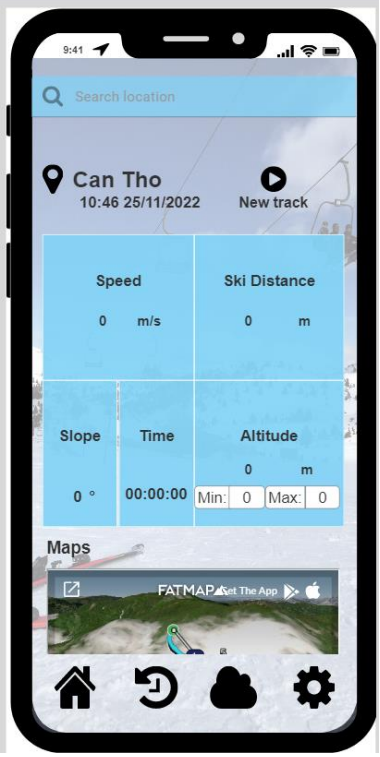
Icon	Name	Description
	Battery icon	Used to display the battery level of the device.
	Eye icon	Used to display the view button.
	Wi-Fi icon	Used to display the Wi-Fi status
	Location icon	Used to display the location status of device
	Lock icon	Used to represent account password
	User icon	Used to represent account username

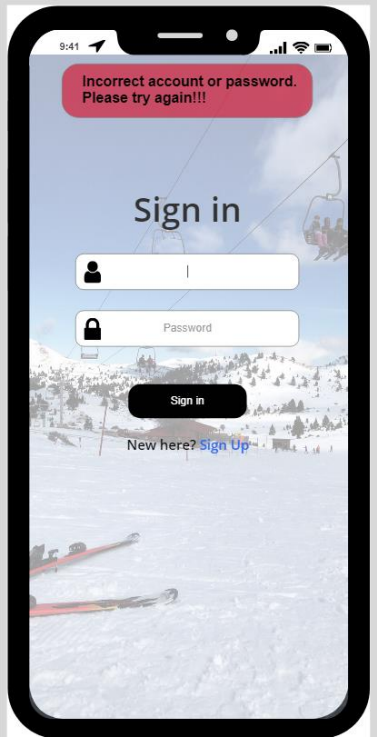
	Search icon	Used in location search bar and history search.
	Play icon	Used to start a new track
	Pause icon	Used to pause tracking
	Stop icon	Used to stop tracking
	Home icon	Used to return to the home page
	History icon	Used to return to the history page
	Cloud icon	Used to return to the weather forecasting page and represents cloudy weather
	Setting icon	Used to return to the setting page
	Sun icon	Used to represent sunny weather
	Snow icon	Used to represent snowy weather
	Pencil icon	Used to represent editing profiles
	Life buoy icon	Used to represent where FAQ
	Calendar icon	Used to represent birthdays
	Back icon	Used to go back to the previous page

3.2 Five Dimension of Interaction Design

In book Designing Interactions, Moggridge first described the dimensions of interaction design(Moggridge and Atkinson, 2007). Later, Gillian Crampton Smith stated that interactive design relies on the 1D, 2D, 3D, and 4D dimensions already in use. Kevin Silver proposes the fifth dimension is behavior(Freire, 2016). In this course, I apply most aspects of interaction design. This helps users interact with the design interface in a more intuitive way. The following are illustrations of the dimensions in the prototype:

Table 2 Dimensions in design prototype

Dimensions	Define	illustrations
Word	represents interactions, so that words are interacted with by the user.	
Visual representations	the use of icons, other graphics, and typography as visual representations of interactive elements	
Physical objects or space	this is where the user interacts with the design interface through devices such as phones or tablets.	
Time	is the cumulative effect of user engagement with the first three dimensions.	

Behavior	is composed of action and response. How the user interacts with the interface and how the interface responds to the user.	

4. Prototype

In part 4 of this coursework will cover low-fide prototype and mid-fide prototype. These are also evidence for the application of dimensions of interaction design.

