# High-Fidelity Prototype and Summative Evaluation

Navya Gupta, navya.gupta@mail.utoronto.ca

Alana Hodge, a.hodge@mail.utoronto.ca

Aonushka Aeron, aonushka.aeron@mail.utoronto.ca

Vijayalaxmi Hiremath, viju.hiremath@mail.utoronto.ca

Mohamad Hamdy, mohamed.hamdi@mail.utoronto.ca

Artem Albert, a.albert@mail.utoronto.ca

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CSC 318: Designing Interactive Systems for Users

TA: Zhichong Lu

# Executive Summary

As a group, we worked to implement the feedback on our solution that we received from our peers, our usability tests, and our peer expert evaluators in our design studios. We iterated over our previous paper prototype and identified where our users were finding issues, and spent hours planning how we could improve our design to eliminate the issues that arose, while still designing a functional and practical solution that would satisfy the necessary job stories, functional requirements and user experiences. Thus, we created a high-fidelity prototype of our solution, which is aptly named PARKEEE. We conducted a heuristic evaluation using Nielson's Ten Heuristics as criteria, the results of which we analyzed to see what other improvements we could make. This document contains a link to our interactive high-fidelity prototype and an explanation of how it satisfies the necessary requirements, as well as our evaluation protocol, the results of our heuristic evaluation study and the subsequent discussion. This document also includes the implications of our study and a critique of our evaluation plan, links to video clips of our study, and our prototype application's screens to view in detail.

# Table of Contents:

# High-fidelity prototype

## How to install and launch

To launch the PARKEEE prototype, please use the following link to open PARKEEE in your web browser.

https://marvelapp.com/e1hf7f4

The link can be copied and pasted into a web browser such as Chrome or Safari on either a desktop computer or on a mobile phone. The desktop version of this prototype will automatically display the app in an Iphone screen shell to demonstrate what the app would look like on an Iphone. The mobile version of this prototype will closely mimic the display of the actual app on an iPhone.

The user does not have to sign up for a new account or log in (although the sign-up button is interactive and will take the user to a sign up screen). The user can simply select “Go” on the screen to enter the app as if they have successfully logged in, for the purposes of testing this prototype.

The prototype can be used interactively, with the exception of input fields such as text boxes and drop down menus, as well as mapping services. Thus, the directions that the user will see in this prototype are pre-generated and are not meant to be accurate reflections of the actual directions or their environment. New information cannot be “added” to the prototype, but the user can interact with the application as if they are using it in real life to complete a task. If the user intently presses a button or part of the screen that does not have any use or capability, the app

will highlight the interactive features of the screen that the user is currently on in a blue shading for a moment before returning to normal.

When finished, the user can simply exit their browser, and can use the provided link to access the prototype at any time.

Our prototype supports the functional requirements and job stories that we outlined in our previous reports as follows.

## Functional Requirements

1. The system has access to the user's location when they open the app.

AND

2. The system must be able to automatically store the user's current location when the user selects the ‘save location’ option.

**High-fidelity prototype** PARKEEE can use and store your location to pin the user’s parking spot when they park, as well as their current spot for when they want to leave, thus accessing the user’s location AND storing it accordingly as required by these functional requirements.

3. The system must allow the user to manually input their location if the user feels that the automatically saved location is inaccurate.

PARKEEE users can manually input the mall exit that they are near to in case their pinpointed location seems inaccurate. The user’s parking spot can also be saved via location when the user parks, and if the map cannot accurately pinpoint the user’s location, directions can also be viewed as written directions from start to end with a single tap.

4. The system is able to provide a path with directions back to the user's parking spot.

    PARKEEE's directions can be viewed as a normal interactive map with a clearly defined path, or as written directions back to the user's parking spot, thus providing a path with directions back to the user's spot.

## Job Stories

1. When I park my car, I want to set a marker so that I can easily find it when I come back to find it.

    PARKEEE marks where the user is parked by either their location or by their manual entry of their parking lot and parking spot number into the app, effectively setting a marker for the user to return to.

2. When I park my car, I want to be able to tell my car apart from others so that I do not get confused when I come back to find it.

    PARKEEE directs the user right back to their exact parking spot, so that they don't have to look for their car amongst others.

3. When I come back to look for my car, I want to take the shortest path to it so that I can easily get to my car quickly.

    PARKEEE gives the user directions from either their current location or from whichever mall exit you choose. With this feature, they can compare one exit to another by entering in the ones they were thinking of taking to see which direction pathway is shortest.

4. When I'm trying to find my car, I want to see the marker as soon as possible so that I don't waste time trying to look for it.

    PARKEEE puts a "marker" on the user's car or their location for them, so the user doesn't have to worry about remembering the "marker". PARKEEE can then immediately direct the user back to the "marker" without the user needing to look for anything.

## Issue Correction

The high-fidelity prototype addresses all of the issues identified in our evaluations in A2 as such:

***Issues that arose in the Cognitive Walkthrough:***

- Experts: Safa, Shaheera
    - The experts questioned if the user has to login every time.
        - PARKEEE now requires an account and the user must be logged into the app, but only has to log in once and will only have to log in again after the log out, which they can do whenever they choose to.
    - The expert suggested having a forgot password option.
        - A forgot username/password option has been implemented, and the app will send a recovery email to the email account associated with the User's account
    - The experts needed clarification on what an exit number is.
        - Users are now asked to "Select the Exit [they] are leaving from" from a drop down menu, rather than being asked to manually enter an exit number, so that they can attribute their real-life surroundings to the app and understand what is being asked of them.

