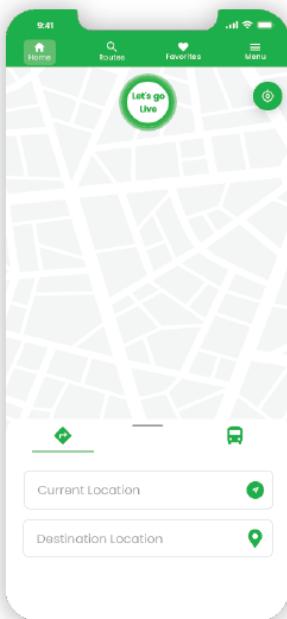


Designing for usability 2



Public bus tracking
System

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Abstract

The public bus transportation determines economic development of the country. When the user is unfamiliar with the area they are traveling, it is painful to use. Both infrequent users and regular user faces these problems when they are travelling to new areas. To resolve these problems, navigation information or live bus location can substantially ease the use of public transportation and it will be the inspiring factor in motivating commuters to prefer it over other transportation modes. However, tracking the location of a user is not easy, although it is critical for providing relevant information. This report will show UI and UX design of cost-efficient user-friendly public bus tracking system named JAMJAM that get live data of bus from driver app and provide those data to server which will then display real time movement of public transport buses to commuter through map interface on smartphone. By helping travelers move from vehicles with lower seat capacity (private vehicle) to public transportation systems, Urban areas can reduce traffic congestion as well as its environmental pollutions. Here, our efforts are to increase the satisfaction of current public transportation users and help motivate more people to ride by bus rather than current mode of transportation. This app can help existing commuters and encourage new commuters by enhancing the usability of public transportation through location and route tracking features.

Introduction

Public transportation systems play vital role in the life of people who often move around different places. There are lots of benefits of public transportation while the major challenges are its widespread adoption. For individuals, public transportation gives easiness to those who do not use private vehicle or either they don't prefer drive it, including access places such as jobs, schools, college, and medical services. If public transportation is efficient at any places to move around, there are lots of opportunities to get employment, with research showing, for example, a direct connection between car ownership and employment. By helping travelers move from vehicles with lower seat capacity (private vehicle) to public transportation systems, Urban areas can reduce unnecessary traffic congestion and it helps to reduce environmental pollutions. An important feature of a smartphone is that it can allow to track the user, not only for use on the device but also for other applications that require tracking of the user or device. Furthermore, tracking must accurately deliver current position updates when faced with changing conditions such as delays due to network, positioning, communication, and accuracy. The proposed system tracks pedestrian and driver equipped with GPS-enabled devices. UI and UX has been designed, keeping User in center of application so that user will find this application useful and easy to navigate, so that they can get bus information quickly and efficiently. Such information is valuable for both new and frequent commuters. There are two mode by which user can get live location of buses; Location tracking and Route tracking. With location tracking user can get nearest available bus

that are heading toward destination while with route tracking user can see all available bus on that route with their live location. Motivated by this consideration, I have closely worked for UI and UX for Smartphone application for public buses that leverages the live tracking technology in smartphone to quickly provide users with information for nearby buses, selected routes, and improved context-sensitive responses to their searches.

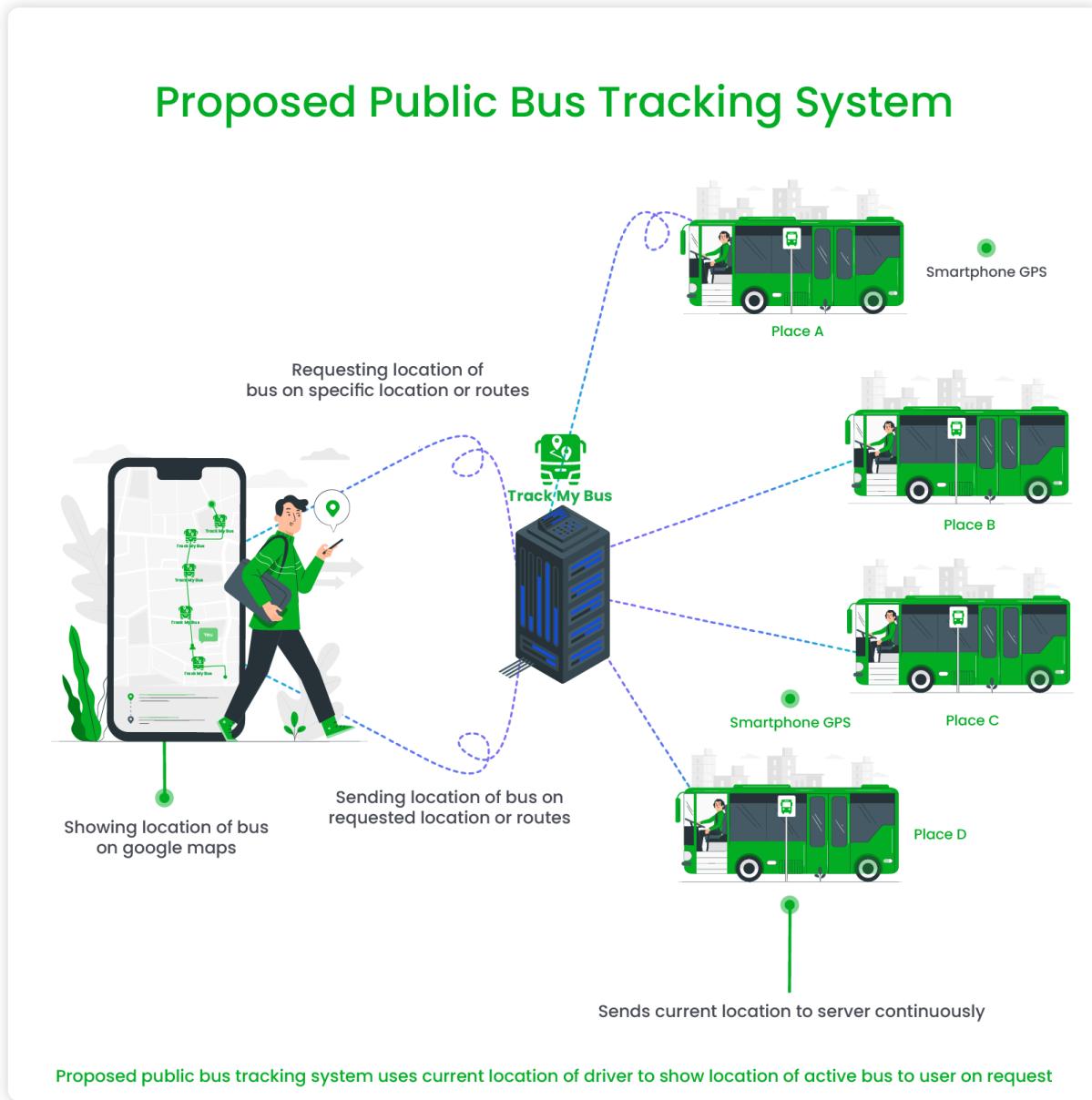


Figure 1 Proposed Public bus tracking system

Background and Motivation

At the beginning, Companies wanted to know where each vehicle was at any given time, therefore vehicle tracking systems were originally deployed for the shipping business. However, with the rapid advancement of technology, automated vehicle monitoring systems are now being employed in several ways to track and display real-time vehicle locations.

Many developed countries have implemented bus fleet management system, which monitors each vehicle's location and keep track of them. As a theft prevention and retrieval technology, vehicle tracking systems are also common in consumer automobiles. The stolen vehicle can be found by simply following the signal provided by the tracking system. A Vehicle Tracking System can be utilized as an addition to or replacement for a typical automobile alarm when employed as a security system.

Whereas, In Nepal, there is very weak public transportation information available. Passengers are only aware of the scheduled estimated arrival time, not the exact arrival time. Public bus transportation service lacks a proper mechanism for tracking all buses' locations and arrival times at user location. These issues arise because of current bus service system's failure to deploy real-time tracking system to follow each bus on the road, as well as the lack of a platform to provide bus users with the most up-to-date bus location information.

To address these issues and improve the current bus transportation system, a real-time bus tracking system must be developed and implemented. Where bus location data can be captured from driver's smartphone and transferred to central server for processing and displaying bus location in real time to map interface of bus user with bus tracking system.

Many cities have discovered that using a GPS tracking system not only increases the efficiency of public bus operations, but it also encourages commuters to use the public bus. It has been studied that installing a GPS tracking system that allows commuter to monitor their bus's location and arrival time increases the number of people who use public buses for normal transportation. The application is simple to use and can be accessed for free by anyone. The primary concept behind this project is to provide bus passengers with route information, as well as all possible stops along the way to their destination, as well as to display maps, track their locations, and estimate arrival time. The goal is to overcome all the shortcomings of prior apps and produce quick and accurate results.

Methodology

User-centered design (UCD) is a project methodology that places the users at the center of the design and development phase of application (Le, 2017). It keeps the most probable user at the center of the design; yet, only a few users are real users of the application, so making a design user-centered requires extensive research and analysis of the target user. To conduct user research, personas were created based on the user's age, gender, income, brand influences, education, profession, product usage, expectations, and demands. It is a comprehensive study of the user's behavior, based on their interactions with the product while developing the application and taking their feedback and suggestions to make the product more user centered.

The benefits of User-Centred Design (UCD) in a digital environment



It **improves performance** by reducing the number of user errors and makes it easier to use and learn (usability).



It **increases traffic** and widens use by improving the numbers of returning customers, new users and organic visits.



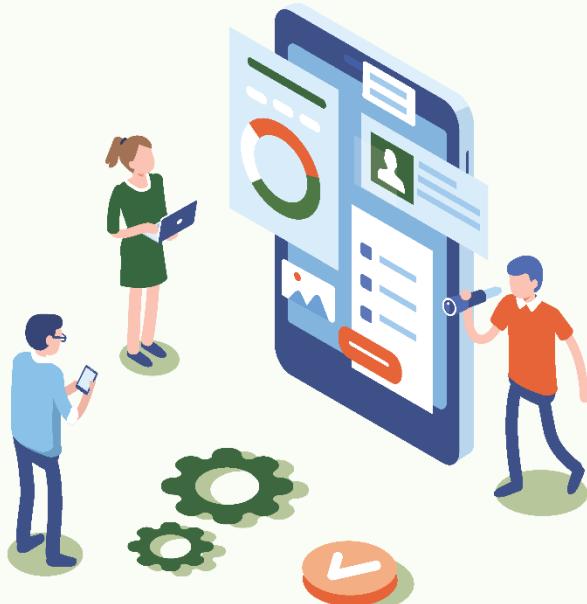
It **improves credibility** by producing greater user satisfaction and confidence, and therefore, positive reviews.



It **reduces development**, maintenance, redesign and support times and costs.



It **increases profits** by boosting transactions and product sales.



Source: usability.gov.

Figure 2 Benefits of User Centered Design

PACT analysis is also very significant; it assists product designers in determining who will be the user, where the application may be used, and how the application should be developed so that most of the target user, including especially abled persons from various geographic locations, can use it. Following the completion of a user formative study, a low fidelity prototype was developed and tested utilizing the Wizard of Oz technique. Data was collected based on several test parameters, such as time spent on task, how many actions taken to complete the task, and it was analyzed to identify design flaws. Recommendations and criticism were also obtained. Followed by the improvement of the flaws, Adobe XD, a prototyping tool, was used to create a high-fidelity prototype. The high-fidelity prototype was tested using the Guerilla testing approach, in which participants were chosen from public locations and the most likely users were filtered out based on who uses public transportation the most and who was between the ages of 13 and 35.

Methodology



Figure 3 Methodology

PACT analysis

People

People differ in a variety of ways, including physical appearance and personality traits. People have a wide range of personalities and respond to situations in a variety of ways. Because the five senses (listening, sight, smelling, taste, and touch) are highly reliant on the app, it is vital that it be user-friendly, accessible, and pleasant to a wide spectrum of people. One approach to do this is to make sure the app is accessible to those with disabilities like visual impairments

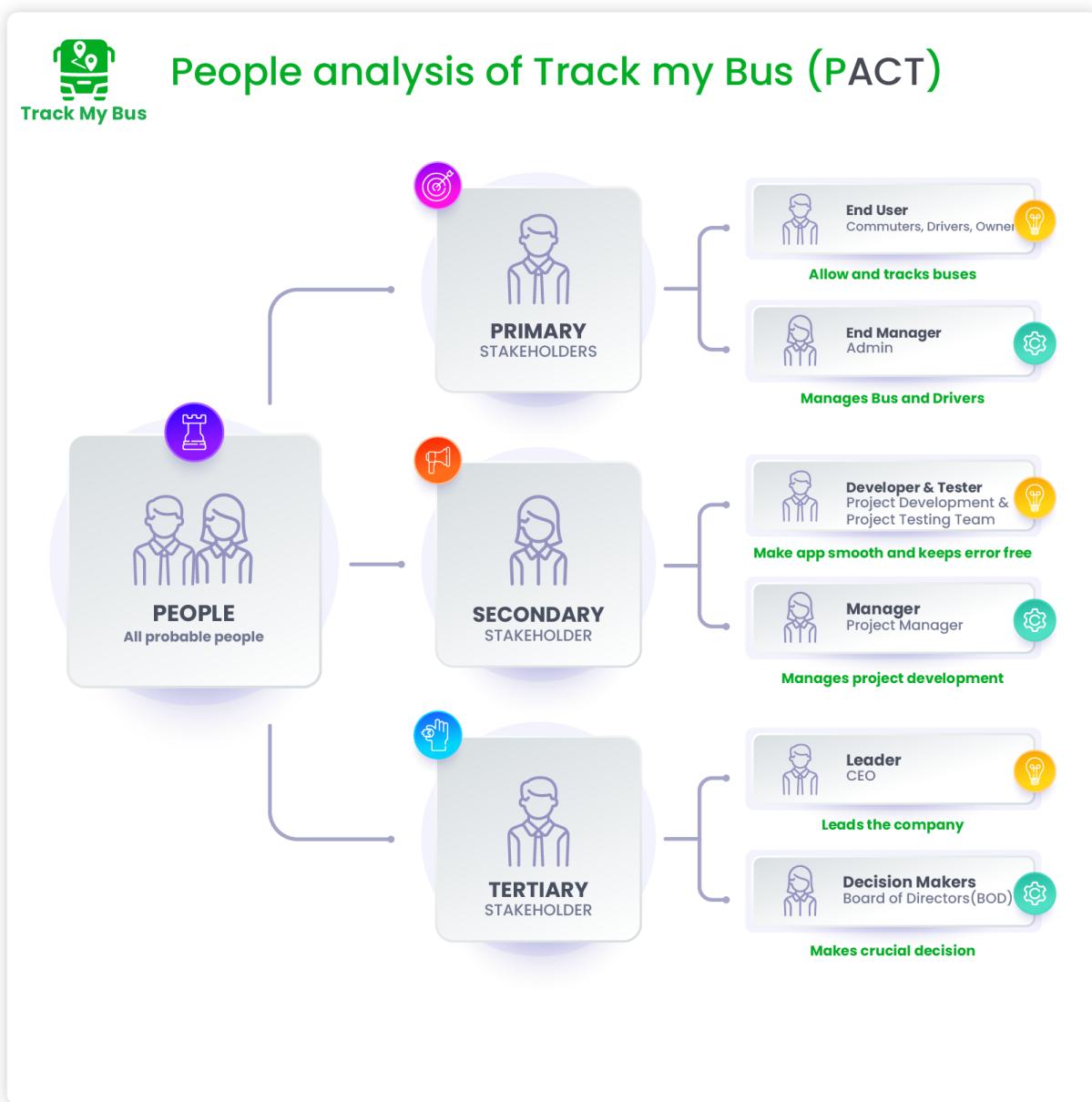


Figure 4 People analysis

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Physical Difference (PACT)



Figure 5 Physical Difference

Activities

Various activities can be carried out on track my bus. This application's major purpose is to provide online services that show the bus's current location as well as the route to a certain destination. The actions that can be done with this application are grouped into three categories.

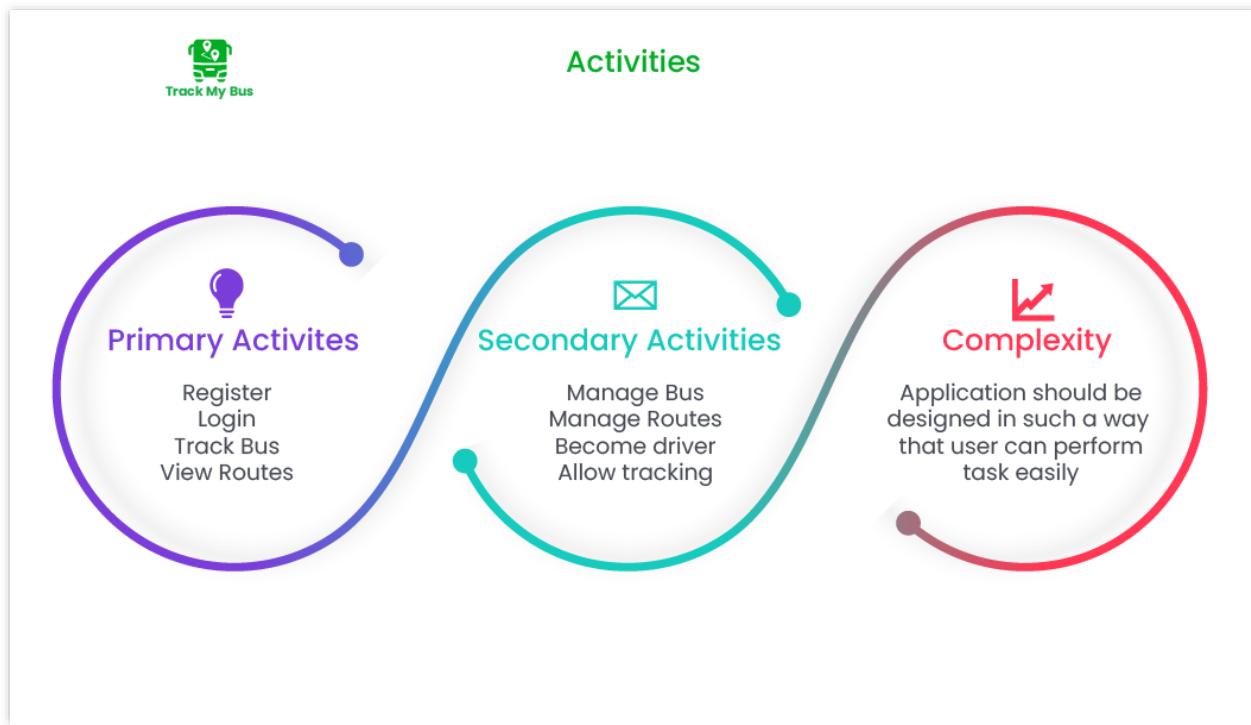


Figure 6 Activities

Context



Context

To perform any activity on application different context are required.
So these context is divided into three part.

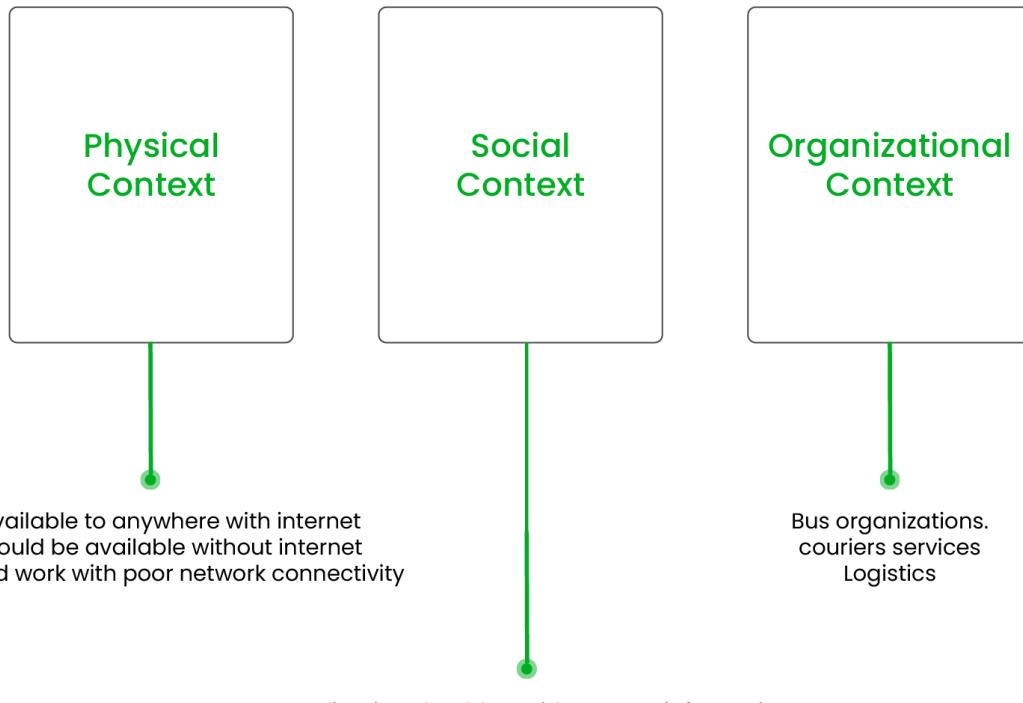


Figure 7 Context

Technology



Technology

Application must be responsive, which implies that it should run on a variety of devices and resolutions. To accommodate visitors and people who are unfamiliar with the device and system, the application must be clear and respond automatically based on the device they are using

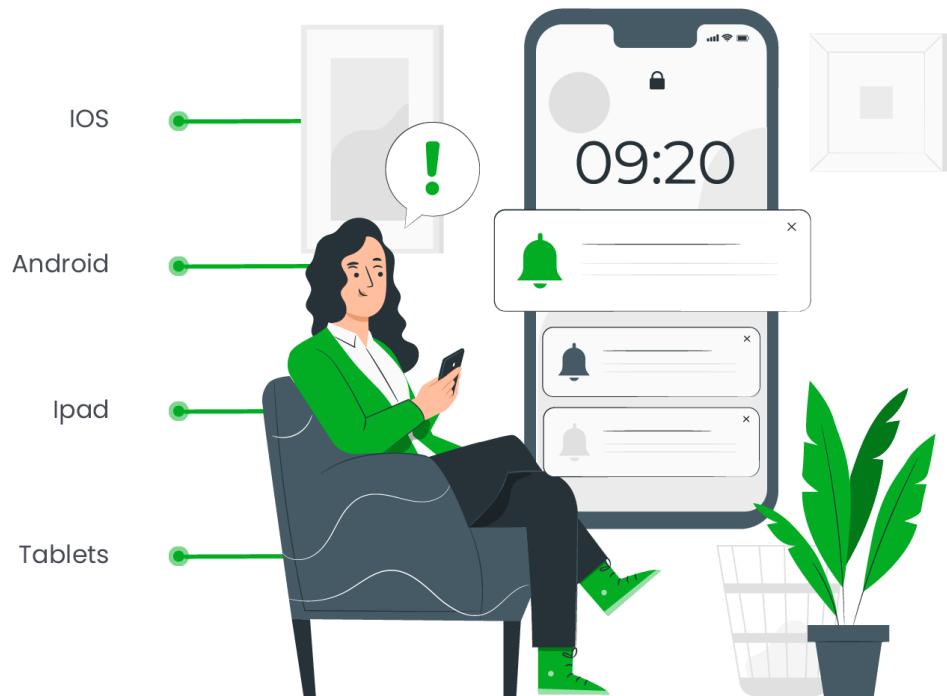


Figure 8 Technology

Formative User Study

HTA

HTA are important to determine the flow of application about how user will perform the given task.

HTA description

Task 1: To finish onboarding, login, and registration.

0. Open app
1. Click next
 - 1.1. Click let's go to finish onboarding
2. Click Skip
3. Sign up
 - 3.1. Enter required details
 - 3.1.1. Click Signup
 - 3.2. Click Google Icon
 - 3.2.1. Select account
 - 3.3. Click Facebook Icon
 - 3.3.1. Authorize app
 - 3.4. Click login here
4. Login
 - 4.1. Enter required details
 - 4.1.1. Click login
 - 4.2. Click google icon
 - 4.2.1. Select account
 - 4.3. Click Facebook icon
 - 4.3.1. Click Login
 - 4.4. Click sign up here

Plan 0: Do 0 — 1(Multiple times) — 1.1 to finish onboarding if you want to see all onboarding screen.

Plan 1: Do 0 — 2 to skip onboarding

Plan 2: Do Plan 0 or Plan 1 then Do 3 — 3.1 — 3.1.1 if you want to create account using email address

Plan 3: Do Plan 0 or Plan 1 then Do 3 — 3.2 — 3.2.1 to register using google account.

Plan 4: Do Plan 0 or Plan 1 then Do 3 — 3.3 — 3.3.1 to register using Facebook account.

Plan 5: Do Plan 0 or Plan 1 then Do 3 — 3.4 to go to login when you are at signup screen

Plan 6: Do Plan 0 or Plan 1 then Do 4 — 4.1 — 4.1.1 to login using custom account if already done Plan 2.

Plan 7: Do Plan 0 or Plan 1 then Do 4 — 4.2 — 4.2.1 to login using google account if already done Plan 3.

Plan 8: Do Plan 0 or Plan 1 then Do 4 — 4.3 — 4.3.1 to login using Facebook account if already done Plan 4.

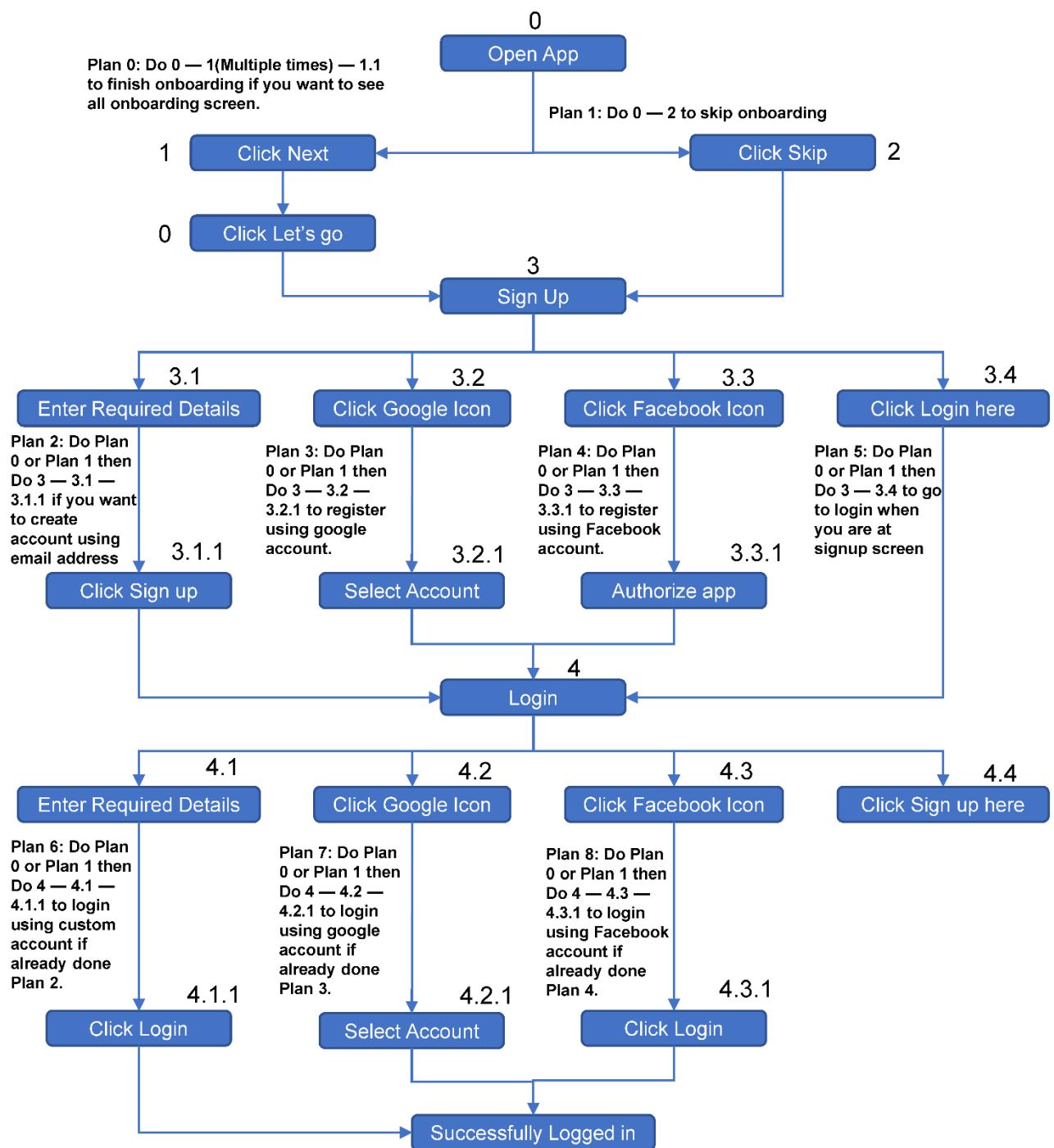


Figure 9 HTA — Task 1

Task 2: To track bus using location or route.

0. Swipe up to open search panel
1. Track bus using source and destination location
 - 1.1. Enter source and destination location
 - 1.1.1. Click add to favorite
 - 1.1.2. Click search
 - 1.1.2.1. Drag map
 - 1.1.2.2. Click bus
 - 1.1.2.2.1. Click select bus again
 - 1.2. View updated location
 2. Track bus using route
 - 2.1. Click route icon
 - 2.1.1. Search route name
 - 2.1.2. Click information icon
 - 2.1.3. Click favorite icon
 - 2.1.4. Select route
 - 2.1.4.1. Drag map
 - 2.1.4.2. Click bus
 - 2.1.4.2.1. Click again to confirm
 - 2.1.4.2.1.1. View live location of bus.

Plan 0: Do 0 — 1 — 1.1 — 1.1.1 to add search data to favorite

Plan 1: Do 0 — 1 — 1.1 — 1.1.2 to search bus heading to destination through source location.

Plan 2: Do Plan 1 then 1.1.2.1 to look for other buses that are not visible on screen

Plan 3: Do Plan 1 then 1.1.2.2 — 1.1.2.2.1 to track bus

Plan 4: Do 0 — 2 — 2.1 to open search by route panel

Plan 5: Do Plan 4 — 2.1.1 to search routes

Plan 6: Do Plan 5 — 2.1.2 to see details of selected route.

Plan 7: Do Plan 5 — 2.1.3 to add route to favorite

Plan 8: Do Plan 5 — 2.1.4 to select route

Plan 9: Do Plan 8 — 2.1.4.1 to see buses that are not visible in screen

Plan 10: Do Plan 8 or Plan 9 — 2.1.4.2 — 2.1.4.2.1 — 2.1.4.2.1.1 to view live location of selected bus.

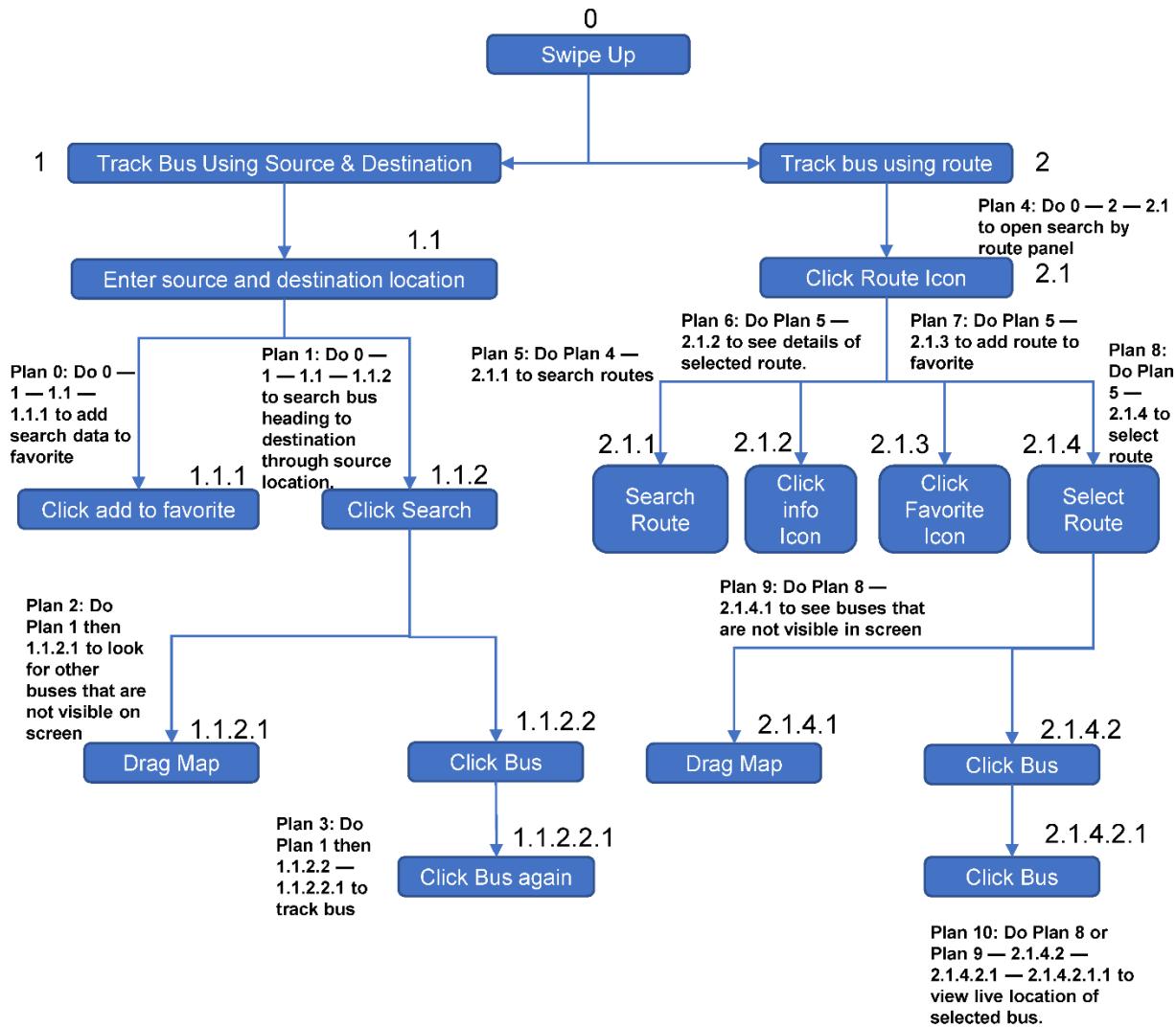


Figure 10 HTA -Task 2

Task 3: Become driver and allow tracking

0. Click Menu icon
 - 0.1. Click Dashboard
 - 0.1.1. Click Account type
 - 0.1.1.1. Click become driver
 - 0.1.1.1.1. Enter required details
 - 0.1.1.1.1.1. Click Apply
 - 0.2. Click Home
 - 0.3. Click Allow tracking button
 - 0.4. Click stop button.

Plan 0: Do 0 — 0.1 — 0.1.1 — 0.1.1.1 — 0.1.1.1.1 — 0.1.1.1.1.1 to become driver.

Plan 1: Do Plan 0(if not already done) — 0.2 — 0.3 to allow tracking

Plan 2: Do Plan 1 — 0.4 to stop tracking.

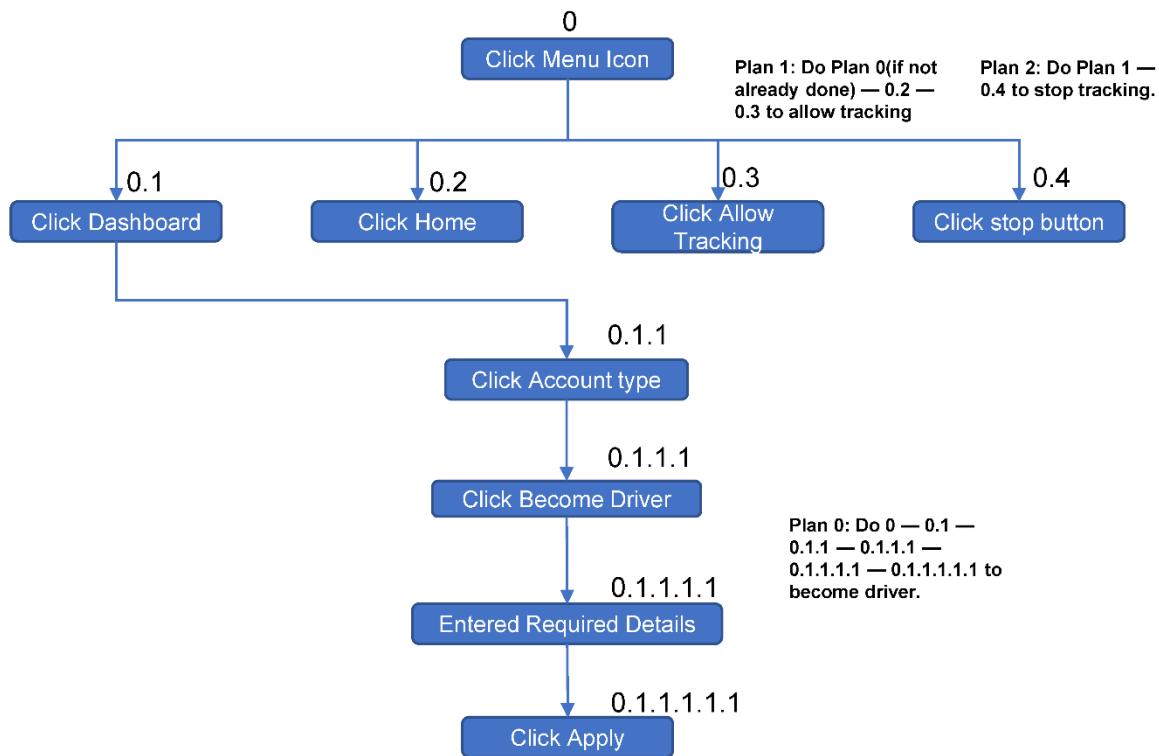


Figure 11 HTA - Task 3

Task 4: Become owner and manage bus

0. Click Menu icon
 - 0.1. Click Dashboard
 - 0.1.1. Click Account type
 - 0.1.1.1. Click become owner
 - 0.1.1.1.1. Enter required details
 - 0.1.1.1.2. Click Apply
 - 0.1.1.1.3. Click Back
 - 0.2. Click Manage Bus
 - 0.2.1. Click add
 - 0.2.1.1. Enter bus details
 - 0.2.1.1.1. Click Save
 - 0.2.2. Click edit
 - 0.2.2.1. Update details
 - 0.2.2.1.1. Click Save
 - 0.2.2.2. Click Delete

Plan 0: Do 0 — 0.1 — 0.1.1 — 0.1.1.1 — 0.1.1.1.1 — 0.1.1.1.1.1 to become Owner

Plan 1: Do Plan 0(if not already done) — 0.2 — 0.2.1 — 0.2.1.1 — 0.2.1.1.1 to add bus

Plan 2: Do Plan 1 — 0.2.2 — 0.2.2.1 — 0.2.2.1.1 to update bus details

Plan 3: Do Plan 1 — 0.2.2 — 0.2.2.2 to delete bus

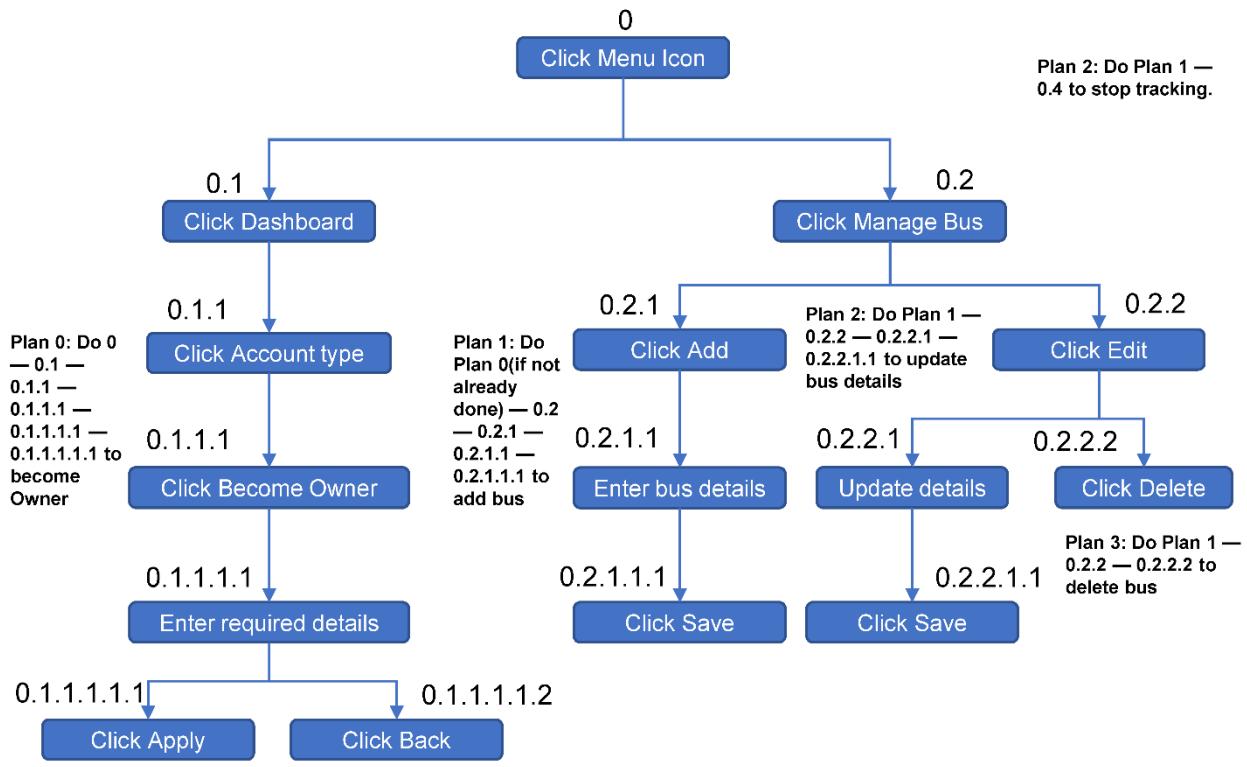


Figure 12 HTA - Task 4

Personas

Personas was created to depict group of target users who share similar attitudes, ambitions, and behaviors regarding my product. Based on user research, they're human-like snapshots of relevant and meaningful commonalities in our customer groupings ([\(Salazar, 2018\)](#)).

