

Mobile Human computer Interaction

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Abstract

This report represents a mobile application that allows users to find the bicycle parking place. The application was developed to explore the influence of the theorems of mobile human center interaction to the mobile application design interface. This report is going to introduce the process of application design, implementation and evaluation of the mobile application and the future improvement for the mobile application based on mobile HCI.

1 Introduction

Nowadays, the increasing number of people decide to travel around cities with bicycle because it provides a fast and environmentally-friendly way [2]. Comparing with other traffic tool such as vehicles and motorbike, it is cheaper to buy and more convenience to use. Therefore, the aims of this project is to develop a mobile application that could be in conformity with the major principle of mobile human computer interaction. Furthermore, it is a multi-functional interactive systems that would give information to users of bicycle parking areas.

1.1 Idea

According to the scenario from mobile HCI coursework and the principle of mobile HCI, we came up with the mobile application called "cycle buddy" in which it provides information to cyclists of their current location, the location of bike parking area and the direction to the parking place. In addition to the information of the parking area, the application can also records the data about the distance the users have ridden, how long the users have ridden, the current speed of the bike and the calories the users have burned.

1.2 Report Structure

The rest of the report can be constructed as follow:

- Section 2: **Design** represents four initial paper prototype for the application the evaluation for each prototype and the wireframe for the final product.
- Section 3: **Implementation** discusses the techniques we used for our application and how did we implement these techniques into our application.

- Section 4: **Evaluation** states the evaluation method we used for evaluating our application and future work base on the feedback from evaluation.
- Section 5: **Conclusion** concludes the reflection on the project from initial design to the end and demonstrates did our Mobile application satisfy the major principle of Mobile Human Computer Interaction course.

2 Design

This section introduces the journey of designing from initial paper prototype to the final wireframe, the tools we used for coming up with the paper prototype, the evaluation for each paper prototype and final wireframe for the application bases on the evaluation.

2.1 Initial Design

Initially, we decided to create a storyboard in order to gain an empathic understanding of the functions we want for the application. And then, we drew a map that helps us define all of the function of the application more clearly.

2.1.1 Storyboard

1. **Ming Huang, 26.** Ming is a supervisor in a Korea restaurant. The distance between her home and restaurant is quite far and she can not afford to buy car. These leads her to travel with bicycle everyday. She needs to application that can tell her where is the closest bicycle near the restaurant.
2. **Aiden Smith, 23.** Aiden is a final year student of university of Glasgow. He always staying in the library till midnight for his final dissertation. This cause him did not have time for exercising. Therefore, he takes bicycle everyday for his exercising and he needs to know how many calories he burnt each time. Consequently, he needs an application that can help him know the number of burnt calories.
3. **David Jones, 25.** David is a professional cyclist, he needs to cycle everyday for his training. But he found it is hard for him to know how long he has ridden already. He needs a method that can help him record how far he ridden everyday.
4. **Williams Brown, 30.** Cycling is Williams's habit. He likes to rent a bike and travel around with cycling when he arrives at a new city. This cause him hard to find a parking area because he is unfamiliar with the new city. He needs a method that can help him finding a bike parking area.

Based on the storyboard we drew a map for the functions of the application (See figure 1).