***Issues that arose in the Think Aloud***

- The expert suggested that instead of username, have an email because the sign up did not include an username option.
    - To sign up for PARKEEE, the user must provide a username, password and an email for the account. To log in to PARKEEE, the user must now enter their username and password only, eliminating the confusion between the two options.
- The expert questioned what happens if the mall does not have parking spot numbers marked.

    - To remedy this or a similar situation where the user is unsure of their parking lot and parking spot number, PARKEEE can instead use the user's location as a marker for both parking and leaving.
- The expert needed clarification on what leaveeng means. Does it mean leaving the car or just leaving the mall?
    - The "Leaveeng" option button was rewritten to "Find My Car", and the "Parkeeng" option button was rewritten to "Parking"
- The expert displayed confusion on how to go from entering the exit number page to next page.
    - A "next" button was added as remedy for this confusion, so that the transition between screens was evident.

***Issues mentioned in "A2 Lessons Learned":***

- "There was a slight confusion over the directions screen which displayed instructions with distances on how to return to the car's location. Experts found that the system of trailing "e's" to represent remaining distance, similar to a count-down, wasn't exactly clear and had to be explained when asked what it was."

  This issue was prevalent among experts within the Cognitive Walkthrough and the Think Aloud.
    - As a correction, written directions have been simplified to simply include the direction and the appropriate metric distance(i.e. Turn left - 0.7km)
- "...and adding "back" buttons so the user could move back and forth between the map instructions and the text based directions. "
    - Back buttons have been added on all screens of the prototype that are accessed from other screens, including the map screen and the corresponding written direction screen

# Evaluation Protocol

Our team decided to conduct a heuristic evaluation to evaluate our high-fidelity protocol as we decided that it would best help us identify the improvements to be made in our application as well prioritize the improvements based on user feedback. We developed our application through a software called Pop by Marvel. The software allows for interactive prototypes instead of using paper and pen and simulates the idea of an application. To conduct our study, we used two iphones. The first phone was used to record clips of participants. The second iphone was used by users to engage with our prototype by performing the assigned tasks. In addition to this, we used a laptop to take notes of the feedback provided by the participants and any observations made. We categorized our user feedback into the ten heuristics provided by Jakob Nielsen's in 1994:

1. Visibility of system status
2. Match between system and real world
3. Aesthetic and minimalist design
4. User control and freedom
5. Consistency and standards
6. Error prevention
7. Recognition rather than recall
8. Flexibility and efficiency of use
9. Recognition, diagnosis and recovery from error
10. Help and documentation

We were able to recruit five participants for the evaluation of our high fidelity prototype. Our participants all belonged to different age groups. All our participants were mostly family members or friends as we had to improvise due to the COVID-19 pandemic. We started off our usability study by providing a brief introduction about our team, our application and how it works. The introductions were prepared in the following way:

"Hello, our team is called the Dream Team and we are from University of Toronto, Mississauga. We are enrolled in a course which teaches us about solution designing, Human-Computer Interaction, and designing user interfaces. As part of our course, we developed an application and would like to conduct tests to understand how we can improve our design. Hence, we are hoping you will be able to provide us with some valuable feedback. Our application is called PARKEEE. PARKEEE is a new parking assistance for mobile users. Users can sign in, mark the shopping mall of their choosing, save their car's location, shop, and then depending on their mall exit or their location, follow a defined path back to their car. Through our application, you can manually enter your parking spot number, which our application remembers, or use your location as a marker. When leaving the mall, you can open up the app and enter the mall exit you are leaving from, or use your current location as a starting point. The app then displays a path from that point to the saved parking spot, helping you find your parking spot quickly and conveniently".

Following introductions, we informed users that they will be provided by an application made through a software called Pop on an iphone where they will be given three tasks to perform. We described the tasks as mentioned below. We informed our participants that we would ask for user feedback after every task and ask them to rate the severity of the issues that

they came across based on the scale below. We also informed the participants that our team would make notes of our observations, the feedback the participants would provide, and would also record clips of participants performing the tasks.

Tasks:

1) Register with a new account.

2) You just arrived at a mall that you have never been to and would like to use the app to save your parking spot location. Once completed, proceed to go shopping.

3) You have just completed your shopping experience and would like to return to your vehicle with the help of the app.

Severity Scale Rating

- 0 = Not a usability problem
- 1 = Cosmetic Problem (fix if extra time)
- 2 = Minor Usability Problem (low priority to fix)
- 3 = Major Usability Problem (high priority to fix)
- 4 = Usability Catastrophe (must be fixed before release)

After describing the process of evaluation, we asked participants for their consent to record and store their personal data. We asked our participants if they have any questions before we begin our study and answered them all with the best of our ability. Lastly, we proceeded with our usability study.

After conducting our study, we asked participants if they had any questions regarding the evaluation and if they were still comfortable with our team recording and storing their data. In the end, we thanked our participants for their time and feedback.

After conducting our usability study, we categorized the results into the ten heuristics mentioned above and noted the severity level of any improvements suggested by the participants described in the document called Results of the Study.