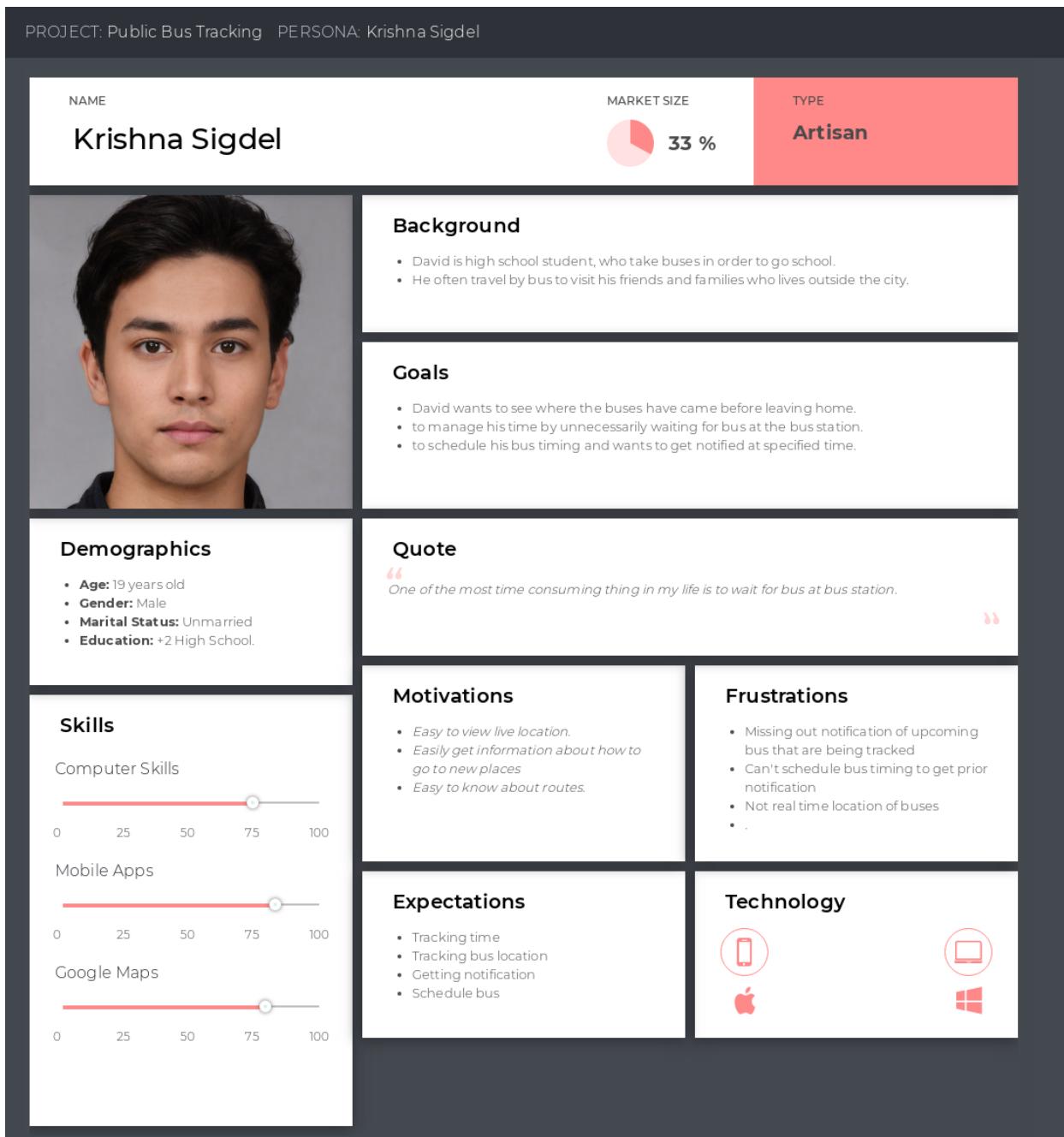


Figure 13 Persona - Krishna Sigdel

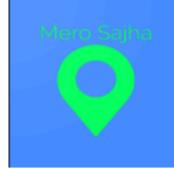
NAME	MARKET SIZE	TYPE
Bidhya Kunwar	 18 %	Rational
	Background Bidhya is hard working women, she often travels by bus to go for her teaching job. She is always in hurry as she have to make meal and manage time, she is always afraid of missing buses.	
Demographic Female 27 years Nepal Married Teacher have a 3 years old son	Goals <ul style="list-style-type: none"> To see live location of buses while being at home To schedule timing and get notification of any bus that will arrive at that time on chosen bus station. 	
	Quote <i>“Being working women is not easy, managing time and missing buses is painful moments”</i>	
Skills Computer Skills: 70 Mobile Apps: 85 Google Maps: 60 Ride Sharing App: 88	Motivations <ul style="list-style-type: none"> Can schedule bus at bus time Easy to get information of upcoming bus 	Frustrations <ul style="list-style-type: none"> Missing bus No any prior notification of buses Lack of real time location
	Brands and influencers  	
	Technology      	Browsers  

Figure 14 Persona — Bidhya Kunwar

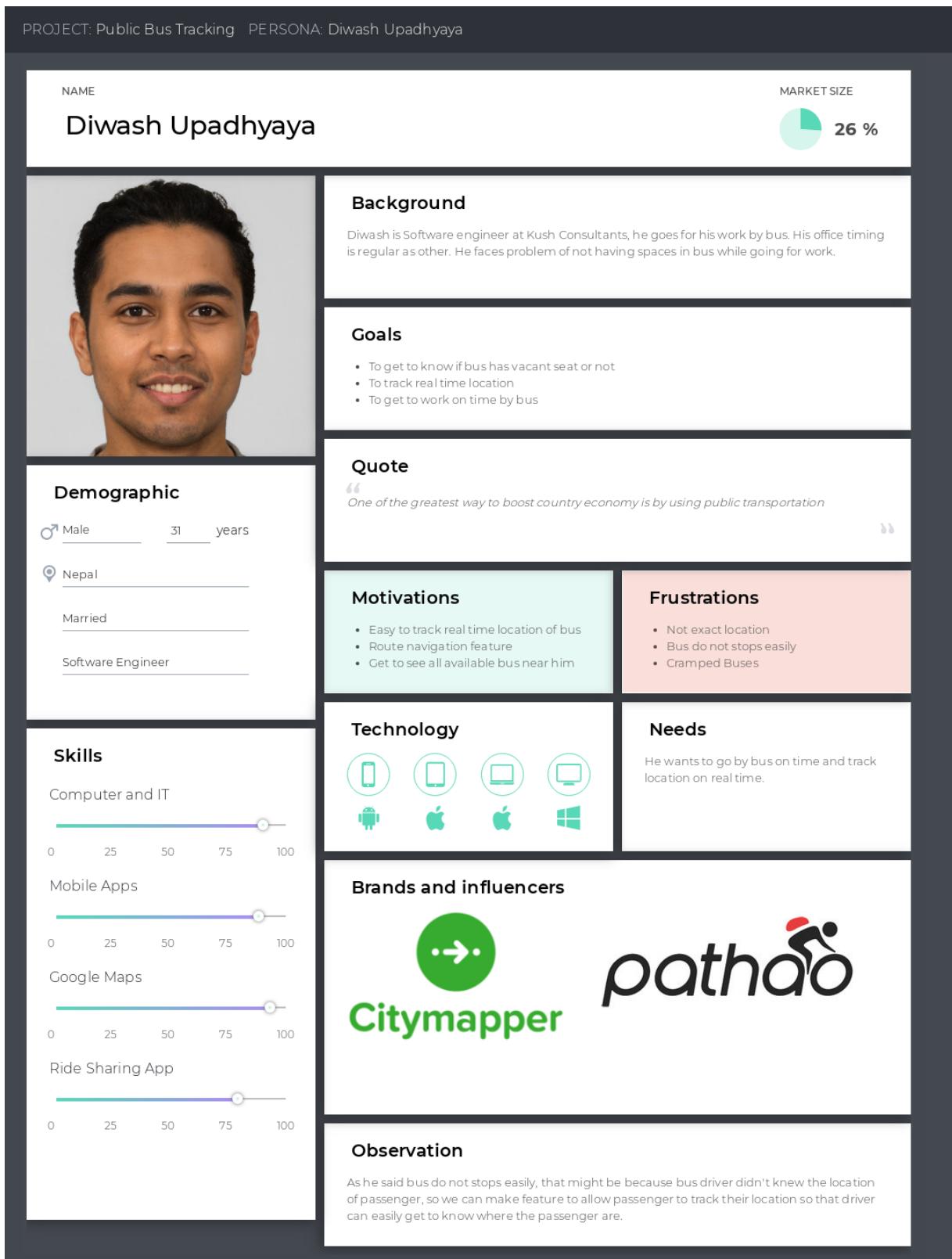


Figure 15 Persona — Diwash Upadhyaya

NAME
MARKET SIZE
 4 %



Background

Padam is Bus business owner who have more than 2 dozens buses that is running on the road. He have more than 22 years of experience on this business and wants to digitally track his buses.

Demographic

Male 48 years

Nepal

Married

Owes Bus Business

Have 30+ Public Buses

Goals

- To track real time location of his buses
- To manage bus
- To schedule bus departure and arrival on the basis of daily information.

Quote

“Public bus transportation is key to minimize traffic congestion, and I want people to use it.”

Motivations

- Have Owner dashboard
- Can invite driver
- Easy to track real time buses

Frustrations

- Unavailability of all in one tracking system
- No separate tracking interface for his all buses

Technology



Browsers



Brands and influencers



Context/environment

As he mentioned robust bus tracking system in Nepal are not available, also we need to provide more features to owner like tracking all of his buses and getting reminder of servicing.

Figure 16 Persona — Padam Koirala

NAME

Smriti Gupta



Demographic

Female 22 years

Nepal

Single

Part time Job

Loves travelling

Skills

Computer and IT: 85

Mobile Apps: 90

Google Maps: 88

Ride Sharing App: 95

MARKET SIZE



Background

Smriti is part time job holder working on call center. She loves travelling and do travels by bus most of the time. She likes visiting new places and explore them.

Goals

- To get location of bus heading toward her destination
- To get exact time that bus will arrive
- To Track real time location of bus

Quote

One of the hard thing while travelling is transportation, and it seems impossible to travel by public bus due to uncertainty of buses and lack of route information.

Motivations

- Easy to track real time location of all bus
- Can easily know by which route public bus will go towards her destination
- Can schedule bus timing

Frustrations

- Unavailability of real information of routes
- Not real time location
- Buggy applications
- Only online tracking

Brands and influencers




Technology




Browsers




Observation

As she mentioned, information available through only online is painful for her as she travel to rural and hilly areas too, so in future release offline features should be considered as important feature.

Figure 17 Persona — Smriti Gupta

After doing research on target users and establishing personas for them, I had a good sense of who my target user was, what their goals were, and what they expected from my app. It assists me in identifying the pain points of my potential consumers so that I can address all of their concerns and make the application more user-friendly and problem-solving. From these personas, I discovered that the majority of users are students who struggle to find a bus on time, with a market share of 33%. Other personas include working men and women who become late and have difficulties managing their time owing to the uncertainty of public transportation. Bus Owners are willing to implement online navigation system for their buses so that their driver don't need to wait for customers at bus stations. Furthermore, I discovered that personas such as travelers demands an offline navigation system that will allow them to obtain information even if their network is unstable. Personas seemed to be one of the most successful techniques for identifying my target users.

Storyboard

Daily, most people who use public transportation experience bus waiting issues. They miss the bus by a few minutes or even seconds, forcing them to wait for longer for the next bus, unsure if they will arrive on time. Commuters spent more time waiting for the bus than on the actual traveling time. A storyboard is an excellent tool for generating ideas ([Babich, 2017](#)). Storyboards was used for UX design to form the user journey and the character (persona). It assisted me in putting personas, user stories, and various research findings together to create product requirements. Even the most complex thoughts became clear thanks to the familiar blend of visuals and words.



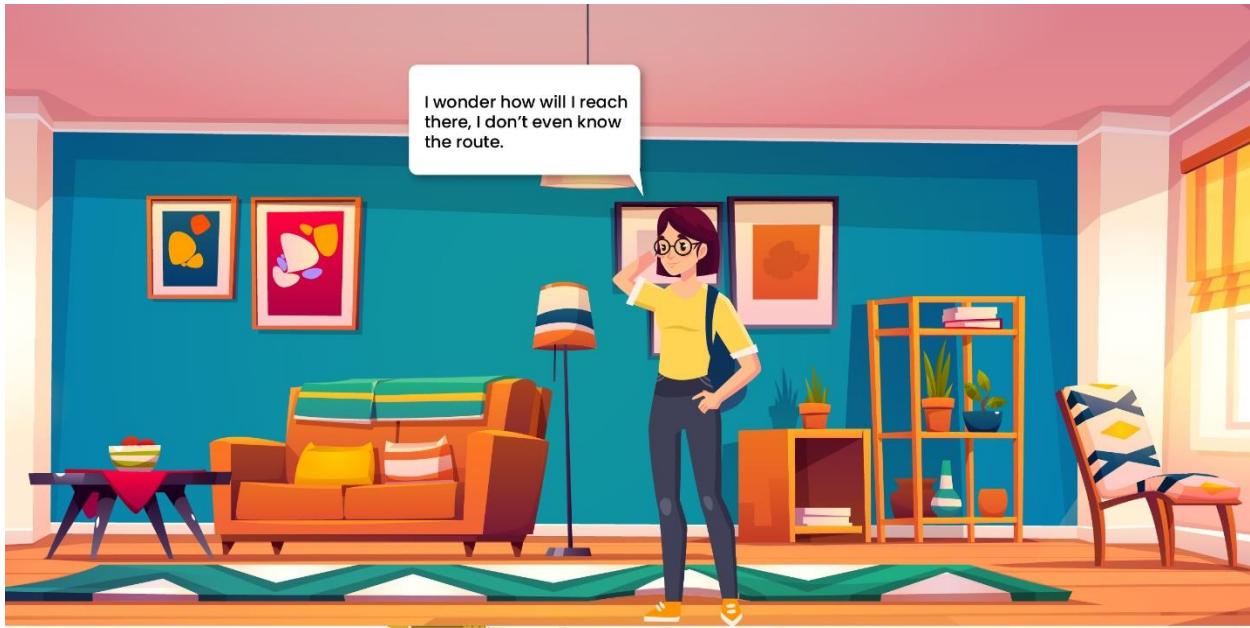
A person is late for interview and he is moving towards the bus station to catch the bus.



He missed the bus, being late for just 1 minute.



Two men waiting for their buses



She is new in town, and is struggling to find the routes to reach her destination



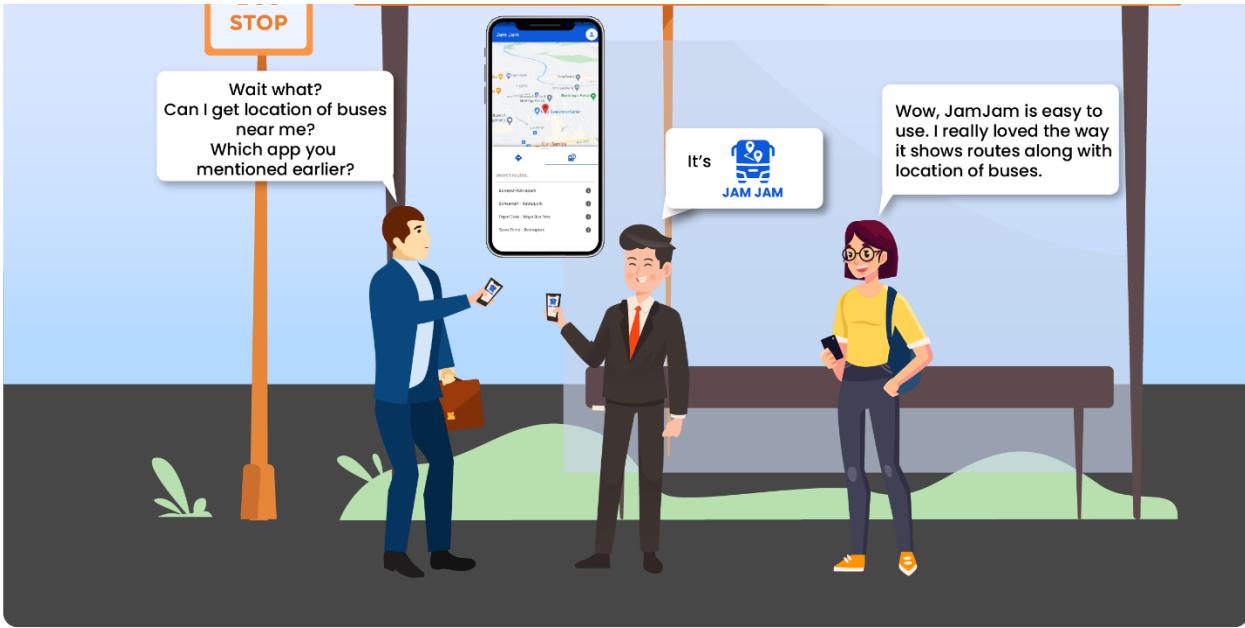
She is trying to find the routes to reach her destination by asking strangers.



That interviewee person seems to be worried waiting for his bus and
The girl is asking the boy if he knows about bus that will help her reach the destination.



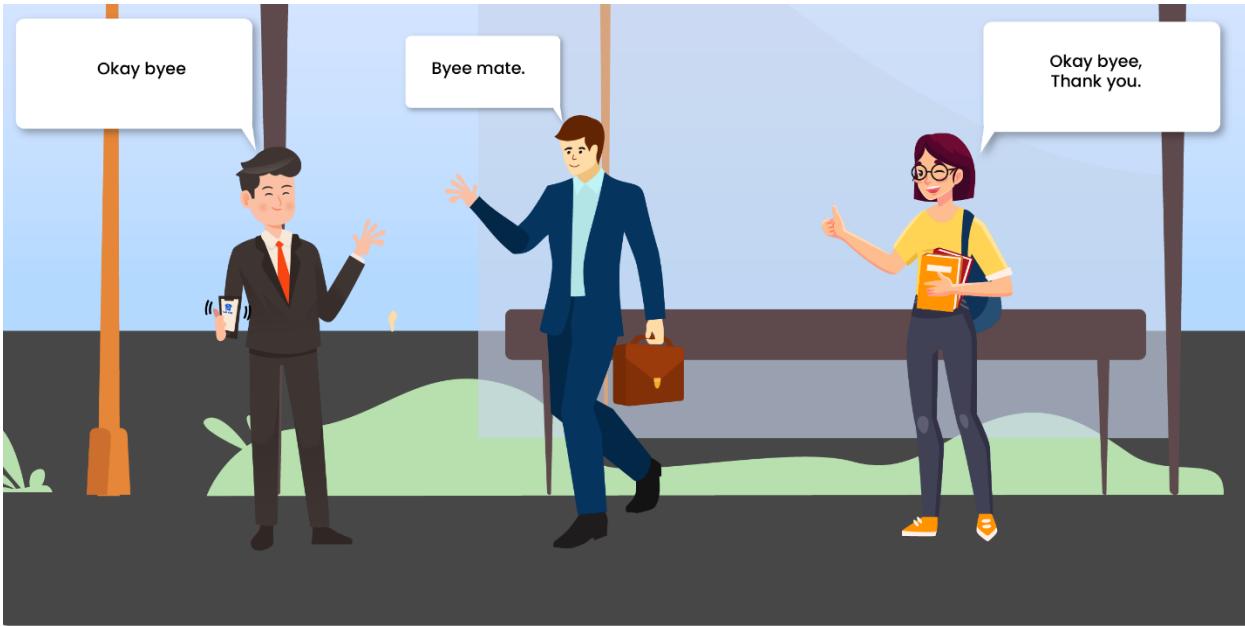
She seems curious to know about JamJam app, also he is helping her know about its features.



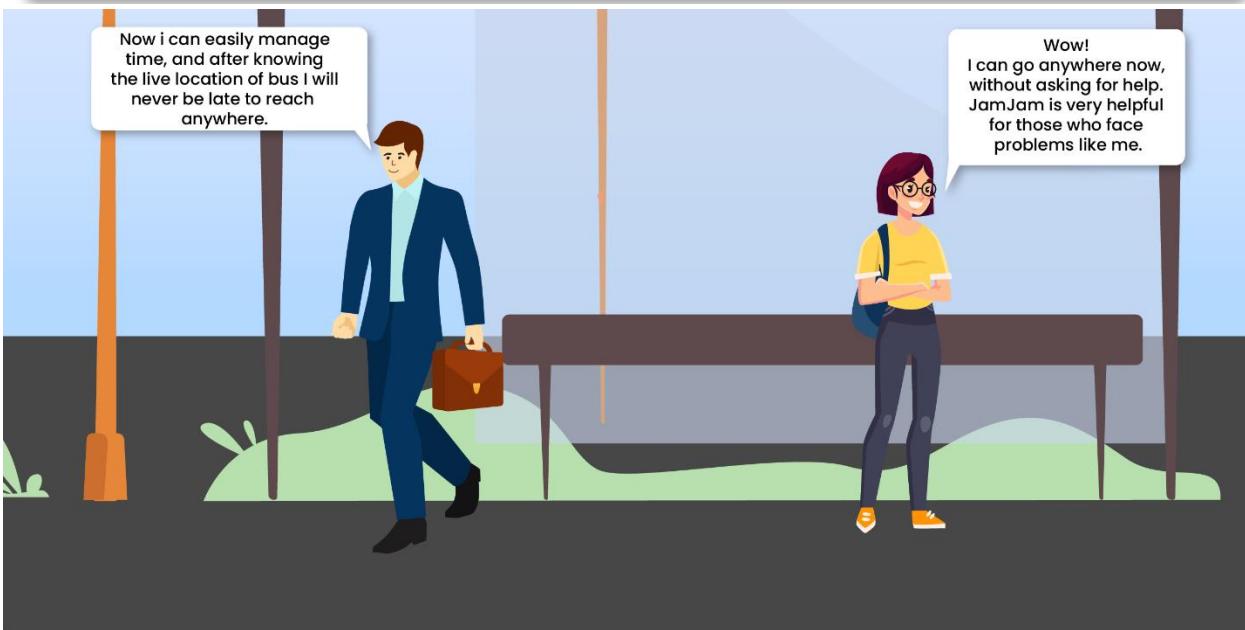
After listening to their conversation, the interviewee guy asks the boy about the app and then installed it.



The boy is now leaving and they are thanking for his help.



They seem happy and leaving to reach their own destination.



They are happy using JamJam, and thinking about how JamJam helped them to solve their problems.

Card Sorting

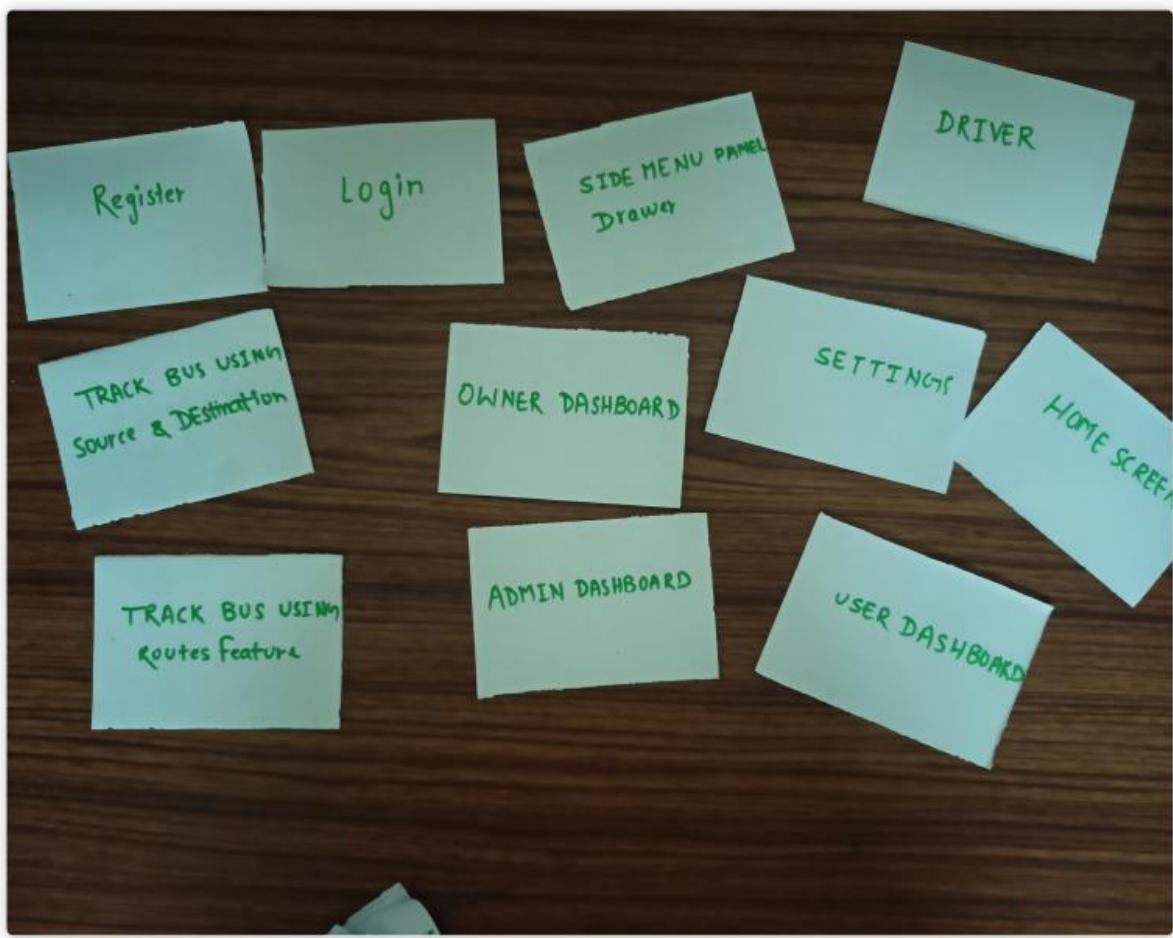
Card sorting determines the mental models of target customers and that's determine the best way to organize application content ([Sherwin, 2018](#)). A closed card sorting was performed to identify how user will interact with UI having better UX and keeping user at the center of design.

Participants were asked to select topics from my application's content into pre-determined categories. Because I was working with a pre-defined set of categories and wanted to discover how users sort content items into each category, a closed card sort was the ideal option for me.



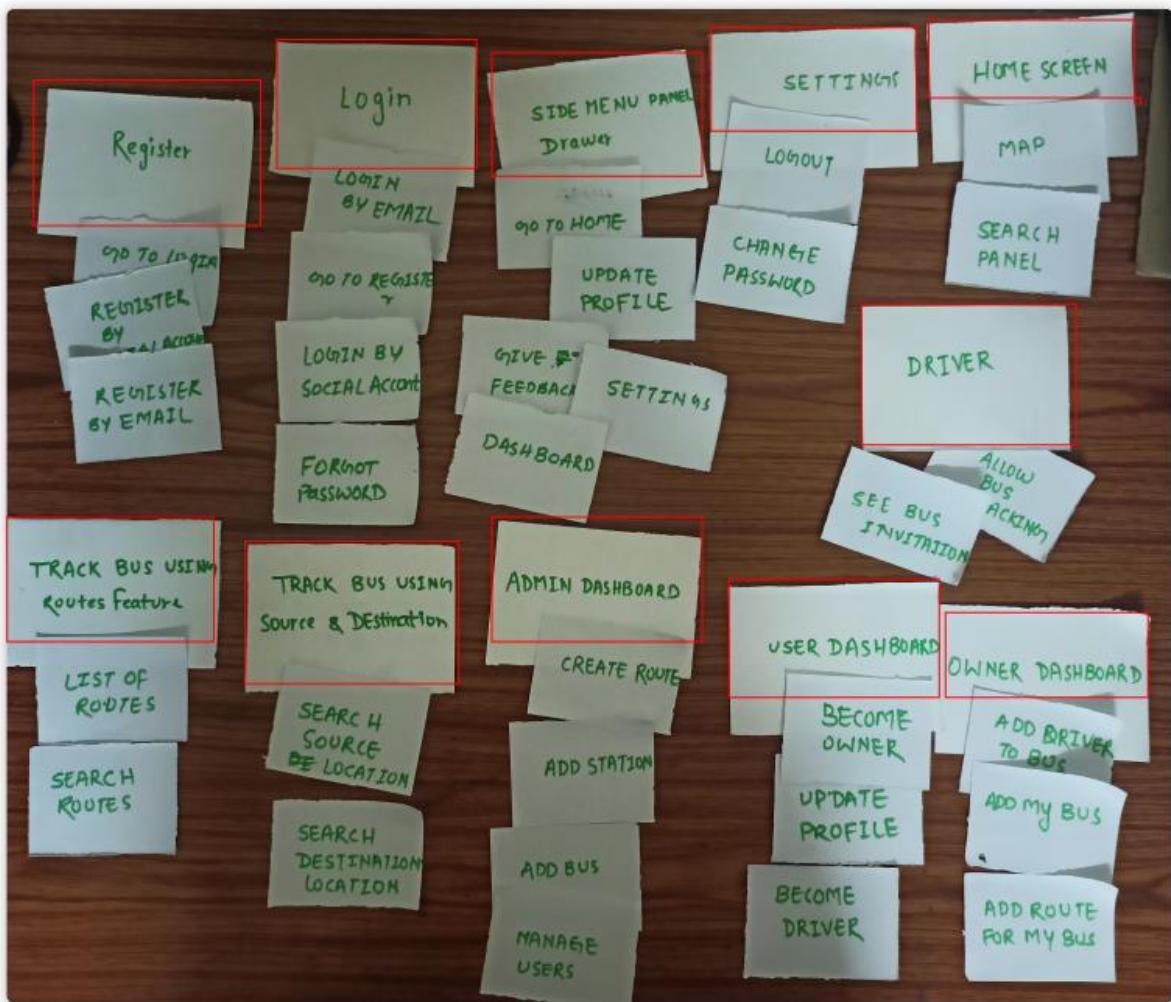
PUBLIC BUS TRACKING UNSORTED CARD

Figure 18 Unsorted card



PUBLIC BUS TRACKING CARD CATEGORIES

Figure 19 Card Categories



Categories

PUBLIC BUS TRACKING CARD SORTING

Figure 20 Sorted Card

After sorting the cards, I had a clearer concept of how card patterns would look, and I was in a better position to figure out which organizing scheme would work best for my users.

First Prototype — Low Fidelity

A low-fidelity prototype is a simple and low-tech version of a prototype. This prototype isn't even close to the finished result. In terms of prototype fidelity, the higher the fidelity, the closer the prototype is to the final product. Low fidelity refers to the lack of capture of numerous characteristics of the result. Visuals, content, and interactivity are among these factors ([Angelica, 2021](#)). Low-fi prototypes were built to obtain better and more honest feedback since users feel more at ease making comments on low-fi prototypes. It aided me in determining the user's actual interaction with the application rather than its mere presentation (Chen, n.d.). It also assisted me in refining page flows and was a less expensive tool for detecting errors in my design process.

Snapshots of low fidelity prototypes are shown below

The figure consists of two mobile application screens side-by-side, each with various UI elements and annotations.