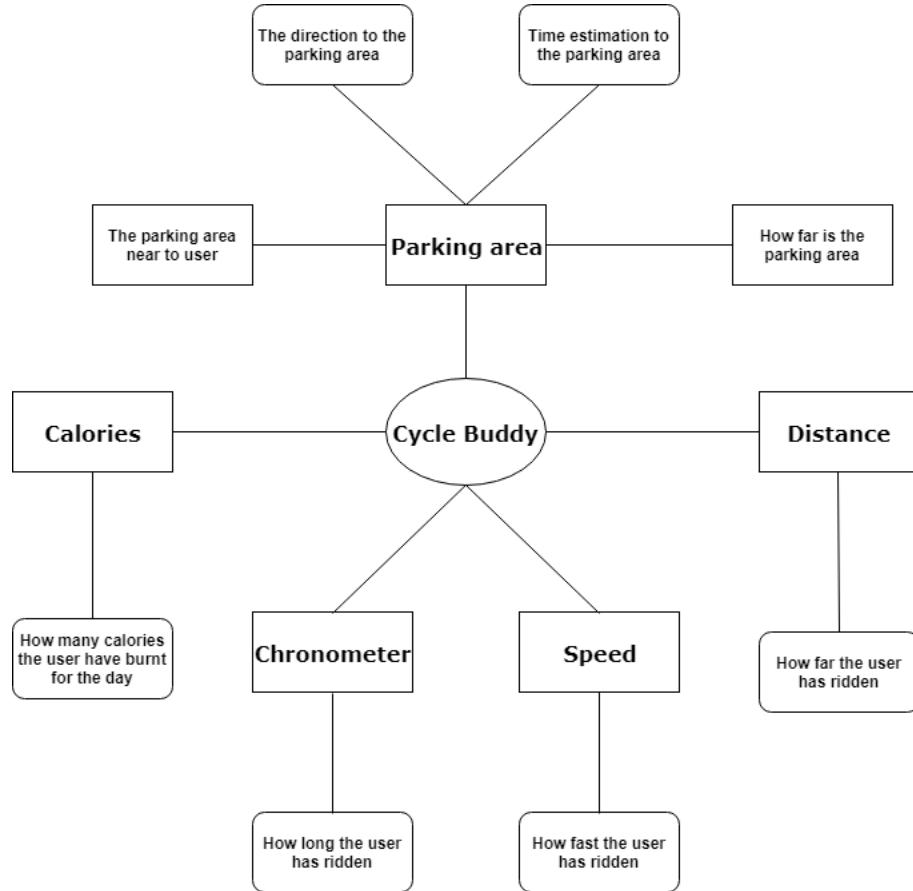


Figure 1: Map for identifying the function

2.1.2 Paper prototype

Based on the storyboard and the map we came up with, we gathered all of the features required from the personas and the map, next, each of the group member drew a paper prototype for the mobile application (see figure 2,3,4 and 5). We decided the application should have five pages: Home screen, Login, Parking Area, Current Status and Histogram.

After we finished the paper prototype, We realized that even though all of our design were based on the same personas and map, there were still some slight difference between each prototype. In order to find the best design between these designs, we decided to present our design to other students to seek some advises.



Figure 2: Prototype 1

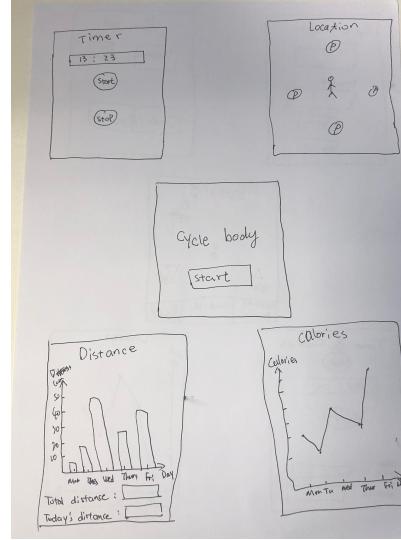


Figure 3: Prototype 2



Figure 4: Prototype 3

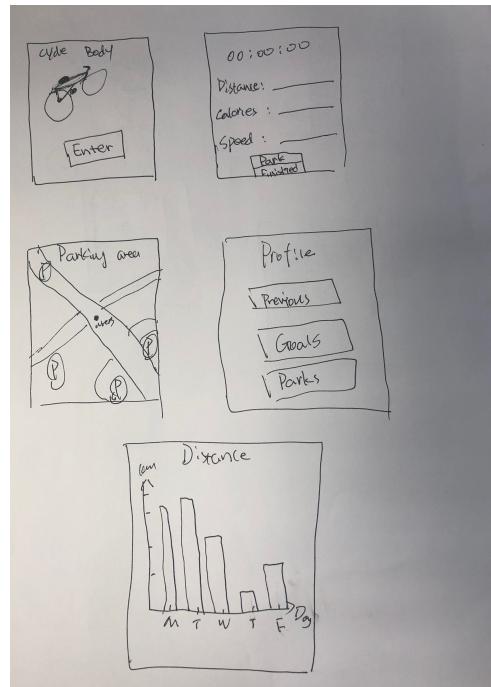


Figure 5: Prototype 4

2.1.3 Evaluation for Paper Prototypes

We realized that not all of the users have background knowledge about the mobile HCI, thus, the paper prototypes were presented to other 5 students who are not taking the Mobile

Human Computer Interaction course. We supposed that they did not have background knowledge of mobile HCI and they did not know the main principle of Mobile HCI. After the presentation, We received some beneficial feedback and negative feedback from the student. The summary for each paper prototype will be displayed as below:

- **Paper Prototype 1:** All of the students suggested that one of the essential function is missed for the application, which is bicycle parking area. Three of them like the design for distance and calories page because it is simple and users can visualize the data directly. Two of them suggested that should add icons into distance and calories page so users can back to timer page. Four of them think the buttons in home page are inconsistently placed and the name of the application should more obvious and in the center of the screen.
- **Paper Prototype 2:** We received a lot of negative feedback for this design. In terms of the home page, participants think the it is too simple and they got confused about the function of start button. In terms of the timer page, three of them think it should add more function in this page such as total time users have ridden. Furthermore, the hierarchy of this page is not consistent because the shape of button are circle and the place for displaying the time is rectangle. Therefore, they suggested that change three frames into the same shape. The only positive feedback we got for this paper prototype is the design for distance page. participants think the page is good because of the layout, at the same time, they think the function of today's distance and histogram is a bit overlap.
- **Paper Prototype 3:** This prototype received some positive comments on parking page and distance page. In terms of home page, they think it is too complicated for home page and home page should more focus on the name of the application as well as allow users to start the application from home page directly rather than let users to sign in or sign up. In terms of the parking page, they think it is a good design to put the text beneath the icon, helping users know what the icons mean. Moreover, we received some negative comments about adding symbols in the title of the page for time and calories page.
- **Paper Prototype 4:** This prototype received some positive comments on home page for having a bike image in home page. Most of the participants like the design of parking area. they also suggested that should add more function in this page such as the route to the parking place and how long the users would spend from their current location to the parking area. Furthermore, they think the design for time page is innovative because it has a function that will display the speed.

After analyzing the feedback from participants, we decided to maintain the function which we received the positive comments on each prototype and discard or edit the function which we received some negative feedback. Therefore, a final design is generated for the application (see figure 6 in appendix).

2.1.4 Final Paper Prototype

In the final paper design, we decided keep the bike image on the home screen and the layout for the home page is same with the prototype 4. We decided that adding an extra page in which only has one button in the screen would not bring any value to the app and then

removed it. Furthermore, we added two extra pages (from prototype 1 and 3) that allow users to check their profile and sign up for the application. As for parking page, we decided to implement the page from prototype 4 and add extra functions in this page that direct users to the parking place and display the distance between users and the parking area. In terms of distance page, we decided maintain the histogram design (from prototype 2) because we received a lot of positive comments on it.

2.1.5 Wireframe

In order to move into implementation, we decided to build a wireframe shown in Figure 7 in appendix. During producing the wireframe, we put each screen into a specific order and made some refinements to our final paper prototype after the discussion for the final paper design. On one hand, the refinements are adding a home icon to each screen that allows users go back to home screen if they want to restart the application. On the other hand, we adjusted the structure of the display and make the page looks more consistent.

3 Implementation

This chapter is divided into two sections. The first section focuses on a discussion of the various tools and techniques used to develop the application. The second section introduces the graphical user interface layout.

3.1 Software and Language

There are some important technologies and tools used to develop an Android-based application. Among the various available, this report chose three to outline. i.e. Android Studio, Google FireBase and other tools & languages.

3.1.1 Android Studio

Android Studio provided by Google is an integrated development environment based on JetBrains's IntelliJ IDEA for developing Android apps [4]. Since October 2014, Android Studio has been chosen as the official Android IDE. It is exclusively designed for Android development, so our application is only available in a single system, Android.

3.1.2 Google FireBase

FireBase is a backend service that helps quickly develop applications, broadening our user database, and providing essential features needed for web and mobile (Android, IOS) development integration [1]. In the past, it was laborious to develop functions such as server configuration, server architecture, authentication, database models and integration in order to implement a back-end service. With the release of FireBase, the aforementioned hassles have been addressed and helped us to focus more on the front-end development of our application. This is why we implemented FireBase instead of SQL. Another reason is that FireBase is powered by Google which makes its support to Android-based applications more reliable. The FireBase provides an authentication template that speeds the development process by eliminating the need for security patches [1]. Most features of FireBase are free which makes prototyping cost-less for the developers. Thus, we used FireBase for authentication.

3.1.3 Other tools and languages

Java is used as the language that implements the project's underlying functional logic since it is used during Android Studio development. XML is used to design the screens and Google API is implemented to make it possible to utilize Google maps within the application.