# Results of the Study

| Heuristic | User Feedback | Severity |
|---|---|---|
| Aesthetic and Minimalist Design | ● White space on login menu | 1 |
| | ● Font of final screen of sign up process was unclear, a border around the font would enhance visibility dramatically | 1 |
| | ● Username and password boxes not aligned | 2 |
| | ● Two screens asking for Parking Lot | 2 |
| | ● Screen transitioning when entering parking spot number creates some confusion, needs to be more minimalistic | 2 |
| | ● Repetition of parking spot and lot number | 3 |
| User Control and Freedom | ● Logout option when you click a mall, but not when you click parking or find my spot | 1 |
| Consistency and Standards | ● 'Leave' button on the 'Select The Exit' page gives an impression of leaving the app instead of leaving the mall | 3 |
| Recognition Rather than Recall | ● Direction and map on separate pages | 2 |

| | | |
|---|---|---|
| Flexibility and Efficiency of Use | ● After finding your parking spot and arriving when you click done it should take the user back to the main page of malls<br>● When you enter a shopping mall you should have a go button beside the text entry instead of having to find the go on the keyboard<br>● No option to remove mall from favourites | 2<br>2<br>3 |
| Recognition, Diagnosis and Recovery from Error | ● When you click a mall, it should provide some sort of indication of which mall you clicked.<br>○ I could accidentally click the wrong mall and not even know it | 3 |
| Visibility of System Status | None | |
| Match Between System and Real World | None | |
| Error Prevention | None | |

# Discussion and Implications

The results from this study show that the prototype's design continues to be functional. Users could accomplish the task of signing in, choosing a mall, selecting a parking spot, and then returning to it using directions and the mall exit of their choice, with ease. Experts stated that the prototype was "straightforward and simple"; the system of trailing "e's" from the low fidelity prototype had been removed for simplicity, back buttons were added to pages to help with app navigation, and the parking/leaving options were renamed to alleviate confusion and to separate the concepts of leaving from the mall and leaving from the parking spot. Additionally, the flaw of one way trips had been solved − users' car locations were saved until they decided to cancel it, allowing for multiple trips to and from the mall without entering a location each time. To quote one user, "I actually like it". However, despite these successful changes, the experts also revealed the design still had some slight usability problems.

According to the expert feedback and the results of the heuristic evaluation of our prototype, the design suffers in the aesthetic and minimalist categories, along with some issues in consistency and user freedom. Feedback included: significant blank space on screens, mis-aligned input boxes, redundant and repeating screens, lightly-colored "difficult to read" text, and tedious input fields which, as an expert states, users have to "scroll down and hit 'Done' on the keyboard" to proceed. The consistency issues pertained to the logout button and its placement, "on multiple pages at different heights", and the "Leave" button's placement on the return screen being in the exact same location as the logout button, giving the impression of an option to leave the app instead of the intended function to leave the mall and start the navigation process. Additionally, there was a concern regarding user freedom as the app allows users to add

favorite malls but not remove them. Although most of these issues are not necessarily issues with the functionality of the prototype, they are nonetheless important to address as they affect the user experience. A design solution that solves a problem but proves difficult to use is still ultimately a failure.

The aesthetic issues can be resolved with a stronger focus on formatting (alignments, spacing, button placement, etc) and design consistency. The proposed changes to aesthetic are: to align username and password fields; to reduce white space around the login page to properly fit more of the login UI features; to change font size and color to improve visibility; to combine the shopping mall and parking spot input queries into one page - eliminating issues of blank space and redundancies; and to consolidate the navigation and direction screens into one page so that both methods are available to the user without having to switch back and forth, providing the added bonus of resolving recognition issues. The proposed changes to consistency are: to move the logout button to the home page, removing any duplicates along the way; to change the "Leave" button to display "Find my spot" in an effort to clear up possible confusion; to add "Go" prompts at the end of input fields for efficiency; and to add an option on the "Malls" page to remove favorites. Furthermore, during the process of the heuristic evaluation it became clear that the design lacks a certain visibility of system status. Users should be informed and reminded of their decisions - for confirmation, the screens should display either in text or with graphics which mall they've selected - to improve recognition and help with recovery from error. These proposed changes should bring some consistency to the design and help to fix the shortcomings of the UI design aspect, as well as to improve usability and general ease-of-use.