Figure 22 Login Screen:

- Annotations:
 - Textbox (points to the Email input field)
 - If checked it will not ask to login every time (points to the Remember me checkbox)
 - Login button (points to the LOGIN button)
 - Sign in with google account (points to the Google+ icon)
 - Sign in with Facebook Account (points to the Facebook icon)
 - Don't have account? Create new (points to the "Create new" link at the bottom)
 - Figure 22 Login Screen (caption below the screen)
 - CU_ID: 1026917 (text at the bottom left)
 - Go to signup screen (button at the bottom right)

Figure 21 Register Screen:

- Annotations:
 - Choose registration user type. (points to the User dropdown menu)
 - Registration required Text fields (points to the Email, Password, and Confirm Password fields)
 - Sign up button (points to the Sign up button)
 - Sign up with Facebook account (points to the Facebook icon)
 - Sign up with Google account (points to the Google+ icon)
 - Already have account? Sign in (points to the "Sign in" link at the bottom)
 - Figure 21 Register Screen (caption below the screen)
 - Go to login screen (button at the bottom right)

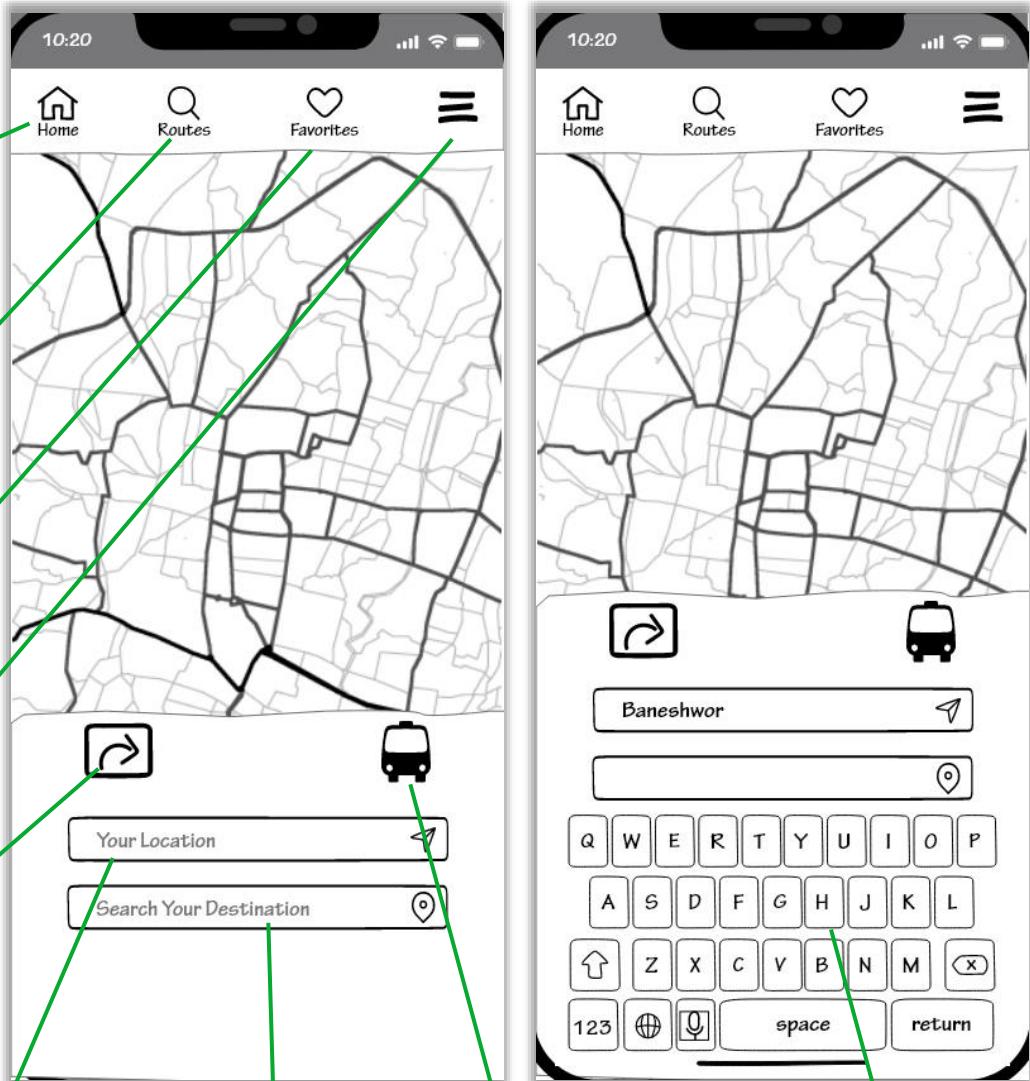


Figure 23 Homescreen — Search by source and destination panel open

Figure 24 Homescreen — Search by source and destination typing



Figure 26 Search by source and destination ready to search

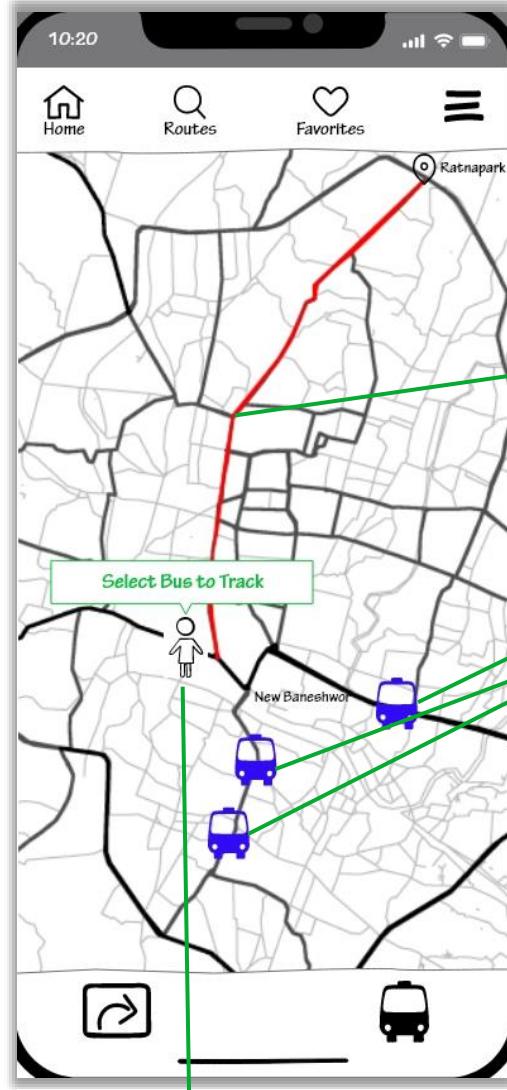


Figure 25 Showing nearby bus heading to Ratnapark

Search for available bus

Person to destination route

Available bus

Add search location to favorite — to easily search for bus next time.

location of user waiting for bus

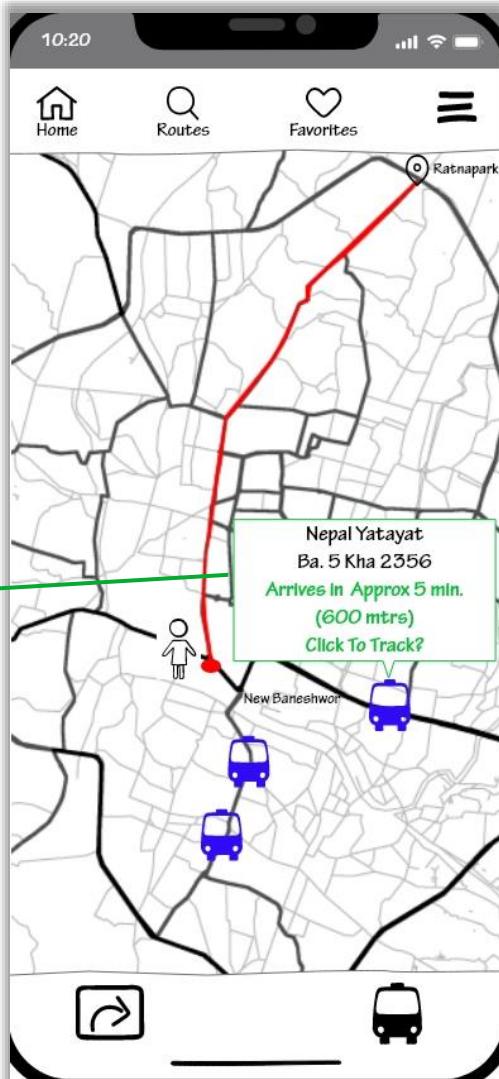


Figure 28 Selecting bus to Ratnapark

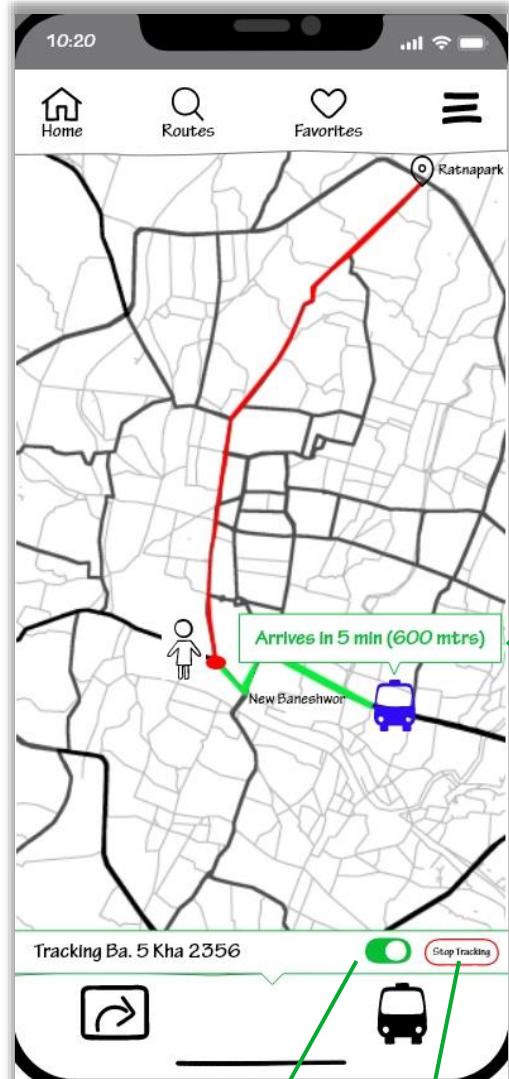


Figure 27 Bus selected and tracking

Selecting bus to track

Showing estimated arrival time after tracking the bus

One can pause tracking specific bus and can track other

Stop tracking bus

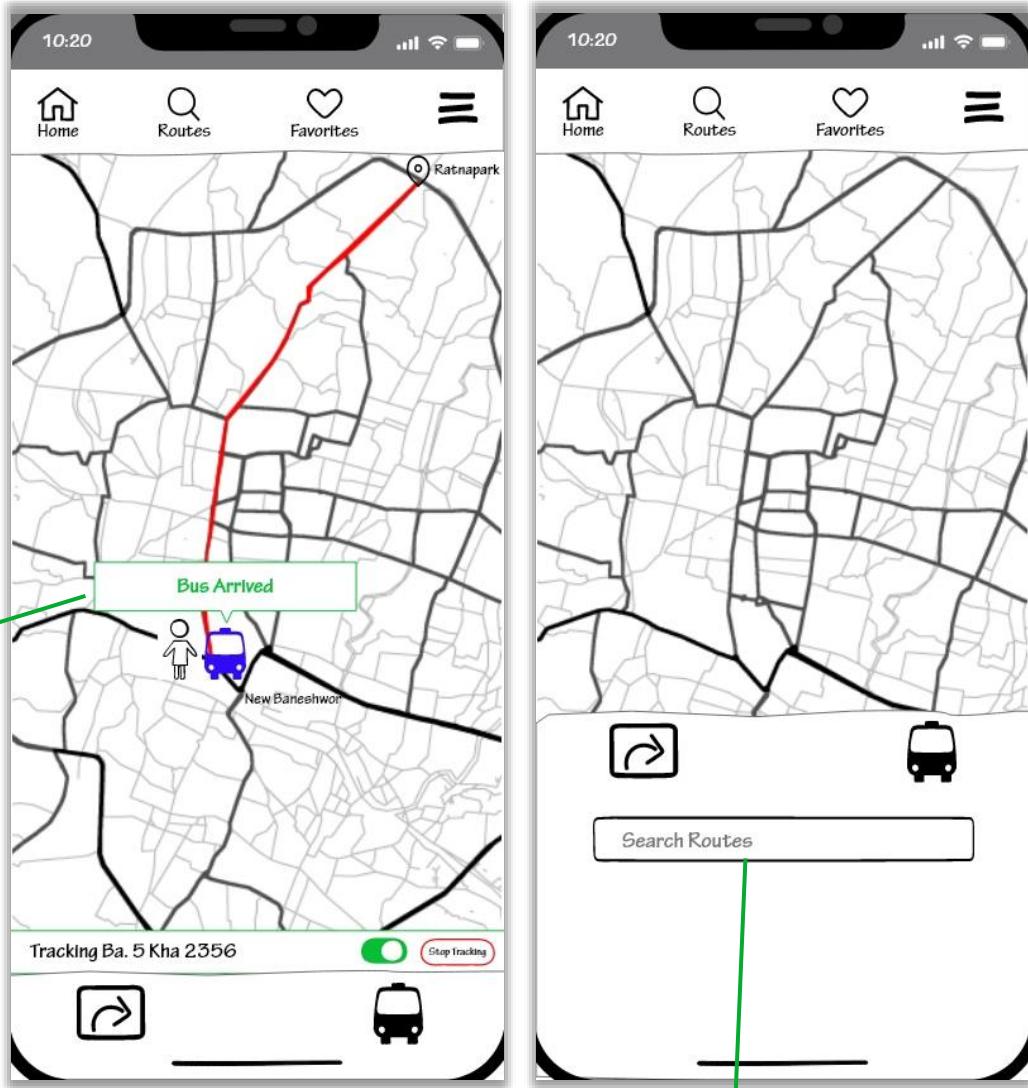


Figure 31 Bus Arrived

Figure 30 Tracking bus by route panel

Search available routes or places



Figure 33 Searching routes

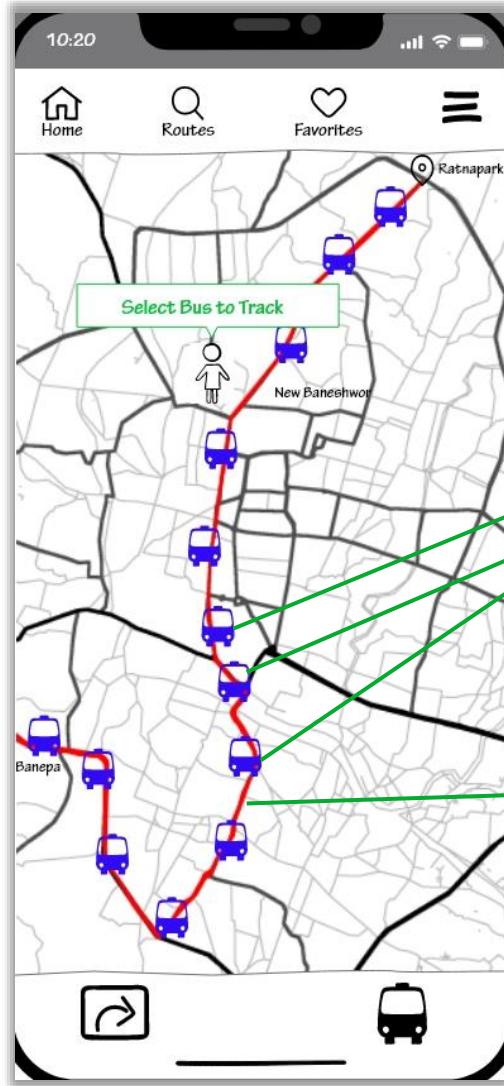


Figure 32 Showing all bus on selected route

Click to Select route to track buses available on the selected route

Can see more information about routes like by which station this route will cross

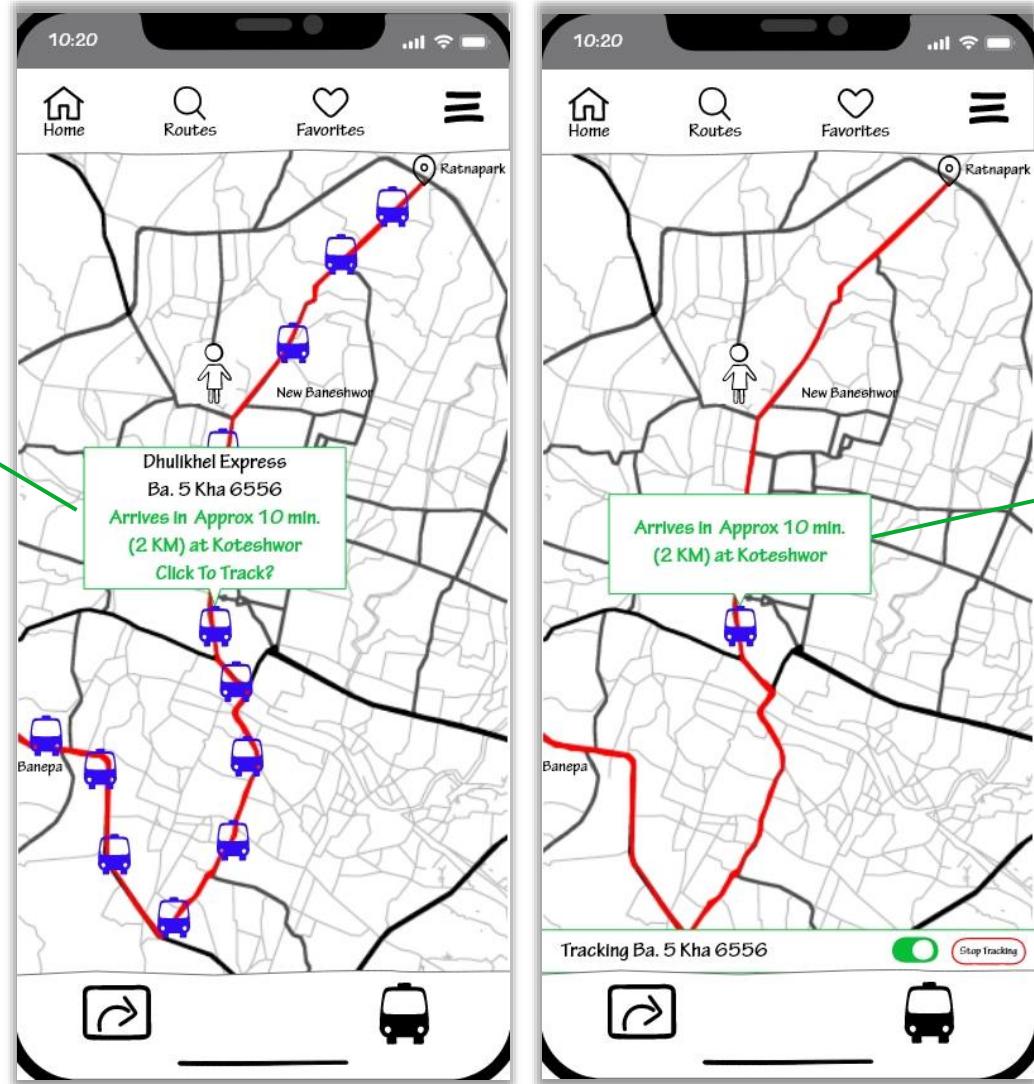
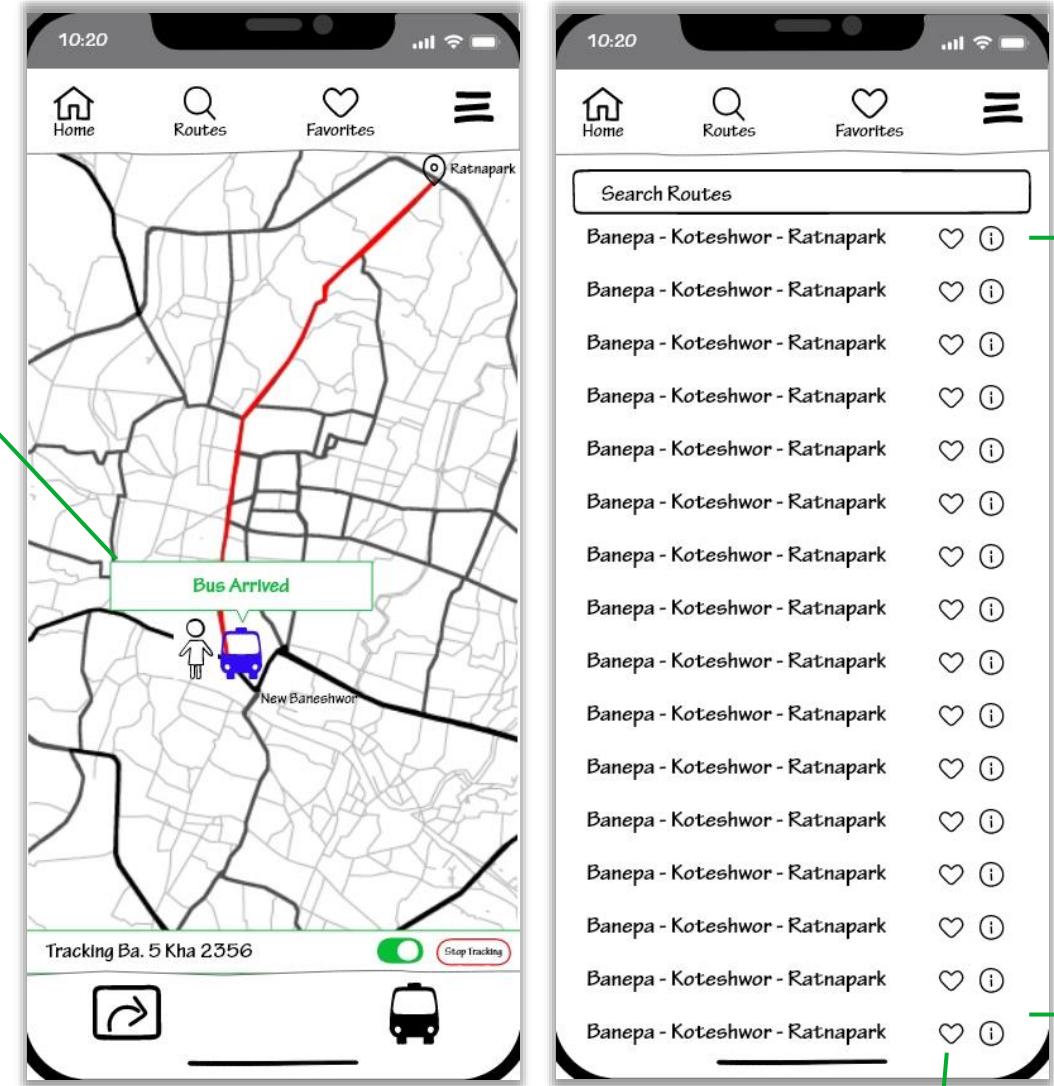


Figure 35 Bus selecting

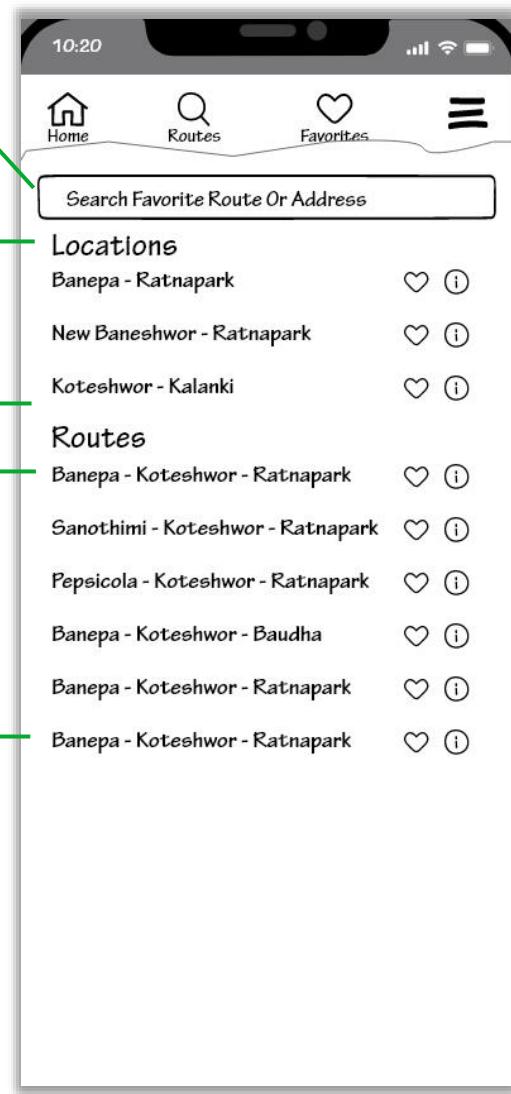
Figure 34 Bus tracking

Showing details of selected bus and click to confirm tracking

Showing approximate arrival time of selected bus.



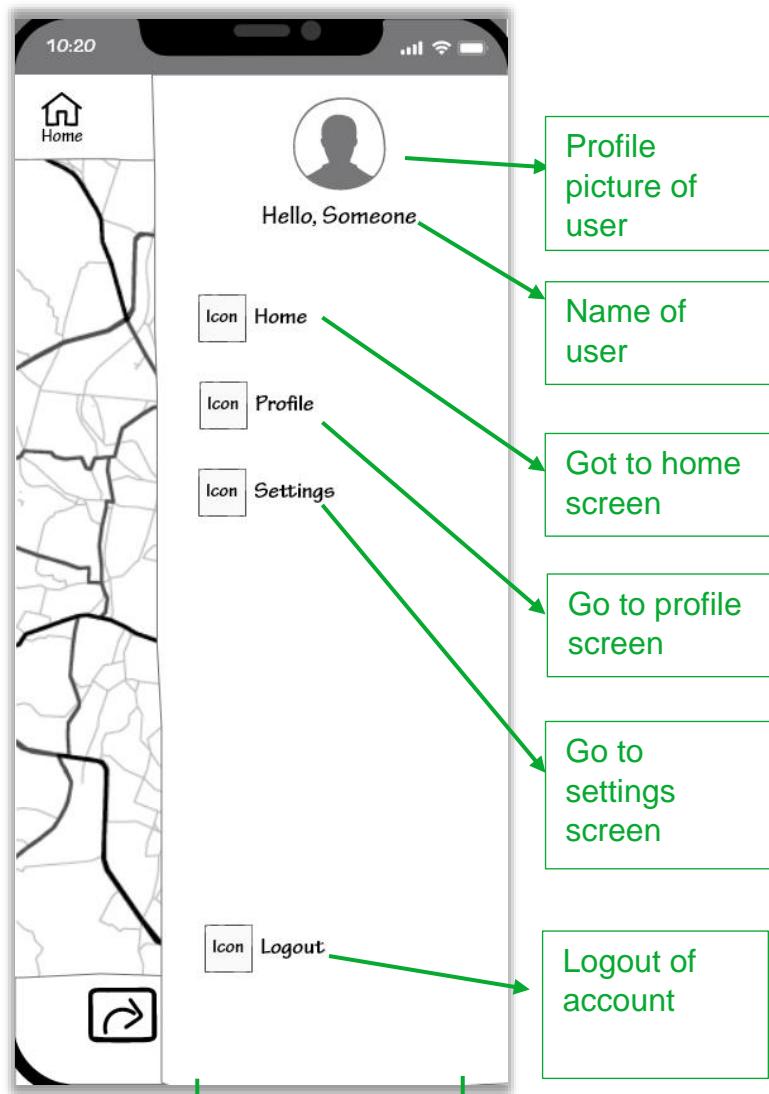
Add to route to favorite



Search route or address

Showing favorite locations

Showing favorite routes



Hello, Someone.

Icon Home

Icon Profile

Icon Settings

Icon Logout

Profile picture of user

Name of user

Got to home screen

Go to profile screen

Go to settings screen

Logout of account

Figure 39 Favorite routes and locations

Figure 38 User Drawer Menu

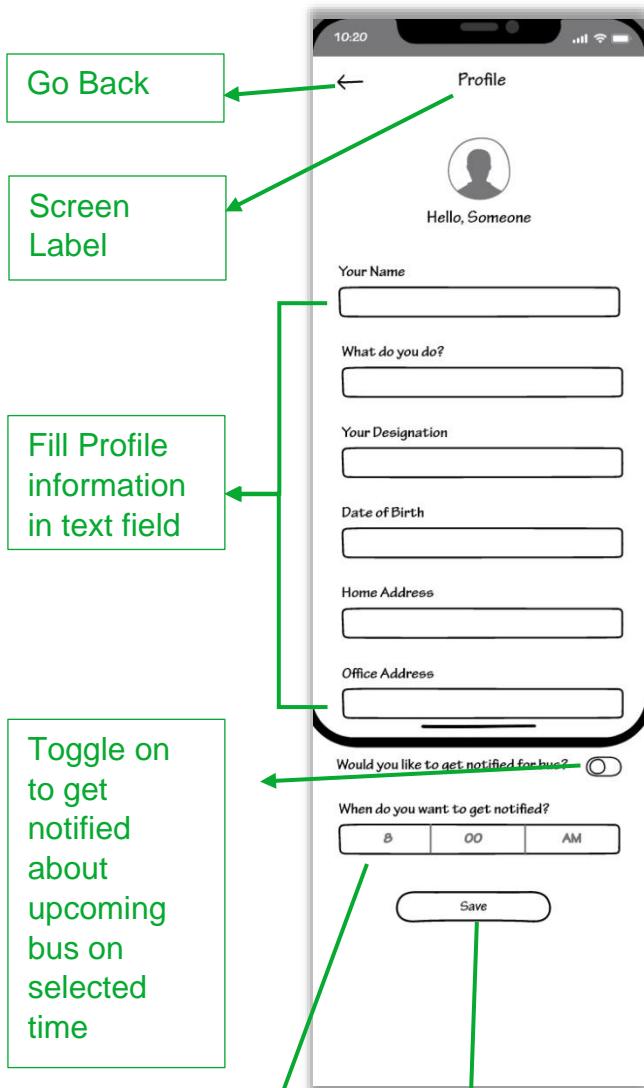


Figure 41 User profile

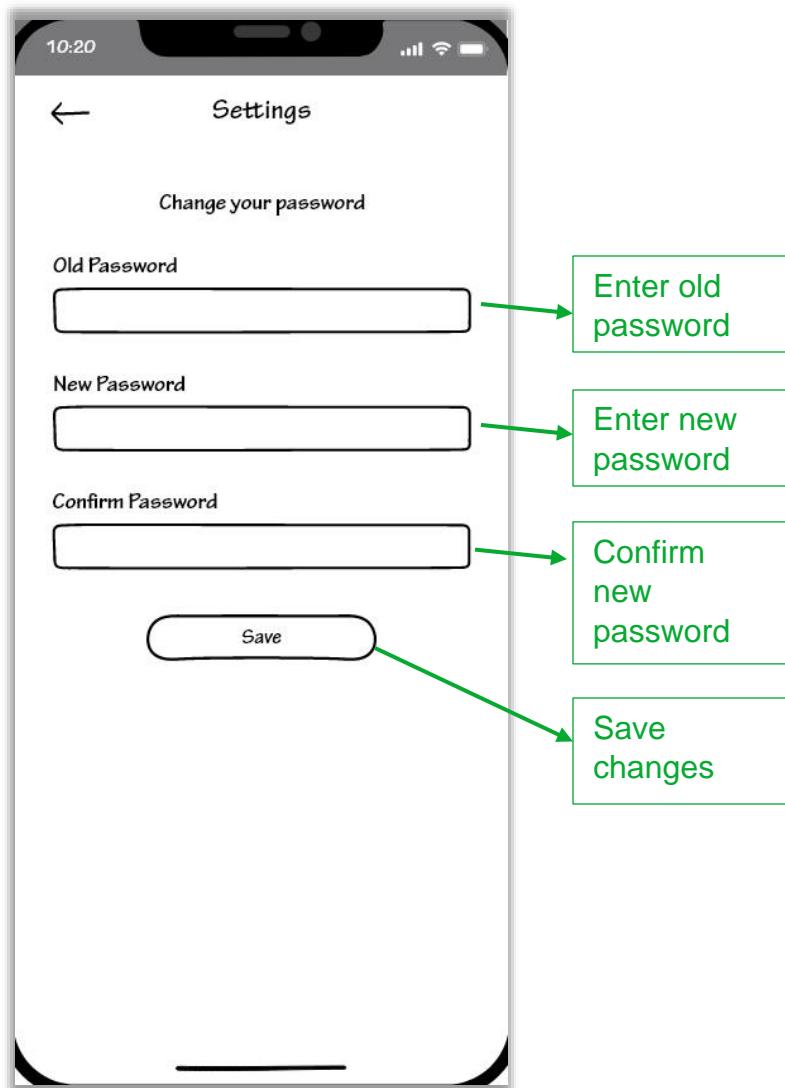


Figure 40 Change password

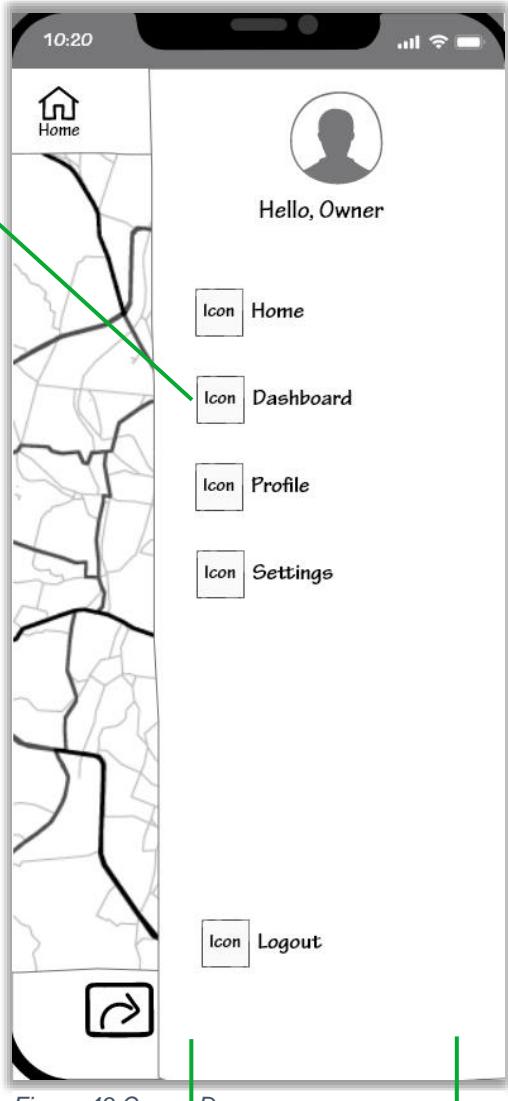


Figure 43 Owner Drawer menu



Figure 42 Owner Dashboard

Manage Buses

Manage Drivers

Manage Routes

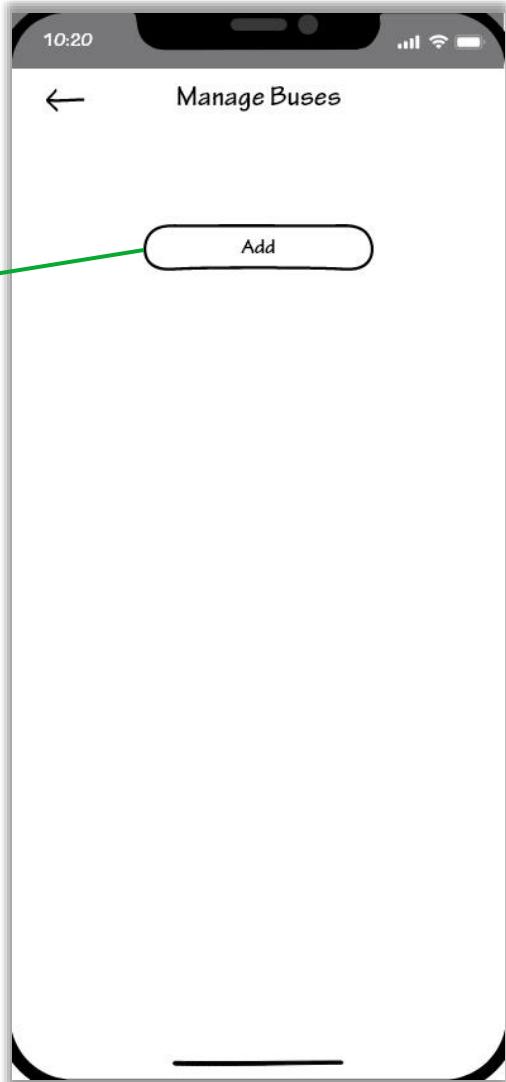


Figure 45 Owner Manage bus — No bus added

A screenshot of a mobile application interface titled "Manage Buses". At the top left is a back arrow icon, and at the top center is the title "Manage Buses". Below the title are three input fields: "Bus name", "Bus Number", and "Choose route". In the bottom right corner of the screen area is a rounded rectangular button labeled "Save". To the right of the "Bus name" field is a green callout box with a black border and rounded corners, containing the text "Enter bus name", with a green arrow pointing from the box to the field. To the right of the "Bus Number" field is another green callout box with the text "Enter bus number", and to the right of the "Choose route" field is a third green callout box with the text "Choose route on which owner's buses are permitted to operate". A green arrow points from the "Choose route" field to the "Save" button.

Figure 44 Owner add bus form

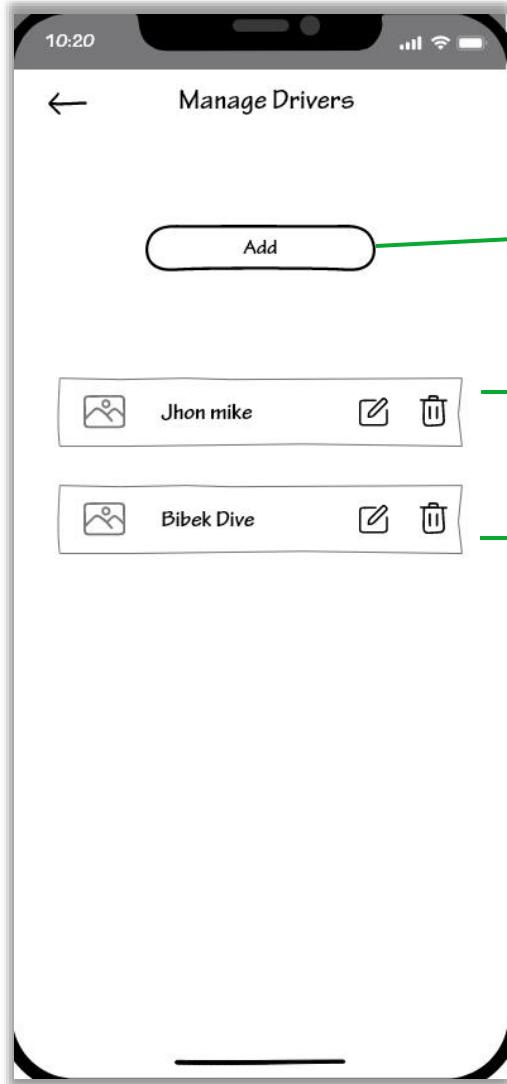
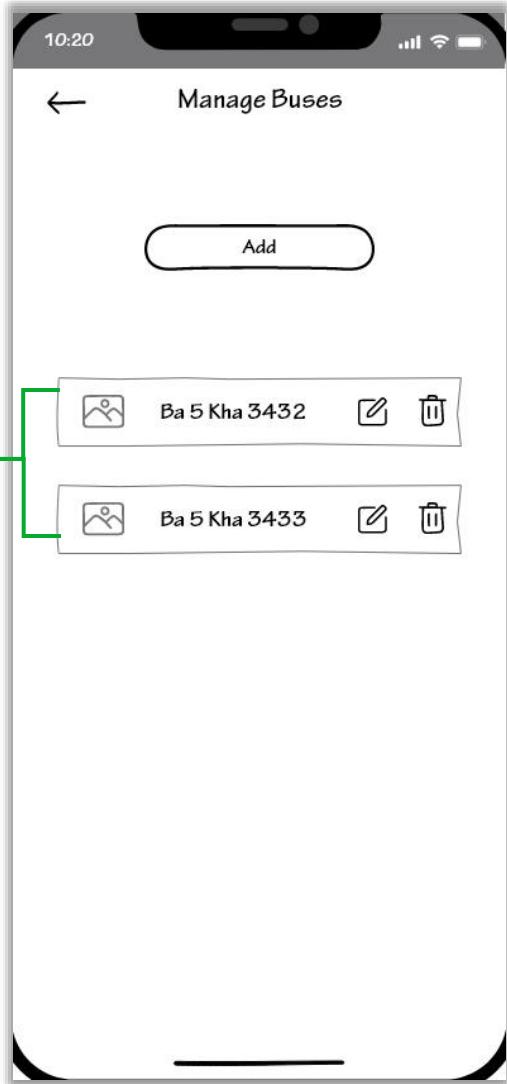