3.2 Graphical User Interface (GUI)

The application is built and designed from the perspective of the user. The user-friendly design makes it easy for them to intuitively navigate through the interface, making it simple for them to do what they want with the application. Therefore, our application does not require the user to make much of an effort to learn the functions and navigate in the application. The screens and features of the application provided as follow:

- Home Screen
- Sign-in Screen
- Sign-up Screen
- Profile Screen
- Previous track Screen
- Start Screen
- Parking Screen

3.2.1 Home Screen

The home page is the start page for the application, it shows the name of the application at the top and a simple bike picture which indicates that this app is for those who ride a bike. There is only one "Enter" button. By clicking the "Enter" button, it will navigate the user to the sign-in page.

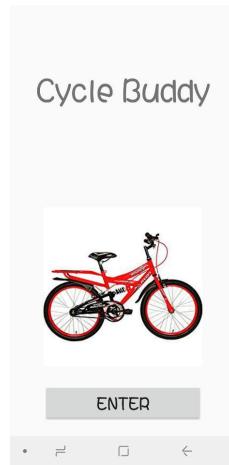


Figure 6: Home Screen

3.2.2 Sign-in Screen

When the user touches the 'Enter' button, the sign-in screen appears and user have two options: login and registration. You can, either login or choose the latter, being then redirected to registration.

3.2.3 Sign-up Screen

If the user is not registered, the app will direct you to Sign-up page. This page takes in the user details, i.e. email, name and password, to then create a profile in the database. When finished the user is sent back to the Login.

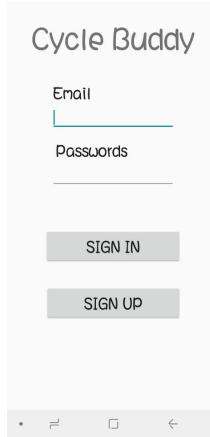


Figure 7: Sign-in Screen

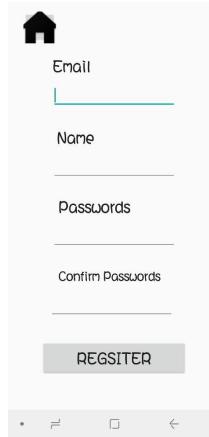


Figure 8: Sign-up Screen

3.2.4 Profile Screen

When a user logs in, it will automatically take him/her to the profile screen. On the profile page, the user can sign out by clicking the button on the top left, or select one of the three other options: 'previous', 'start' or 'park'

3.2.5 Previous track, Start, and Parking Screen

Every page has a button on the top left that allows a user to redirect to your profile page. 'Previous' graphs the exercise history of how many calories the user have consumed per day and how many miles the user have run. When the user click the "Start" button, the application starts to calculate distances, calories, and speeds, assuming the user are starting a trip. At the bottom is a "Park" button that takes the user to the map page. 'Park' is basically a map page showing where the user is and where the bicycle parking space is. When the user clicks on one of the bicycle parking spaces, the nearest route is displayed with information about how long it will take to get to the parking area in miles and in minutes.



Figure 9: Profile Screen

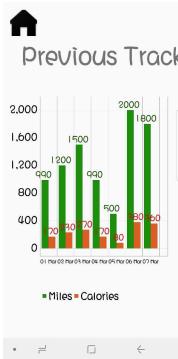


Figure 10: Previous Track Screen

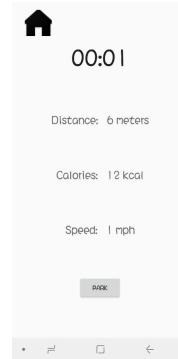


Figure 11: Start Track Screen

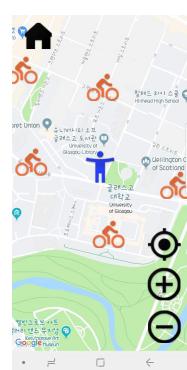


Figure 12: Parking space Screen

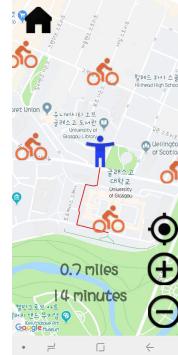


Figure 13: When the user select the parking space

4 Evaluation

We presented our application to other 10 students who are not doing the Mobile HCI course. We asked them to try our application and received feedback in the form of questionnaire.