4.1 Low-fidelity prototype

Here are pictures of the low-fide prototype

Sign in

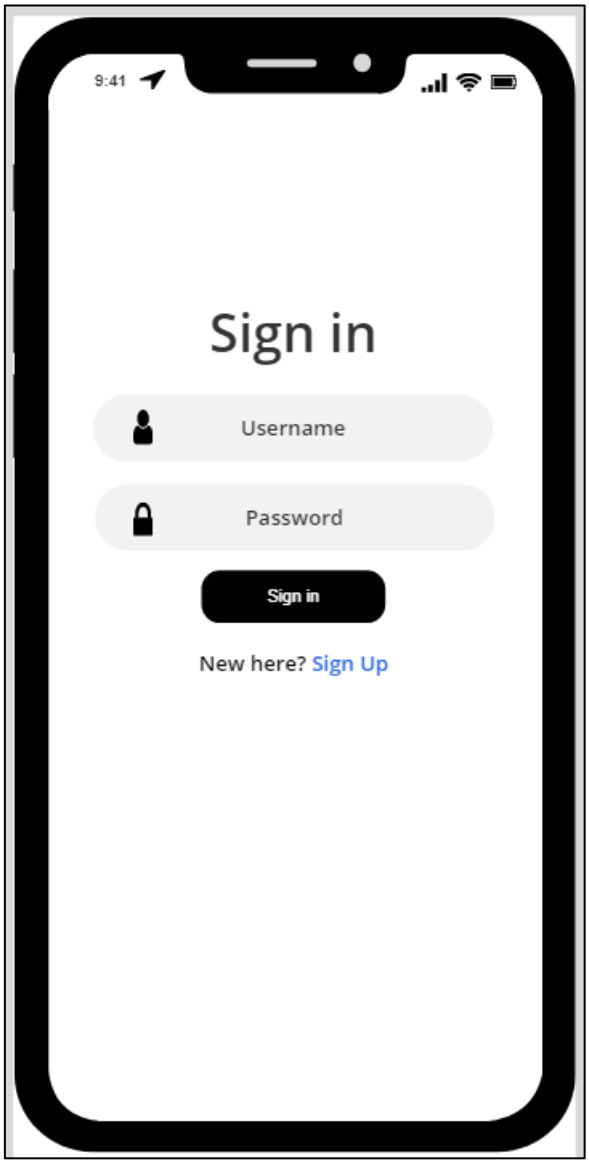


Figure 7 Sign in low-fide

Sign up

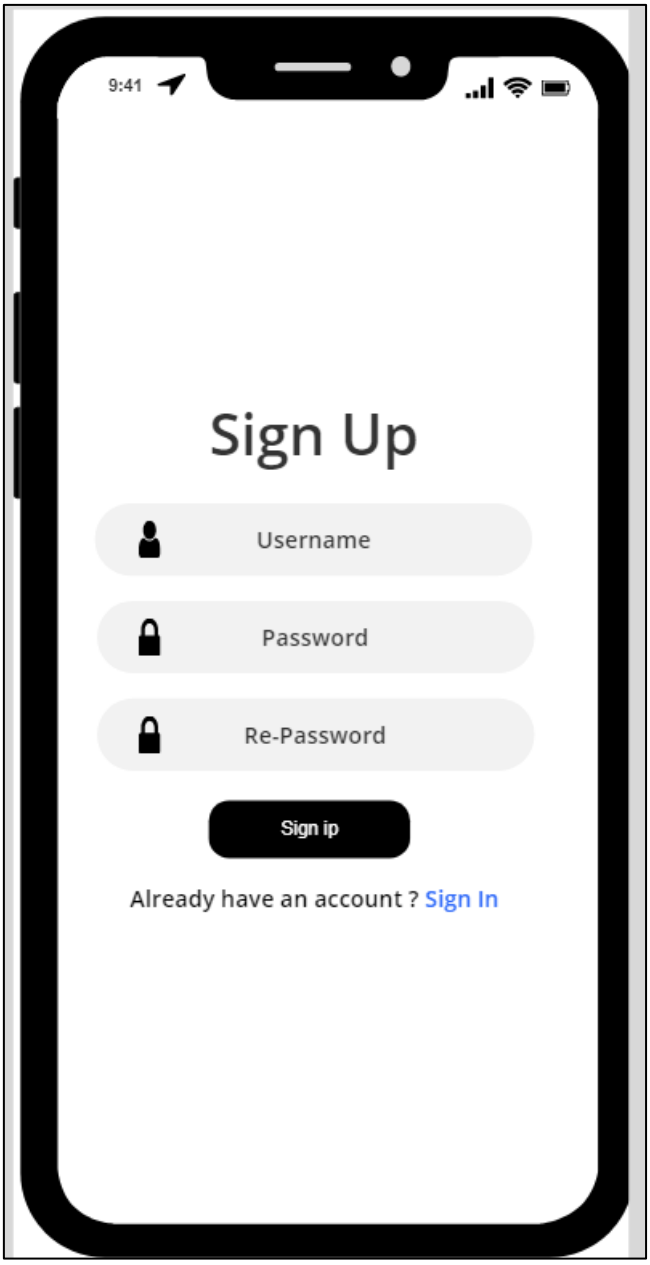


Figure 8 Sign up low-fide

Home

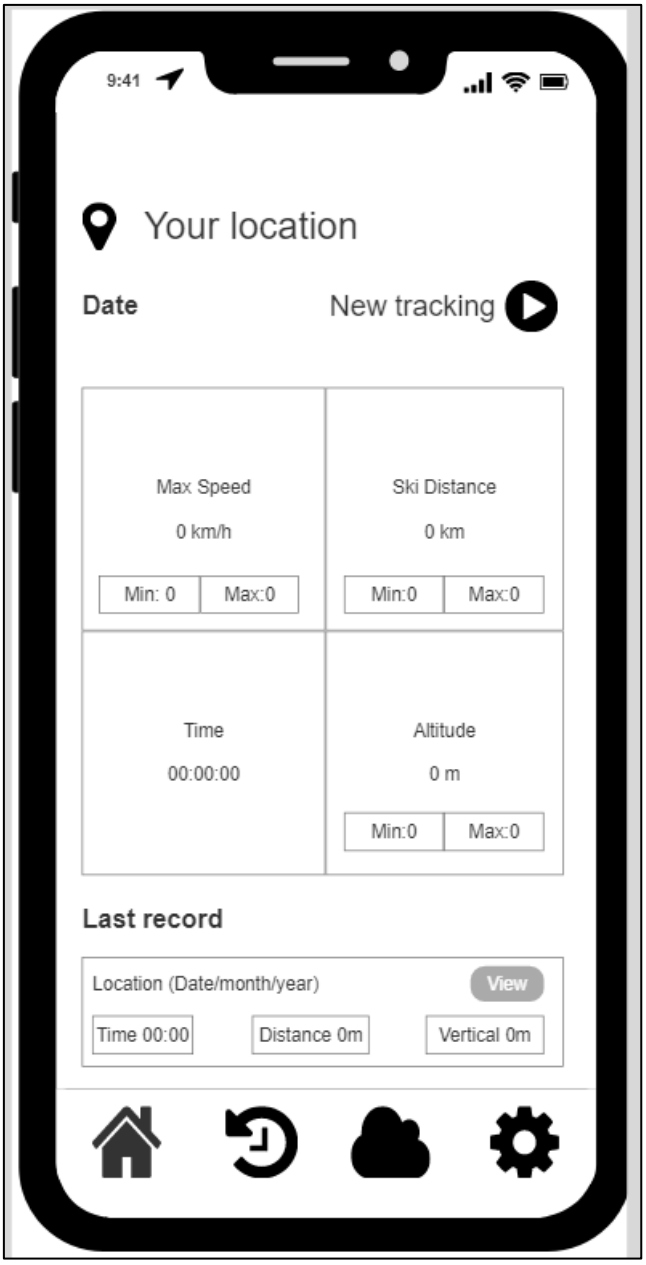


Figure 9 Home low-fide

History

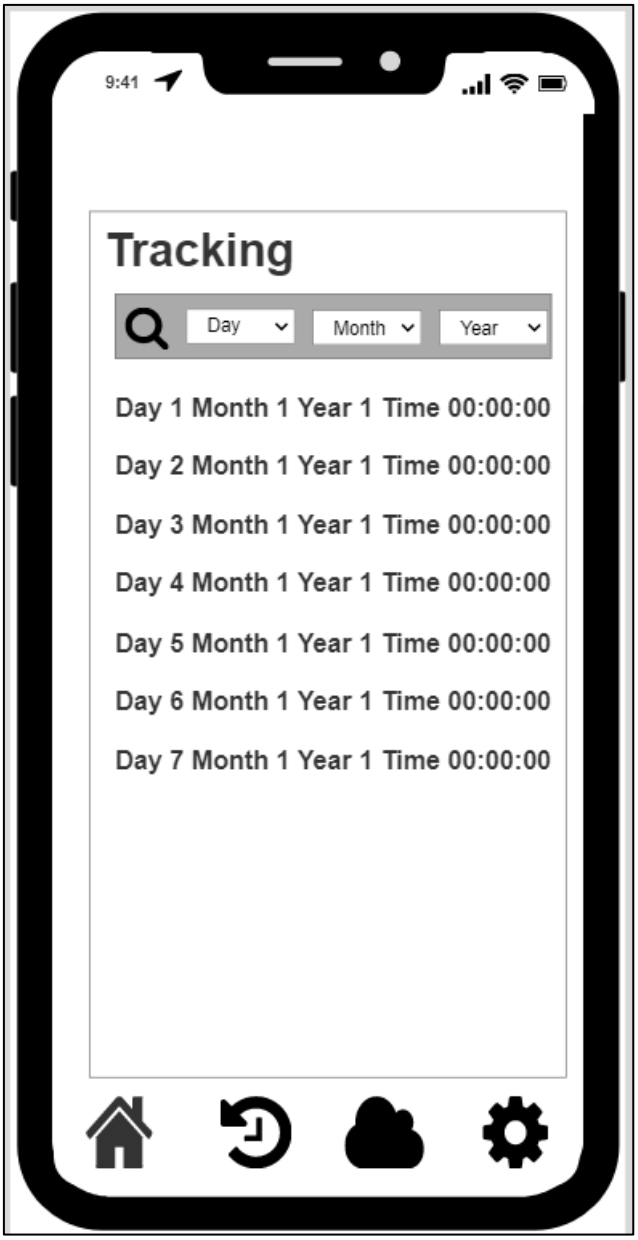


Figure 10 History low-fide

Tracking detail

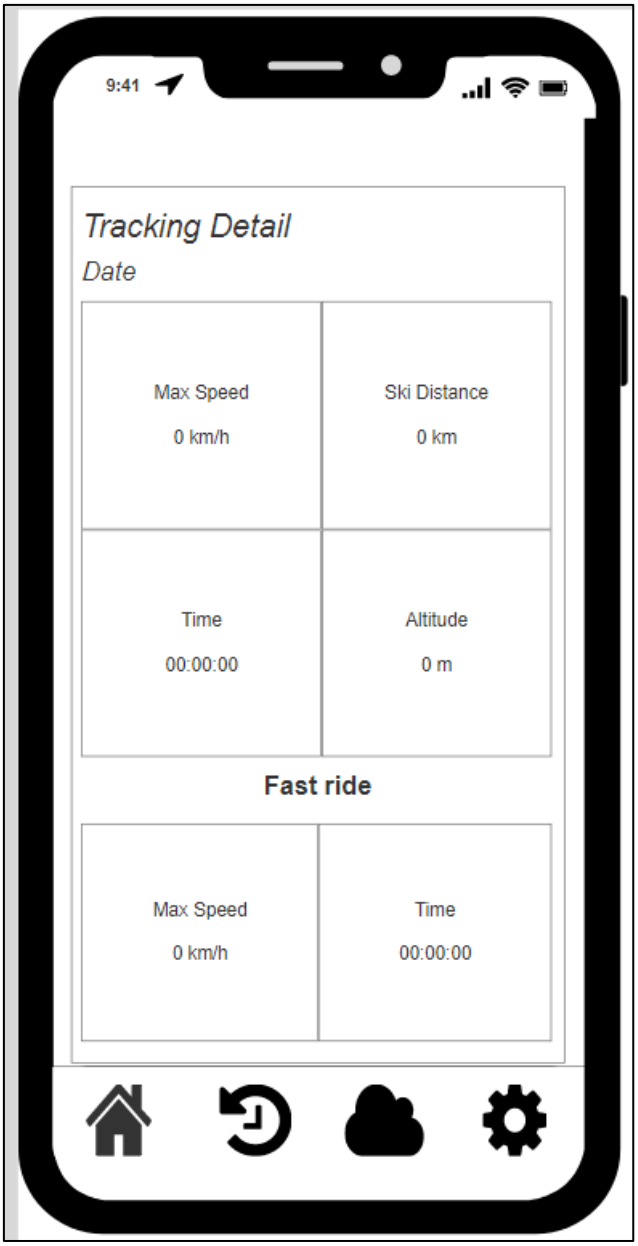


Figure 11 Detail tracking

Weather forecasting

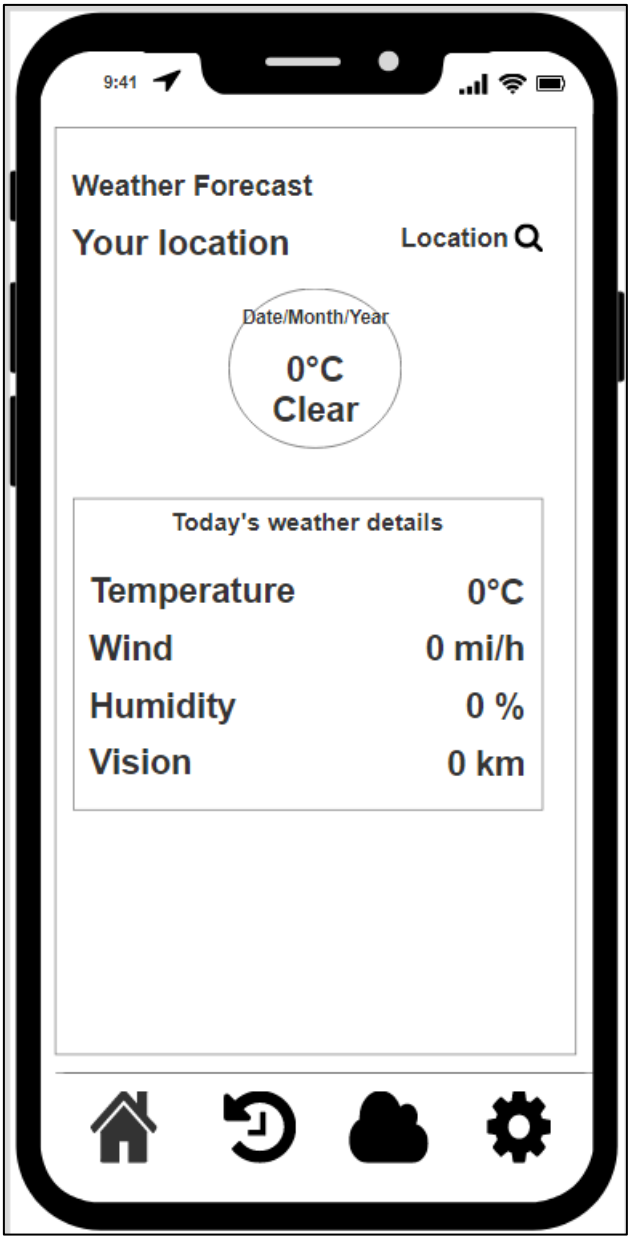


Figure 12 Weather forecasting low-fide

Setting

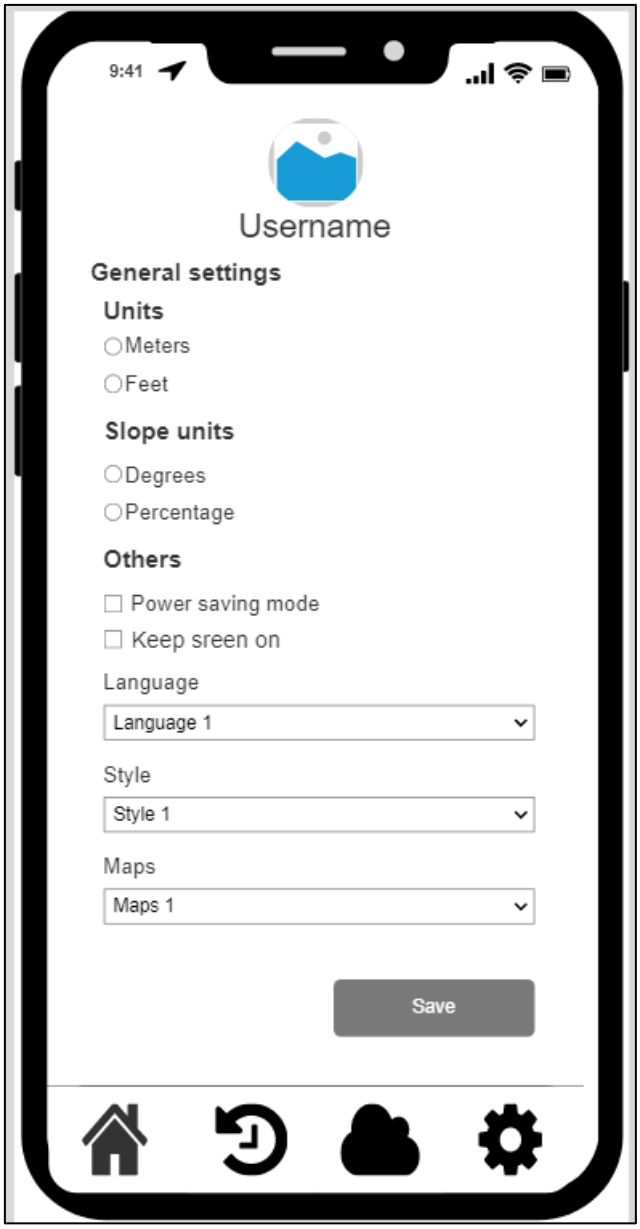


Figure 13 Setting low-fide

4.2 Mid-fidelity prototype

Here are the images of the mid-fide prototype

Sign in

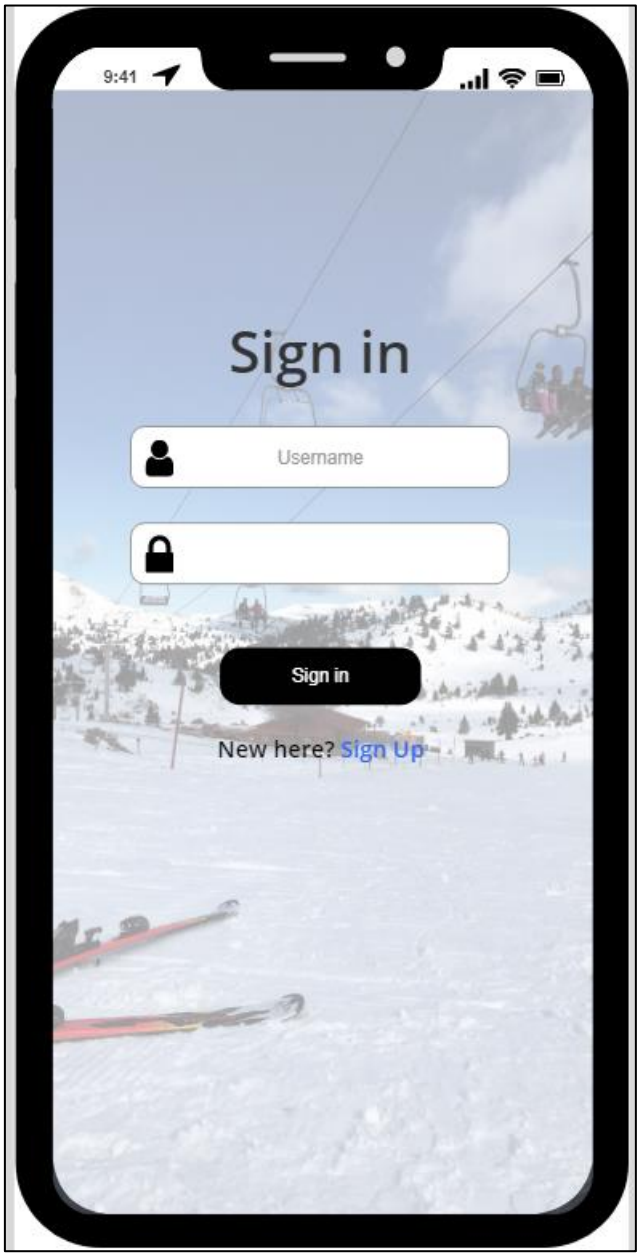


Figure 14 Sign mid-fide

Explain: When logging in, the user needs to enter 2 information: username and password. If successfully logged in, the system will lead the user to the homepage. If the user leaves blank or enters incorrect information, the system will display a message. Users can click on the words "New here? Sign up" to register a new account.