Figure 46 Owner Manage bus — Bus Added

Figure 47 Owner — Manage Driver

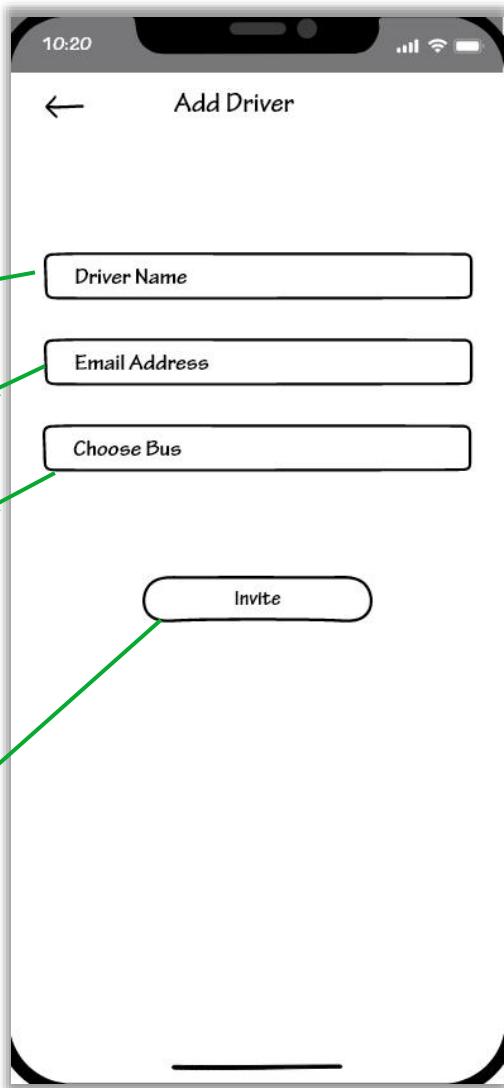


Figure 48 Owner — Invite Driver

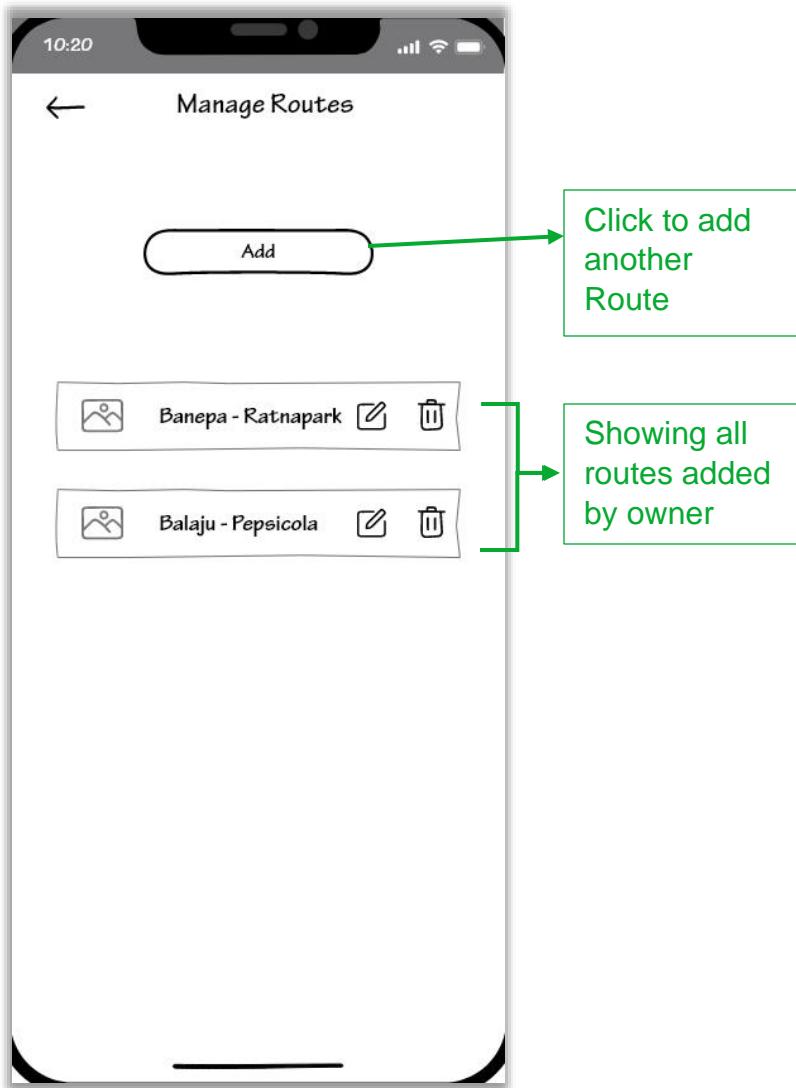


Figure 49 Owner — Manage Routes



Figure 51 Driver Drawer Menu



Figure 50 Driver Home screen

Side Drawer menu of driver

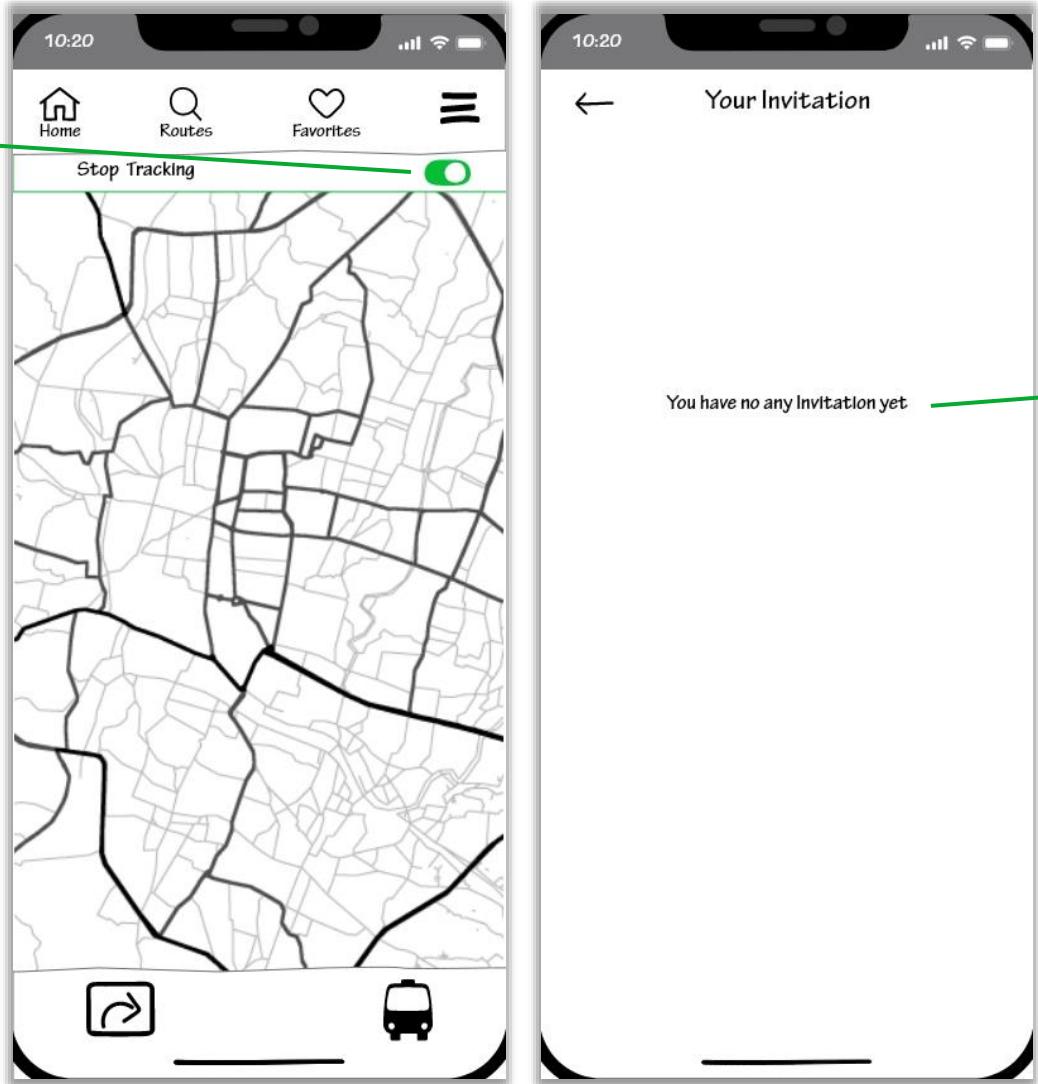
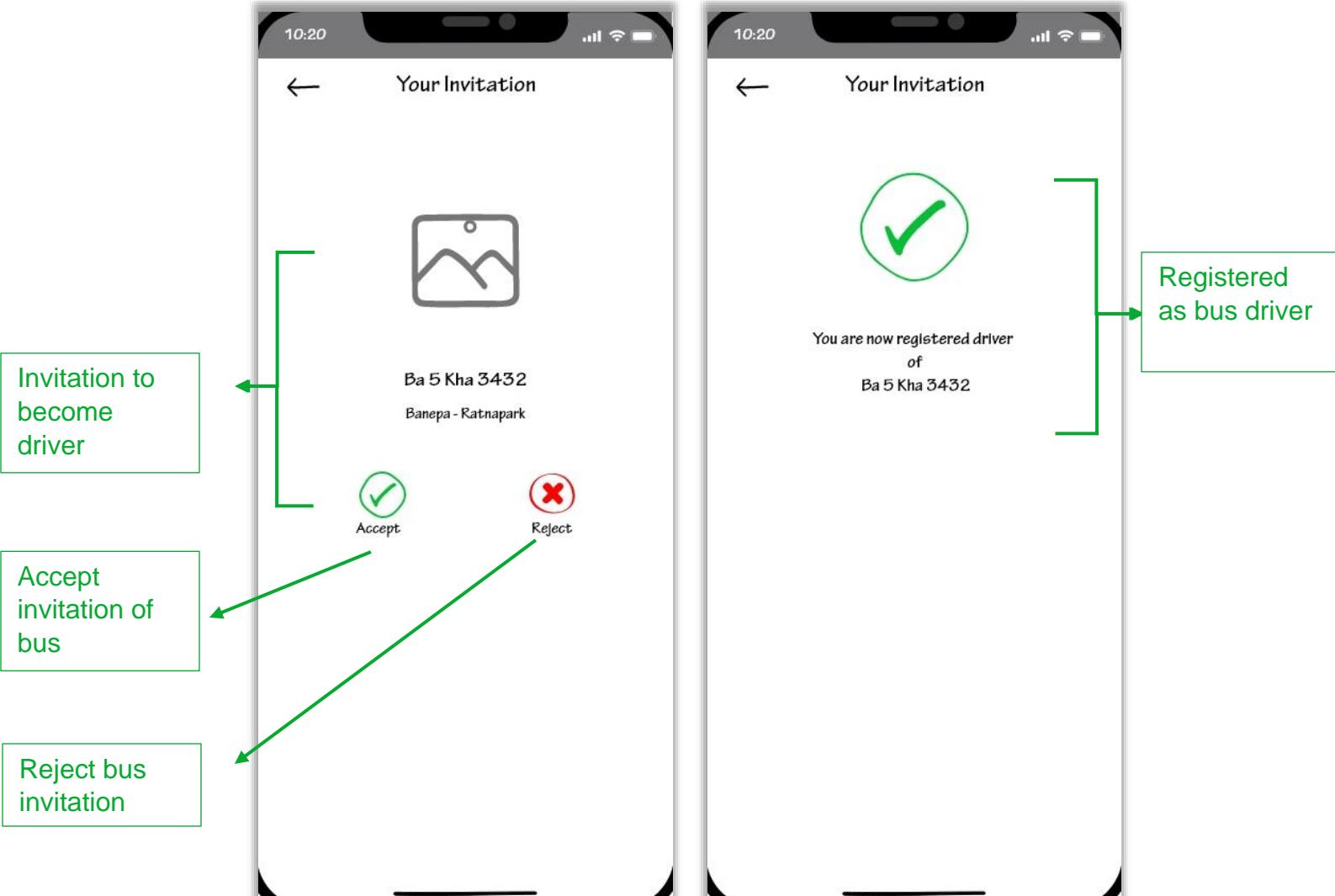
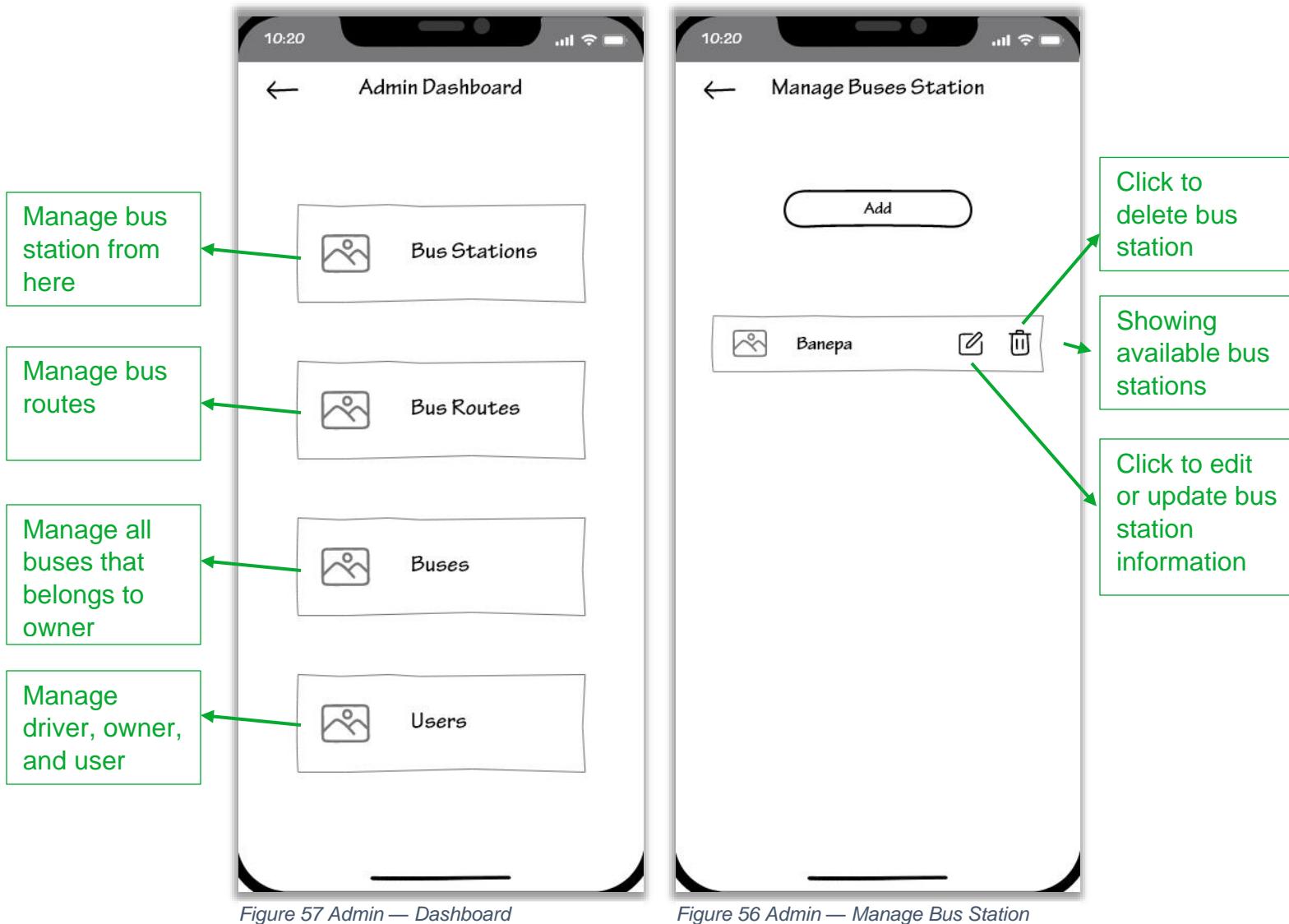


Figure 52 Driver allowed Tracking

Figure 53 Driver — No invitation for bus





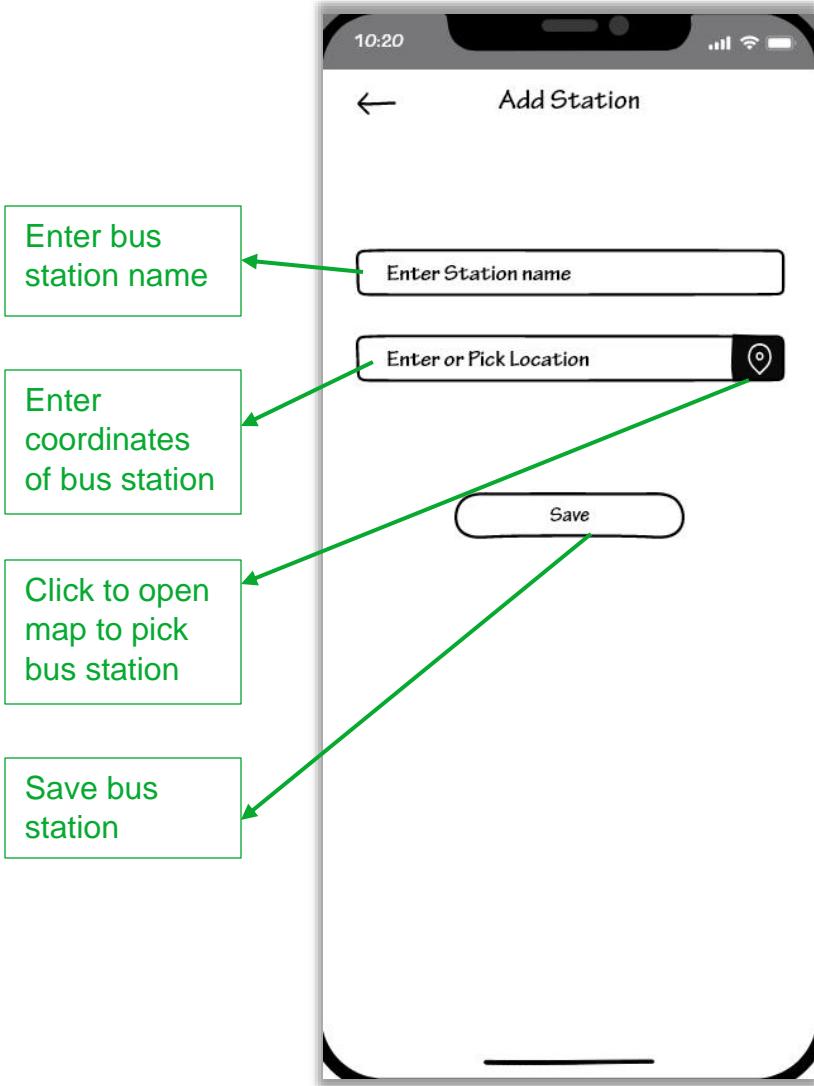


Figure 59 Admin — Bus Station

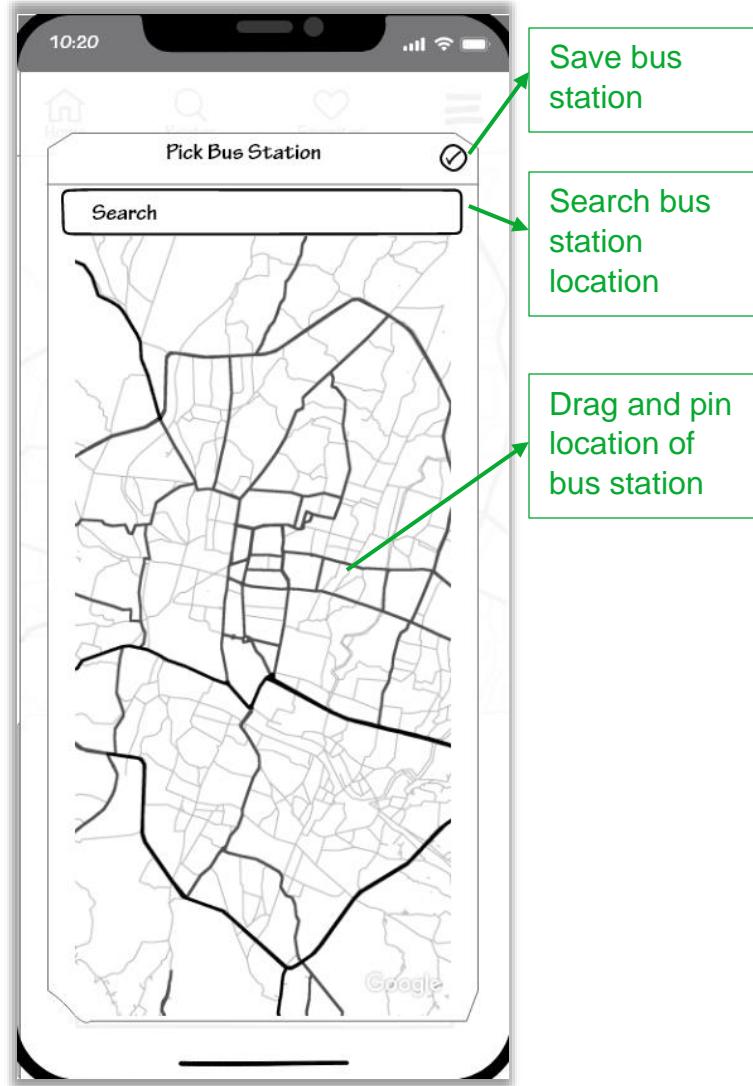


Figure 58 Admin — Pickup Bus Station Location

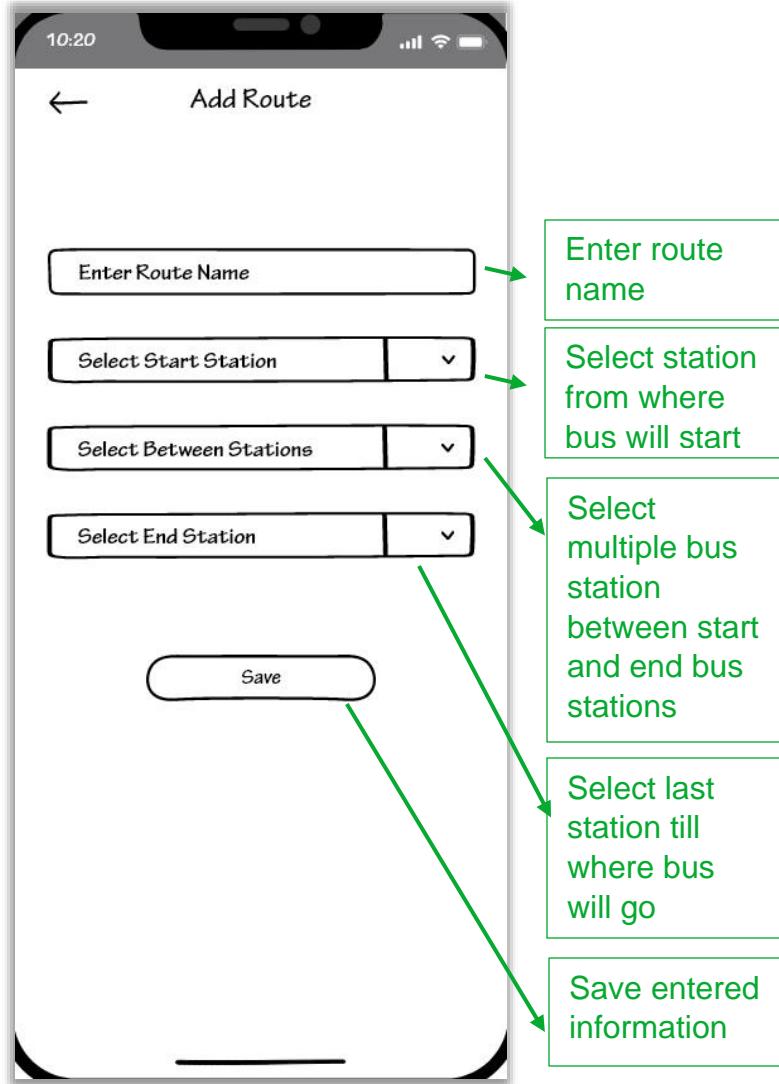
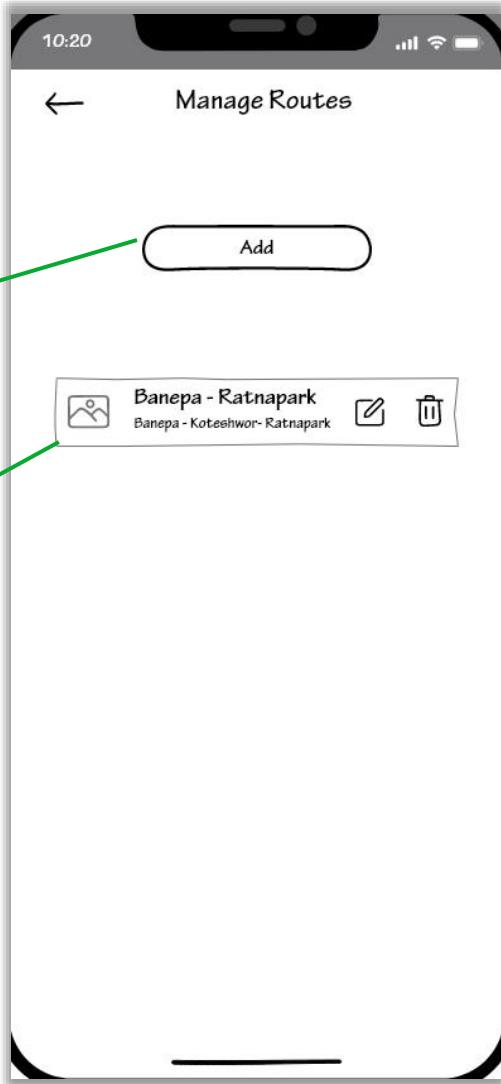


Figure 61 Admin — Manage Routes

Figure 60 Admin — Add Routes

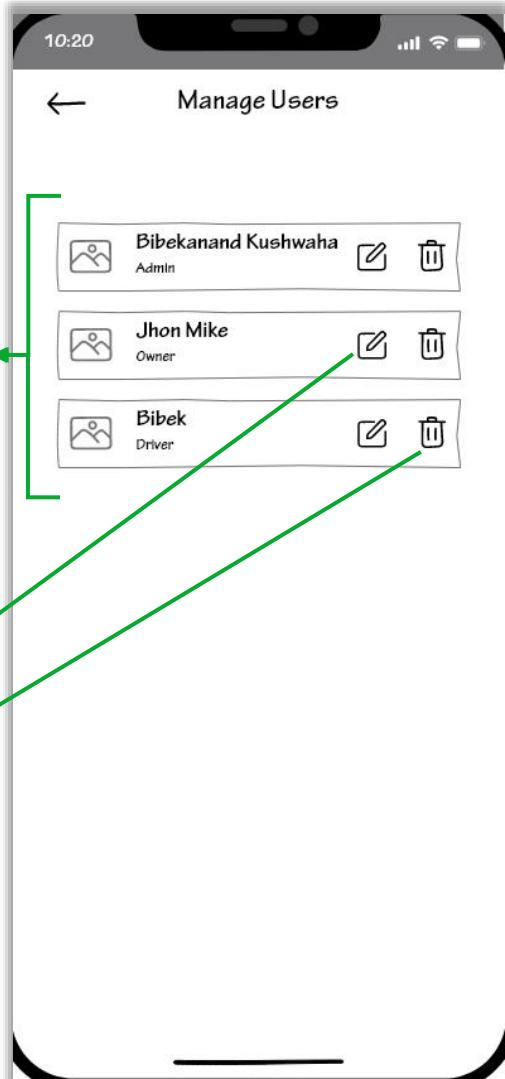


Figure 63 Admin — Manage User

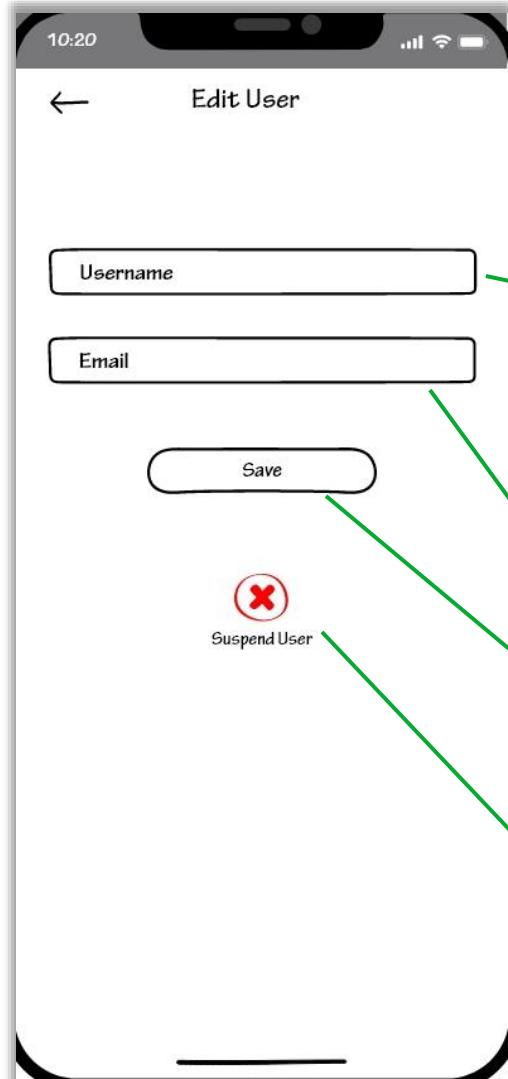


Figure 62 Admin — Update or Suspend user

Showing all available users

Edit user

Delete user

Update username of user

Update email of user

Save updated information

Suspend user

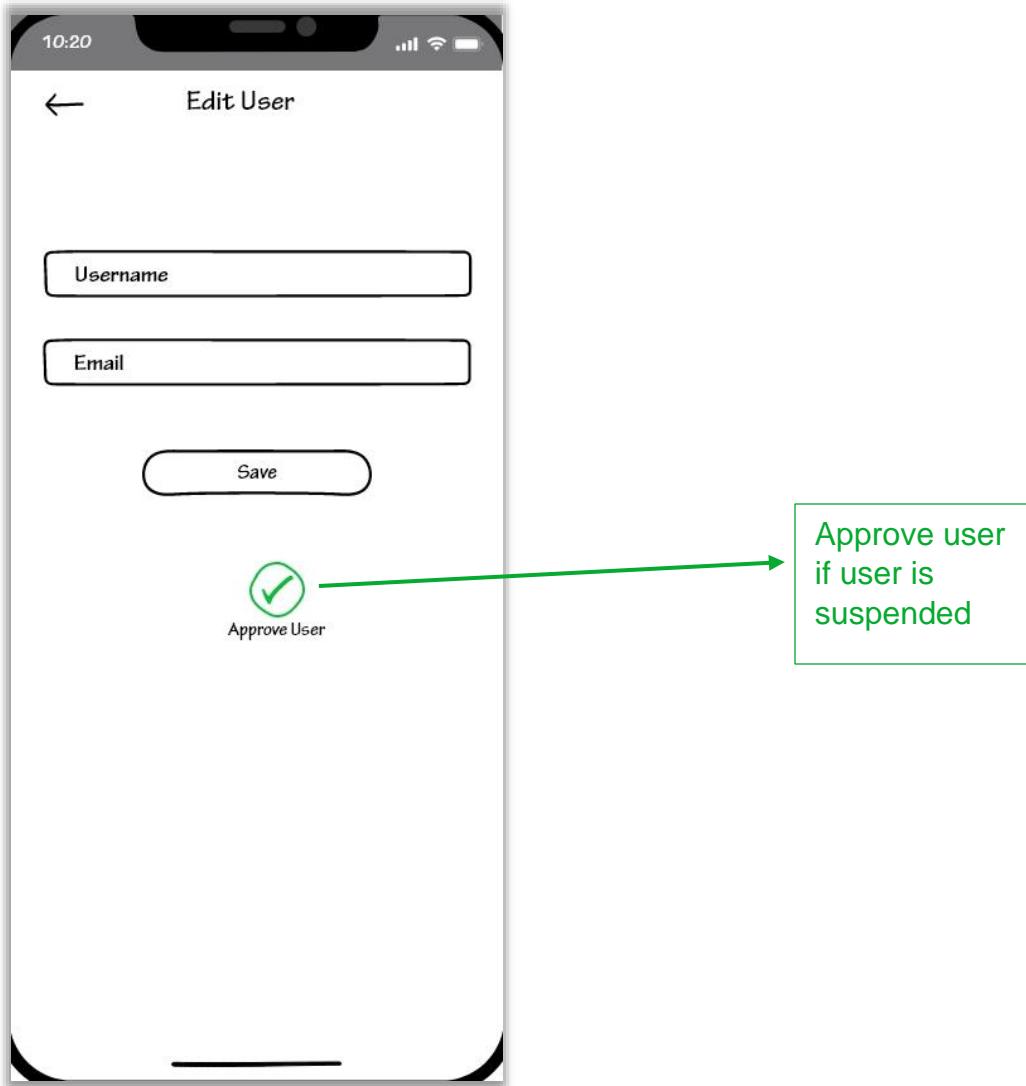


Figure 64 Admin — Approve User

User Evaluation of First Prototype

During the Low-Fi prototype testing, I uncovered several issues in our application that caused users to be unsure of what they were supposed to accomplish at various points during the test. These problems ranged in size from major to minor, with some affecting everyone who used the program and others being personal preferences.

Methodology

The testing was carried out by five separate users, each with a different background and age range. Testing was carried out utilizing the Wizard of OZ testing methodology, in which a person plays the role of the system and makes changes based on the interactions of the real test performer. I chose users who had prior familiarity with Google Maps and ride-sharing applications so that they could critique the app more effectively. I visited colleges, where students are more likely to be found, and cafes, where working people often founds. I attempted to include each persona so that the testing results would be more useful and beneficial in determining the problem and receiving honest feedback from the target group.

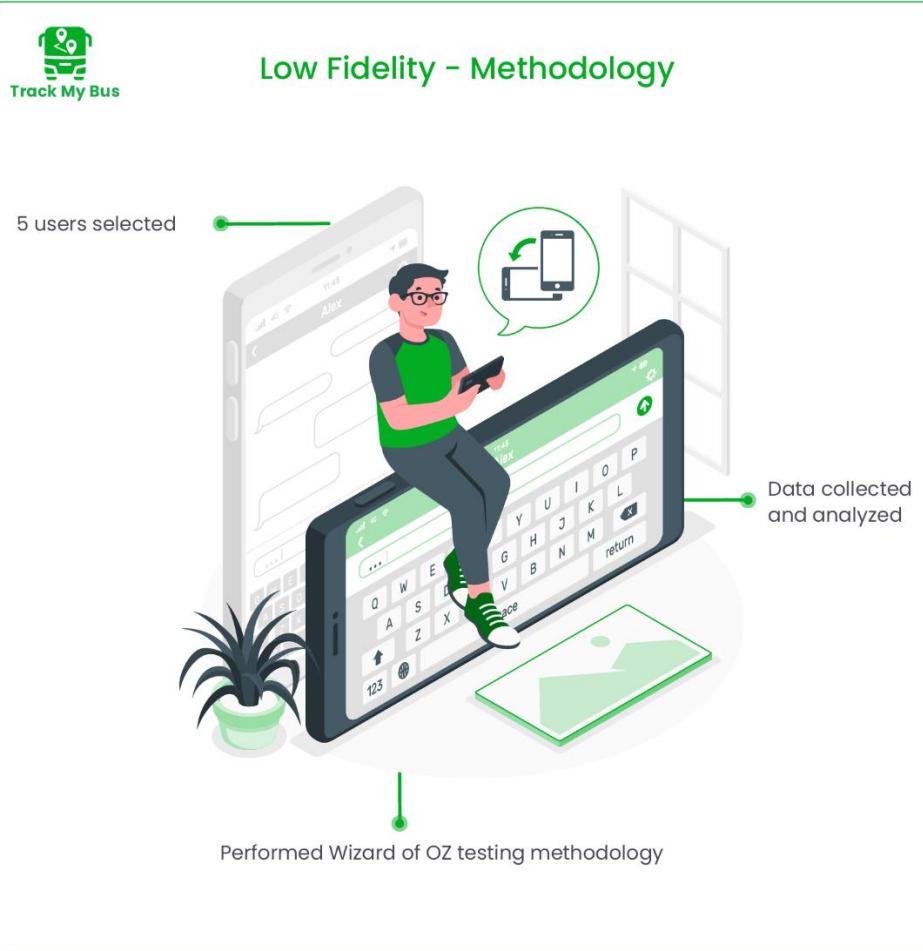


Figure 65 Low fidelity - Methodology

Testing Framework

Wizard of OZ testing framework was used to do low-fidelity prototype testing of JamJam app. Wizard of OZ is a great tool for testing low-fidelity prototypes because it is a less expensive and more enjoyable way to do so. As a Wizard i.e., System, I was responsible for changing UI components based on user interaction. The nicest part about this technique is that it is simple and quick to implement; all we need is a prototype, a wizard, and a user.



Figure 66 Wizard of oz testing method

Questionnaire

Question to be asked before user testing are as follows

Demographic questions



Demographic Questions

1. Which age groups do you belong to?
2. What is your gender?
3. How do you describe your ethnicity
4. What is your relationship status?
4. What's your annual income?



Figure 67 Demographics Questions

Background Questions



Background Questions

1. What is your profession?
2. What do you prefer, public transportation or private? Why?
3. How much do you travel by bus?
4. How much time do you spend using technological devices?
5. Do you use map apps?
6. Which maps do you use most? (Google maps, Apple Maps, Openstreet)
7. What device do you use most often?
8. Which OS do you use?
9. How often do you use internet outside?
10. How often do you use google maps for navigation?
11. Have you ever used any bus tracking application?
12. What do you use for public transportation
(Bus, Taxi, Ride share)?
13. How difficult do you find to get buses?
14. How familiar are you with bus routes in Nepal?
15. What do you think about getting notification
about bus moving to your destination at your
specified time?
16. Do you think implementing tracking system
will help your bus wait less at bus station?



Figure 68 Background Questions

During testing



During Testing

1. How difficult was it to navigate?
2. What are your thoughts on the design and layouts?
3. How is color and contrast of page
4. Is content visible clearly
5. What are you thinking as you view home screen?
6. If you were looking for searching bus, where would you expect to find it
7. How was the experience to of using this app to track bus using route?
8. What are your thoughts on the language used? do you think this should be in Nepali or both?
9. Why did you navigate to add bus instead of adding route first?
10. What motivated you to swipe up panel on home screen?



Figure 69 During Testing

After testing



After Testing

1. How would you describe your overall experience with the product?
2. What did you like the most using the product?
3. What did you like the least?
4. What, if anything surprised you about the experience?
5. What, if anything caused you frustration?

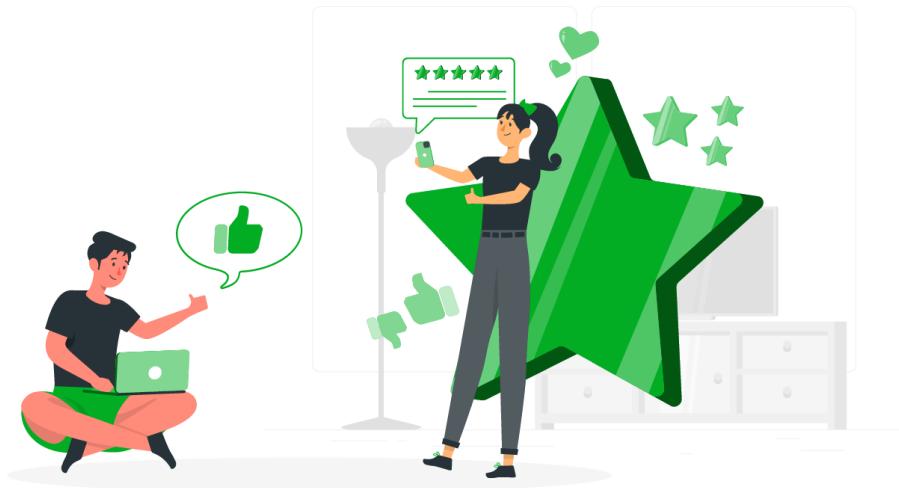


Figure 70 After Testing

Overall impression (Quantitative Questions)



Overall impressions (Quantitative Questions)

1. On a scale from 1 to 10 (1 not likely, 10 very likely), how likely are you to recommend this product to friend?

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

2. How frequently you will use this product

- i. Never
- ii. Very rarely (once per month)
- iii. Rarely (2-3 times/month)
- iv. Occasionally (2-3/weeks)
- v. Frequently (1-2 times/day)
- vi. Very frequently (3+times/day)

3. Was easy to find buses and routes

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

4. Was easy to navigate

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

5. App was easy to use

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

6. After each attempt app successfully made me feel task was completed or not

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

7. Easy to switch between users

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

8. Input form was clear and expressive

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

9. App interface is clean and minimal.

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

10. I felt good while using the app

1	2	3	4	5	6	7	8	9	10
<input type="text"/>									

Figure 71 Quantitative Questions

Participants

Users were wisely picked based on the research done while creating personas because this app can be used by people of diverse demographics. Students, travelers, men, and women in the workforce, as well as elderly persons such as bus business owners, were chosen to test the app and provide the most candid comments. A total of five users, ranging in age from 13 to 30 years, were chosen to perform the testing.

Low Fidelity Testing - Participants				
Participants Name	Age	Gender	Education	Transportation (Private/Public)
Bibek Subedi	20	Male	Ethical Hacking	Public
Riya Ranjit	22	Female	Computing	Private
Dipesh Singh	28	Male	MBBS	Public
Bimlesh Yadav	23	Male	Civil Engineering	Public
Indra Singh	13	Male	Class 7	Public

Figure 72 Low Fidelity testing- Participants

Low Fidelity User Testing - Participants age

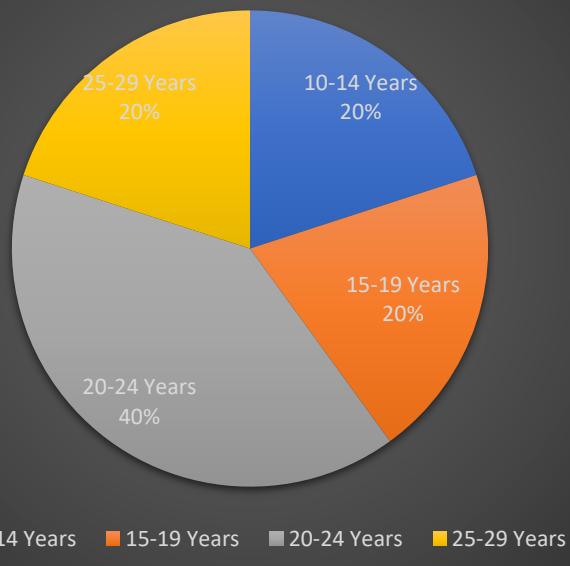


Figure 73 Low Fidelity User Testing - Participant's age

Low fidelity User testing - Participants mode of Transportation

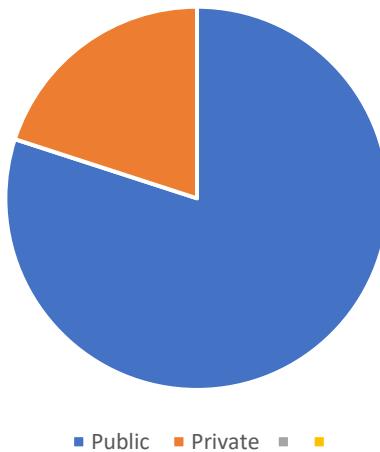


Figure 74 Low fidelity User testing - Participant's mode of Transportation

Wizard of Oz

Wizard of Oz is a Testing method where user can interact with system without realizing that those responses are being generated by human instead of a machine ([Harwood, 2018](#)). In this application I was a Wizard changing the UI of application based on User Interaction. This test was moderated and last for 15 minutes to complete all the task that user was assigned to performed.