# Critique

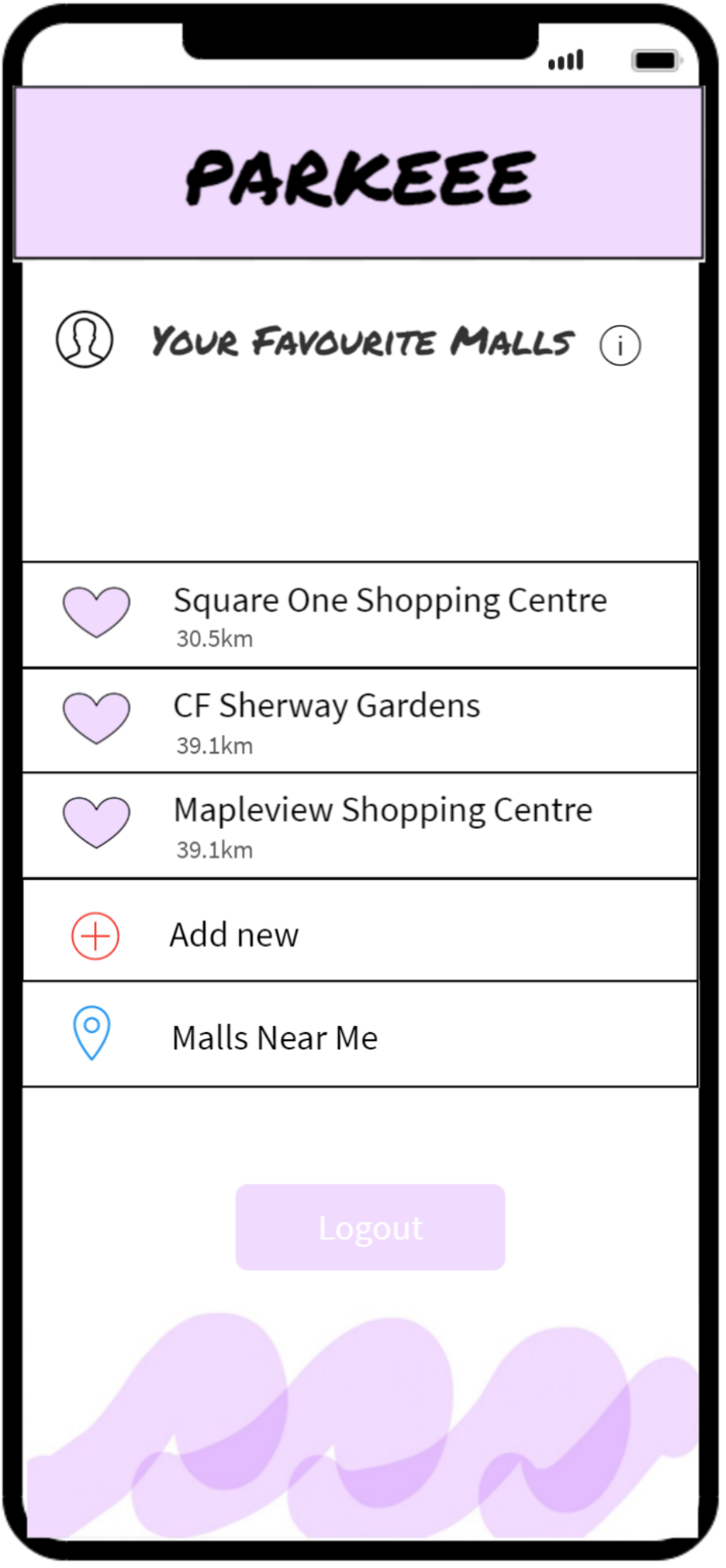
Overall, going with a Heuristic Evaluation was a good decision as it highlighted a few flaws within our prototype that needed addressing. With that being said, there were some setbacks that did not allow us to get a comprehensive evaluation experience.

Most of the critiques that we received towards the protocol were regarding design and overall minor visual flaws. The more evaluation we performed the more flaws were pointed out. ultimately, we needed to increase the number of experts performing the evaluation in order to increase the frequency of the discoveries of these minor flaws. With the current situation of the quarantine, that proved to be challenging to say the least.

Also, time was a significant obstacle that we had to tackle. It was difficult to fully implement the prototype to the best of our abilities due to the time constraint. We were unable to focus on small details as it was later revealed by the experts. The problem with this, is it might take away from the experts' abilities to see more serious underlying issues other than simple flaws that we would have got around to fixing in due time.