Sign up

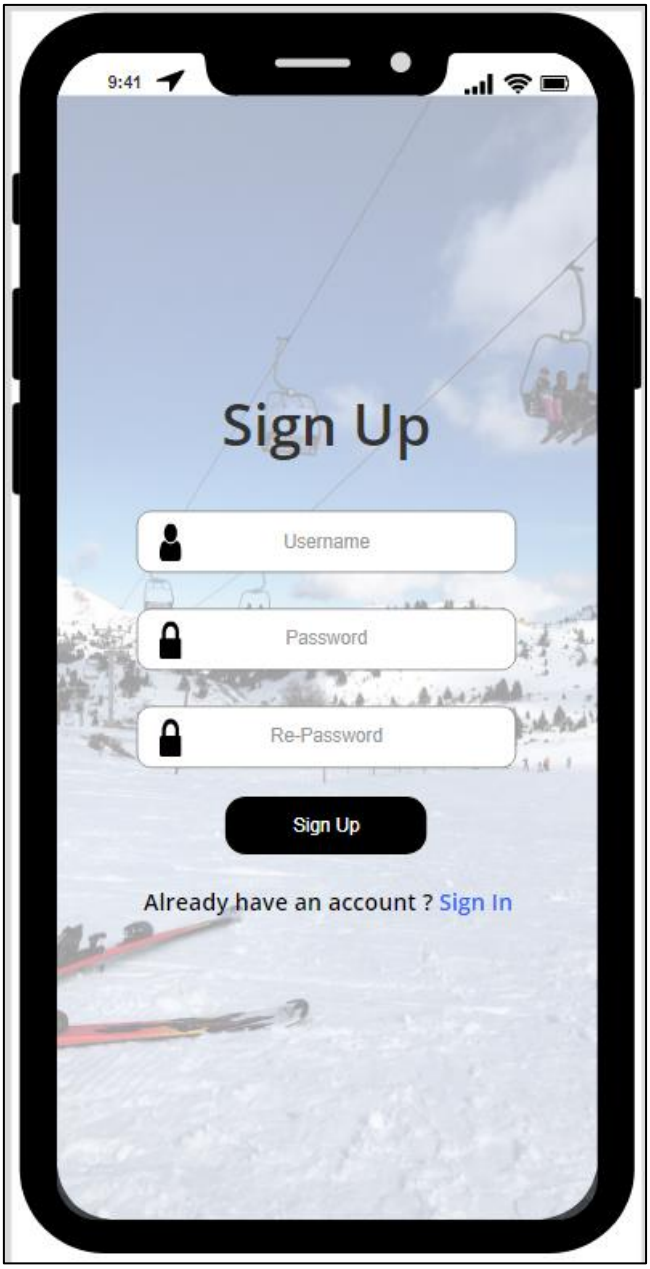


Figure 14 Sign up mid-fide

Explain: To register for a new account, users need to enter their username, password and re-password. If the registration is successful, the system will go to the sign in page for the user to sign into the system. If the user leaves blank or enters an existing username, the system will display a message.

Home

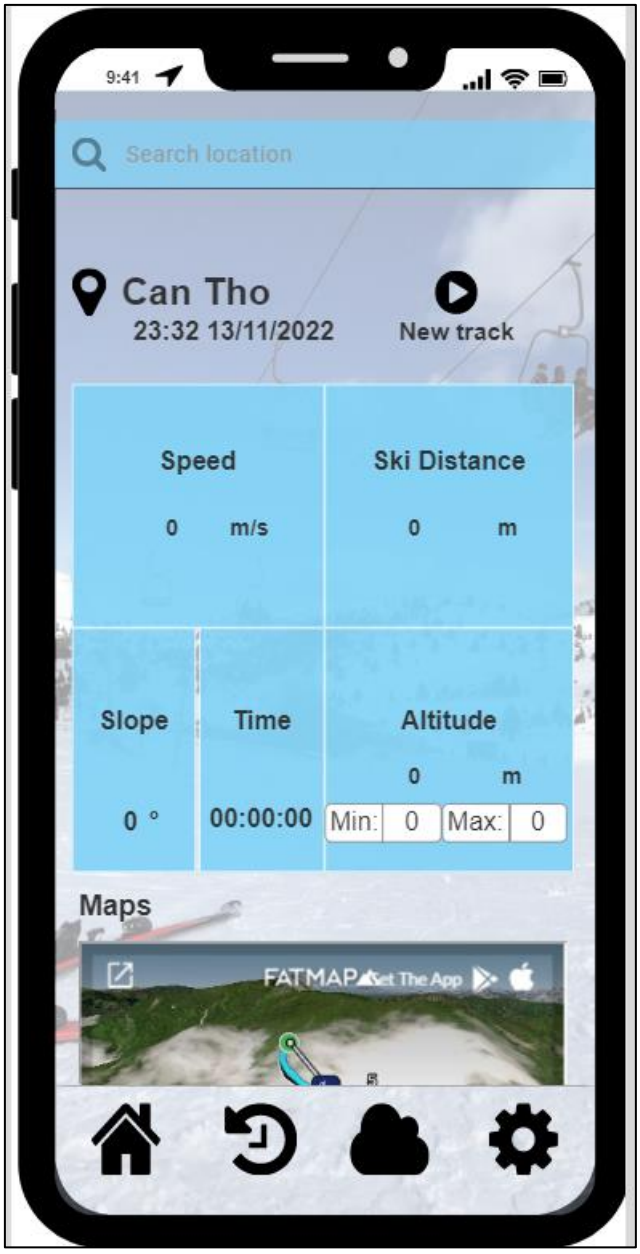


Figure 15 Home mid-fide

Explain: The interface of the home page includes a search bar for users to search for the location, below is the current location and time. Next to the address is a button to create a new track when the user clicks on the new track button, it will turn into a pause and stop button. Below are the necessary parameters to track the skiing process such as speed, distance, time, slope, altitude and time. Below the parameters is the map. Finally, the navigation bar includes home, history, weather forecasting and settings to navigate to the respective pages.

History

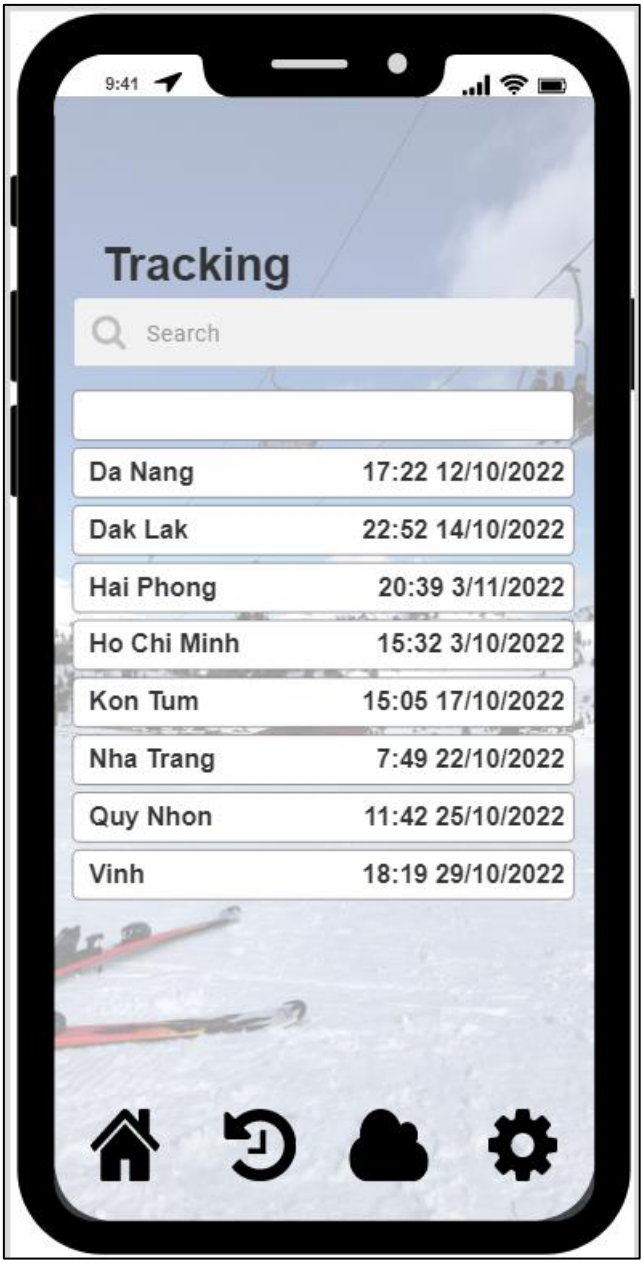


Figure 16 History mid-fide

Explain: On the history page, the search bar allows users to search for records by name or date. When the user clicks on the record name the system will lead the user to the tracking detail page.