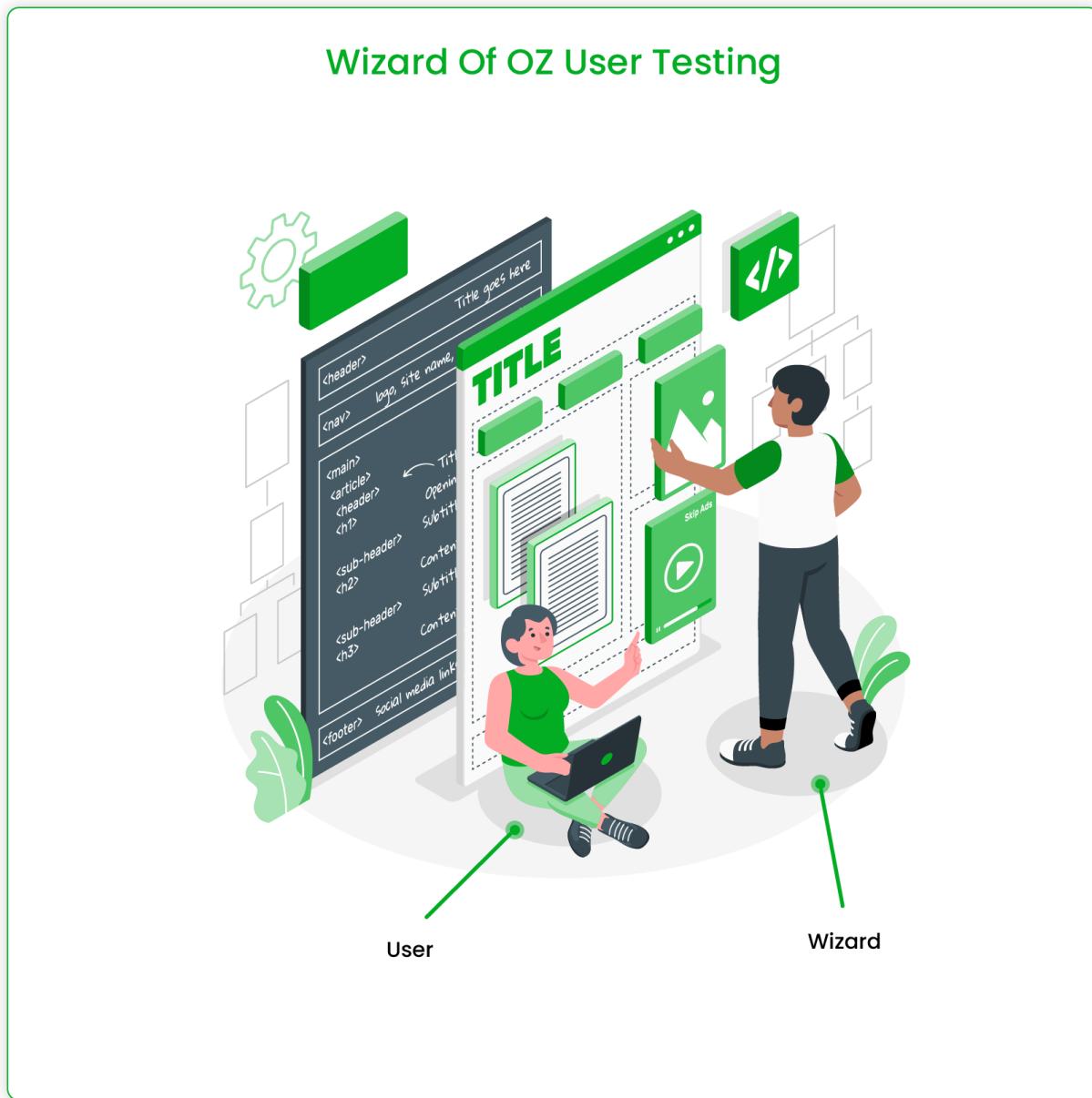


Figure 75 Wizard of OZ

Scenarios

There was total 11 task assigned to each user to test the low fidelity prototype and based on performance.

Task 0

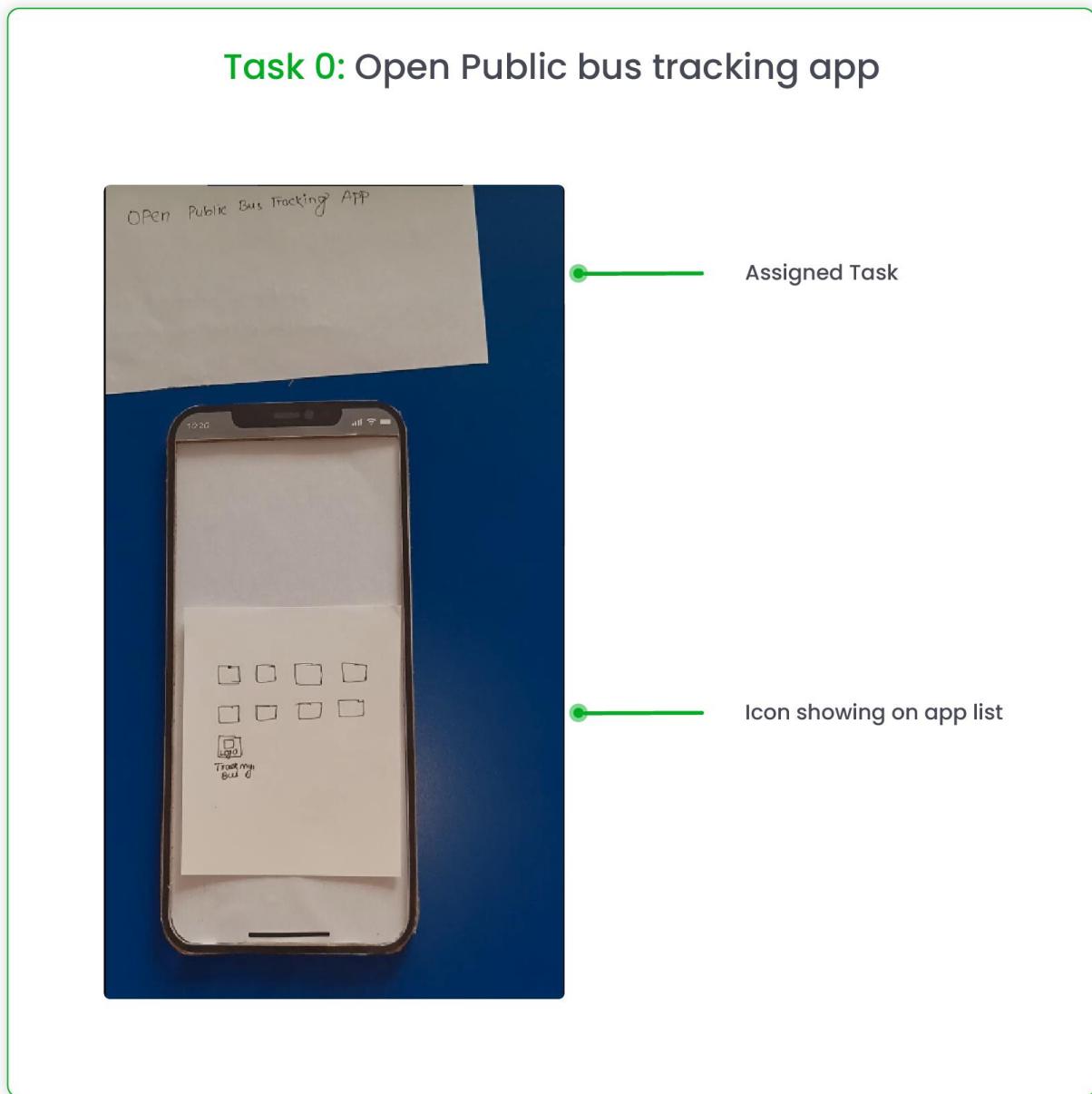


Figure 76 Task 0

Task 1

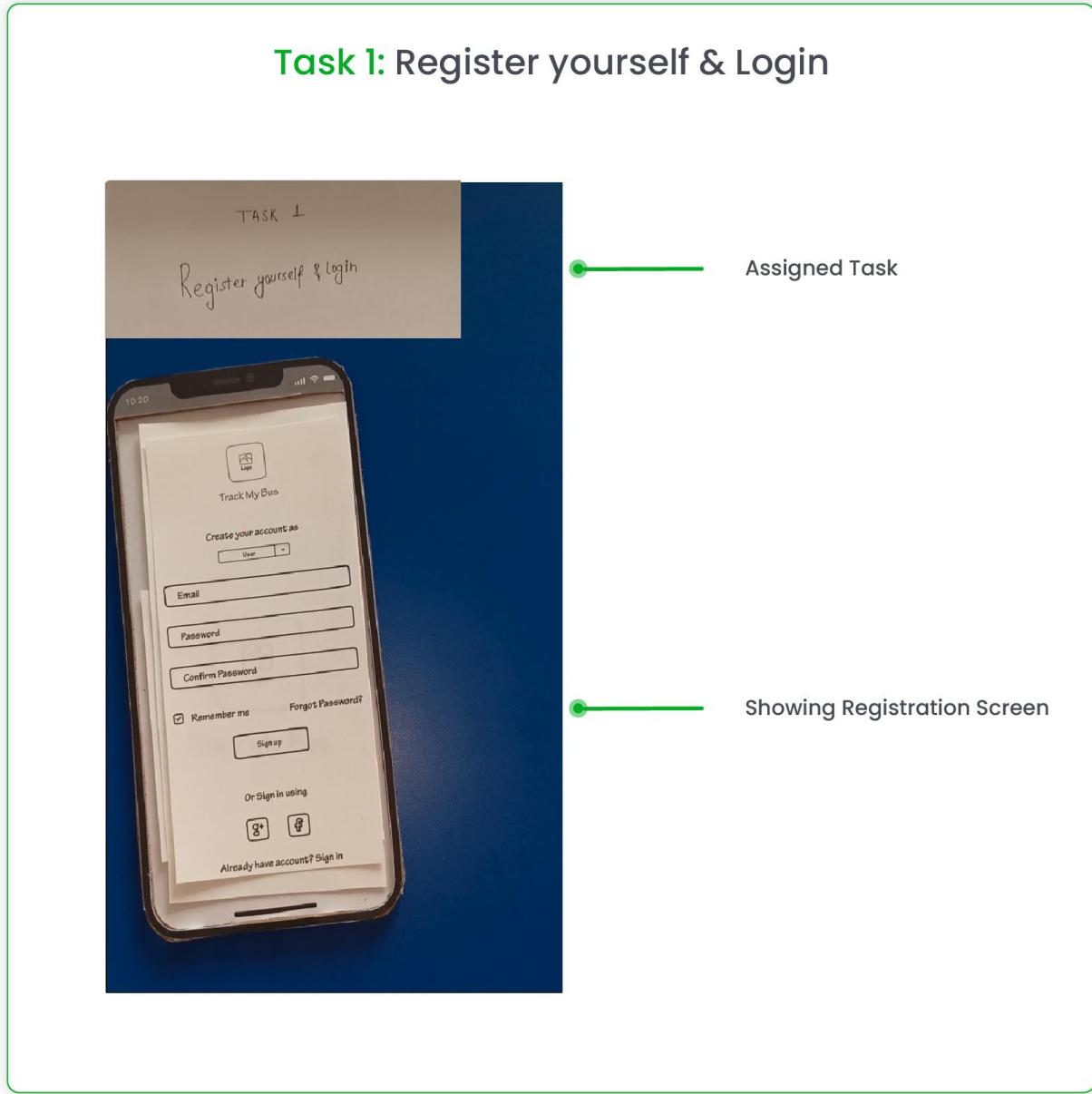


Figure 77 Task 1

Task 2

Task 2: Track bus by location (Source & Destination)

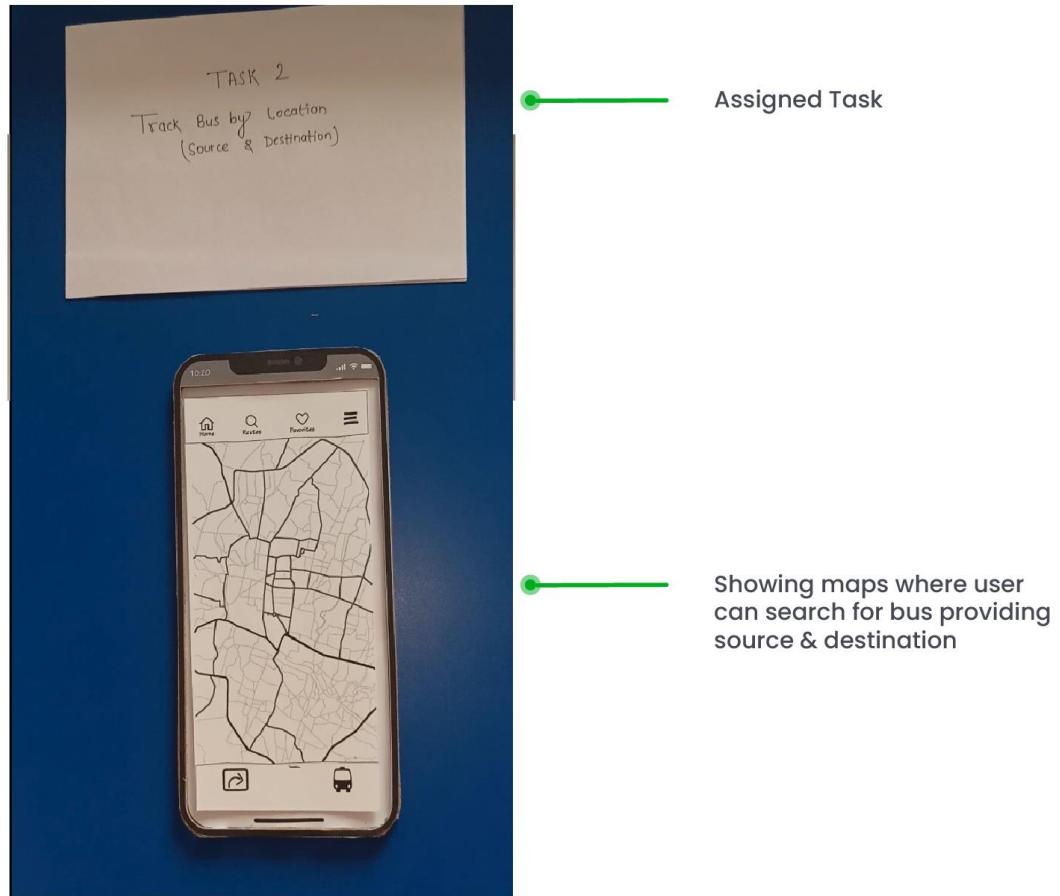


Figure 78 Task 2

Task 3

Task 3: Track Bus by Route

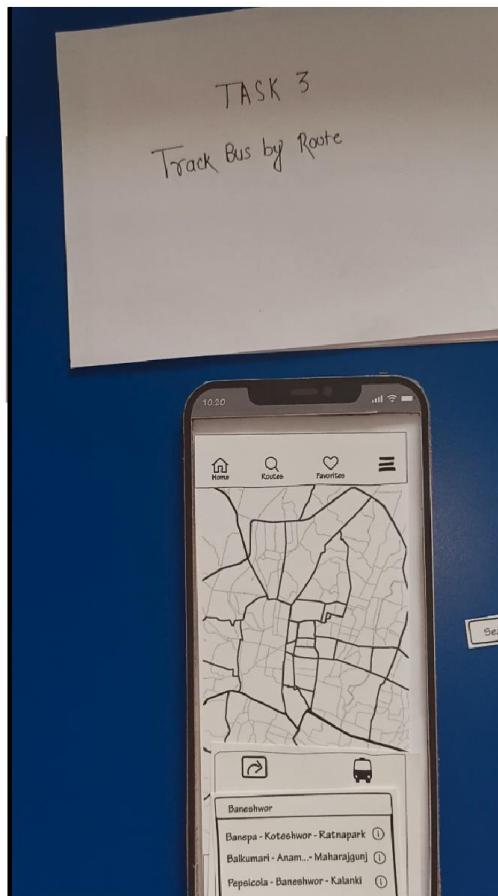


Figure 79 Task 3

Task 4

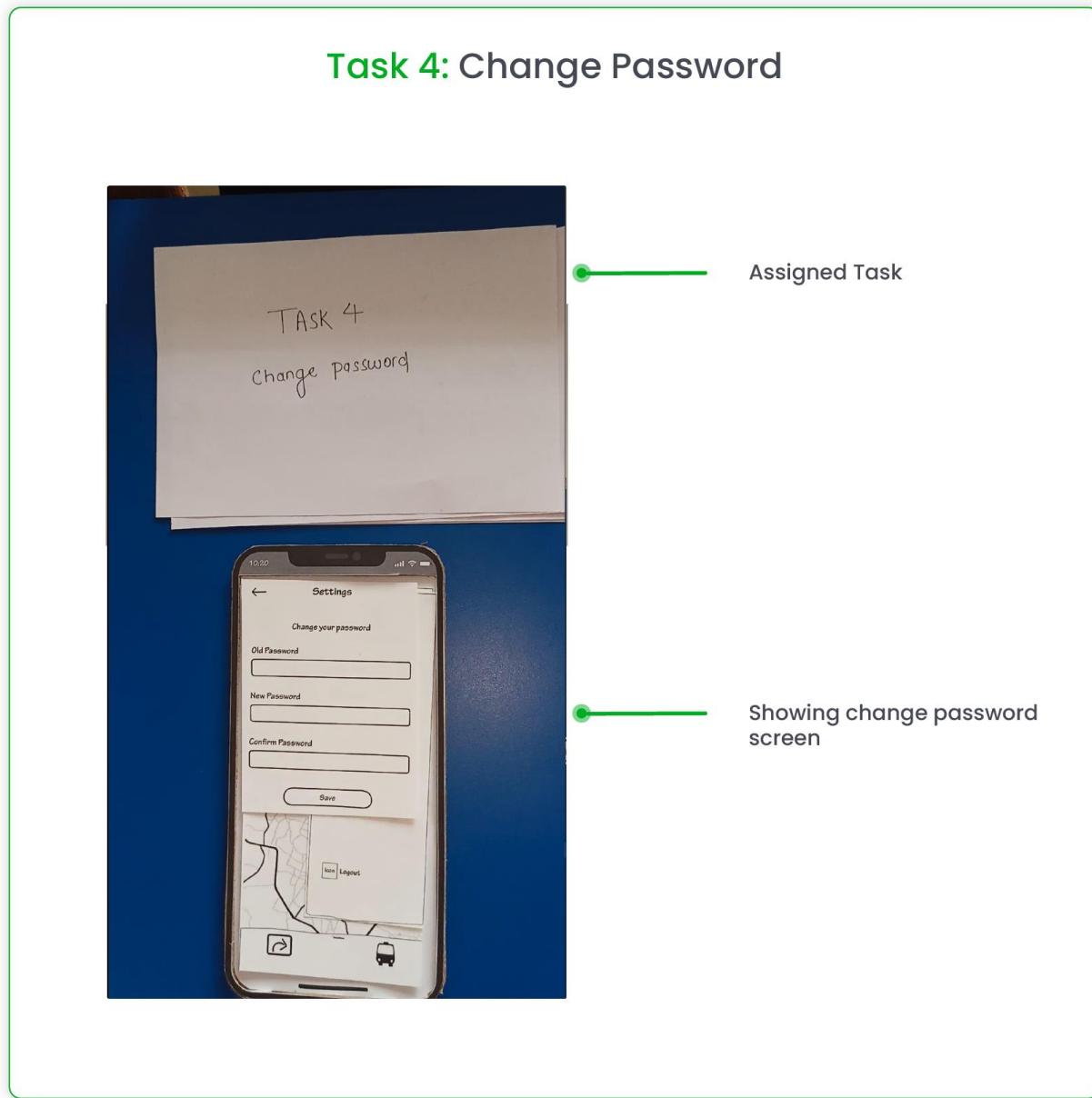


Figure 80 Task 4

Task 5

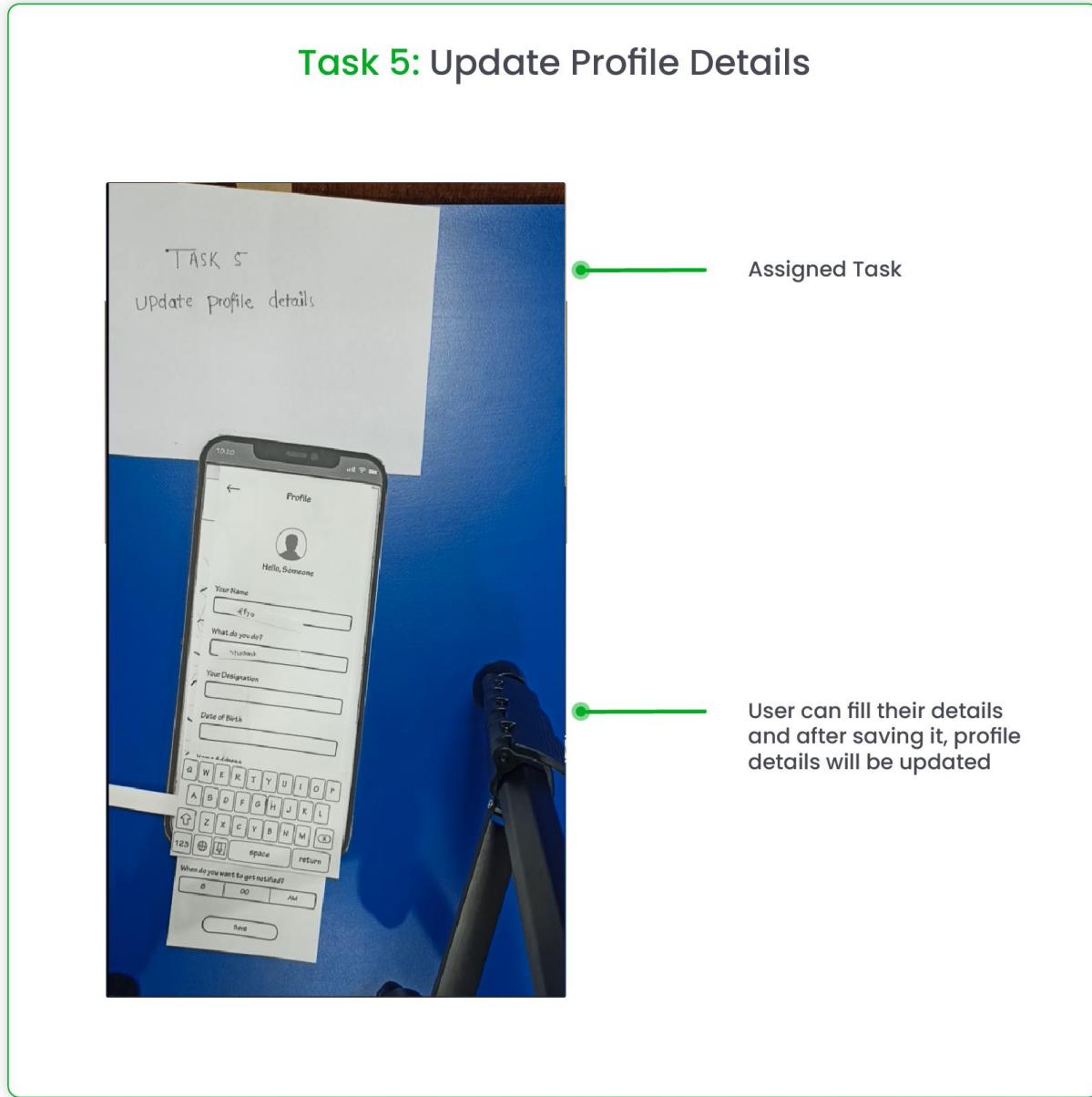


Figure 81 Task 5

Task 6

Task 6: Login with owner and add route, driver & Bus

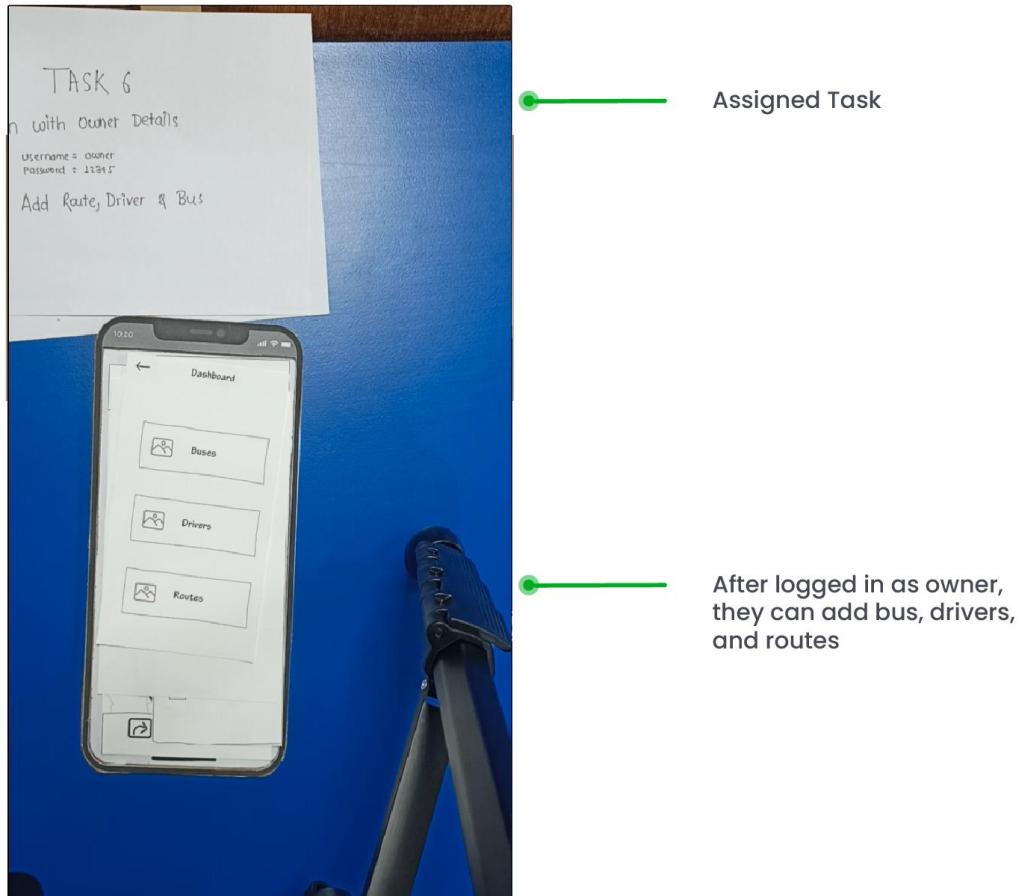


Figure 82 Task 6

Task 7

Task 7: Login with driver account and accept bus invitation

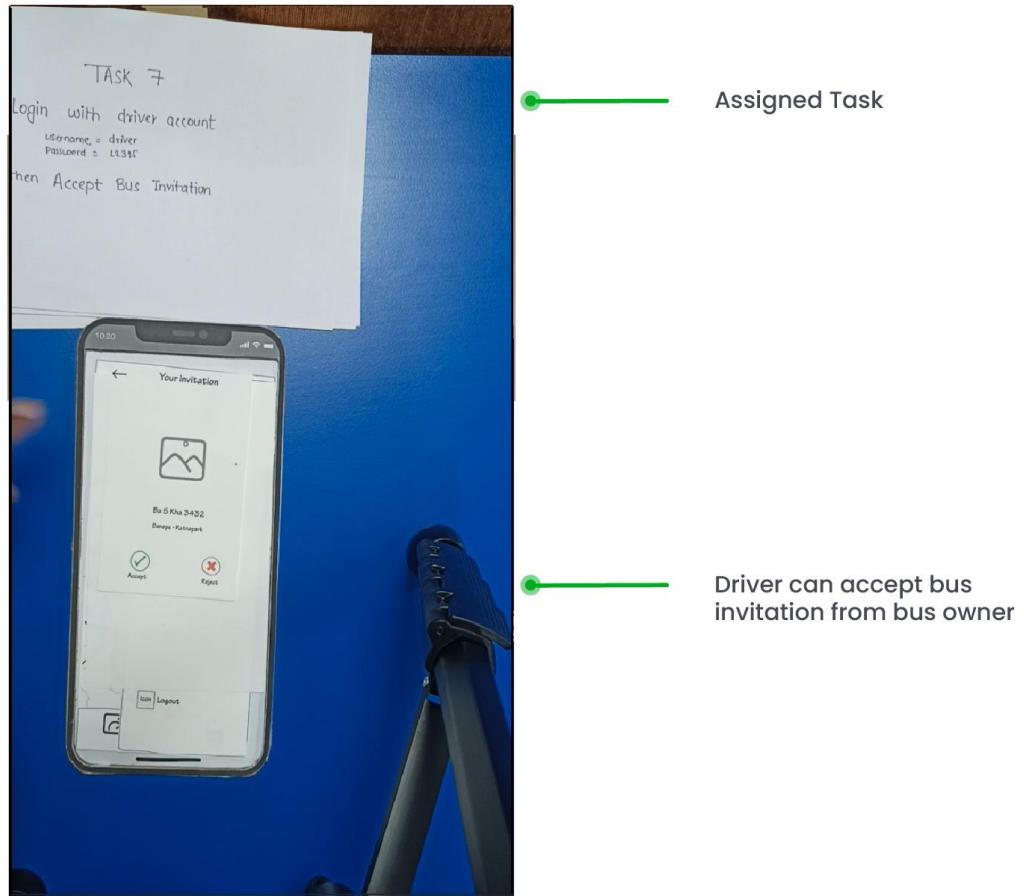


Figure 83 Task 7

Task 8

Task 8: Allow Tracking

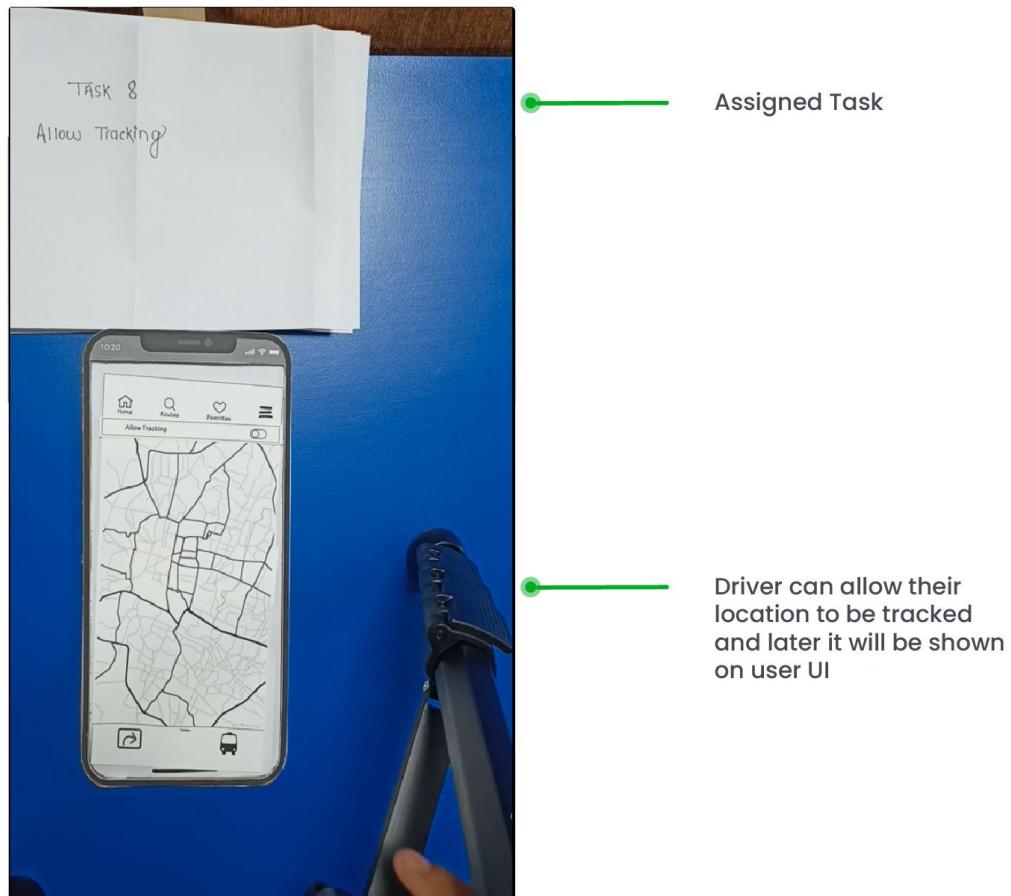


Figure 84 Task 8

Task 9

Task 9: Login with admin then add bus station

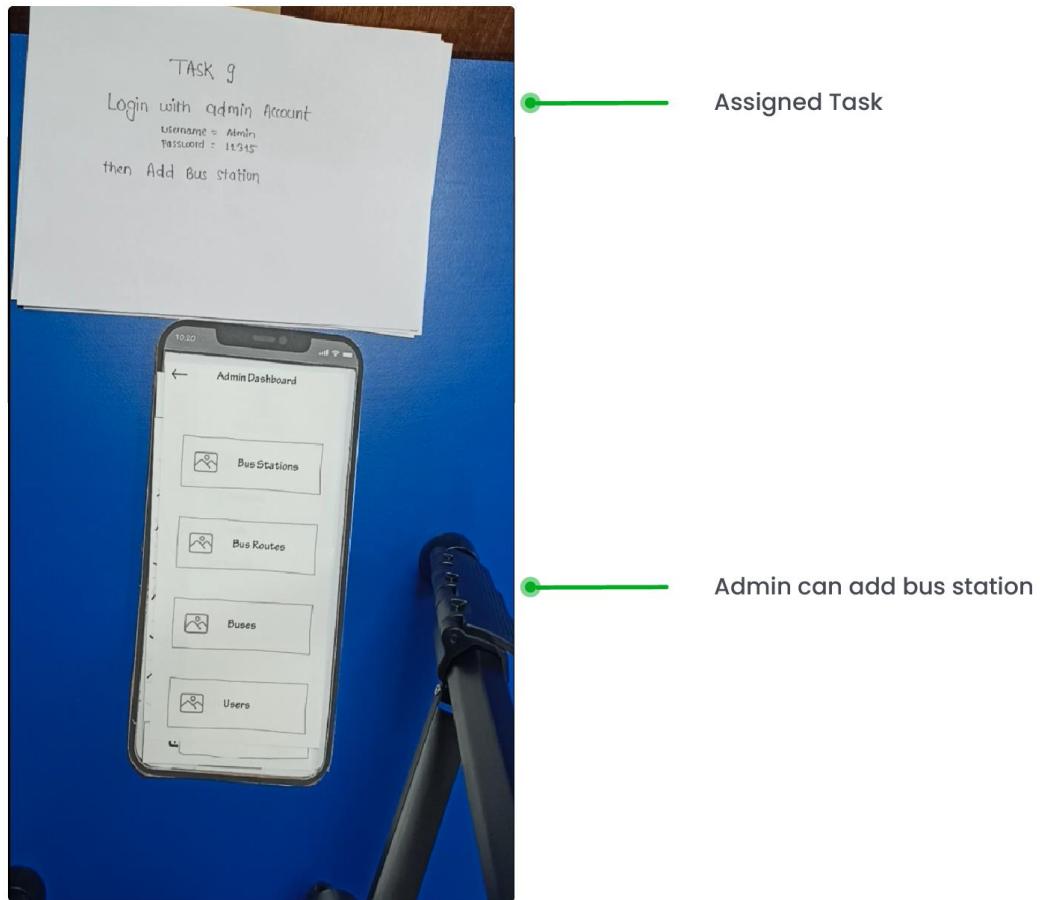


Figure 85 Task 9

Task 10

Task 10: Add Bus Route

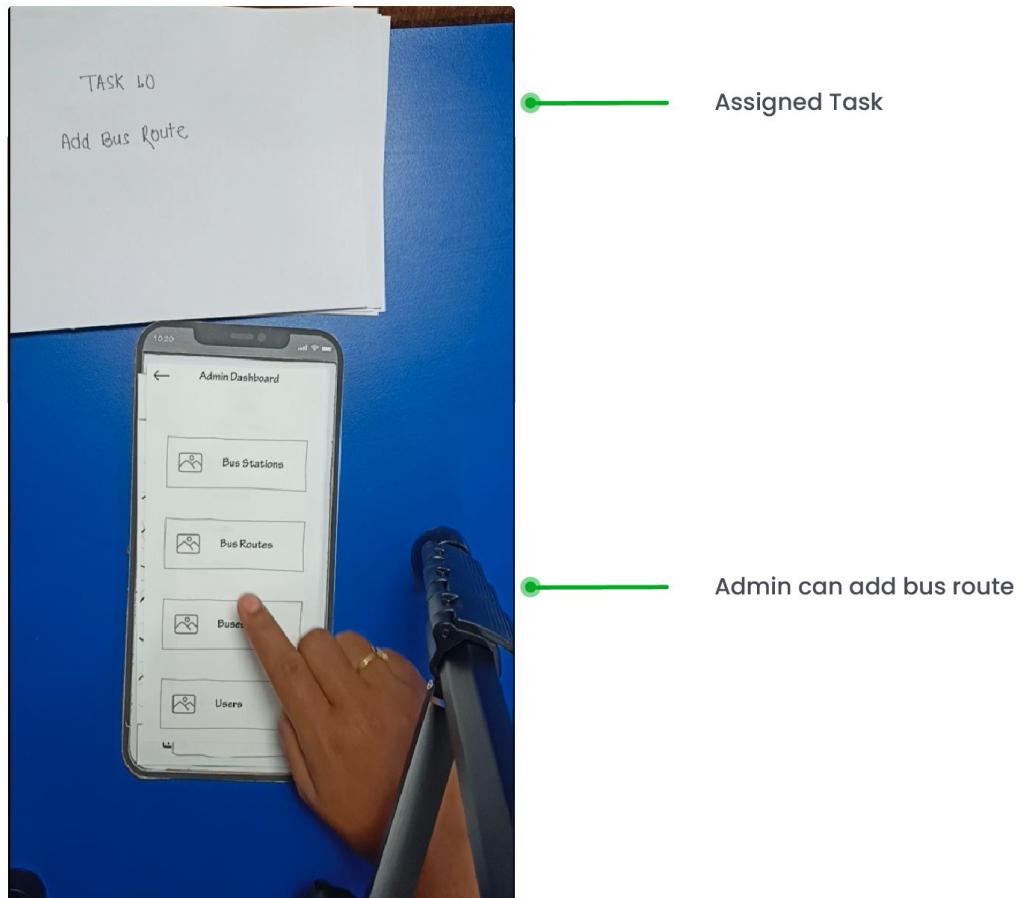


Figure 86 Task 10

Task 11

Task 11: Suspend User

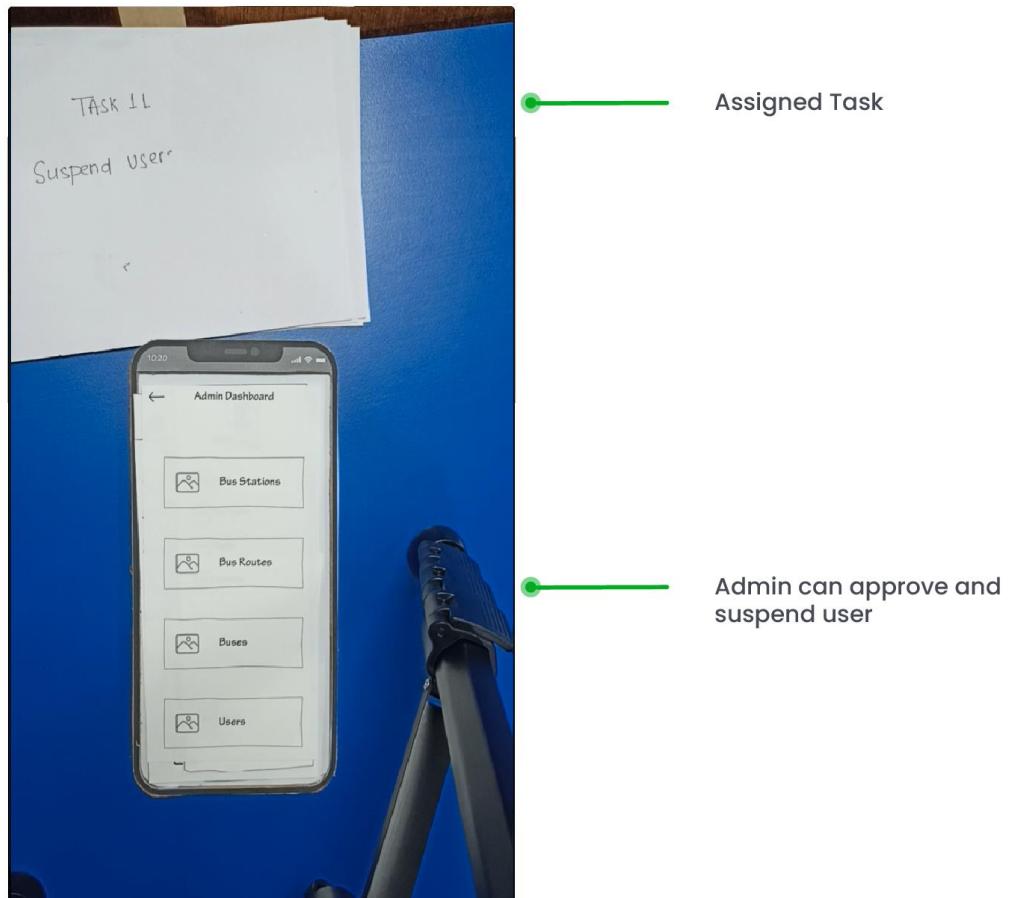
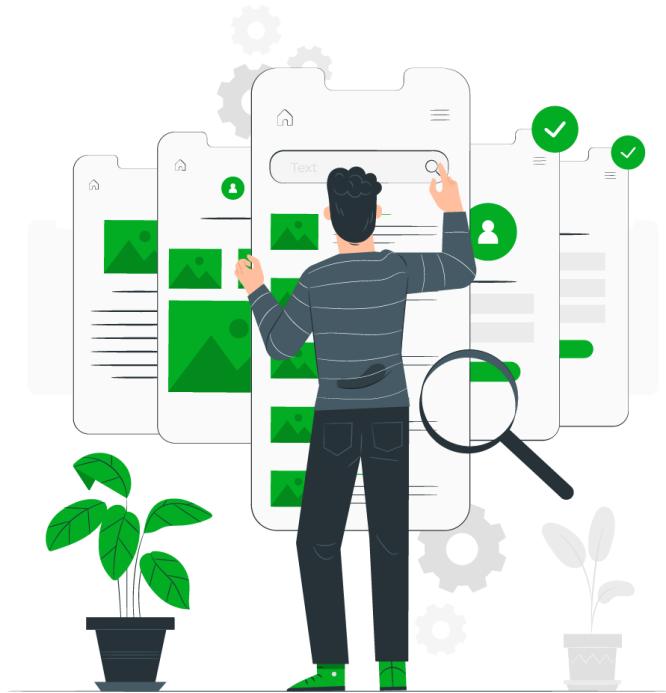


Figure 87 Task 11

Results

Result of Low Fidelity Testing



During the prototype testing, we discovered several flaws in our application that caused users to be unsure of what they were supposed to accomplish at various points during the test. These problems ranged in size from major to minor, with some affecting everyone who used the program and others being personal preferences. These outcomes are organized by the application area in which they were discovered.