The content and the results of the questionnaire are shown as follows:

1. **what do you think of our interface design?** 30 percentage of participants liked our interface design, 50 percentage disliked and 20 percentage was neutral.
2. **Was it easy to understand and use our application?** 80 percentage of participants felt our application was easy to use, 20 percentage felt it was difficult to understand the interface.
3. **What do you like or dislike about our products?** 60 percentage of participants complained about static data, 10 percentage of participants complained about the registration system and 30 percentage of participants pointed out the missing “forgot password” function.
4. **Rating the application (0-10, 0 implies bad, 10 implies good)** 60 percentage of participants rated the app at 7, 20 percentage of participants gave it 5 and the remaining 20 percent rated the app below 5.

4.1 Discussion

As for the feedback we received, three main points stand out. The first point rises from our current interface design as it fails to attract the participants. Many have complained about the simplicity of our chosen theme and its consistence throughout the app. The second point originated from the testers need for a password recovery function, that is not available. This could be easily implemented on a future version of the app, using the FireBase tool. The final point is centred in the nature of our app, which is proof of concept and, therefore, only provides static data to our users. This could be implemented on a next version if more time is spent developing the tracker functions.

5 Conclusion

In conclusion, our final mobile application satisfied all the requirements that been mentioned in the section 2.1. The app is developed with Android Studio and FireBase - two established platforms for android development. According to the result from the evaluation conducted, we noticed that even though our application meets all the basic criteria, the interface could use further improvement.

In terms of the further improvement, there are few functions we need to work on. Firstly, the app does not have a recovery function for users to retrieve their lost password. Secondly, we would like to link the histogram to FireBase in order to generate dynamic values instead of current hard coded histogram. Finally, we are keen to improve the app theme, given that the current received extremely low scores during the evaluation. Overall, work needs to be done in order to elevate the app to current market standards.

To test our app, please use the Google drive link in references [3].

References

- [1] Fu Cheng and Fu Cheng. *Build Mobile Apps with Ionic 4 and Firebase*. Springer, 2018.
- [2] David V Herlihy. *Bicycle: the history*. Yale University Press, 2004.
- [3] Team Ivo. Cycle buddy video, 2019. URL https://drive.google.com/file/d/1eb0mX_ATx72GFUyxZkcOP1hAiOLqXssX/view?fbclid=IwAR0a2Vg76TdEJqEQvPG8PYS534PdwwrCZ424rbpbMpSFnSih30rUj0LKvA4.
- [4] Android Studio. Android studio. *The Official IDE for Android*, 2017.