Tracking detail

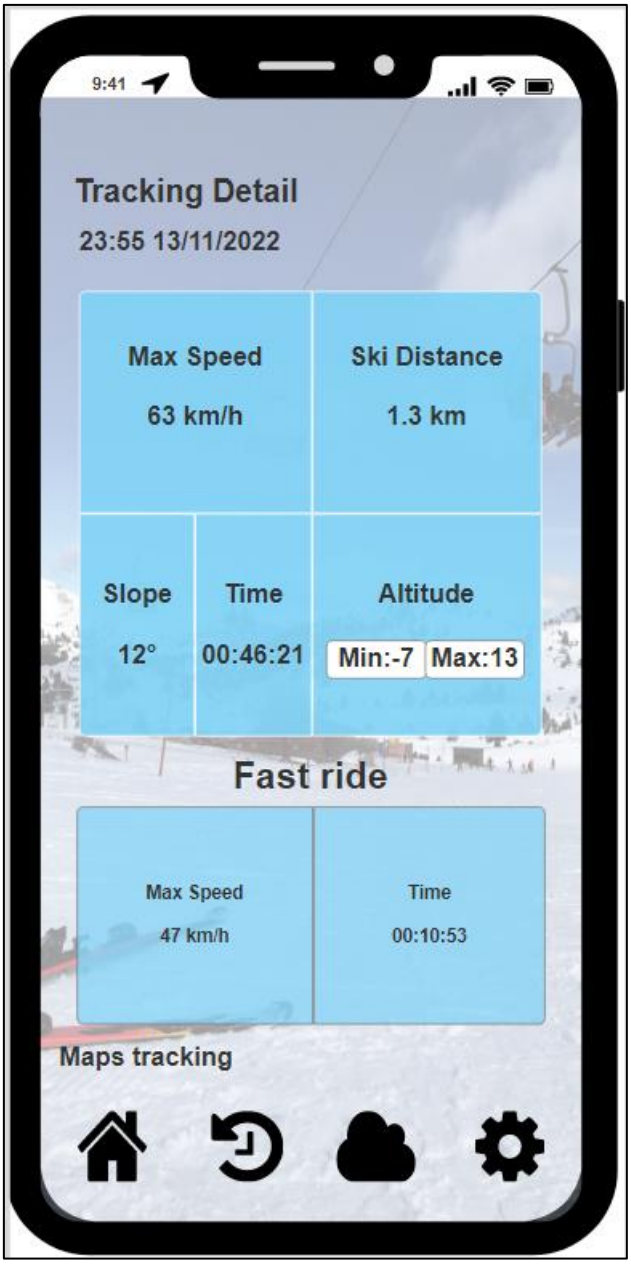


Figure 17 Tracking detail

Explain: The tracking detail page will display all the saved data such as speed, distance, time, altitude. Below is a map of the ski track.

Weather forecasting

19 Weather forecasting mid-fide

Explain: Weather forecasting, above allows users to search for places they want to see the weather forecast. Below is the button to convert the unit from degrees Celsius to degrees Fahrenheit and vice versa. Next is general information about the weather. Below is the condition of the snow it is a very important information for skiers. The bottom is the weather information for the next six days.

Setting

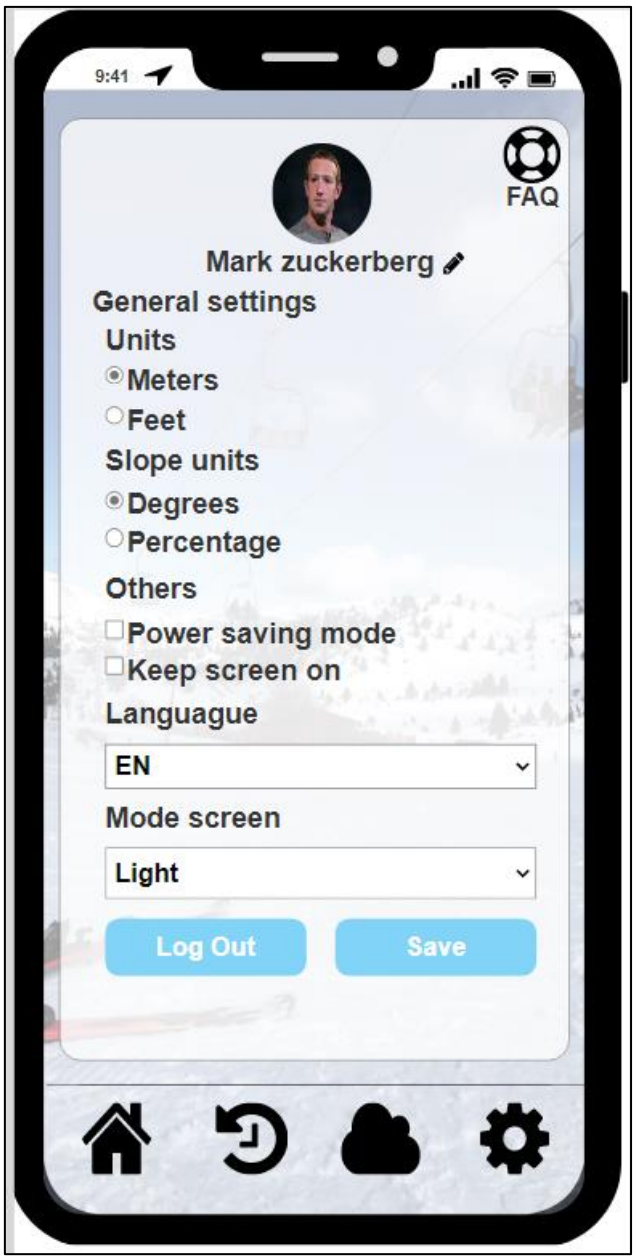


Figure 18 Setting mid-fide

Explain: Here, the system allows users to convert units from meters to feet, convert slope units from degrees to percent, toggle battery saver mode on and off, disable keep screen on, switch languages and screen modes Figure. After clicking the save button, the system will display a message. When the user clicks on the profile picture or name, the system will lead the user to the profile edit page. When clicking on the FAQ wall, the user will be redirected to the system's FAQ page. In addition, it also supports users to manage accounts.

FAQ

Figure 19 FAQ mid-fide

Explain: The FAQ page is used to provide a lot of information to users and allows users to submit their questions.

5. Research Study

To serve the research on the prototype of the Ski tracking application, the following hypotheses are proposed:

- Skiers often apply technology to this sport
- The Ski tracking application is designed to be intuitive and easy to use
- The Ski tracking application fully integrates the functions to support skiers

Participant group: Participants were skiers found at skiing events. Then I created a test session so that the participants could use the Ski tracking app. Through what they

experience from the application, they will participate in answering this survey. I received 18 responses from 20 survey respondents.

I apply both research methods as qualitative research and quantitative research. Quantitative questions will collect answers that are quantifiable for easy analysis. Qualitative questions will collect answers that belong to their personal characteristics. The survey was conducted with a structure consisting of 2 survey questions to determine the age and gender of the respondents. Also with 3 hypotheses, each hypothesis will include 3 questions to clarify that hypothesis.

Link survey: https://forms.gle/ECZ6rUwzCZeEPvd86

Following are the questions and answers collected from the surveyors:

Question 1:

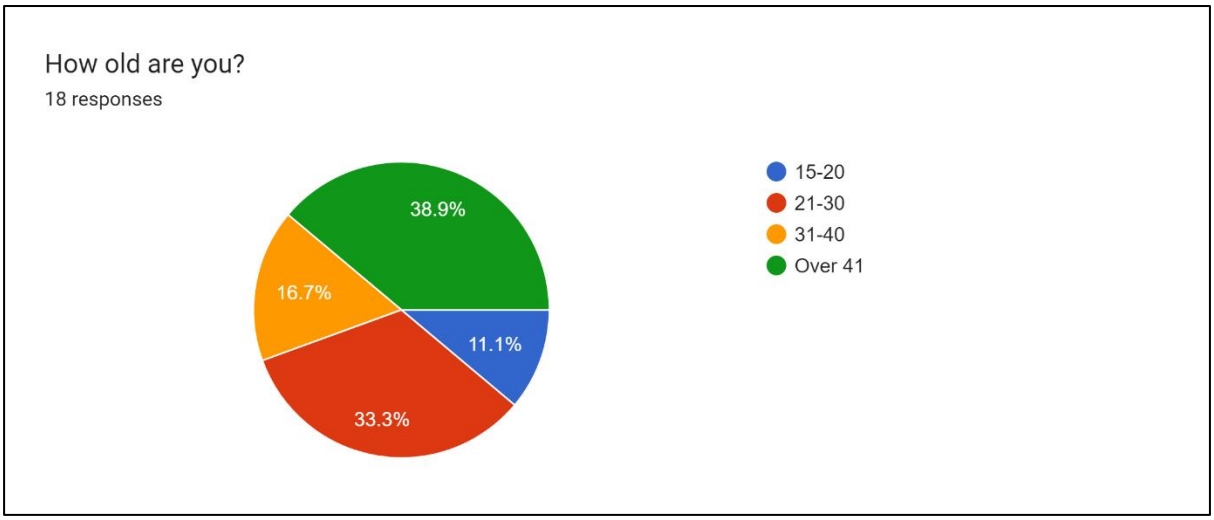


Figure 20 Question 1

Explain: Survey participants are very diverse in age, mainly those aged 21-30 and those over 40 years old.

Question 2:

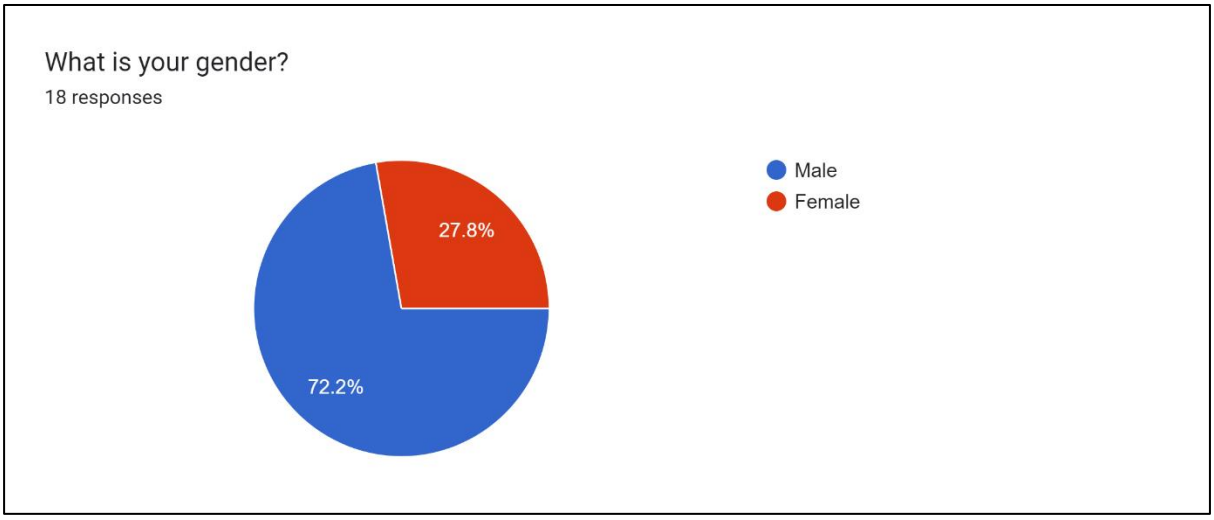


Figure 21 Question 2

Explain: The predominant gender of the survey participants was mainly boys and a small number of women participated in the survey.

Question 3:

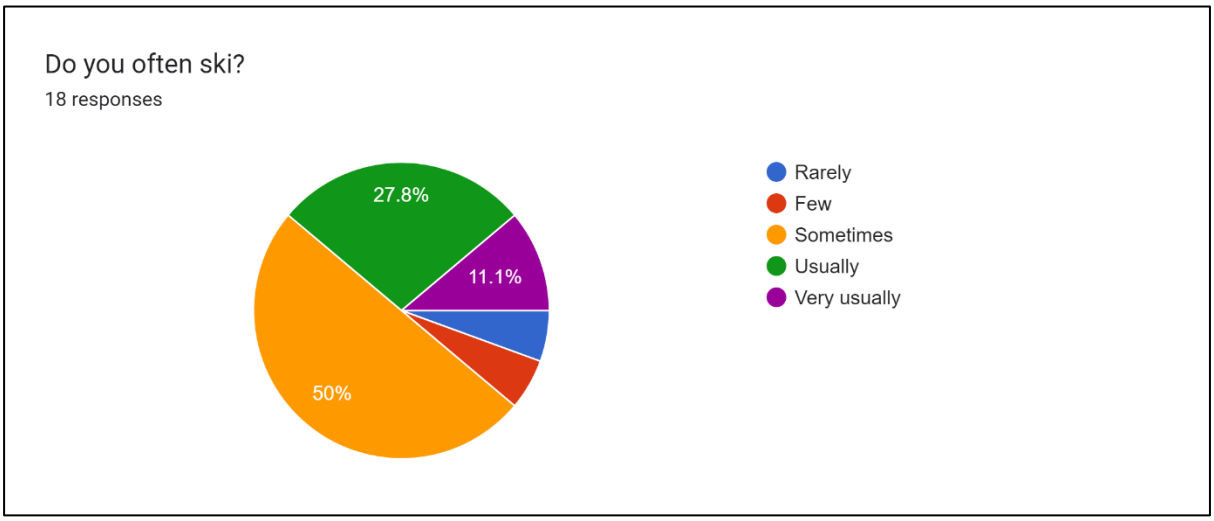


Figure 22 Question 3

Explain: Survey participants spend a lot of time skiing, and a few people are passionate about this sport but have no free time.