Figure 88 Result of Low fidelity testing

Observation

Qualitative and Quantitative data were gathered by crew member based on their response and facial expression while performing the usability testing. Based on these result following test metrics are considered to better improve the application which are shown below.

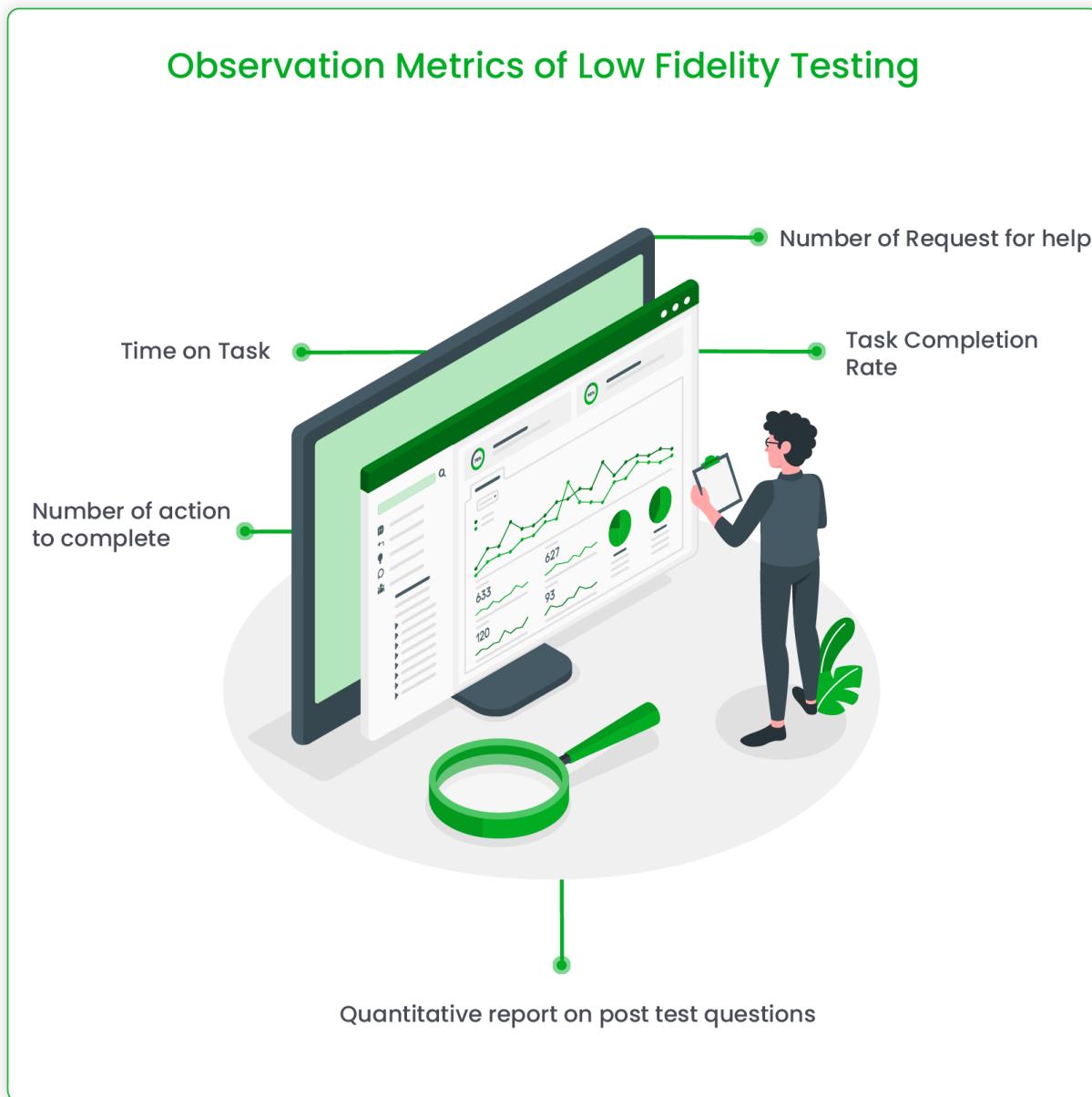


Figure 89 Observation metrics of low fidelity testing

Time on Task

Because everyone has different cognitive abilities, learnability and memorability differ from person to person. It's critical to figure out how long it takes a user to complete a certain task. By determining the amount of time spent on each task, we can examine the data and determine which task need to be improved to provide a better user experience.



Low Fidelity - Time on Task						
Tasks	User 1	User 2	User 3	User 4	User 5	Average
Task 1	68 seconds	59 seconds	70 seconds	80 seconds	55 seconds	67 seconds
Task 2	93 seconds	108 seconds	121 seconds	130 seconds	87 seconds	107 seconds
Task 3	60 seconds	48 seconds	40 seconds	30 seconds	20 seconds	40 seconds
Task 4	57 seconds	50 seconds	70 seconds	47 seconds	60 seconds	57 seconds
Task 5	110 seconds	97 seconds	123 seconds	103 seconds	106 seconds	108 seconds
Task 6	306 seconds	283 seconds	300 seconds	350 seconds	296 seconds	307 seconds
Task 7	89 seconds	78 seconds	95 seconds	67 seconds	102 seconds	86 seconds
Task 8	20 seconds	18 seconds	17 seconds	29 seconds	15 seconds	20 seconds
Task 9	214 seconds	208 seconds	180 seconds	240 seconds	201 seconds	209 seconds
Task 10	87 seconds	73 seconds	83 seconds	67 seconds	91 seconds	80 seconds
Task 11	53 seconds	68 seconds	43 seconds	39 seconds	43 seconds	49 seconds

Figure 90 Low Fidelity - Time on Task

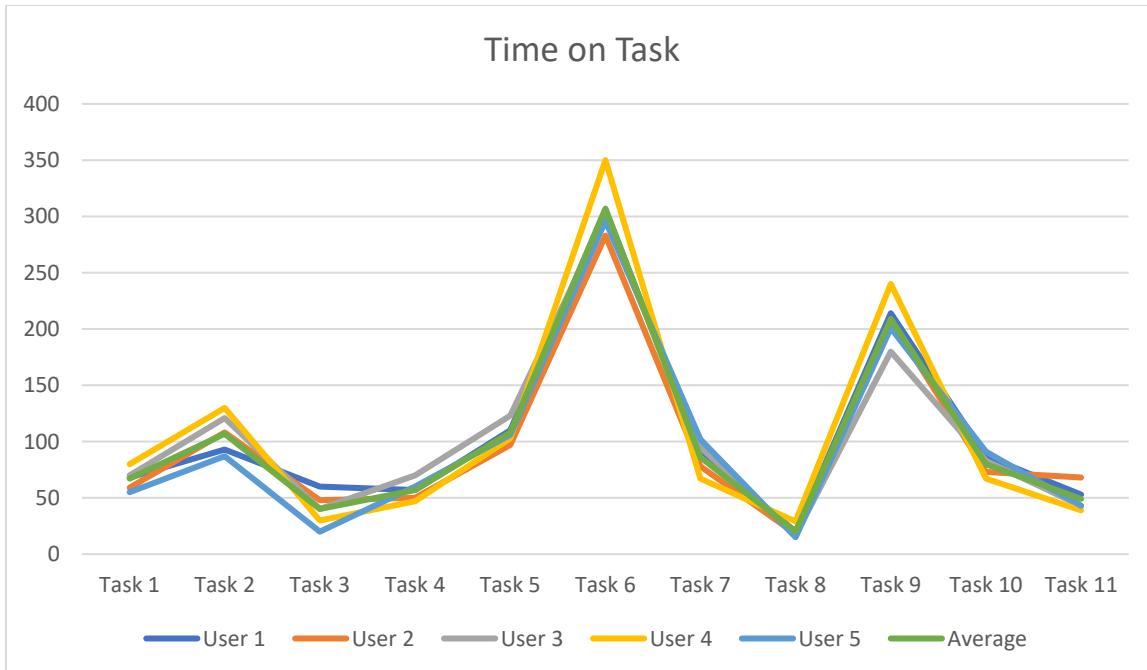


Figure 91 Line Graph for Time on task

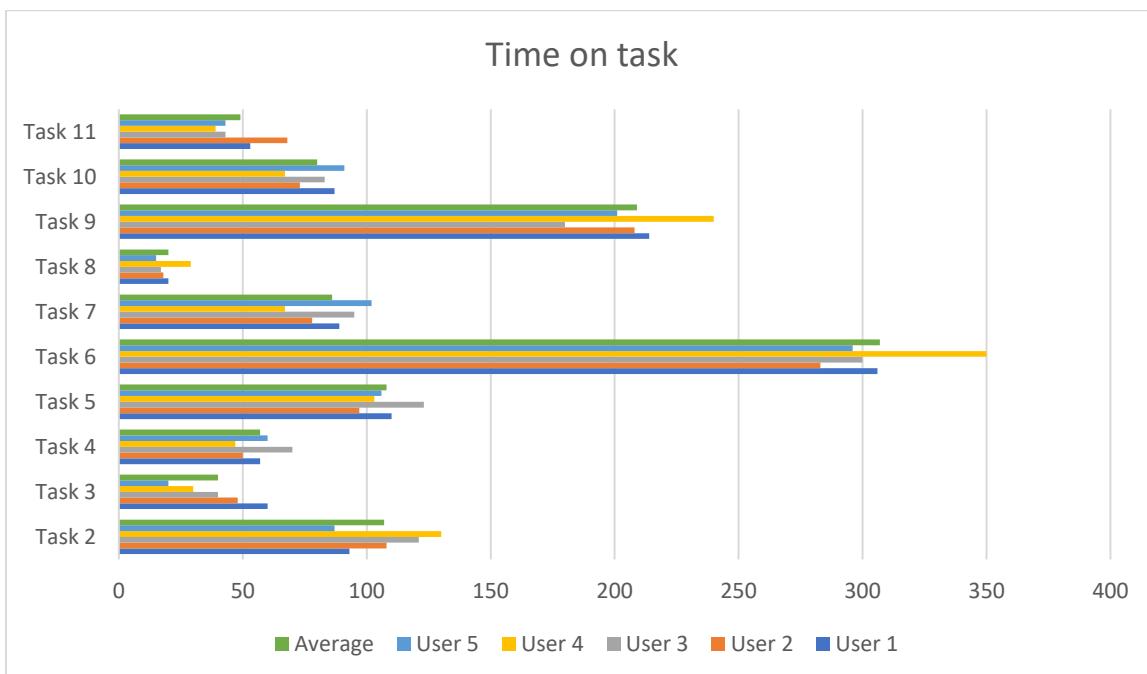


Figure 92 Bar Chart for time on task

Task Completion Ratio



Low Fidelity - Task Completion Ratio

Users Tasks	User 1	User 2	User 3	User 4	User 5	Result
Task 1	Yes	Yes	Yes	Yes	Yes	100%
Task 2	Yes	No	Yes	Yes	Yes	80%
Task 3	Yes	Yes	Yes	Yes	Yes	100%
Task 4	Yes	Yes	No	Yes	Yes	80%
Task 5	Yes	Yes	Yes	Yes	Yes	100%
Task 6	No	Yes	Yes	Yes	No	60%
Task 7	Yes	Yes	Yes	No	No	60%
Task 8	Yes	Yes	Yes	Yes	Yes	100%
Task 9	Yes	No	Yes	Yes	Yes	80%
Task 10	Yes	Yes	No	Yes	Yes	80%
Task 11	Yes	No	Yes	Yes	Yes	80%

Figure 93 Task Completion Ratio

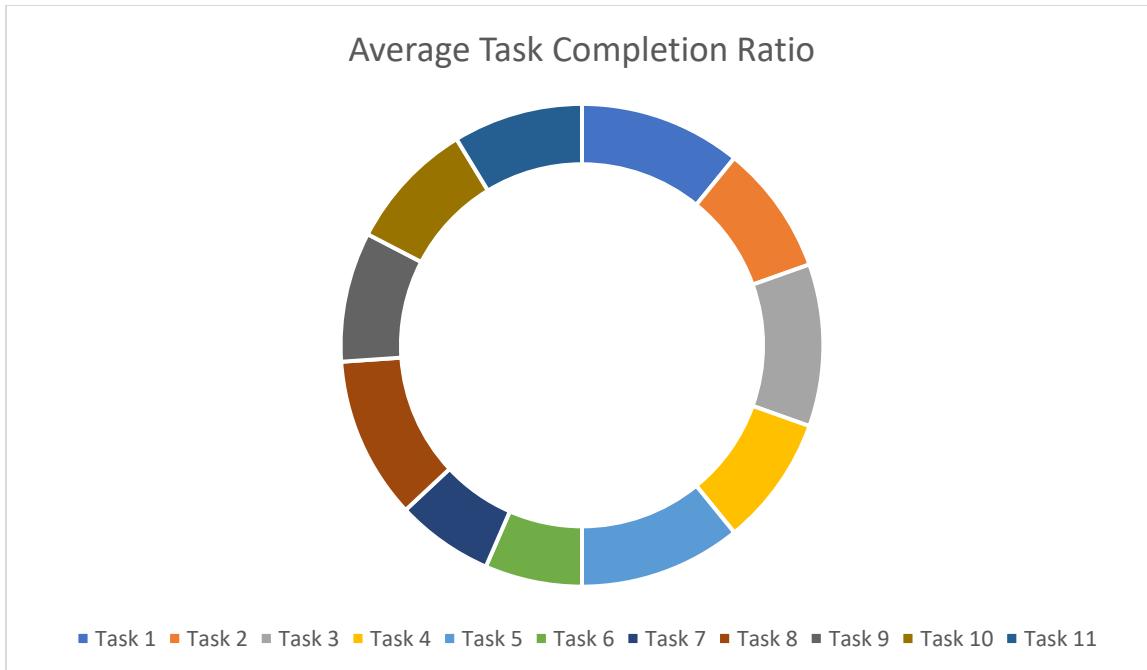


Figure 94 Average Task Completion Ratio

Number of Action to Complete Task

Number of clicks to complete a task determines how user interacted with the UI, and it helps to determine how long user took to complete specific task while comparing with other users.



Low Fidelity – Number of Action to Complete Task

Tasks \ Users	User 1	User 2	User 3	User 4	User 5	Average
Task 1	14	13	11	10	14	12
Task 2	23	21	23	34	21	24
Task 3	10	12	9	10	11	10
Task 4	7	9	7	10	6	8
Task 5	18	16	18	19	17	18
Task 6	56	54	45	49	51	51
Task 7	23	21	22	19	22	21
Task 8	3	5	2	6	3	4
Task 9	64	47	54	46	51	52
Task 10	12	11	14	9	10	11
Task 11	8	7	10	6	7	8

Figure 95 Number of Action to complete task

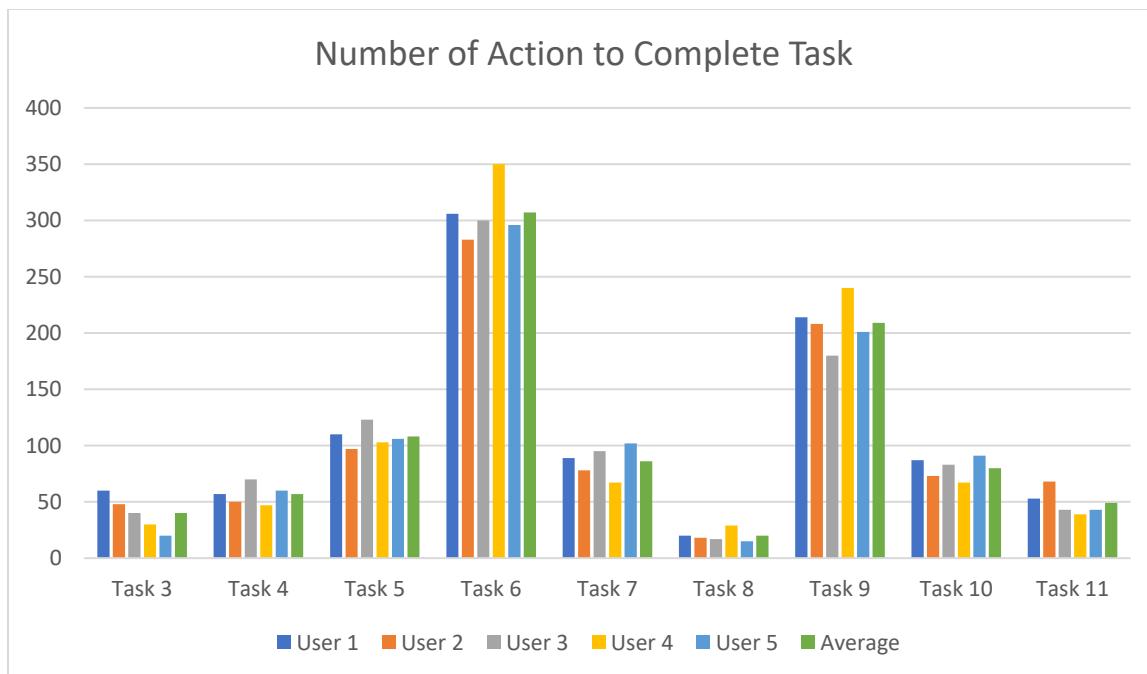


Figure 96 Number of Action to Complete Task

Number of requests for help

Most users were from different background including medicine and school student, since they are not well adapted to new technologies, it become hard for some of them to complete the task and they do ask for help. This analysis is very important to increase user experience of application as user guide for important features can be provided based on these results. So, in this table below, number of helps asked by specific user are shown.



Users Tasks \	User 1	User 2	User 3	User 4	User 5	Total
Task 1	0	1	0	1	0	2
Task 2	0	0	2	0	0	2
Task 3	0	0	0	0	0	0
Task 4	0	0	1	0	0	1
Task 5	0	1	0	1	2	4
Task 6	4	2	0	1	4	11
Task 7	1	1	0	0	5	7
Task 8	0	0	0	0	1	1
Task 9	1	3	0	1	0	5
Task 10	0	1	1	0	0	2
Task 11	0	0	0	0	0	0

Figure 97 Number of Help Request

CU_ID: 1026917

Quantitative report on after test questionnaire



Metrics Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Agree %
how likely are you to recommend this product to friend?	0	0	0	1	4	100%
Was Easy to find buses and routes	0	0	2	1	2	100%
Was easy to navigate	0	0	1	4	0	100%
App was complex to use	0	2	1	0	2	40%
App gave you sign after each task completion	2	1	0	1	1	40%
Was easy to switch users	4	0	0	1	0	20%
Input form was clear and expressive	0	0	1	3	1	100%
App interface was clean and minimal	0	0	0	2	3	100%
Made to feel good while using the app	0	0	1	3	1	100%

Figure 98 After test questionnaire Quantitative result

After posttest quantitative report, lots of UX bug was identified, where switching user task was in critical phase and I needed to fix that as soon as we can, so I did change the application flow of switching between users.

User Feedback

User feedback was an important component of the testing process since users may provide us with vital information that can allow improving the application's UI and UX lot easier and more practical because they are the ones who will use it. They were urged to provide candid feedback because those details will assist the designer and developer better understand the user and make the application more user centered.

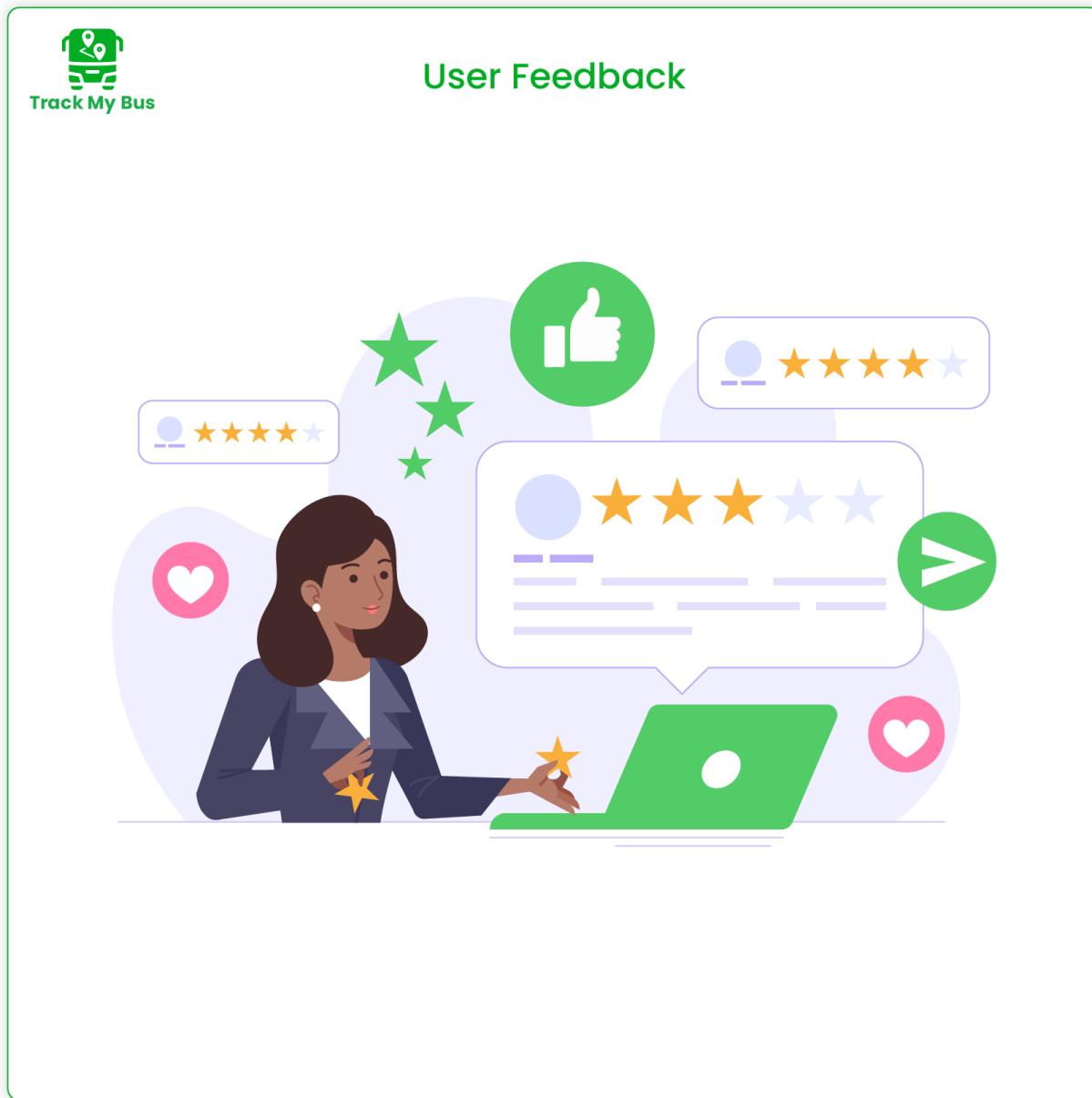


Figure 99 User feedback

Most liked features

After the low-fidelity prototype had been tested, users were asked what they liked most about the app. Most users preferred the tracking bus by route feature, followed by tracking bus based on location. They also loved the ability to favorite a location so that they could quickly access it by selecting their bookmarked location.

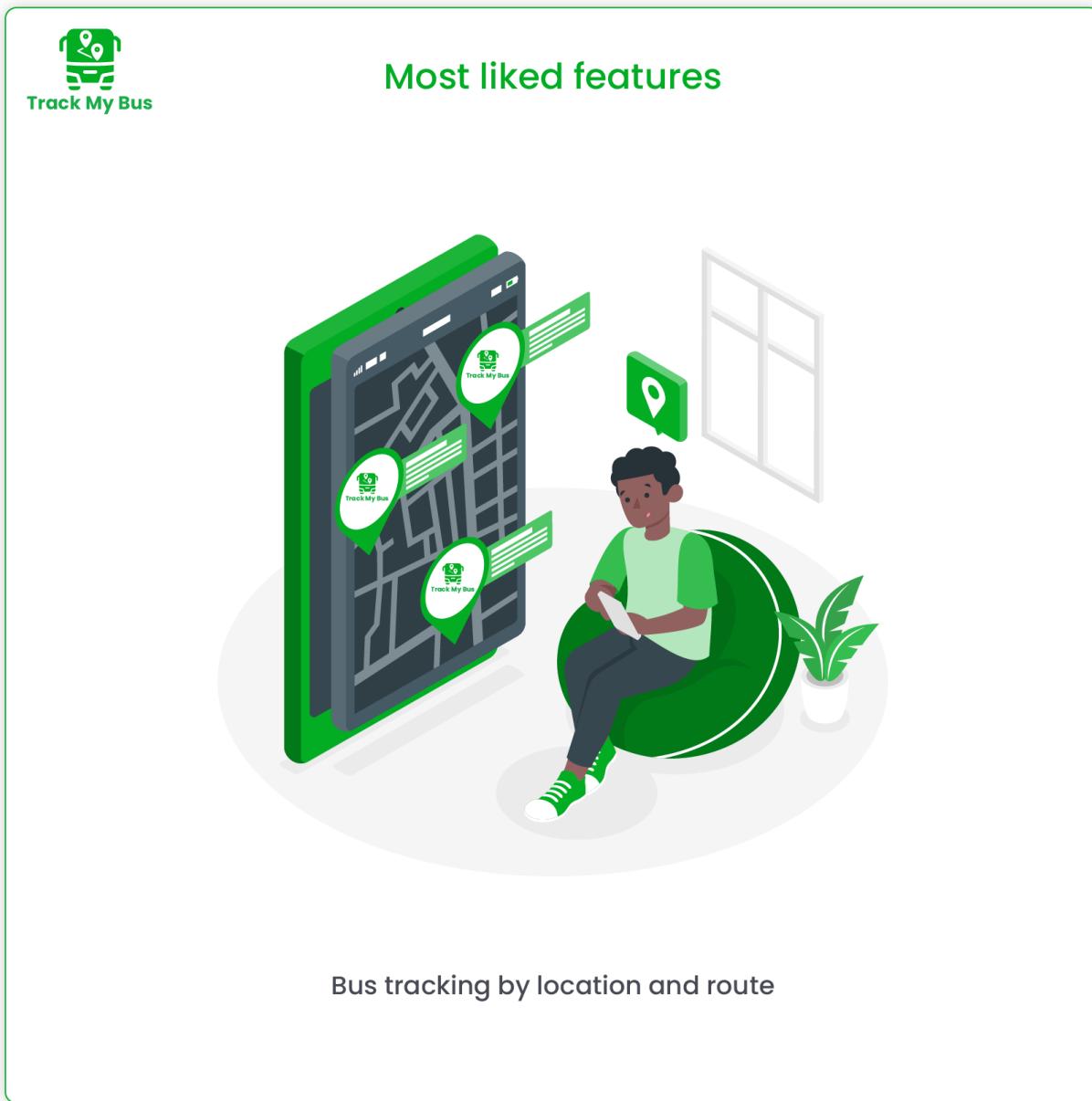


Figure 100 Most liked features

Least liked features

The feature of gathering user information such as home address, office address, and name was disliked by the user. They also didn't appreciate the feature of just being able to schedule one time to receive bus notifications. As a result, the user profile was one of the application's least liked features.

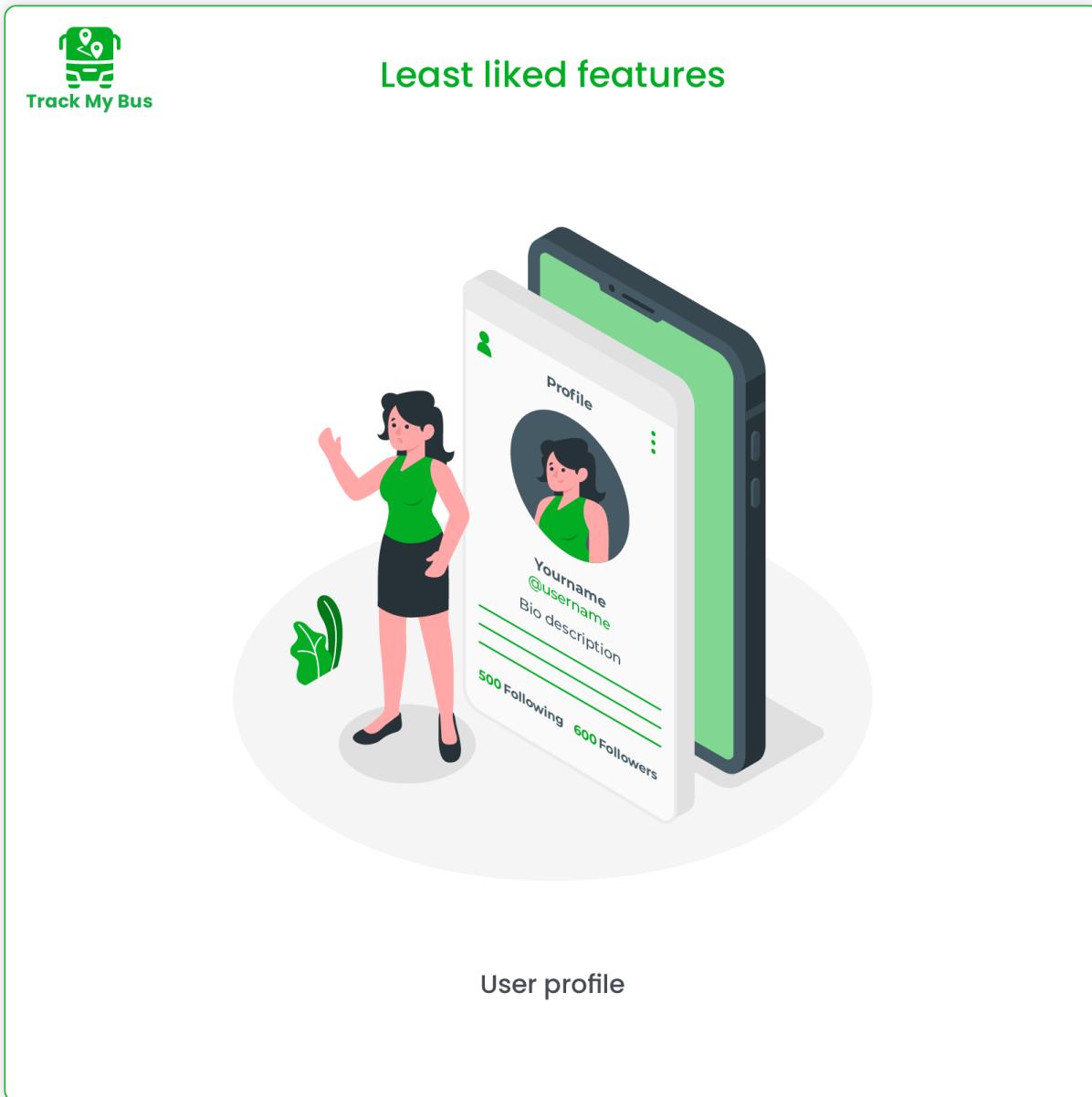


Figure 101 Least Liked Features

Recommendation for improvement

Due to different person have their own perspective, they can better suggest features and give genuine recommendation to improve the application. Some recommendation given by the user are shown below.

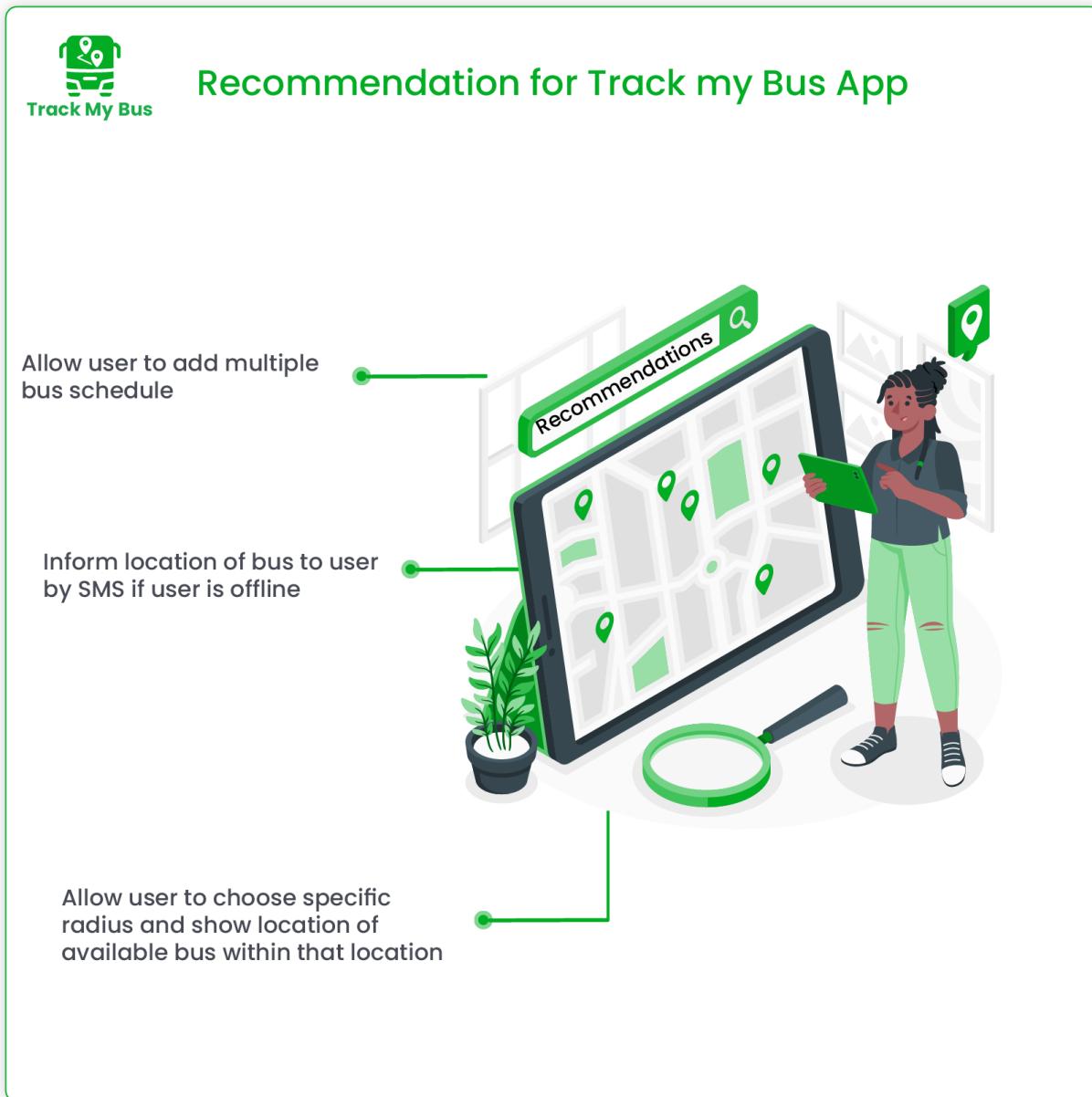


Figure 102 User Recommendation

Conclusion

Before moving on to High Fidelity, it needed to make sure any design problems are addressed by evaluating time on task, task completion ratio, number of actions required to perform a certain task, and how often the user requested help with a specific task. After looking at the time on the task graph, it's clear that task 6 took longer than the others; additionally, task completion rates were lower in task 6 and task 7, and the number of help requests was highest in task 6, followed by task 7 and task 9, implying that task 6 and task 7 are in critical condition and should be redesigned to improve the user experience and make the design more user centered.

High Fidelity Prototype

The level of detail and functionality developed into a prototype is referred to as fidelity of prototype. In this context, a high-fidelity (also known as high-fi or hi-fi) prototype is a computer-based interactive depiction of the product that is the closest in terms of details and functionality to the final design ([Ibragimova, 2016](#)).