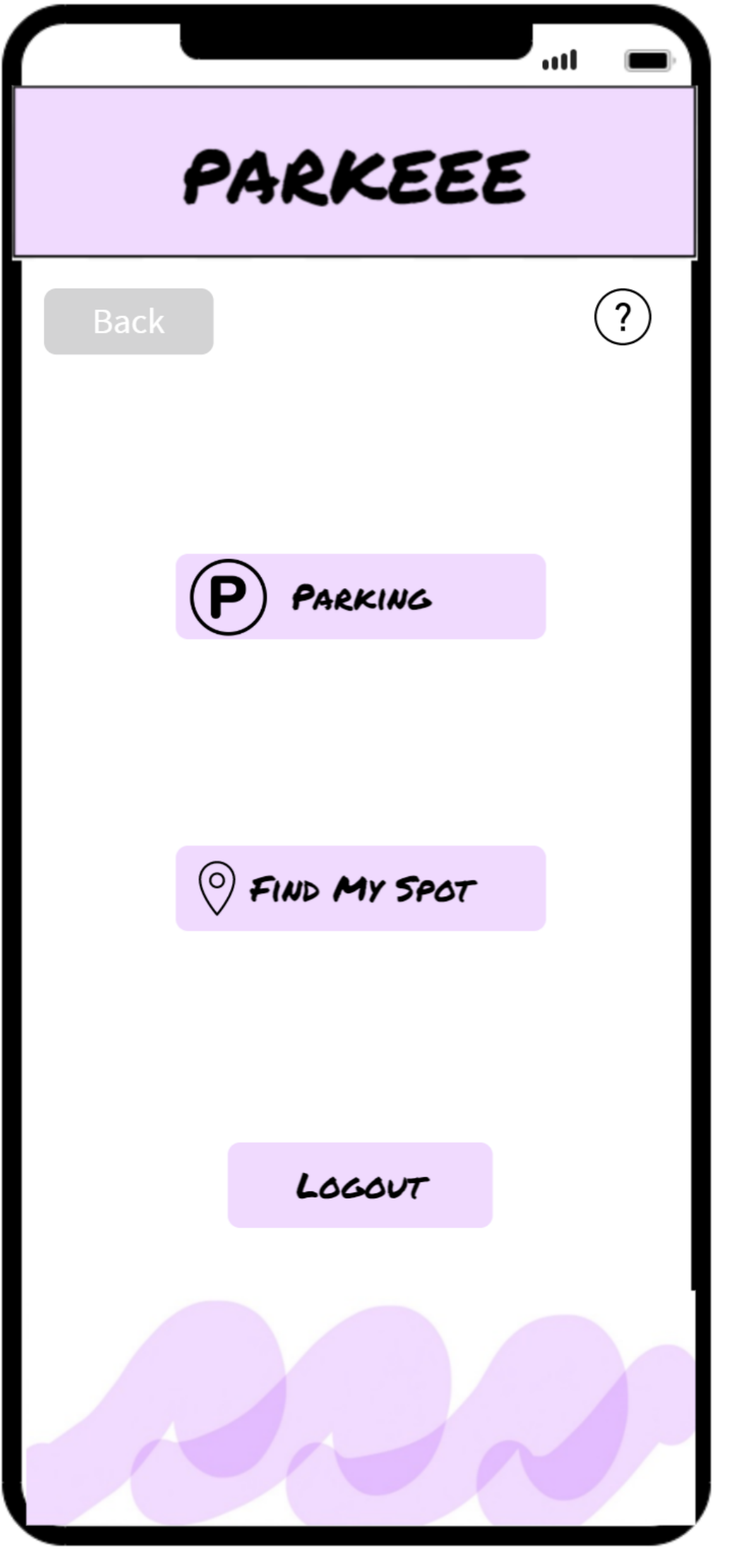

PARKEEE
LOGIN OR
SIGN UP
USERNAME:
PASSWORD:
GO!
FORGOT USERNAME OR PASSWORD?


PARKEEE
Back
Create a New Account
Username:
Email:
Password:
Confirm Password:
Sign Up


PARKEEE
YOUR FAVOURITE MALLS
Square One Shopping Centre
30.5km
CF Sherway Gardens
39.1km
Mapleview Shopping Centre
39.1km
Add new
Malls Near Me
Logout


PARKEEE
Back
Enter The
Shopping Mall
Next


PARKEEE
Back
Enter The
Shopping Mall
Toronto Premium Outlets
Q W E R T Y U I O P
A S D F G H J K L
Z X C V B N M
123
space
Go


PARKEEE
Back
?
P
PARKING
FIND MY SPOT
LOGOUT


PARKEEE
Back
?
Select Your Parking Lot
Select Parking Lot
Next


PARKEEE
Back
?
Select Your Parking Lot
Select Parking Lot
Enter Your Spot Number
Next

# PARKEEE

Back

## Your Parking Spot Has been Recorded!

Happy Shopping

Tap Anywhere to Continue

# PARKEEE

Back

?

## Select the Exit you are leaving from

Select Your Exit

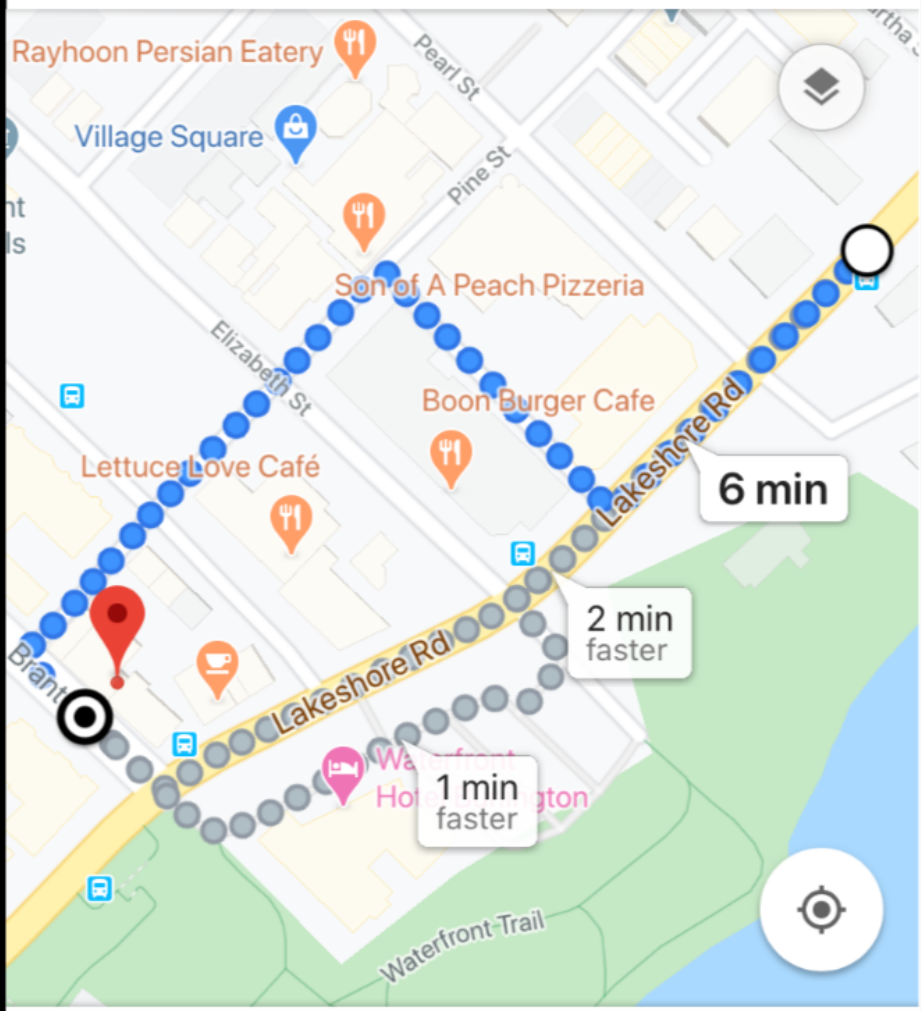
Or Use Your Current Location

Leave

# PARKEEE

Back

Done




**6** min (450 m)

TAP HERE FOR DIRECTIONS

# PARKEEE

?

## Directions

Back to Map

Done

Turn Left 10 metres

Turn Right 5 metres

Turn Left 25 metres

Turn Right 2 metres

You have arrived!