Question 4

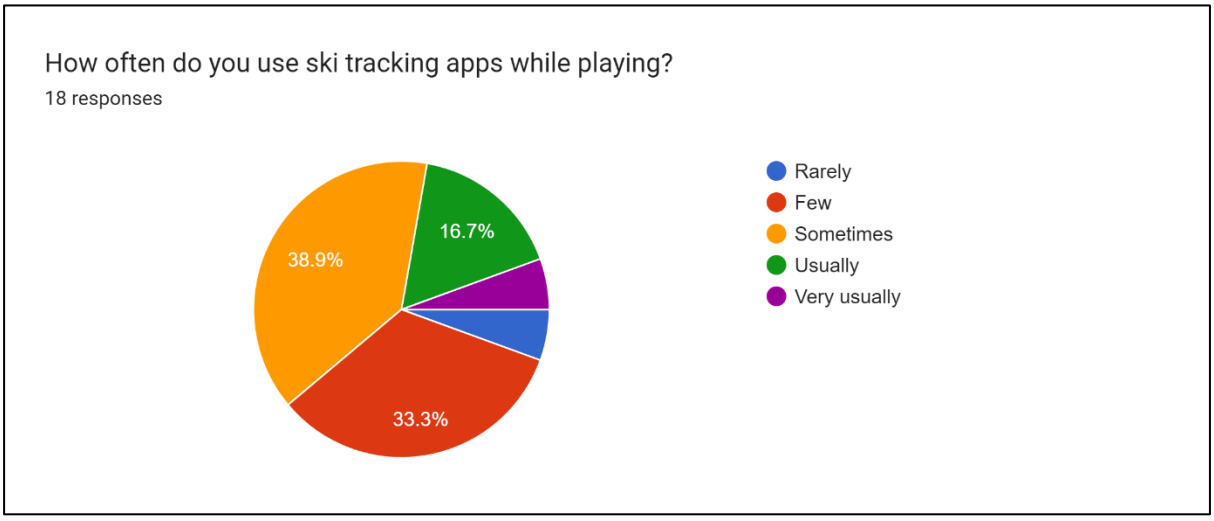


Figure 23 Question 4

Explain: There are many answers that use the application while playing. Because this is a sport that needs to be practiced, it is essential to review play data for them to improve their performance.

Question 5

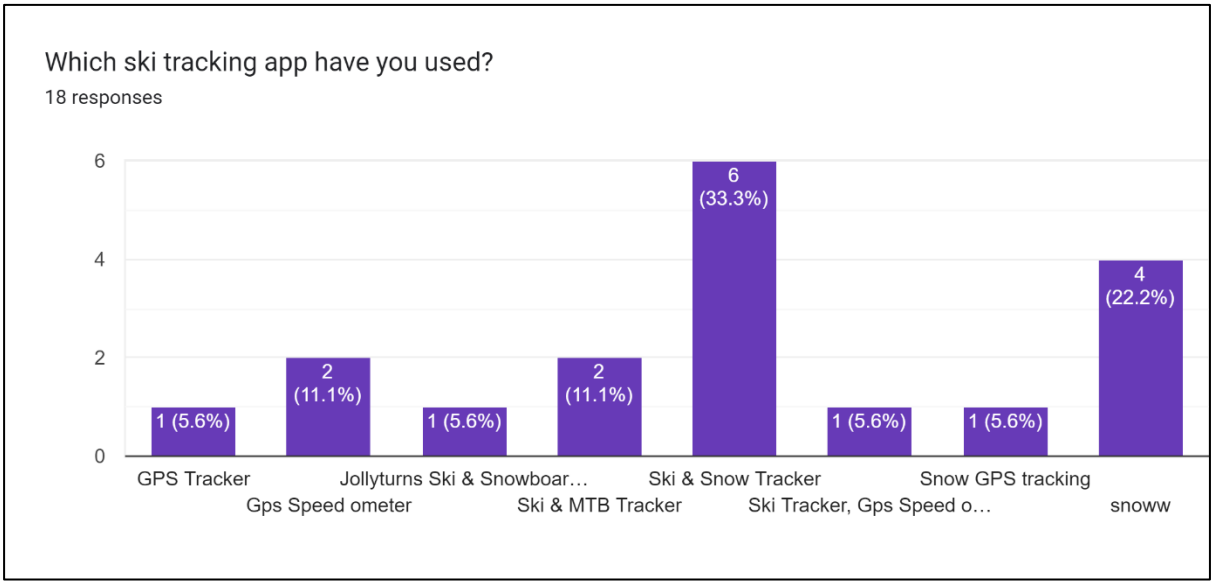


Figure 24 Question 5

Explain: The following are apps that survey respondents have used in the past.

Question 6:

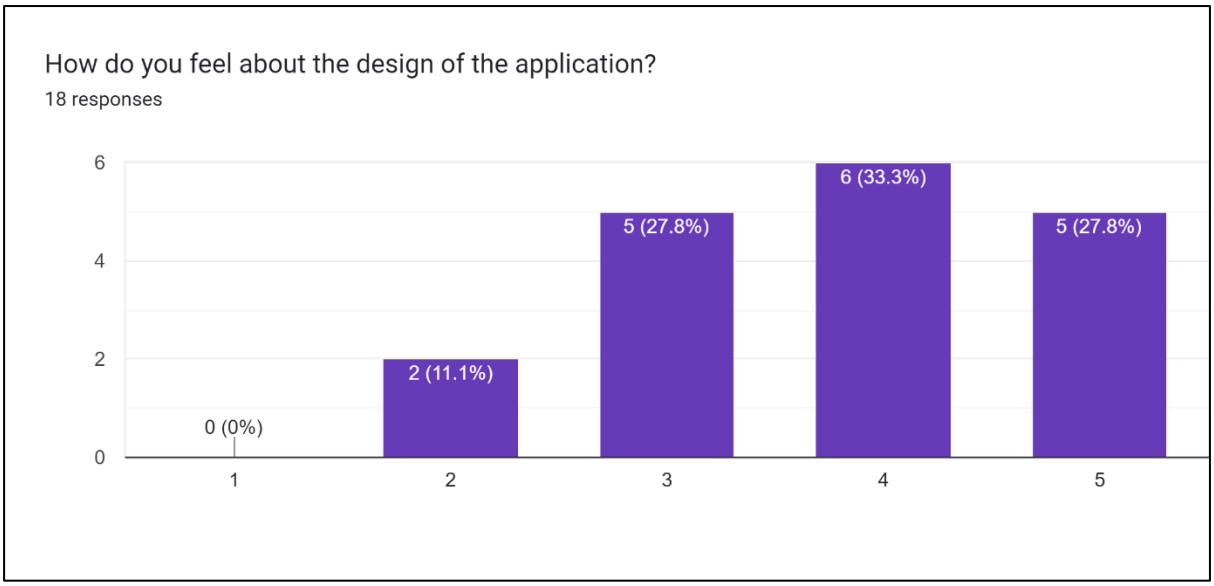


Figure 25 Question 6

Explain: The majority of users commented on the design of the application.

Question 7:

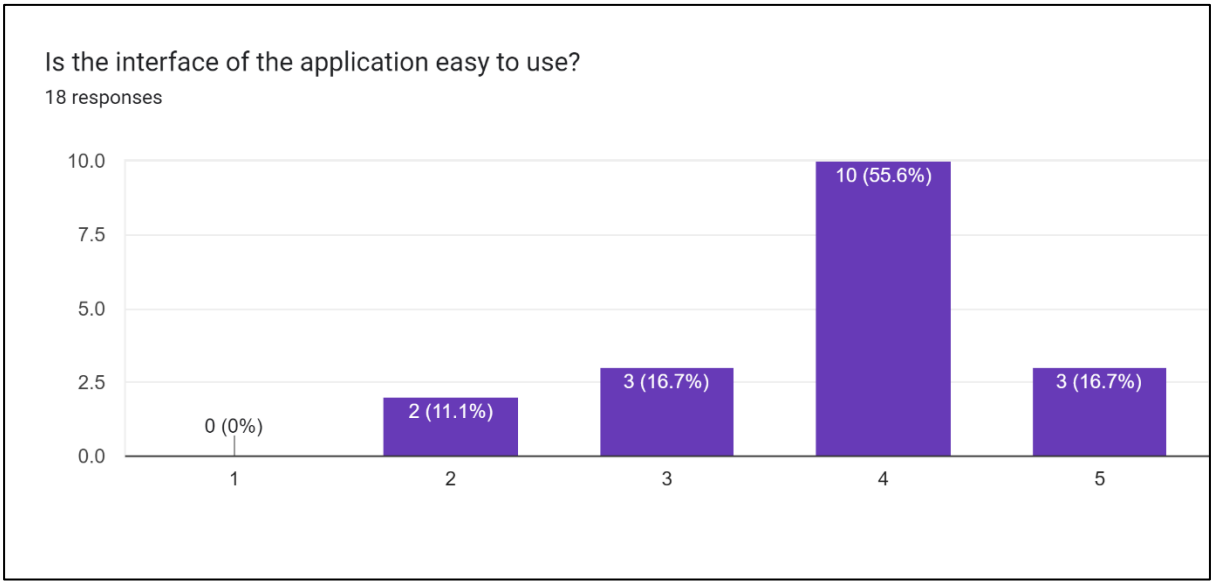


Figure 26 Question 7

Explain: The interface of the application is highly appreciated by users through Figure 7 above.

Question 8:

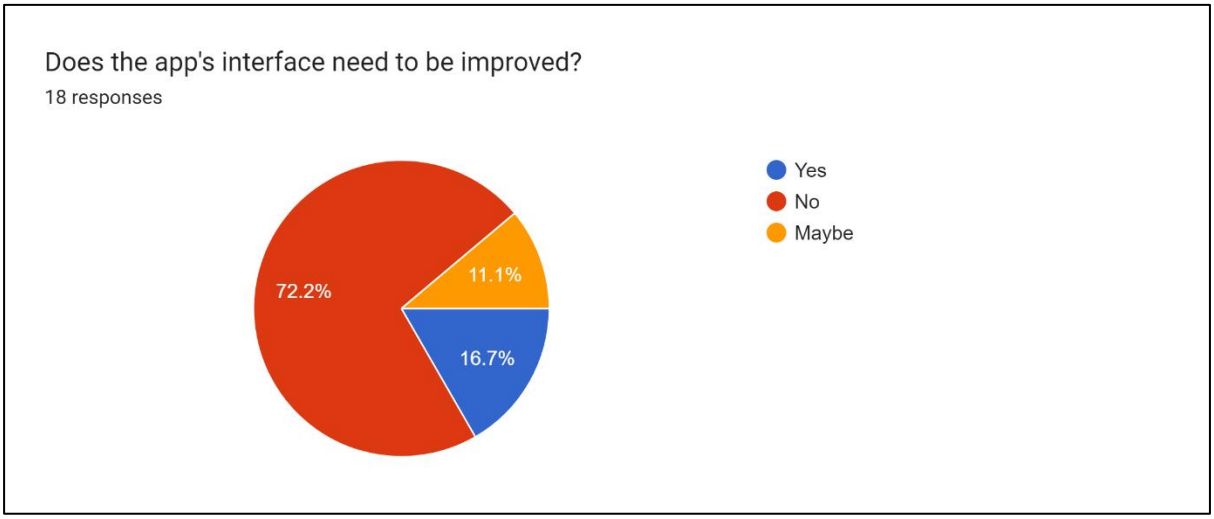


Figure 27 Question 8

Explain: The interface of the application has been highly appreciated by the experiencers. Most people think that there is no need to make any further tweaks to the interface of the application.