Appendices

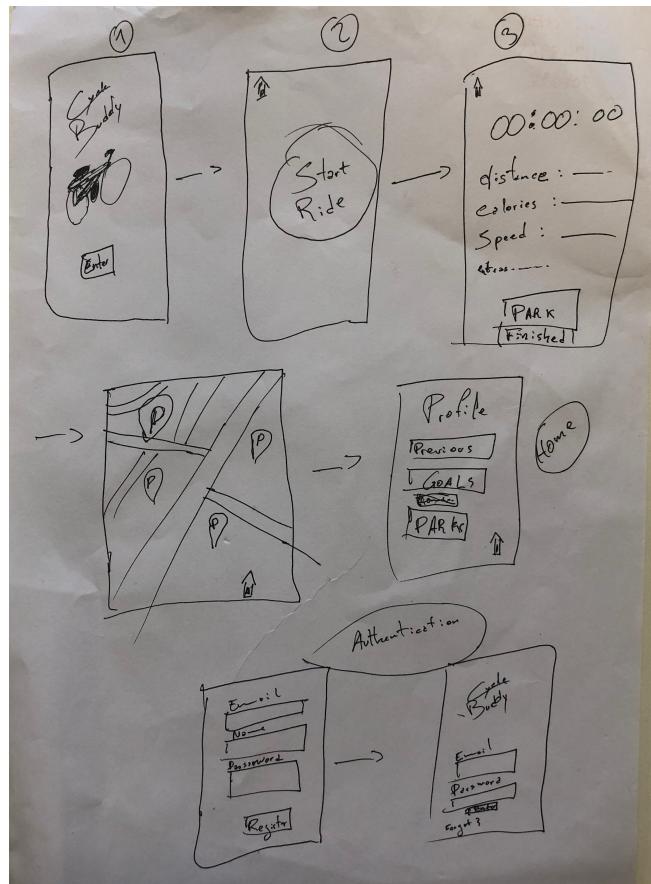


Figure 14: Final paper design for the mobile application

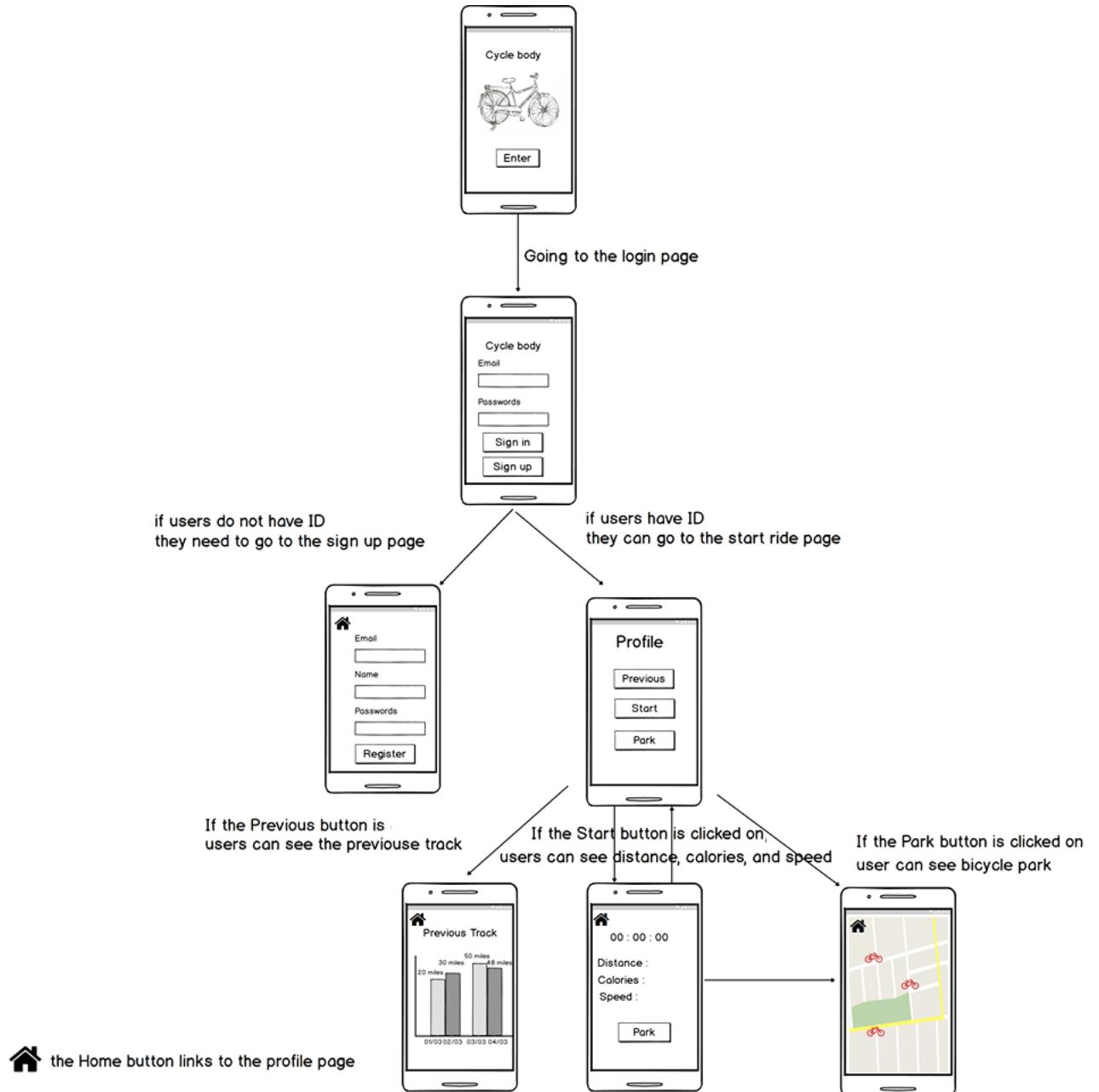


Figure 15: Wireframe for final product

Cycle Buddy

Send us your feedback and all comments will help us provide you with a better product.

How much you like our interface design? *



Was it easy to understand and use our application? *



What do you think we can improve? What did you dislike about our products? *

- Dynamic data
- Registration system
- Recover/forget password system
- Simple functions
- Design
- Other...

Overall, how much do you think you can give the score for our products? *



Other thoughts or comments *

Long answer text

14

Figure 16: Survey Questions