Figure 103 Landing UI

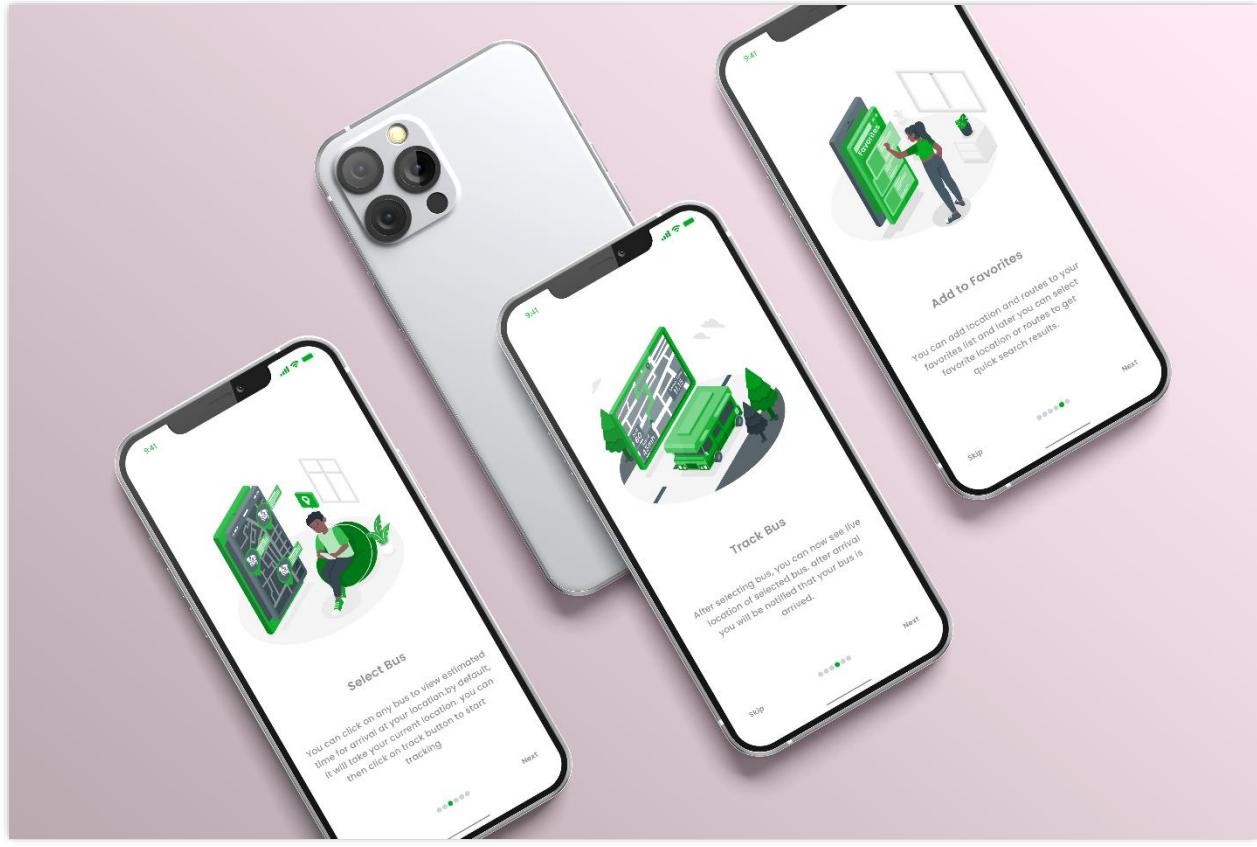


Figure 104 On boarding

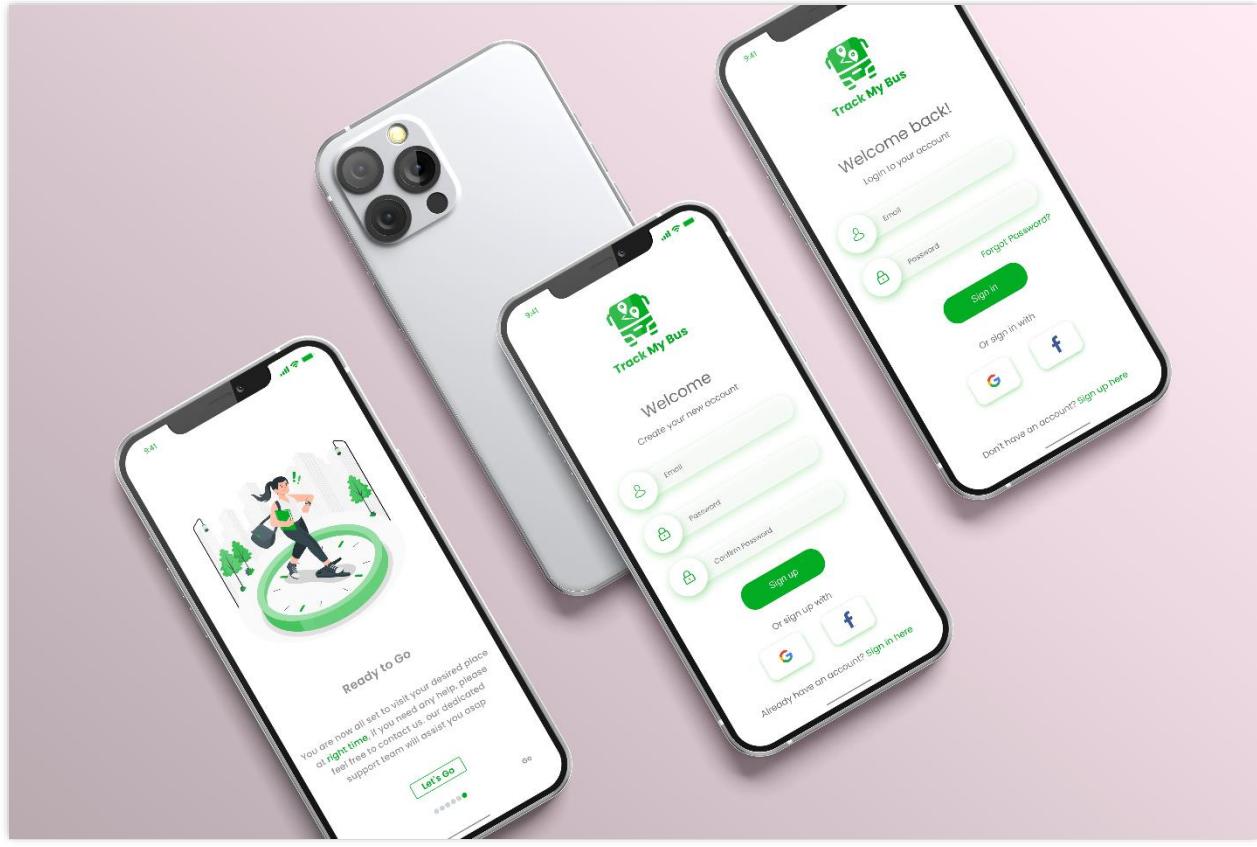


Figure 105 Login and sign up

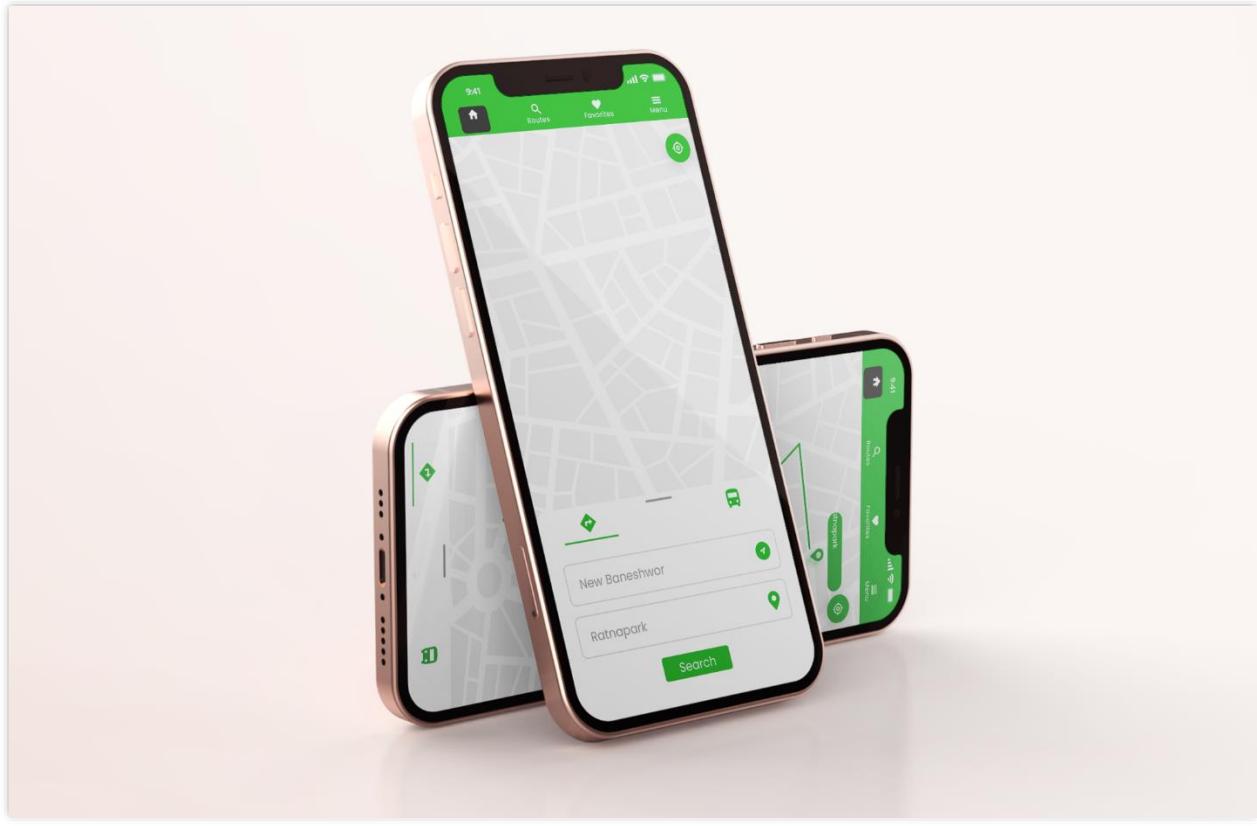


Figure 106 Homepage

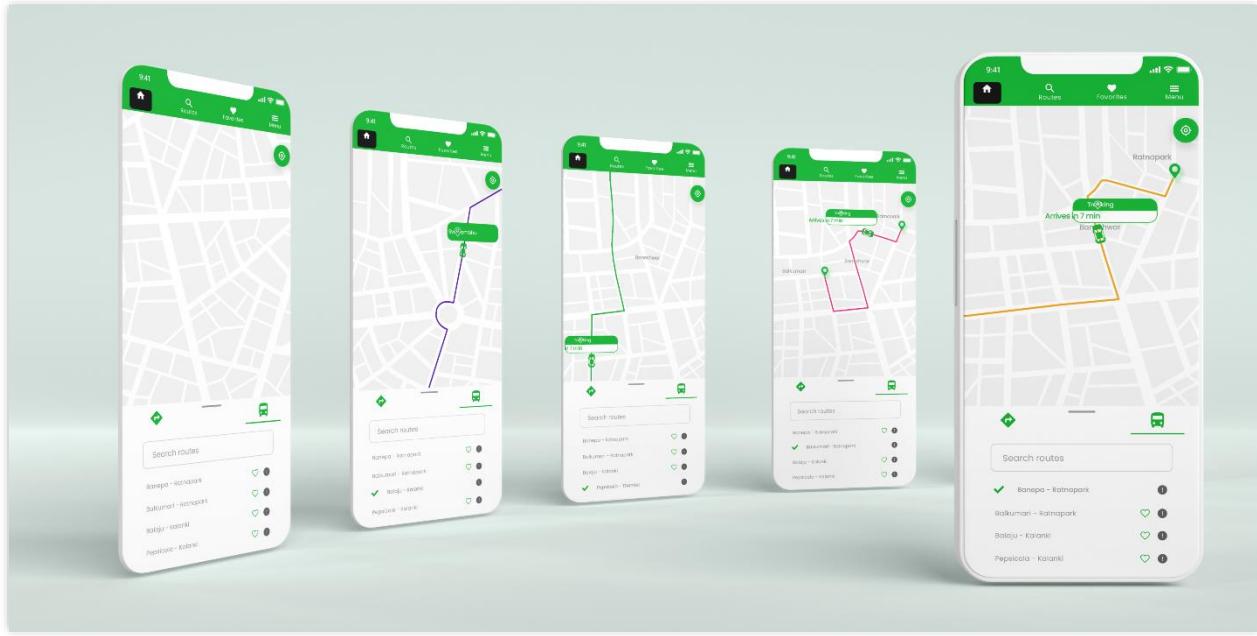


Figure 107 Tracking Bus route

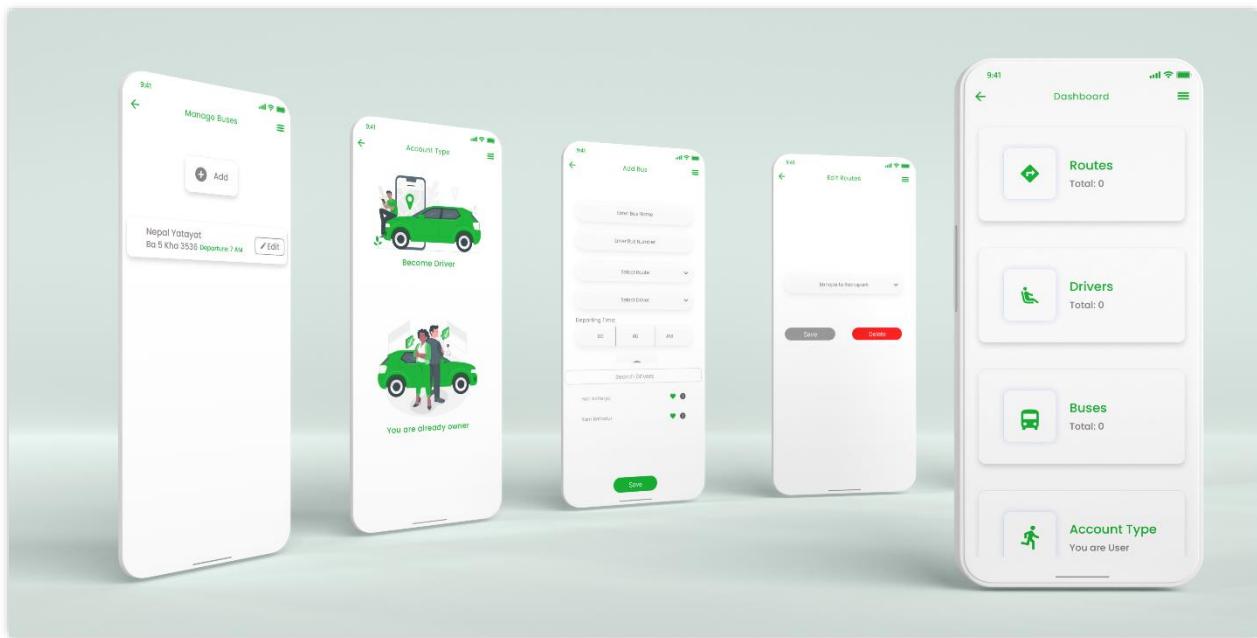


Figure 108 Dashboard

CU_ID: 1026917

Snapshots of High Fidelity User App

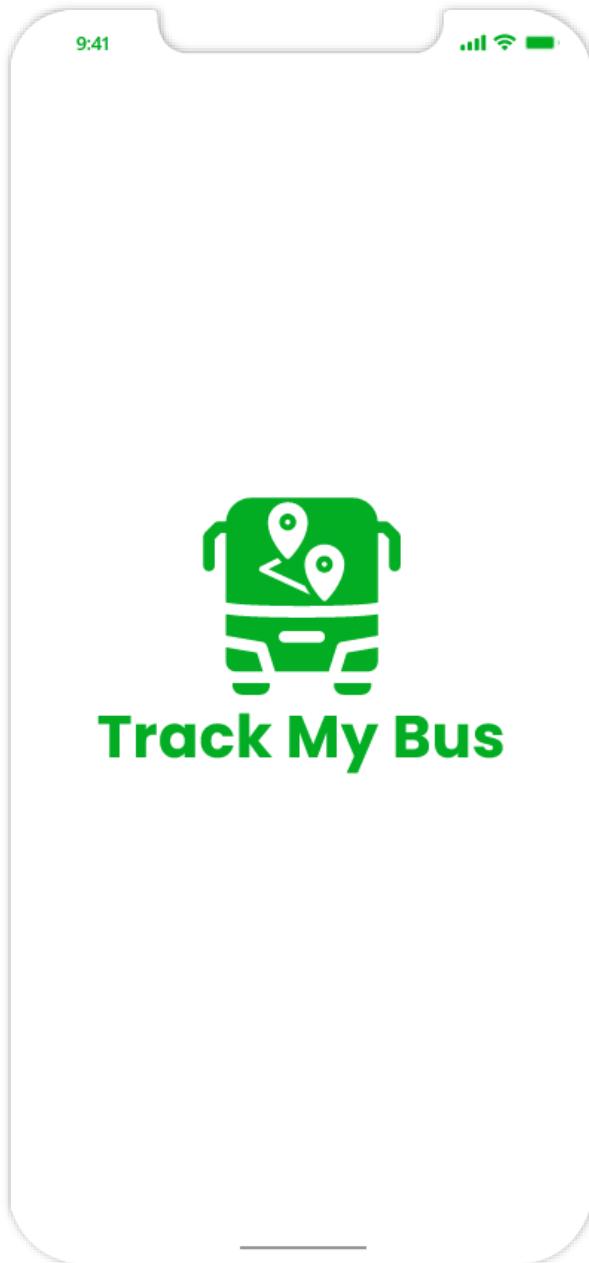


Figure 109 Splash Screen

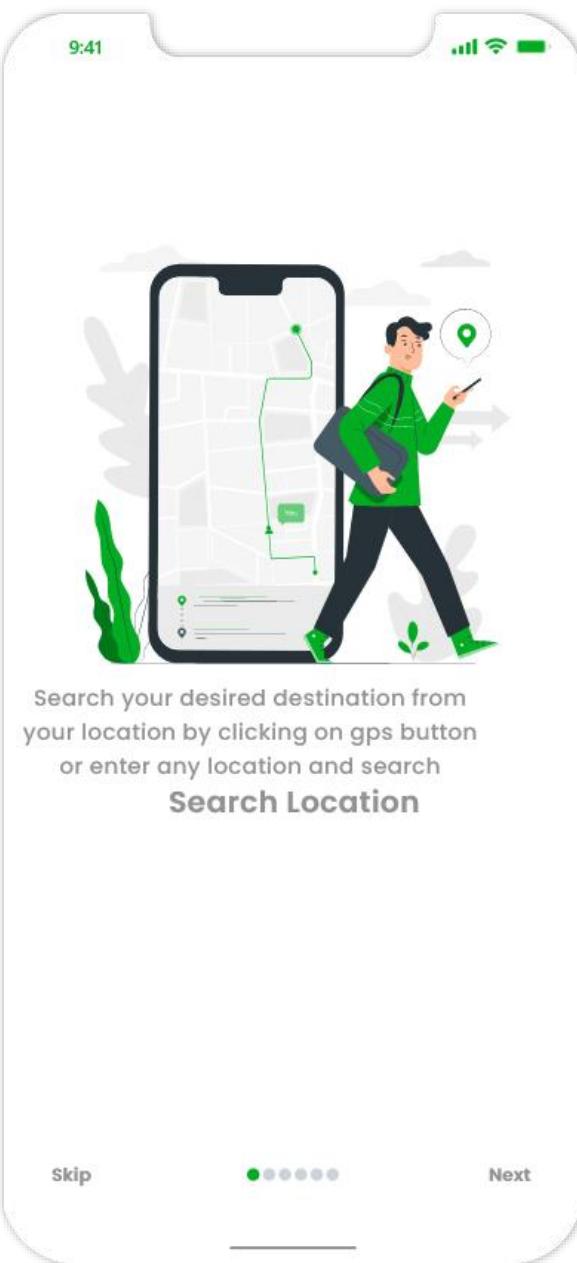


Figure 110 On boarding screen 1

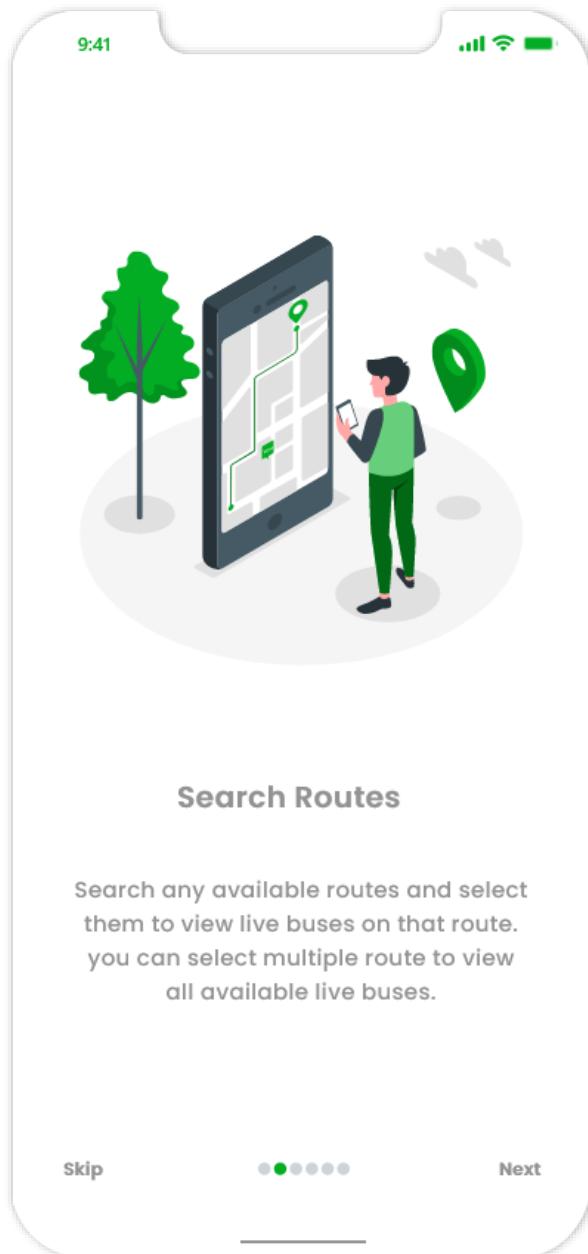


Figure 111 Onboarding screen 2

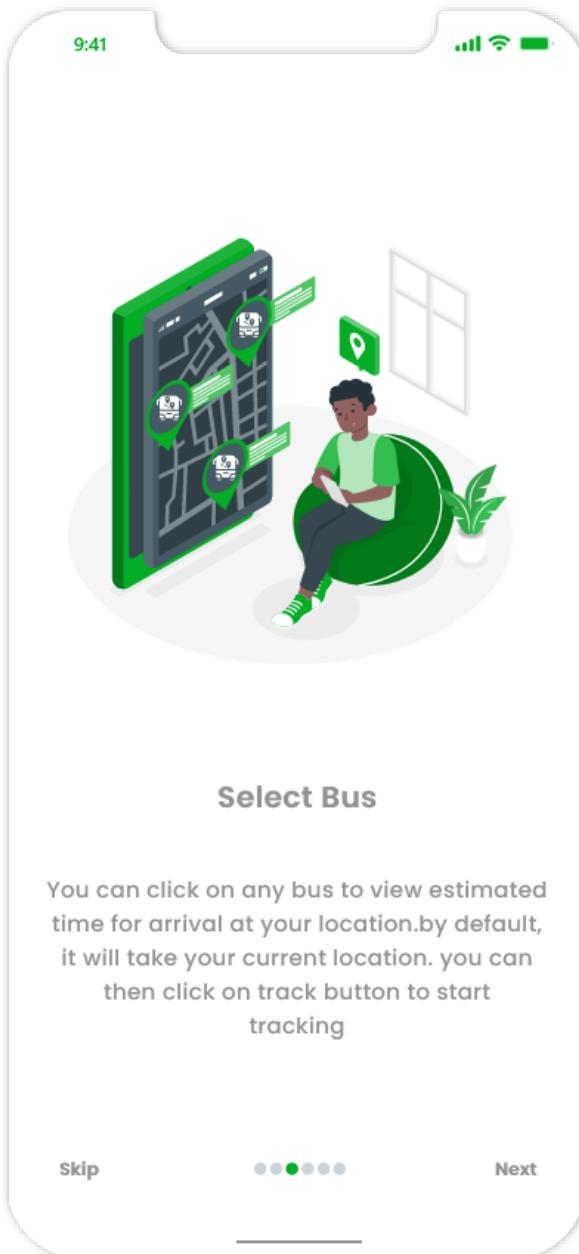


Figure 112 On Boarding screen 3

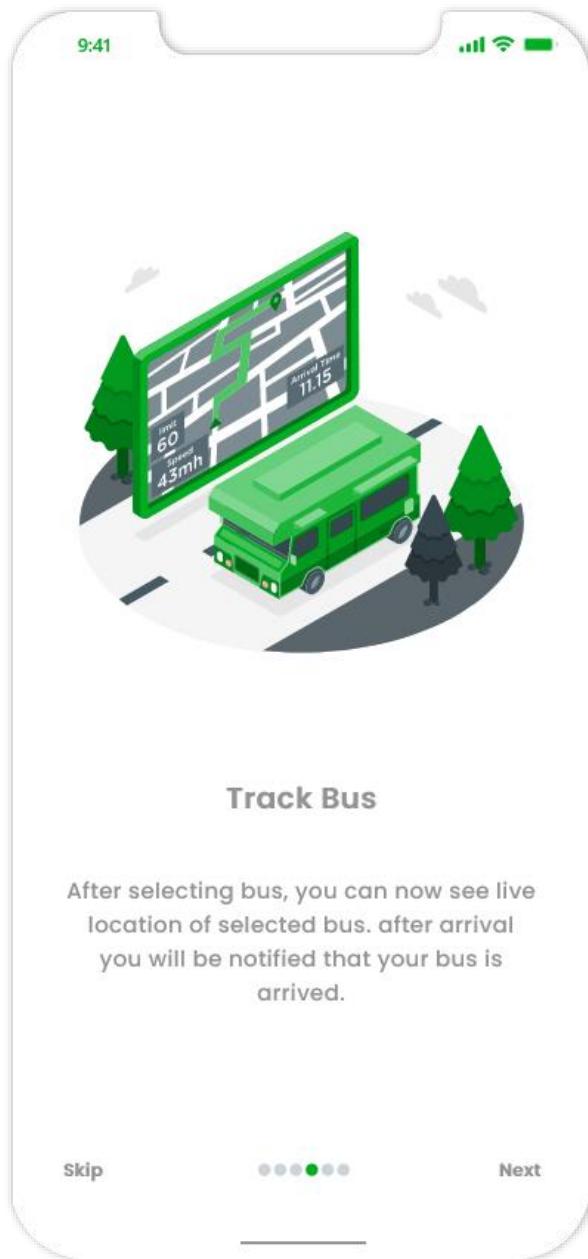


Figure 113 On Boarding screen 4

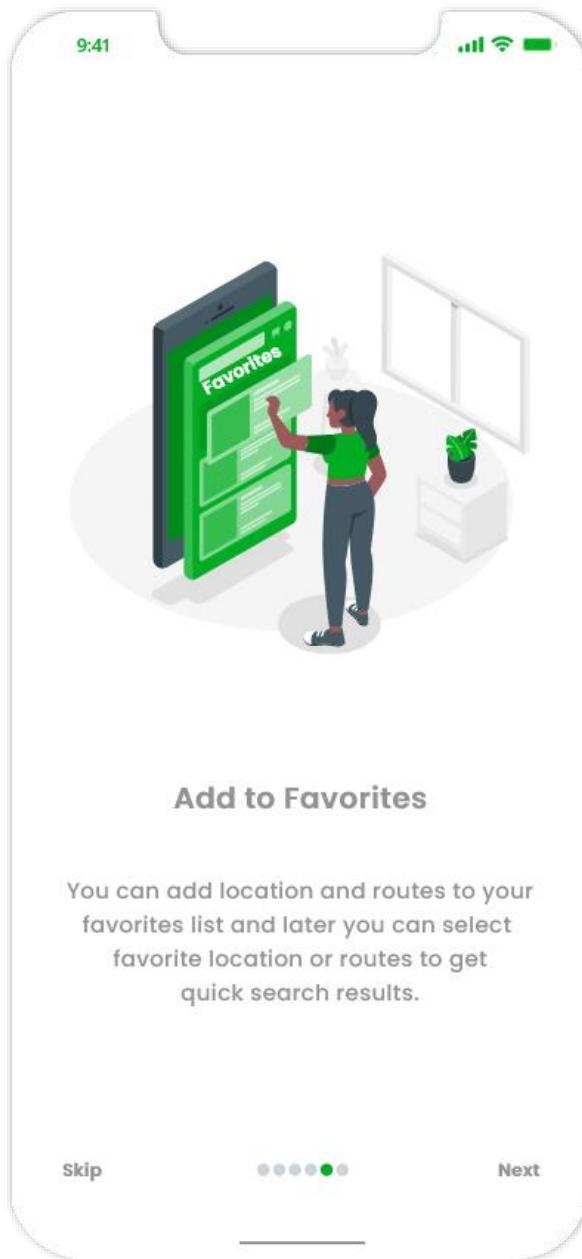


Figure 114 On Boarding screen 5

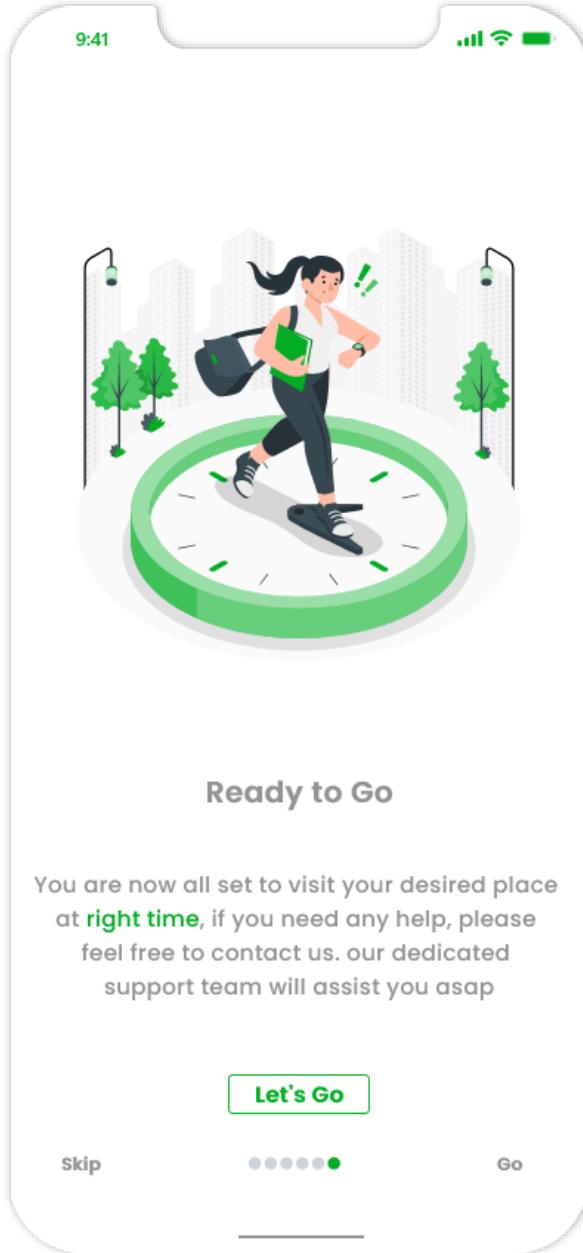


Figure 115 On Boarding screen 6

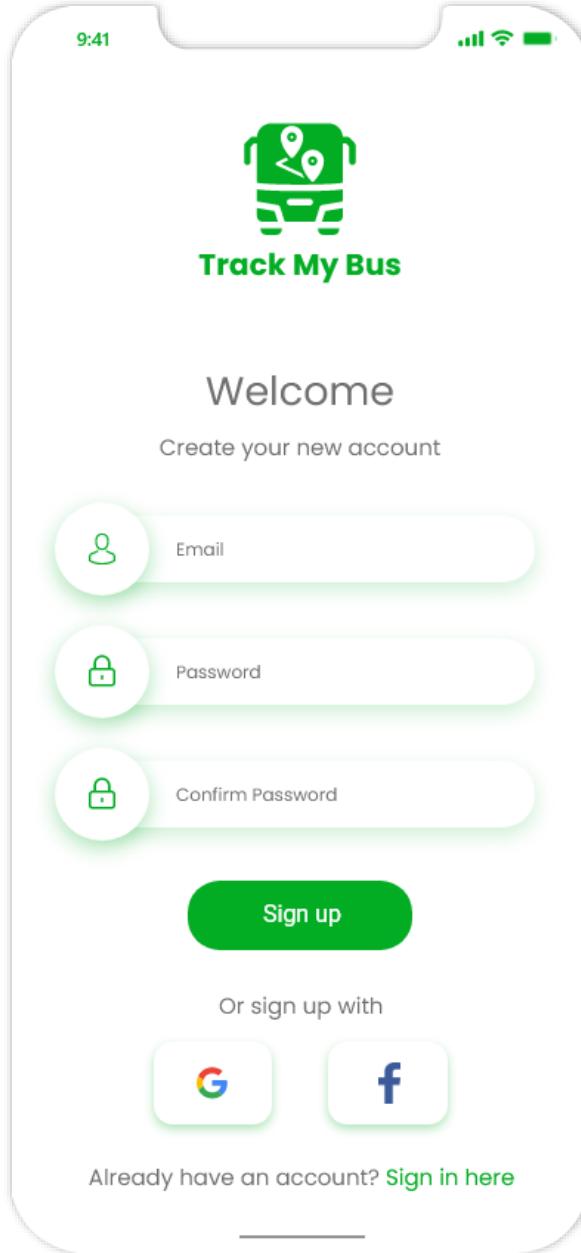


Figure 116 Sign up

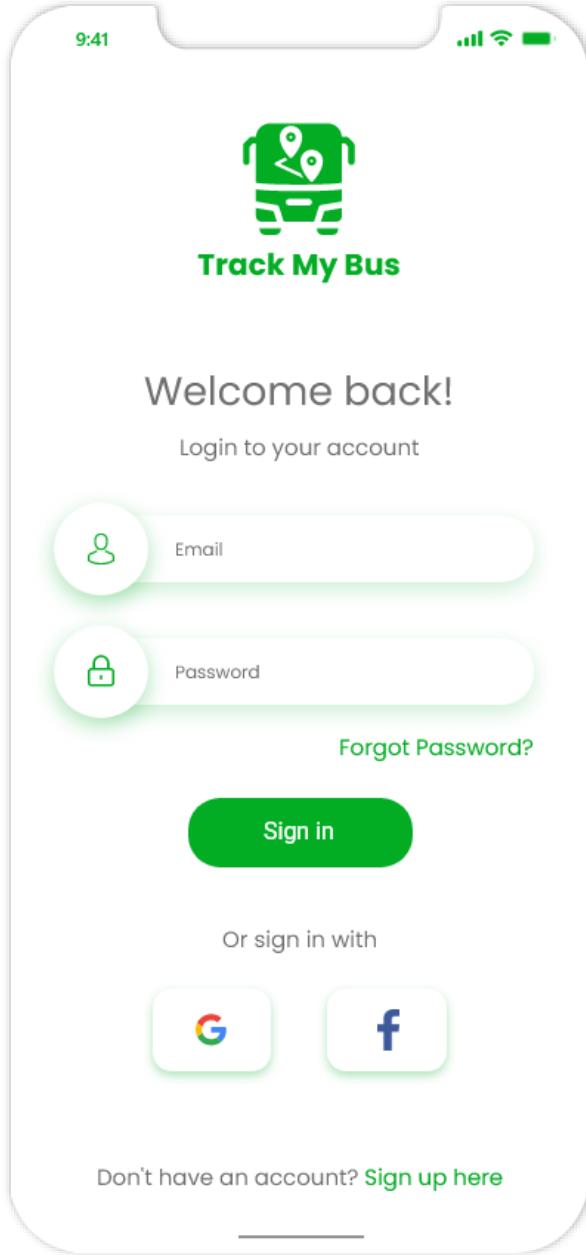


Figure 117 Login



Figure 118 Homepage

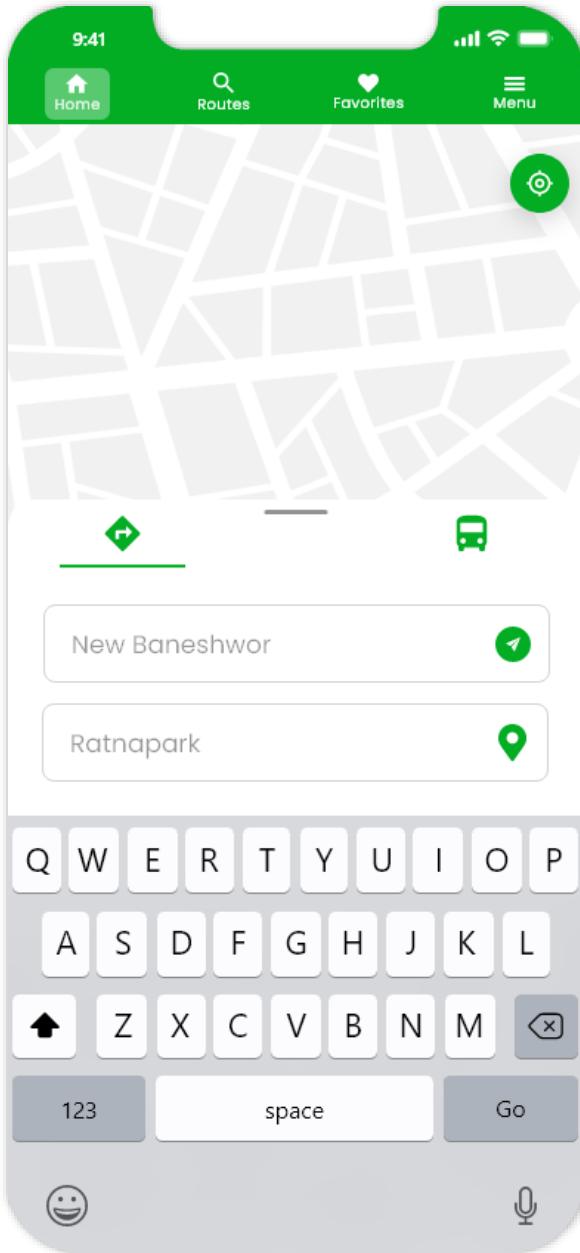


Figure 119 Searching route by source and destination

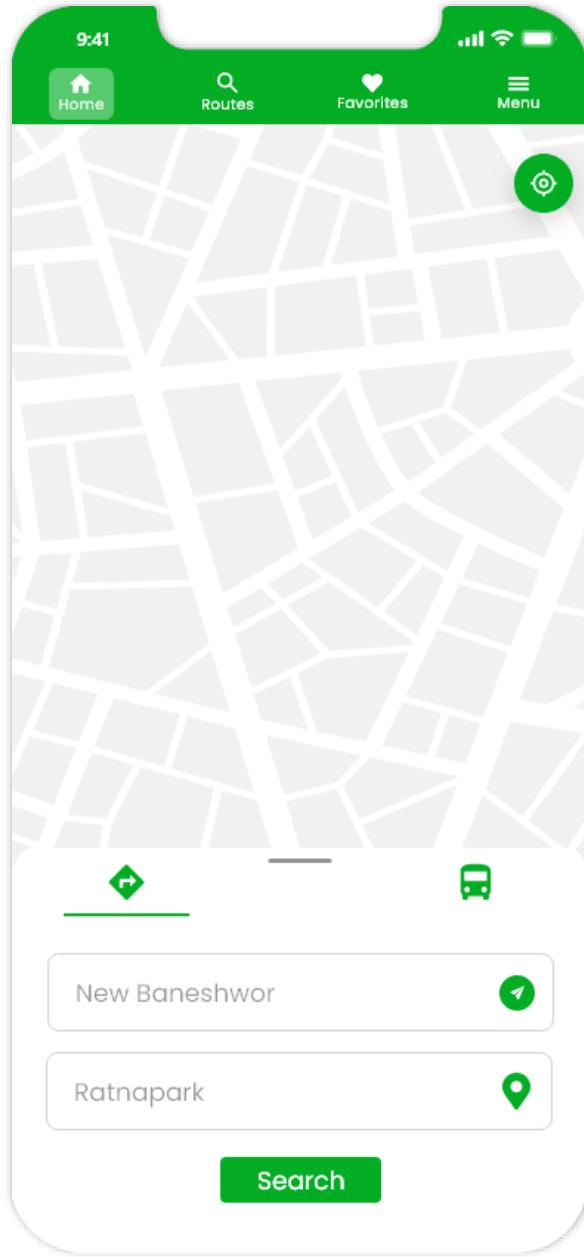


Figure 120 Searching button

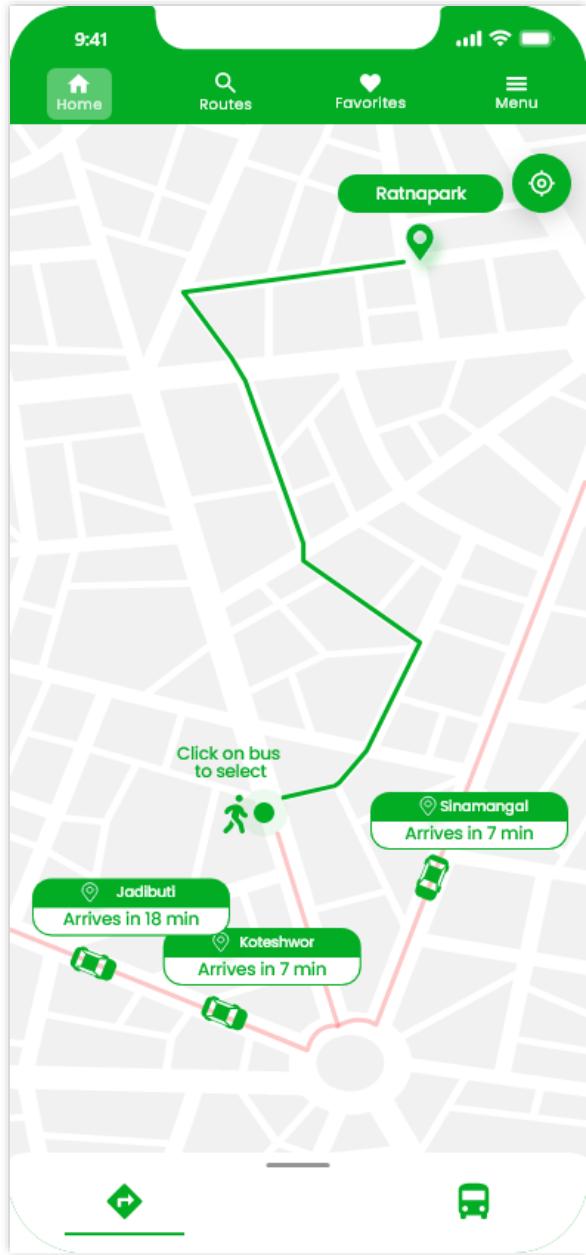


Figure 121 Showing all available bus on that location

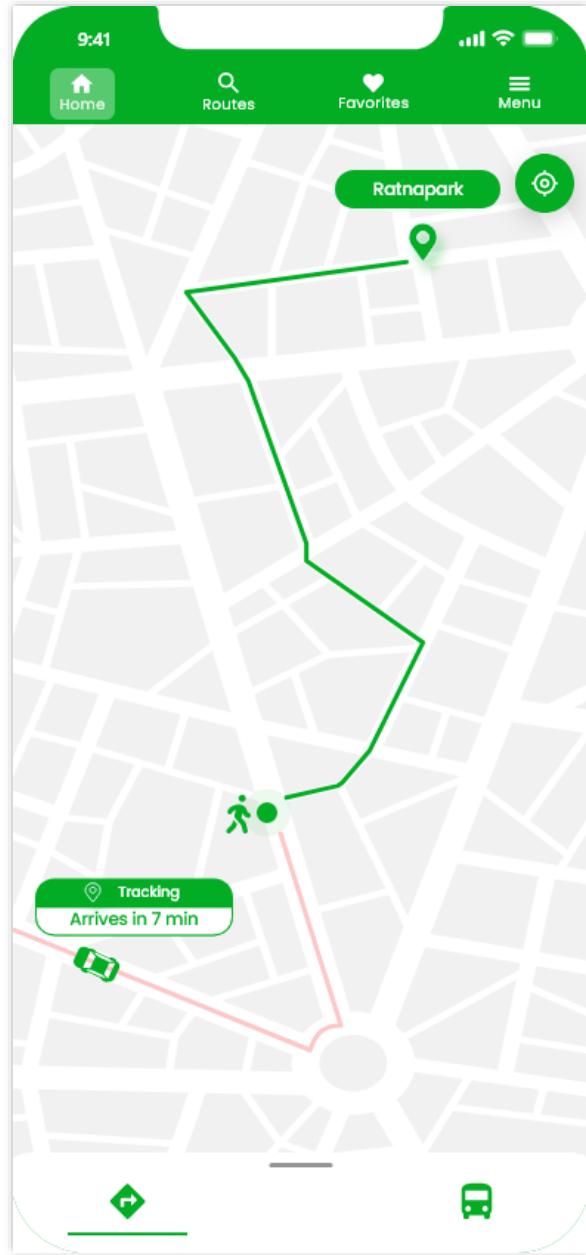


Figure 122 Tracking selected bus

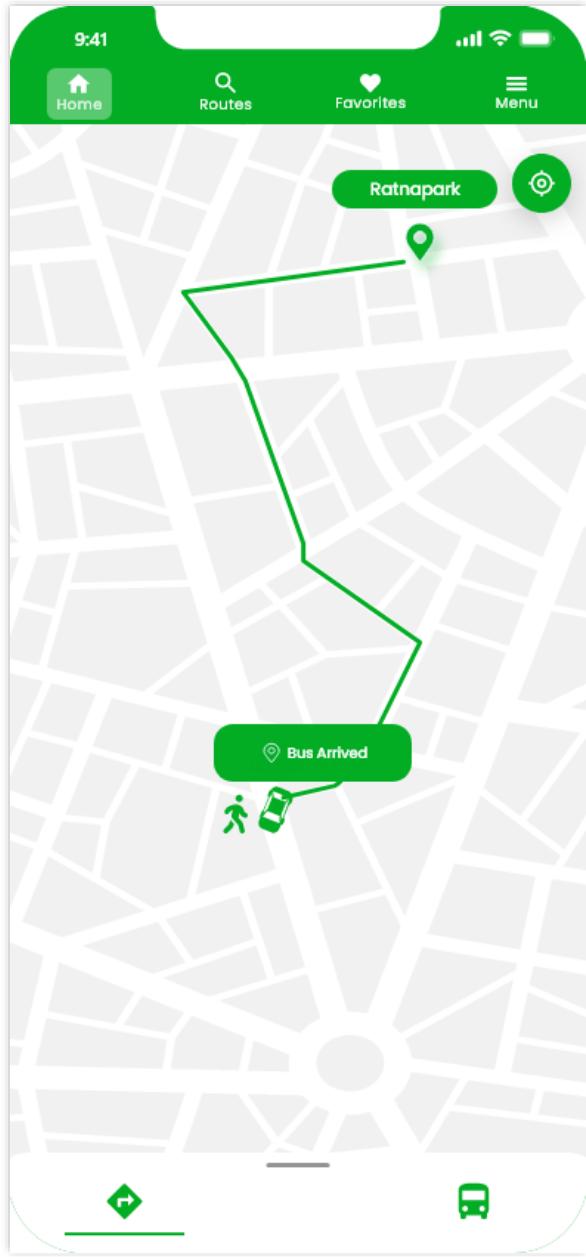


Figure 123 Selected bus arrived

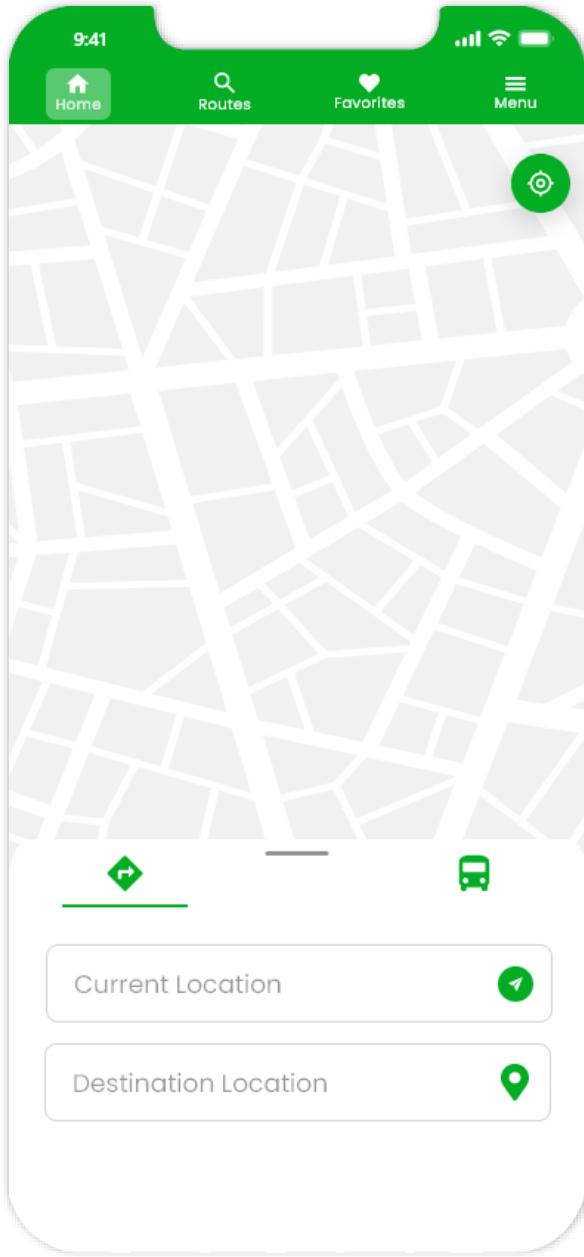


Figure 124 Search location panel

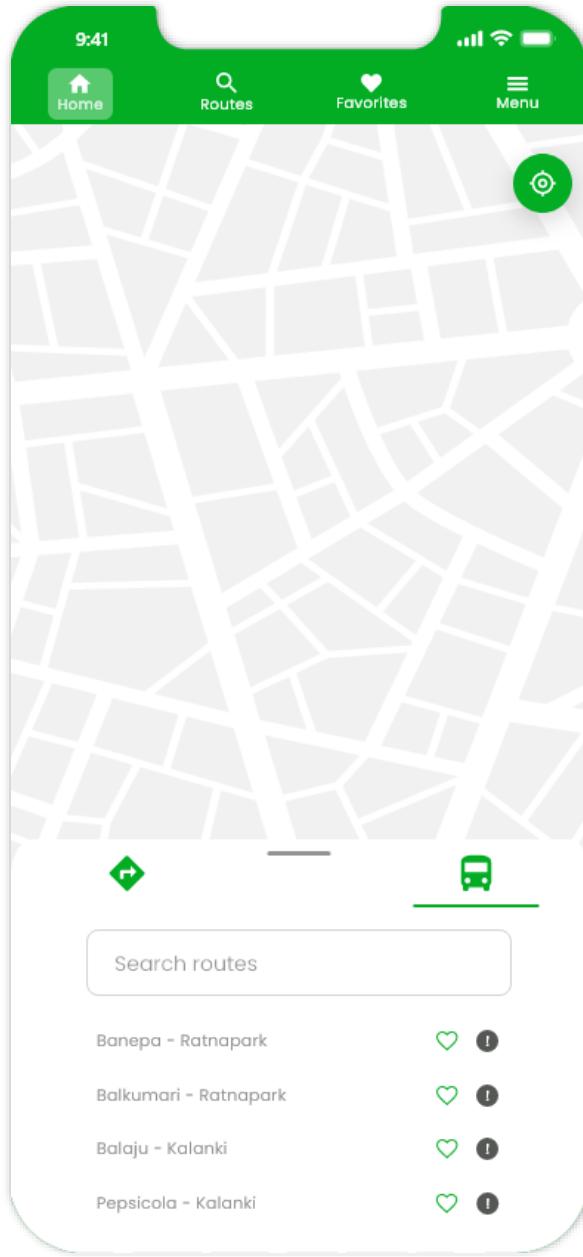


Figure 125 Search bus by route panel

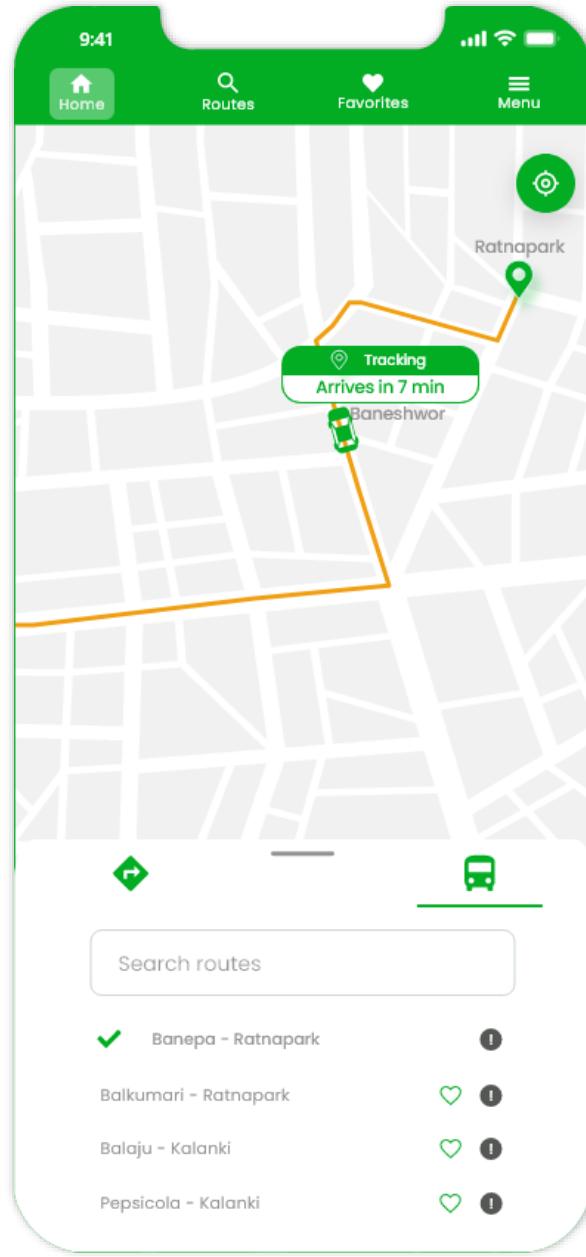