Question 9

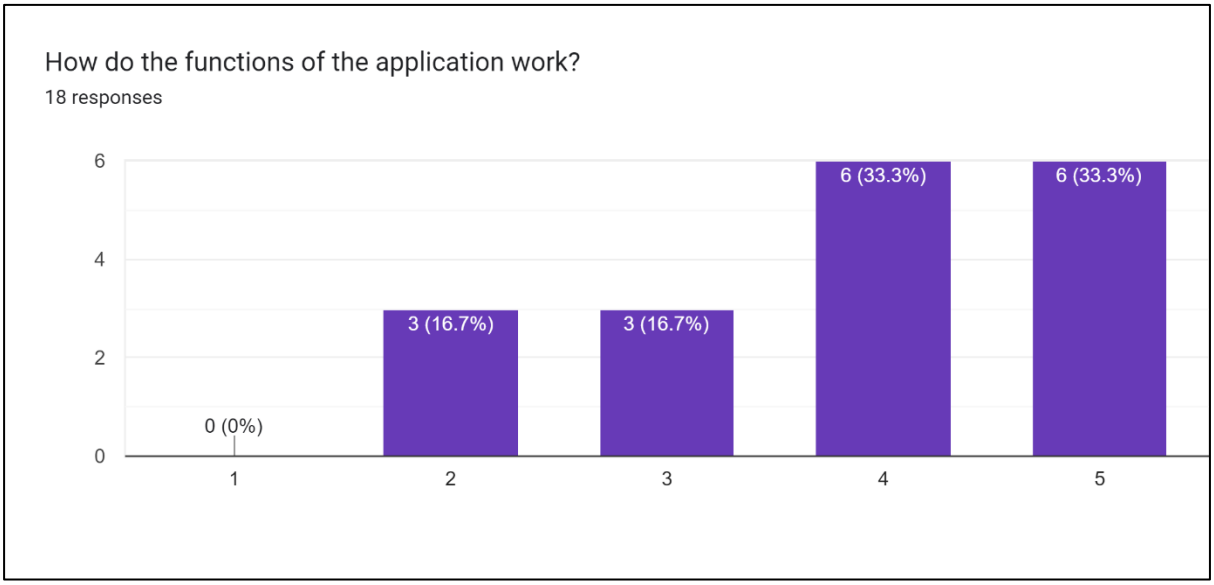


Figure 28 Question 9

Explain: Users claim that the functions of the application work smoothly during use.

Question 10

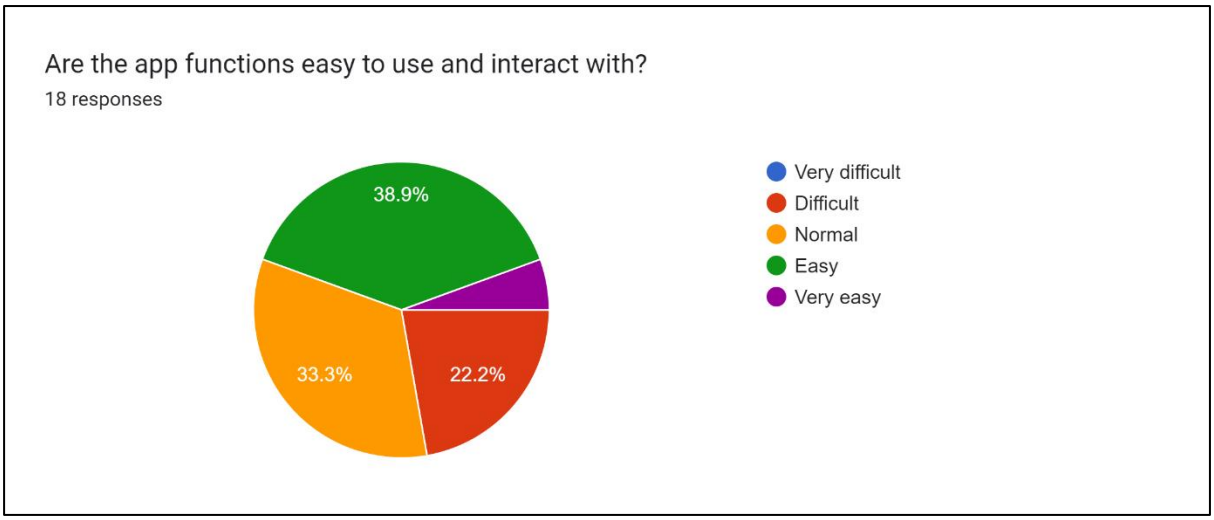


Figure 29 Question 10

Explain: Most of the reviews say that the application is easy to use and interact with.

Question 11:

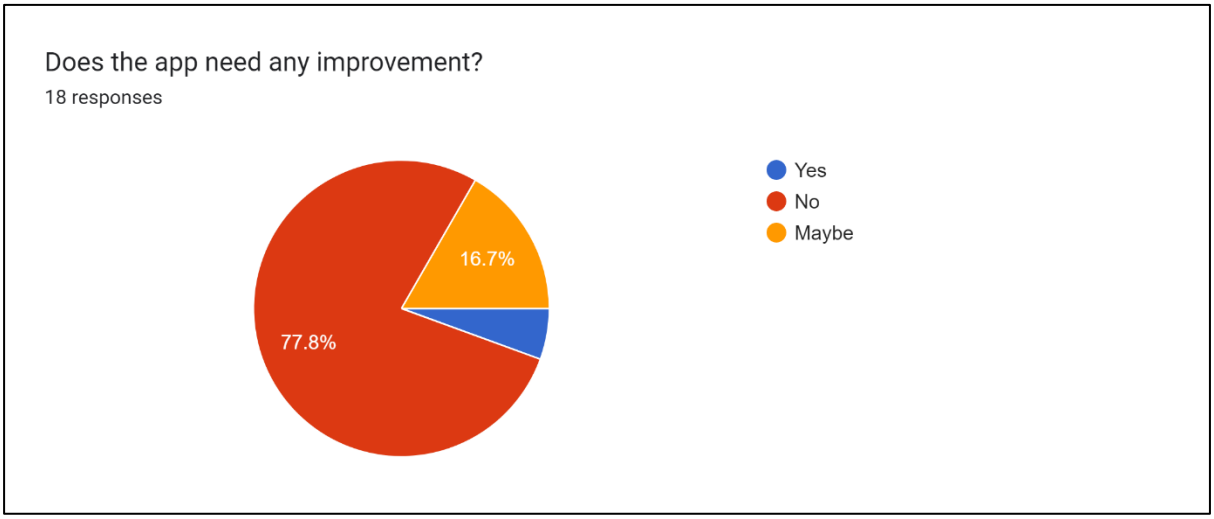


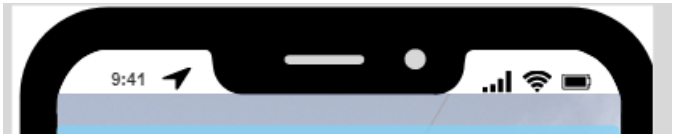
Figure 30 Question 11

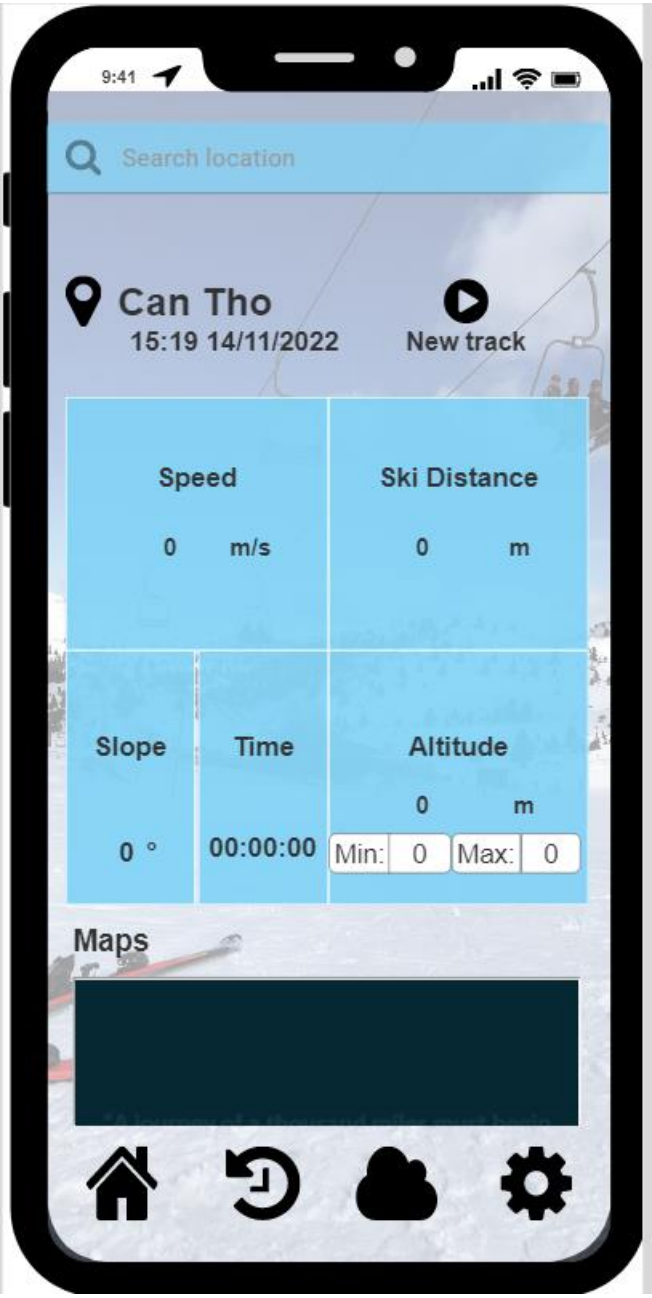
Explain: Only 1 out of 18 people surveyed thought the app should be improved. That we can understand that the application has met the requirements of most users.

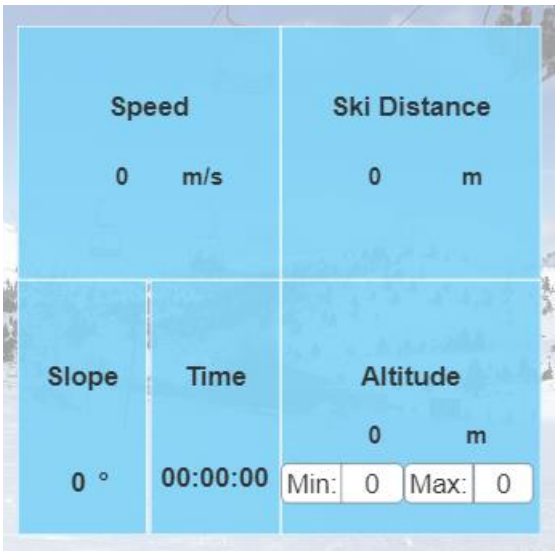
Conclusion: Through the survey data obtained. My conclusion is this: Skiers all want to use an app that lets them record their play. However, most of the apps people used in the past only had ski tracking functionality. Because we see that our Ski tracking application has great potential for development because it integrates the necessary function of weather forecasting. The application is highly appreciated by everyone from the interface to the functionality. Since then, the second and third hypotheses presented above have been clarified.