# PARKEEE

Back

?

Enter a Parking Spot

P

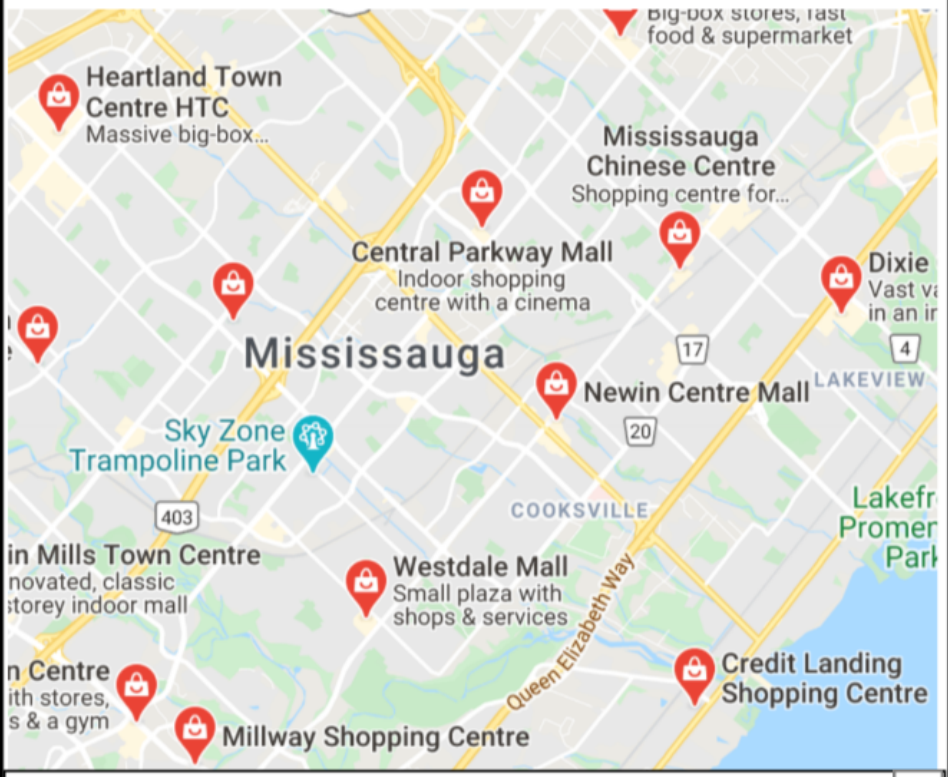
Park using current location

# PARKEEE

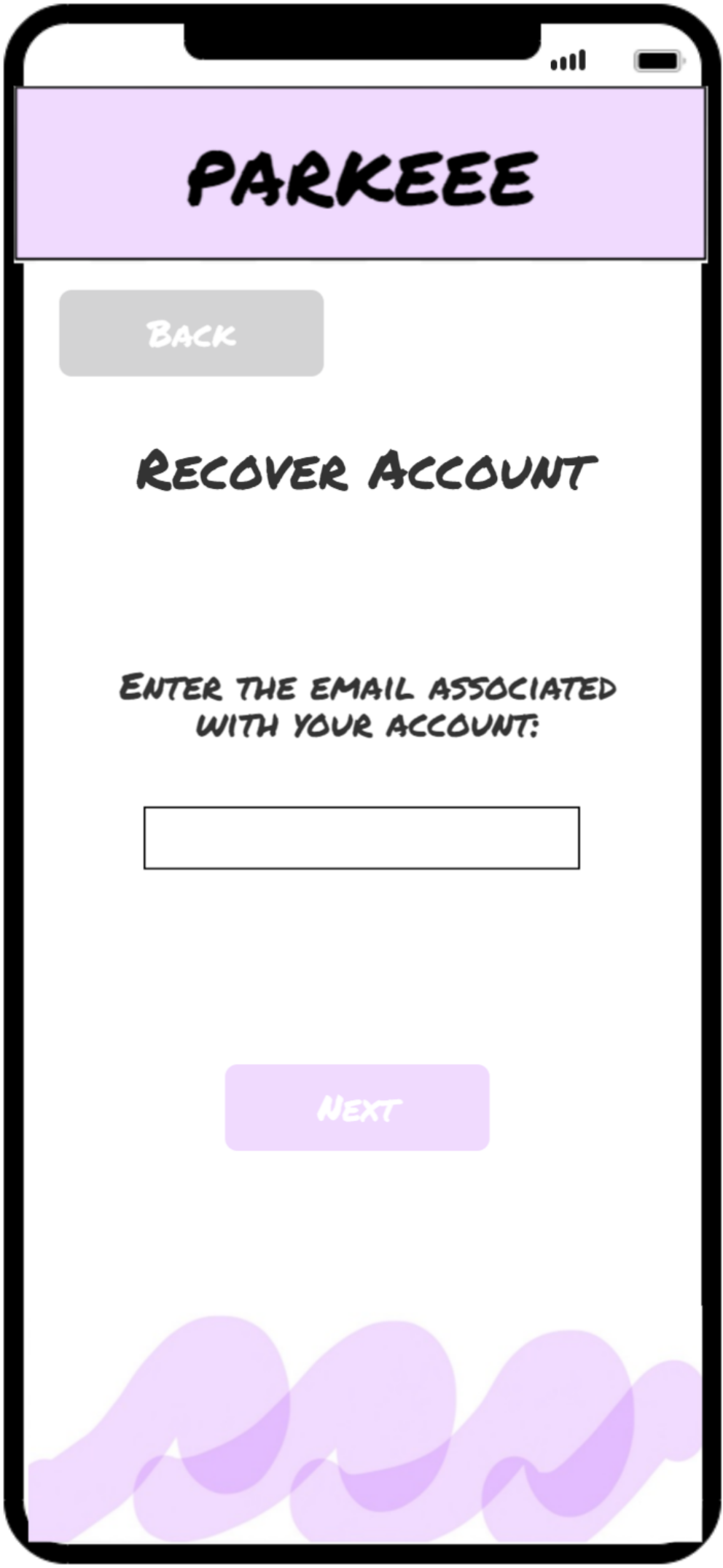
Back

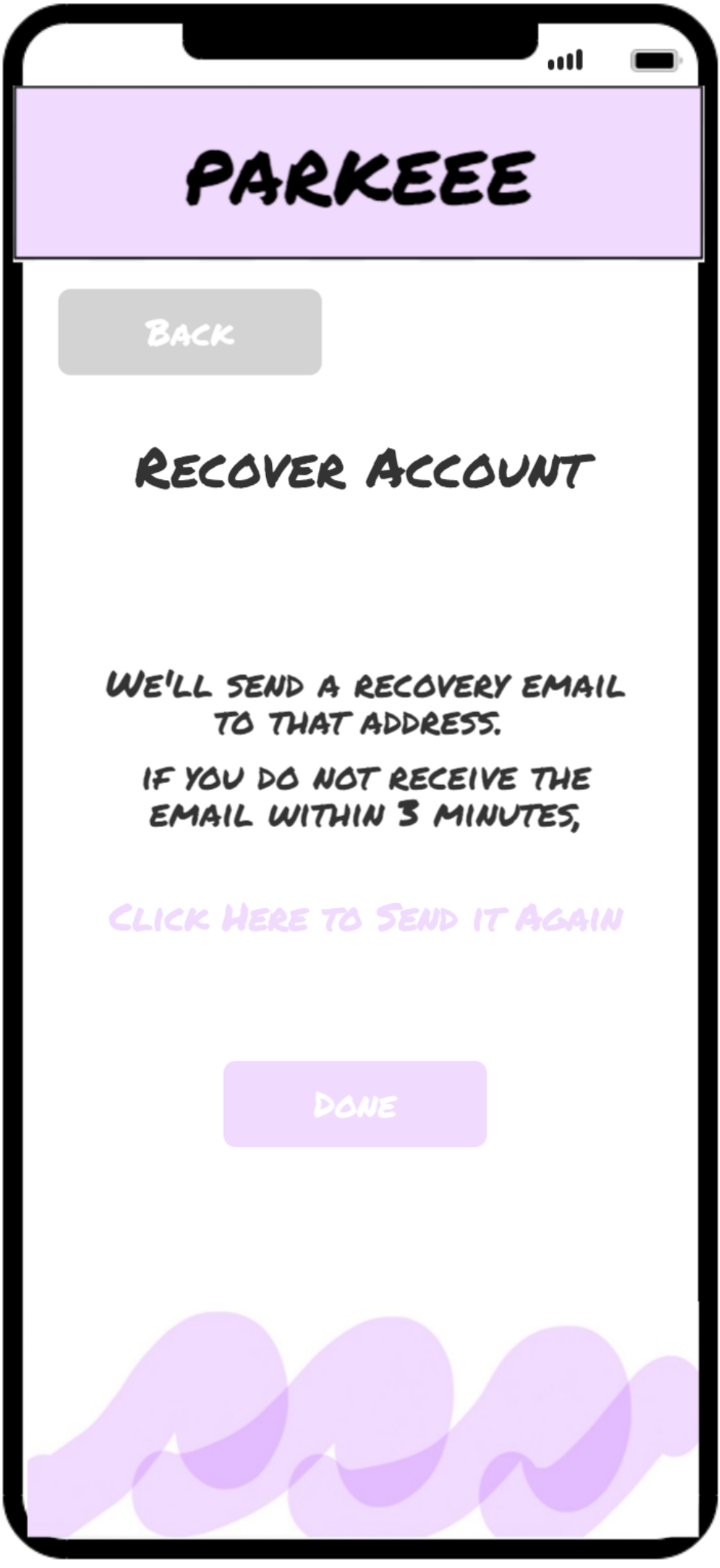
?

## Malls Near Me




| | |
|---|---|
| Central Parkway Mall | 8km |
| Westdale Mall | 12km |
| Newin Centre Mall | 21km |
| Millway Shopping Centre | 30km |


PARKEEE
Back
Recover Account
Enter the email associated with your account:
Next


PARKEEE
Back
Recover Account
We'll send a recovery email to that address.
If you do not receive the email within 3 minutes,
Click Here to Send it Again
Done

# PARKEEE

## Your account has been created!

Welcome to Parkeee

tap anywhere to continue


PARKEEE
Back
?
Oops!
You don't have any parking spots yet
Parking

Evaluation 1:
https://drive.google.com/file/d/1GEUVRXQwk5_xAO1QStHg5YTmiQX6bvcV/view?usp=sharing
https://drive.google.com/file/d/1BKWlaUdgN1pPXMgN0HEcBI5NbWl3a4UU/view?usp=sharing
https://drive.google.com/file/d/1VjTxwNWDjqjps2VO_WOxZqm_rU33iTPY/view?usp=sharing
https://drive.google.com/file/d/1FRU6BfauWzkDHV_lf835aV4uyUN0Xonm/view?usp=sharing
https://drive.google.com/file/d/1_CKbMwiqlh4uM-q7ivyLEpPo2Hs3sT4u/view?usp=sharing
https://drive.google.com/file/d/1FFCQ64Hh8TNp6Eew2PsxgjSjXNjOteLF/view?usp=sharing