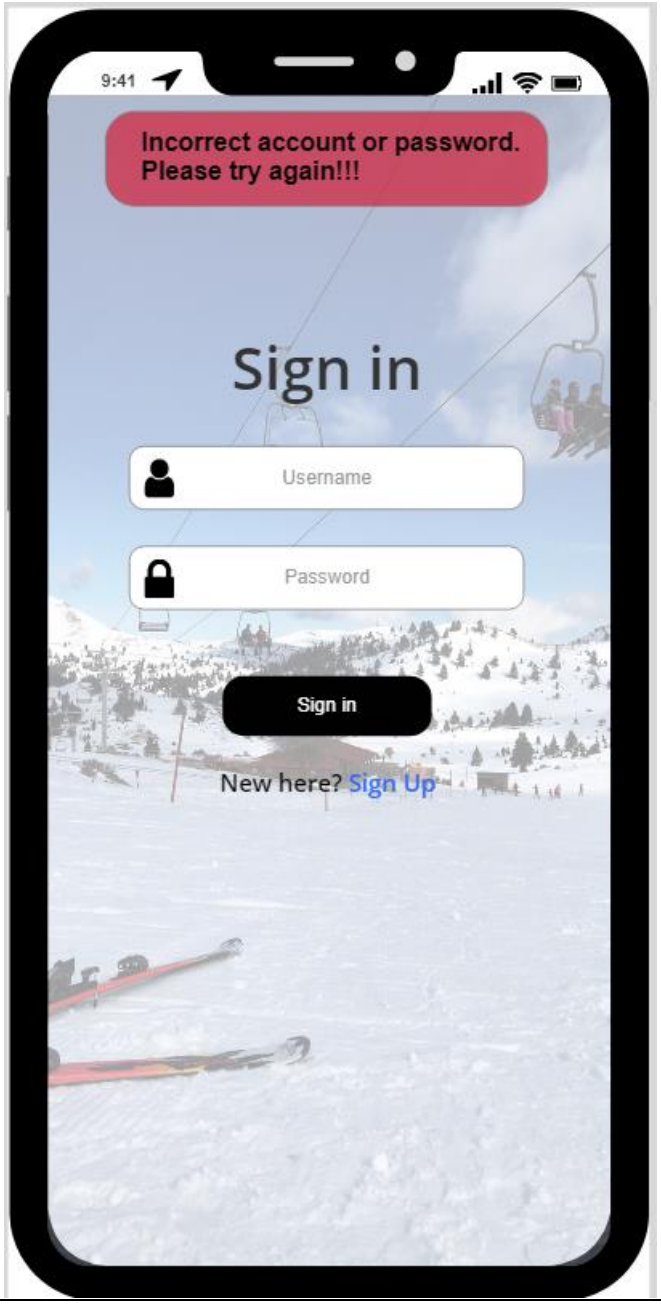
Evaluation Nielsen's 10 usability heuristics in Ski tracking

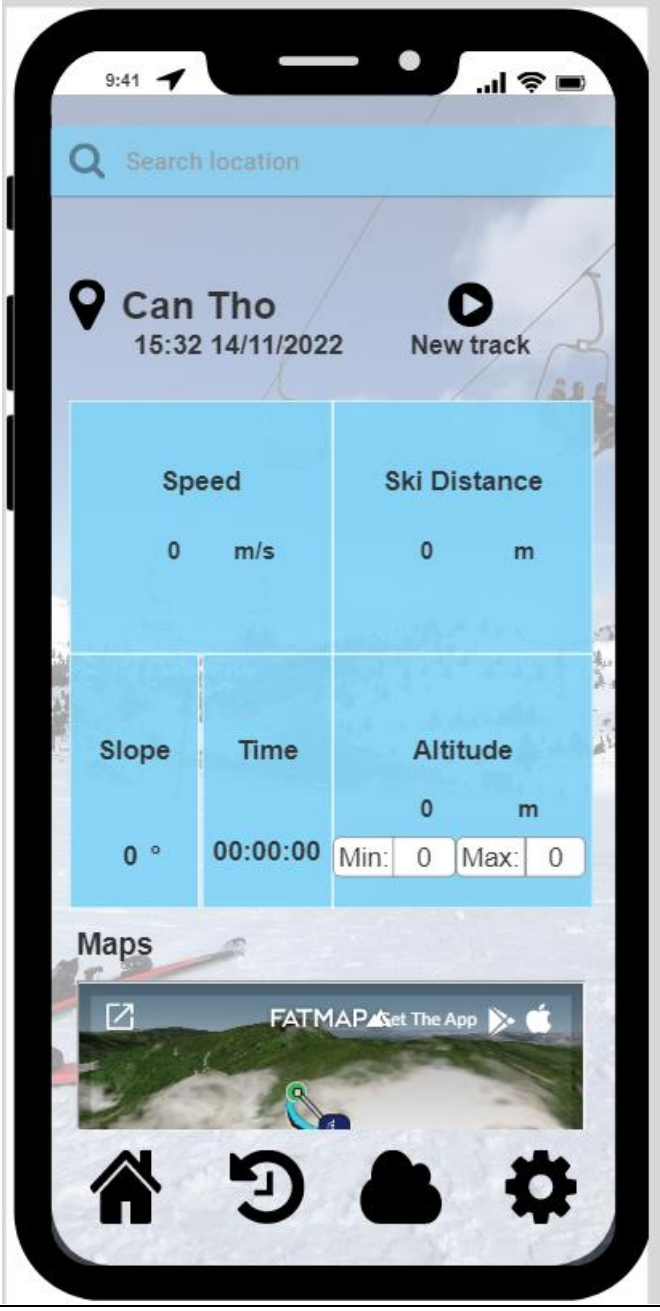
Table 3 Evaluation Nielsen'10 usability heuristics

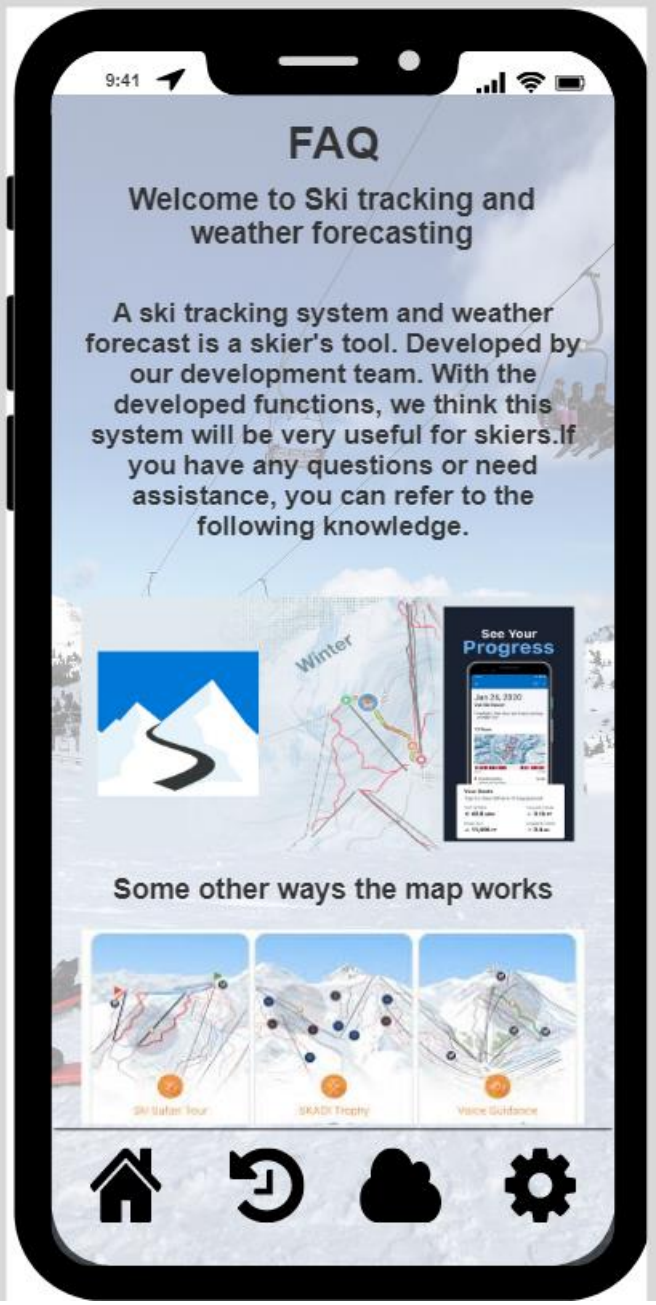
Principles	Description	Illustrating images
Visibility of system status	The system status is always displayed in the device's notification bar. For example: battery, Wi-Fi, location	
User control and freedom	The application allows users to return to the previous page by clicking on the back icon	

Consistency and standards	The app is designed to follow a certain design rule and a specific color code.	

Flexibility and efficiency of use	Tracking shows only the necessary information and no redundant information.	

Help users recognize, diagnose, and recover from errors	Error messages are designed so that users can know where the error is and fix it.	

Recognition vs. Recall in User Interfaces	The application uses intuitive icons so that users can recognize its function. For example: Icons in the navigation bar, new track icon	

Help & Documentation	The app has a FAQ page to provide more information about the app to the users.	

6. Conclusion

I have successfully built a Ski tracking application with the following functions: create new track, review history, weather forecast, settings. With those functions the application will meet the requirements of skiers. Ski tracking application will help users improve their performance. In the process of building the application, I encountered a few difficulties such as not having much knowledge about the sport of skiing so determining the necessary parameters takes a long time and building the interaction flow of the application is not achieve high performance. In the future, I will try to update more good functions for ski users along with improving the performance and processing speed for the existing functions of the Ski tracking application.

There have been several research projects to reduce skier injuries through mobile apps(Curbelo et al., 2018). So, in time, I will try to refer to related research articles to integrate into the Ski tracking application with the desire to help skiers can be safer and more effective.

7. References

Albinsson, P.-A., Zhai, S., 2003. High precision touch screen interaction, in: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '03. Association for Computing Machinery, New York, NY, USA, pp. 105–112. https://doi.org/10.1145/642611.642631

Borchers, J.O., Thomas, J.C., 2001. Patterns: what's in it for HCI?, in: CHI'01 Extended Abstracts on Human Factors in Computing Systems. pp. 225–226.

Chao, G., 2009. Human-computer interaction: process and principles of human-computer interface design, in: 2009 International Conference on Computer and Automation Engineering. IEEE, pp. 230–233.

Curbelo, M., Grzybek, R., Brown, C.A., 2018. A Mobile Application for Reducing Skiing Injuries.

Eelke Folmer, 2015. Interaction Design Patterns.

Freire, A.P.V., 2016. Interaction design.

Jenny Preece, Yvonne Rogers and Helen Sharp, 2015. Interaction Design: beyond human-computer interaction, 4th ed. John Wiley & Sons Ltd.

Johnson, J., Henderson, A., 2002. Conceptual models: begin by designing what to design. interactions 9, 25–32.

McElroy, K., 2016. Prototyping for designers: Developing the best digital and physical products. O'Reilly Media, Inc.

Moggridge, B., Atkinson, B., 2007. Designing interactions. MIT press Cambridge.

Nardi, B.A., Zarmer, C.L., 1993. Beyond models and metaphors: Visual formalisms in user interface design. J. Vis. Lang. Comput. 4, 5–33.

Preece, J., Rogers, Y., Sharp, H., Benyon, D., Holland, S., Carey, T., 1994. Human-computer interaction. Addison-Wesley Longman Ltd.

Seaborn, K., Miyake, N.P., Pennefather, P., Otake-Matsuura, M., 2021. Voice in human–agent interaction: a survey. ACM Comput. Surv. CSUR 54, 1–43.

8. Appendix

All figures of the questionnaire

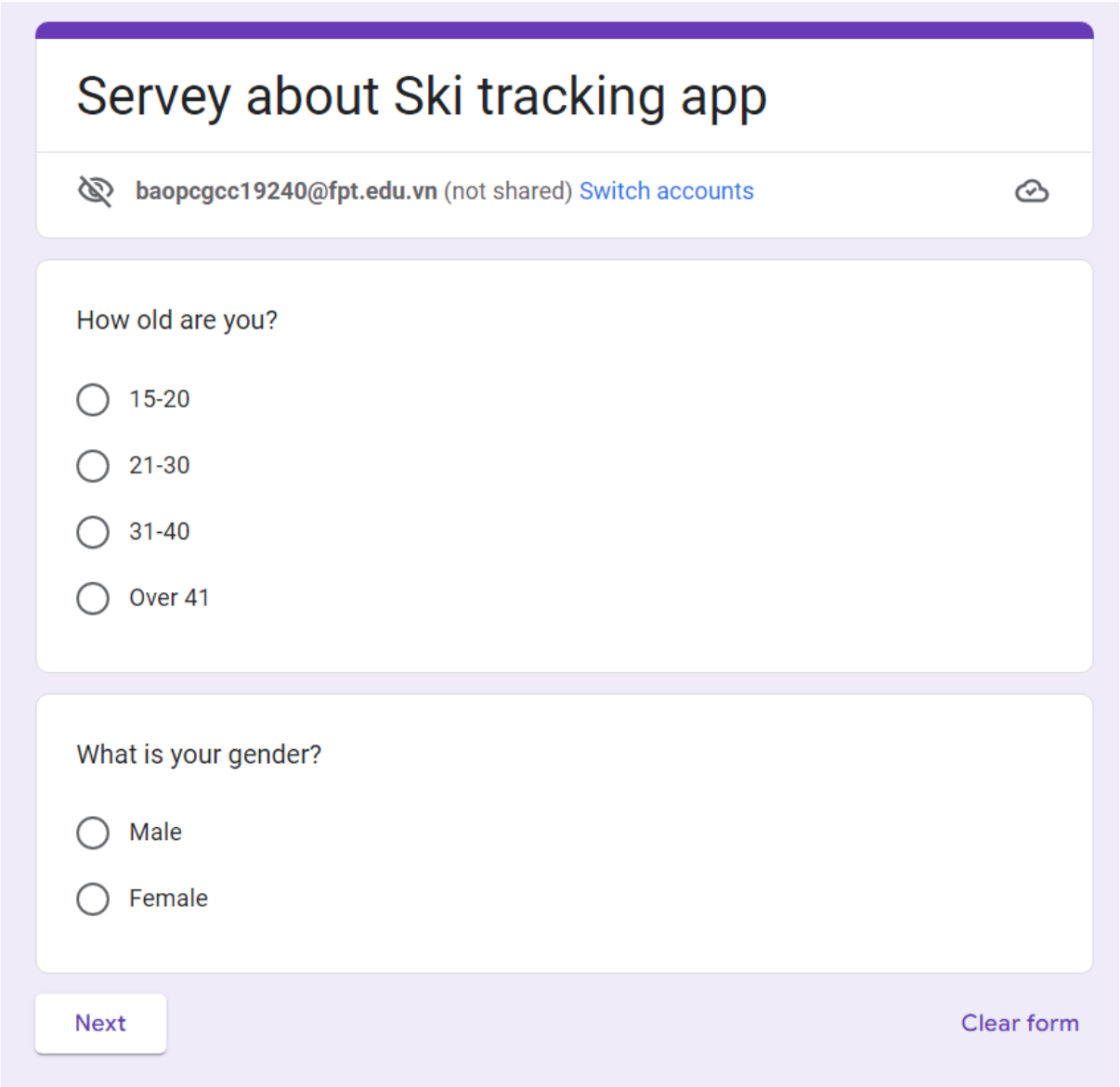


Figure 31 The questionnaire of survey

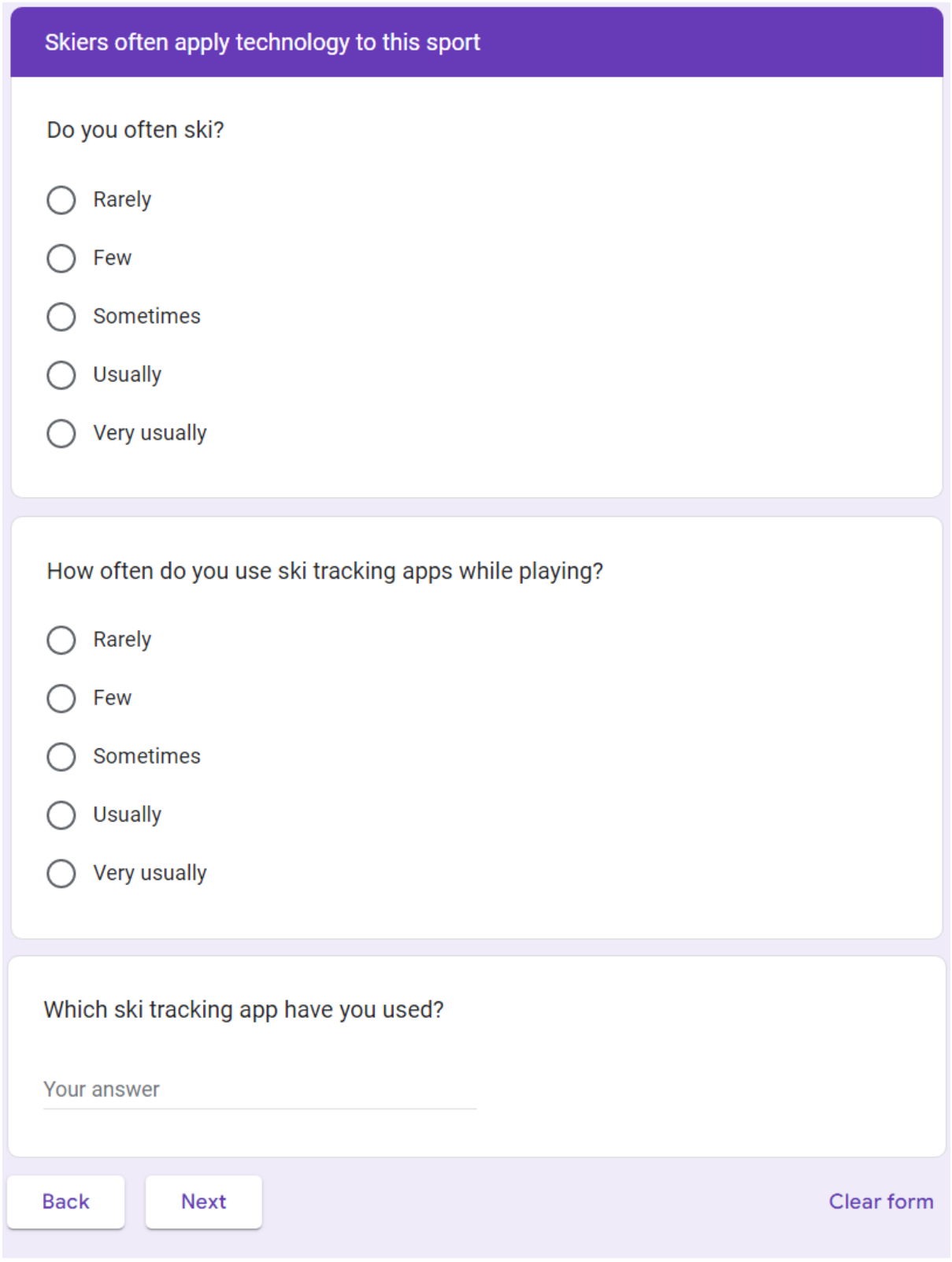


Figure 32 The questionnaire of survey(2)

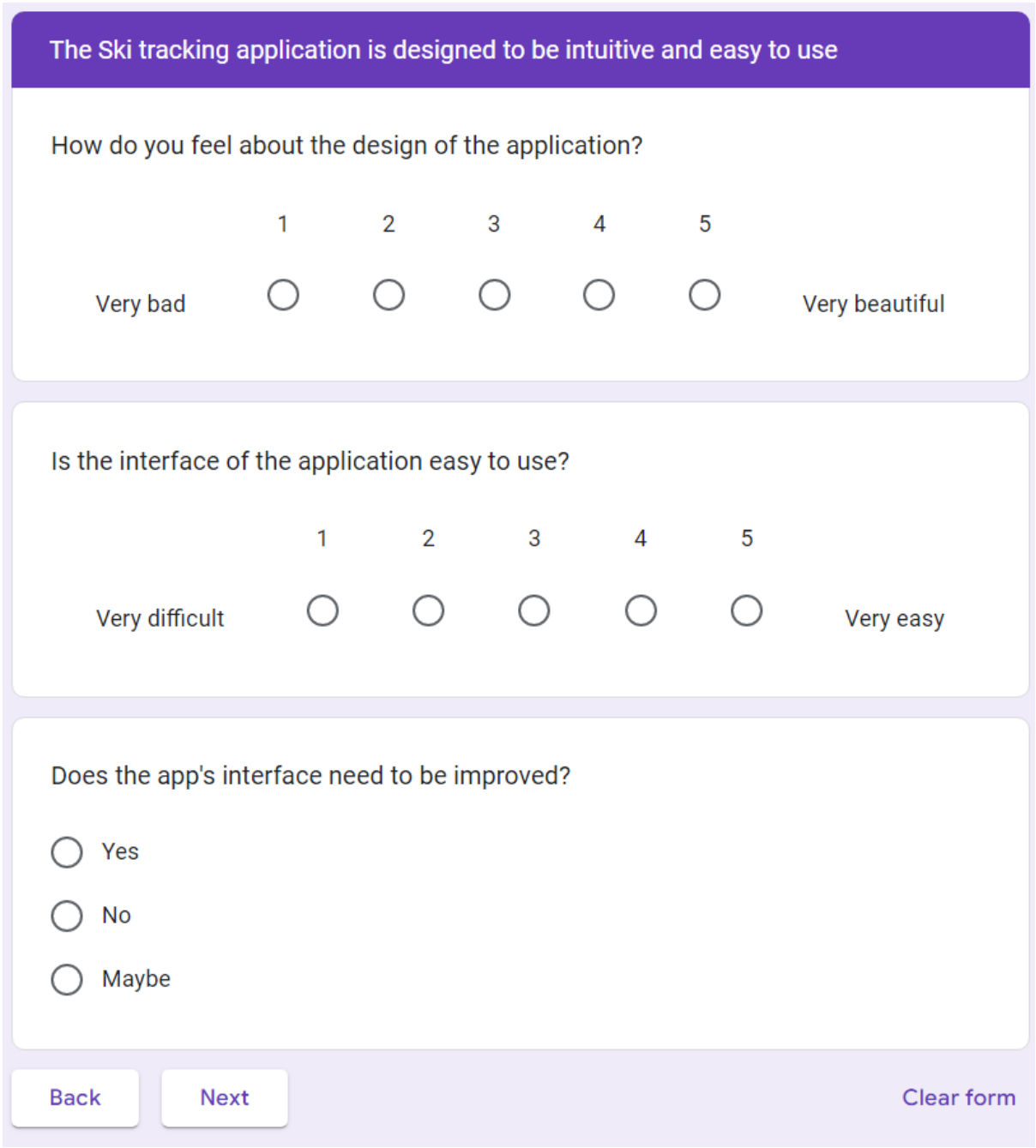


Figure 33 The questionnaire of survey (3)