Evaluation 2:
https://drive.google.com/file/d/1RNL0FL5KRteEQVf5MXLlMhxKgt69Azmb/view?usp=sharing
https://drive.google.com/file/d/1K2fCVzW8FBA_6Fktd67pagkFHuWKJ7Vt/view?usp=sharing
https://drive.google.com/file/d/1qPvd9bmOb6XPBW_DxtvSQBagJ7mvNJgQ/view?usp=sharing

Evaluation 3:
https://drive.google.com/file/d/1WAwTOWoWBWUkAhpfsy0db2OKlONcUn5I/view?usp=sharing
https://drive.google.com/file/d/1T9jycJzLY7mGGB_dqRt6XSKkR4U_7NLr/view?usp=sharing

Evaluation 4:
https://drive.google.com/file/d/1CtiHZOkjMhnQZ7-iixsx81_Sxbz35M6x/view?usp=sharing
https://drive.google.com/file/d/16szZXtojsZV2IeQgKgUKmStshKvrwAog/view?usp=sharing
https://drive.google.com/file/d/19jBbKKGzf545oapArWvbLyNE3YqEHJk9/view?usp=sharing

Evaluation 5:
https://drive.google.com/file/d/1HLZ-cDL34x-kVfwFgBzMEut9G1wSMn7A/view?usp=sharing
https://drive.google.com/file/d/1RahXC3XGHInqiyybHYueHEjPJTcCpjTP/view?usp=sharing
https://drive.google.com/file/d/1vAcM6cRAuKvAhKeN1mAfb7KlX1u9GJwT/view?usp=sharing

# Raw Summary of Heuristic Evaluations

## Visibility of System Status: N/A

## Match Between System and Real World: N/A

## Aesthetic and Minimalist Design

- White space on login menu (Severity: 1)
    - Recommendation: Reduce blank space so more of the UI fits on the screen at a time
- Font of final screen of sign up process was unclear, a border around the font would enhance visibility dramatically. (Severity: 1)
- Username and password boxes not aligned (Severity: 2)
    - Recommendation: Align the boxes
- Two screens asking for Parking Lot (Severity: 2)
    - Recommendation: Delete one of the two screens asking for the same information
- Repetition of parking spot and lot number (Severity: 3)
    - First screen asks for a parking lot, the second screen asks for a parking spot, and then a third screen asks for a parking spot and lot number again. Just ask it once.
- Screen transitioning when entering parking spot number creates some confusion, needs to be more minimalistic (Severity: 2)

## User Control and Freedom

- Logout option when you click a mall, but not when you click parking or find my spot (Severity: 1)
    - Recommendation: For the sake of consistency, I'd recommend removing all logout buttons aside from the one at the main menu

## Consistency and Standards

- 'Leave' button on the 'Select The Exit' page gives an impression of leaving the app instead of leaving the mall (Severity: 3)
    - Change the wording or term used, the symbol itself looks like an exit app symbol

## Error Prevention: N/A

## Recognition Rather than Recall

- Direction and map on separate pages (Severity: 2)
    - Recommendation: It would be more convenient if map and directions were on the same page

## Flexibility and Efficiency of Use

- No option to remove mall from favourites (Severity: 3)
    - Recommendation: Provide option to do so
- After finding your parking spot and arriving when you click done it should take the user back to the main page of malls (Severity: 2)
- When you enter a shopping mall you should have a go button beside the text entry instead of having to find the go on the keyboard (Severity: 2)

## Recognition, Diagnosis and Recovery from Error

- When you click a mall, it should provide some sort of indication of which mall you clicked. I could accidentally click the wrong mall and not even know it. (Severity: 3)
    - Recommendation: Provide some text displaying the mall name and/or provide a picture of said mall

# Who Did What - A Breakdown

**Alana Hodge**

- ➢ High - Fidelity Prototype (9 hours)
- ➢ Heuristic Evaluations (x2) (3 hours)
- ➢ S7 Presentation (4 hours)
- ➢ A3 - Section 1: High Fidelity Prototype (4 hours)
- ➢ General Formatting: (1 hour)

**Total:** 21 hours

**Viju Hiremath**

- ➢ S7 Presentation (2 hours)
- ➢ A3 - Section 3: Results of the study (1 hour)
- ➢ A3 - Section 2 and 3 (Only formatting) (30 minutes)
- ➢ General formatting (30 minutes)

**Total:** 4 hours

**Artem Albert**

- ➢ A3 - Section 4: Discussion and Implications (4 hours)

**Total:** 4 hours

**Navya Gupta**

- ➢ S7 Presentation (1 hour)
- ➢ Heuristic Evaluations (1.5 hours)
- ➢ A3 - Section 2: Evaluation Protocol (3 hours)
- ➢ A3 - General Formatting of the report (2 hours)
- ➢ A3 - Appendices (1.5 hour)

**Total:** 9 hours

**Aonushka Aeron**

- ➢ High - Fidelity Prototype (6 hours)
- ➢ S7 Presentation (2 hours)
- ➢ Heuristic Evaluations (1.5 hours)

**Total:** 9.5 hours

**Mohammad Hamdy**

- ➢ S7 Presentation ( 2 hours)

- ➢ A3 - Section 5: Critique (1.5 hours)
- ➢ S7 - Heuristic Evaluations (2 hours)
- ➢ Heuristic Evaluation Protocol: (1.5 hour)

**Total:** 7 hours