Figure 126 Tracking bus on route Banepa - Ratnapark

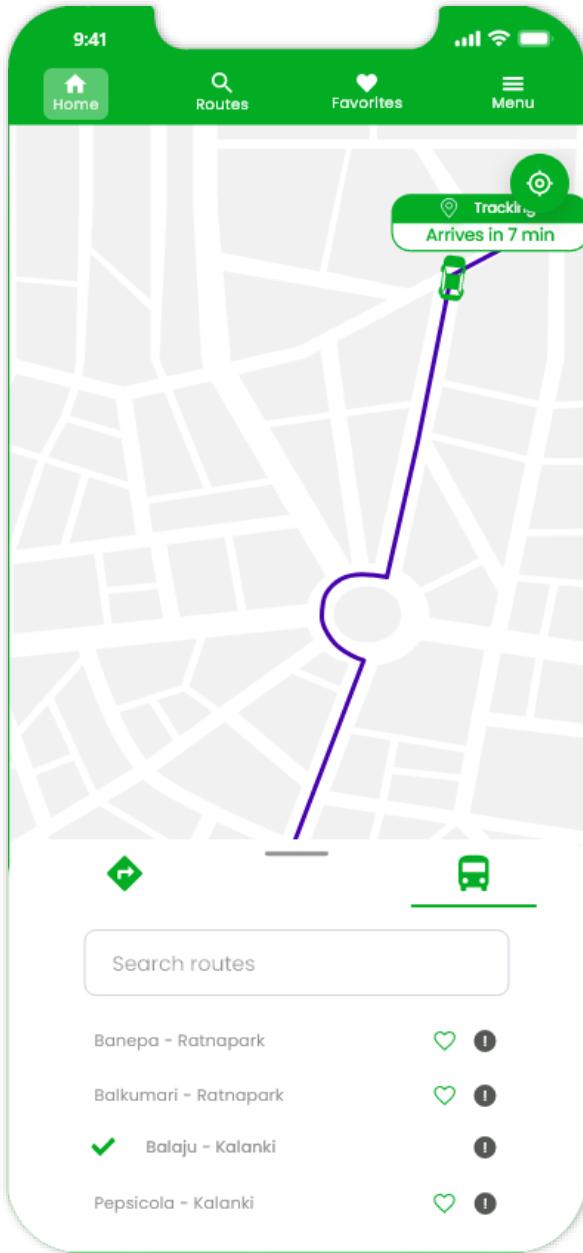


Figure 127 Tracking bus on route Balaju - Kalanki

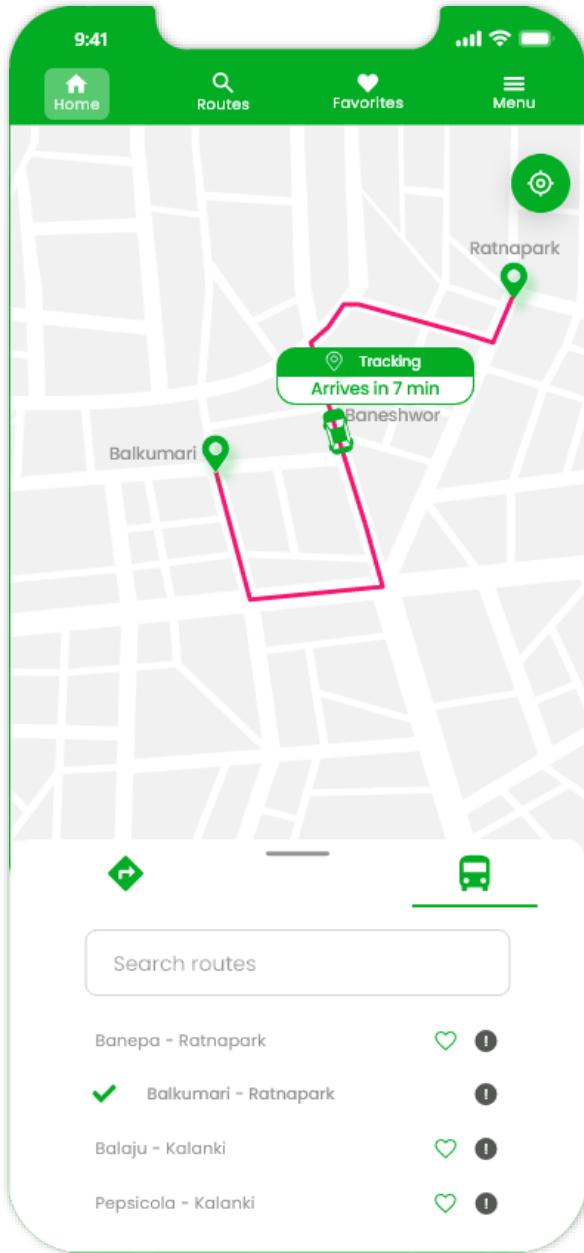


Figure 128 Tracking bus on route Balkumari - Ratnapark

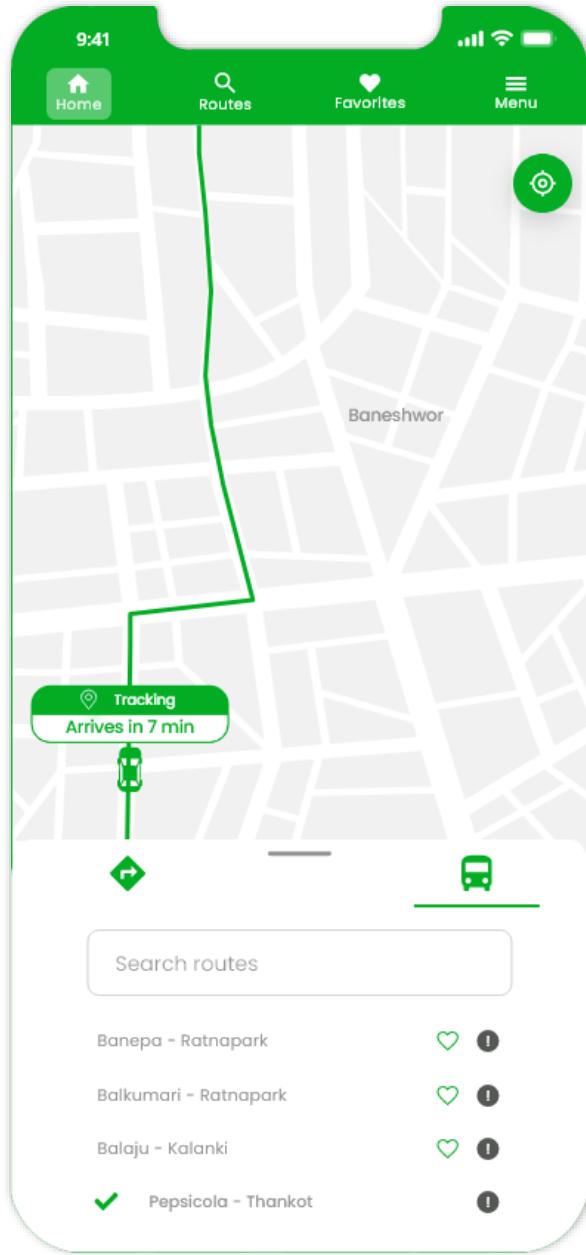


Figure 129 Tracking bus on route Pepsicola - Thankot

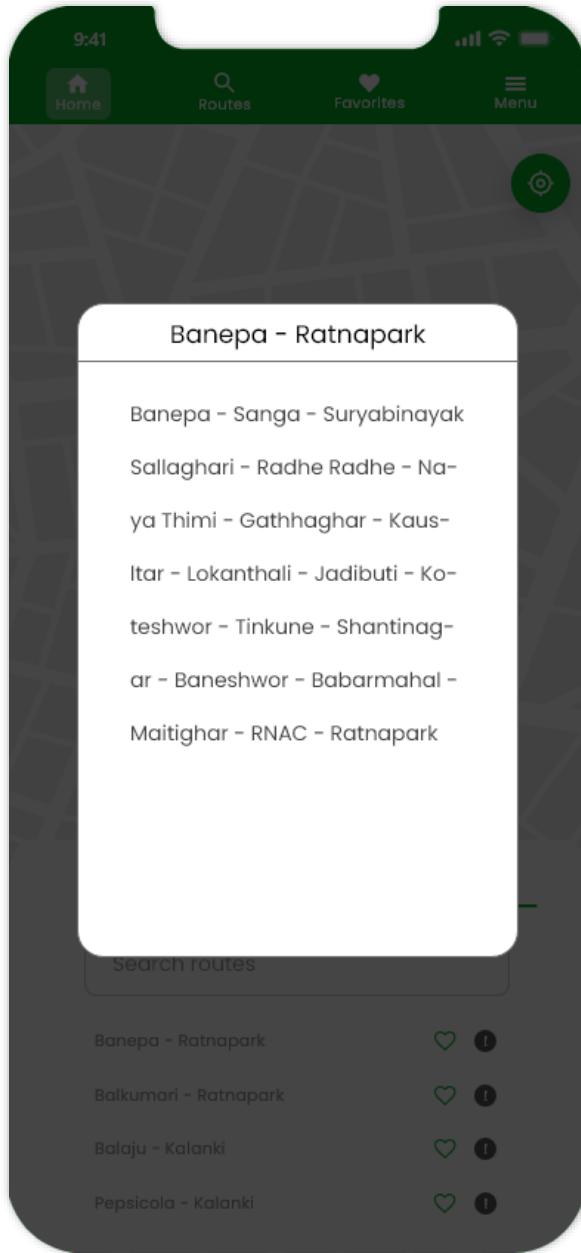


Figure 130 Showing details of routes

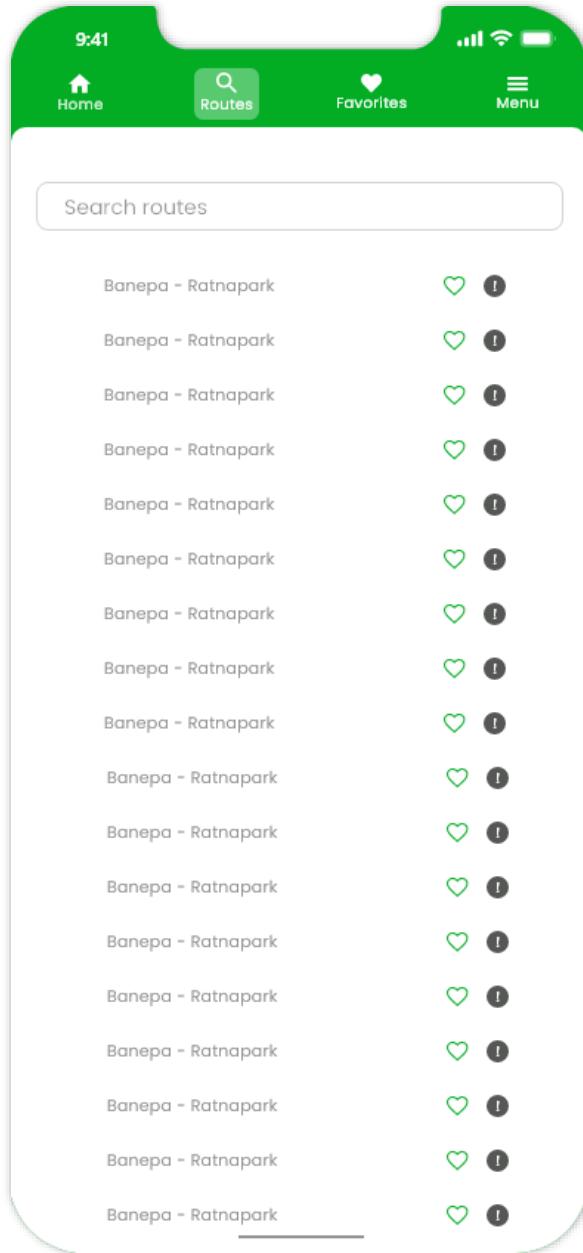


Figure 131 Showing list of all route - Route screen

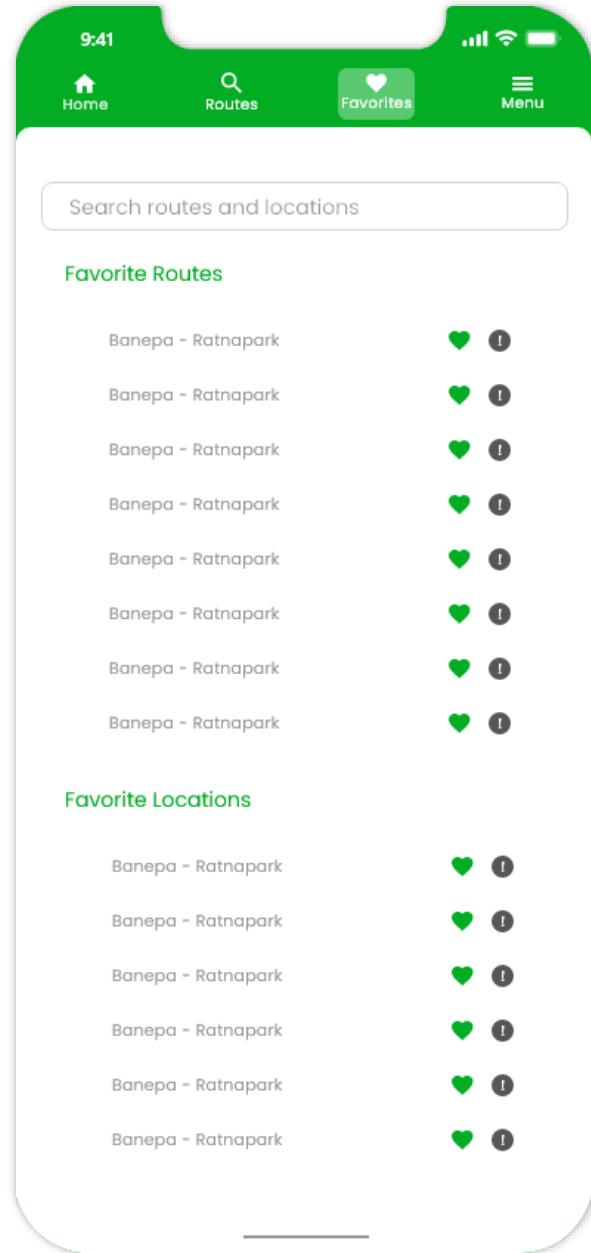


Figure 132 Showing favorites routes and locations - Favorites Screen

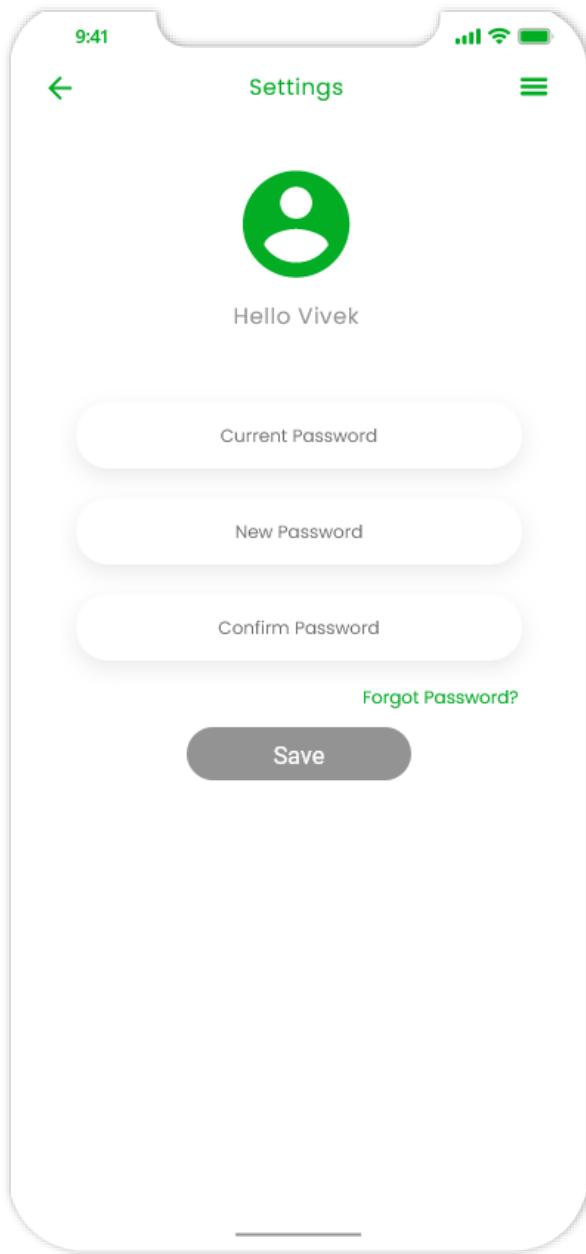


Figure 133 User settings

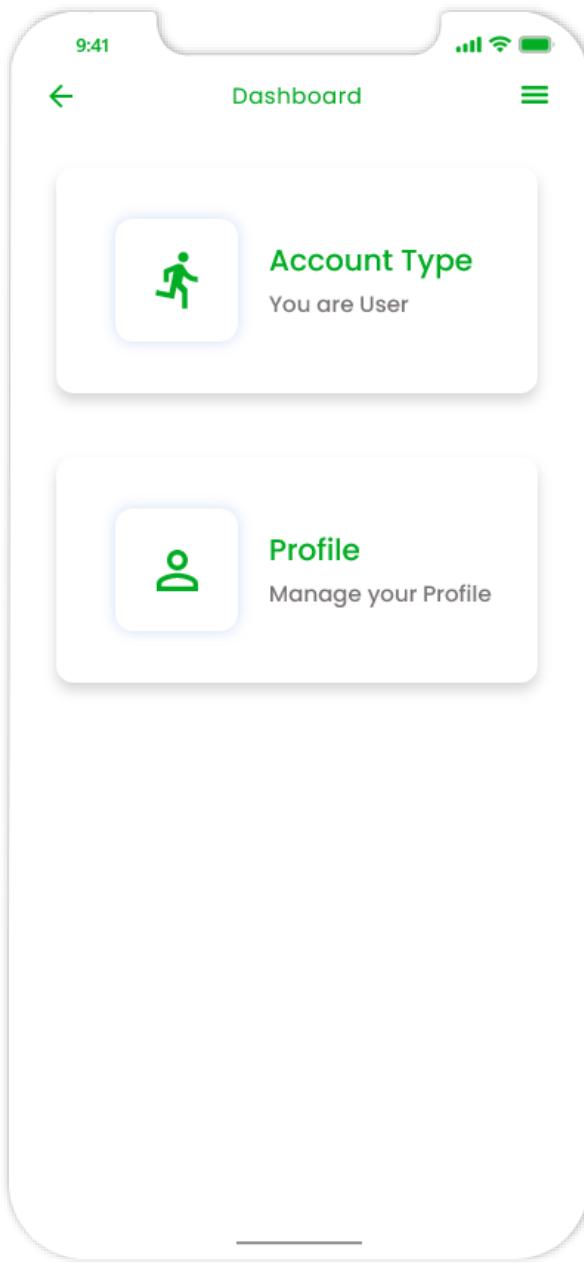


Figure 134 User Dashboard

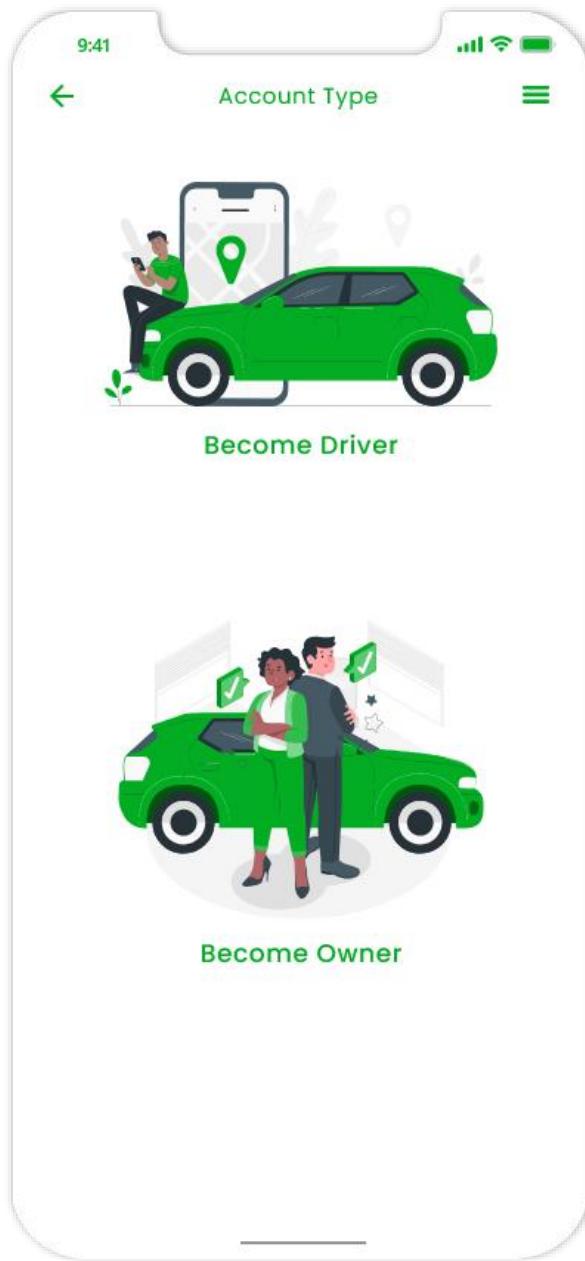


Figure 135 User - Account type

The screenshot shows a mobile application interface titled "Become Owner". At the top, there is a navigation bar with a back arrow, the title "Become Owner", and a menu icon. Below the title, there is a small illustration of a man standing next to a green car. A text prompt "Fill all the information and apply" is displayed. The form consists of several input fields and buttons. The fields include "Full Name" (placeholder "+977"), "Phone Number" (placeholder "32456758678ASH"), and "Citizenship Number" (placeholder "32456758678ASH"). Below these are three camera icon buttons labeled "Profile Photo", "Citizenship", and "Registration". A large "Apply" button is located at the bottom right. The background is white, and the overall design is clean and modern.

Figure 136 User - Become Owner

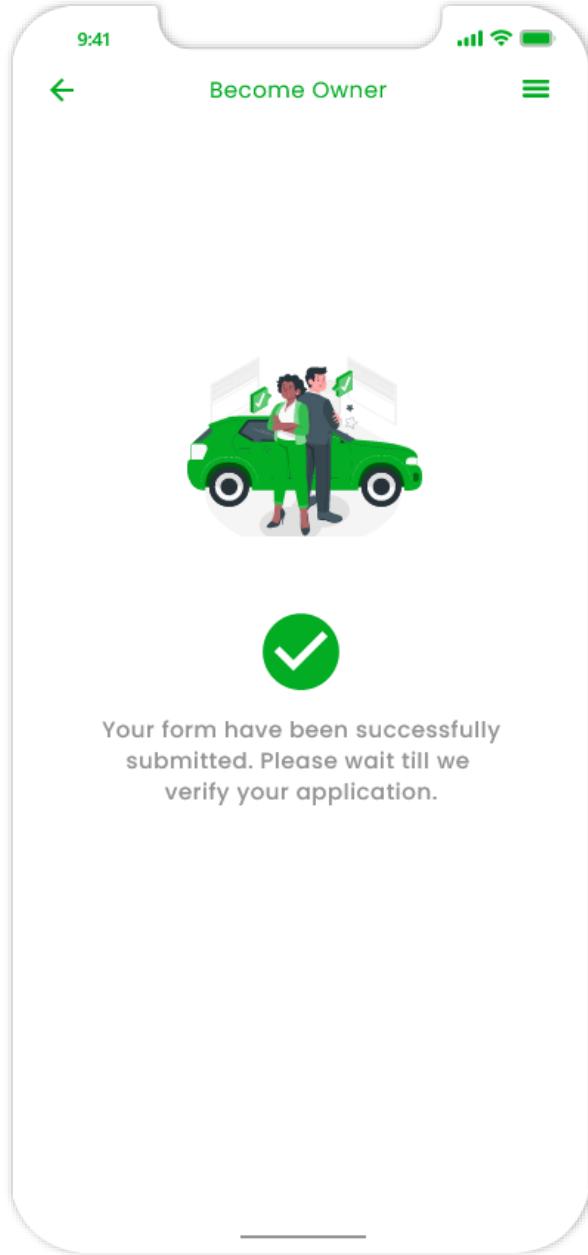


Figure 137 User- Waiting for verification to become owner

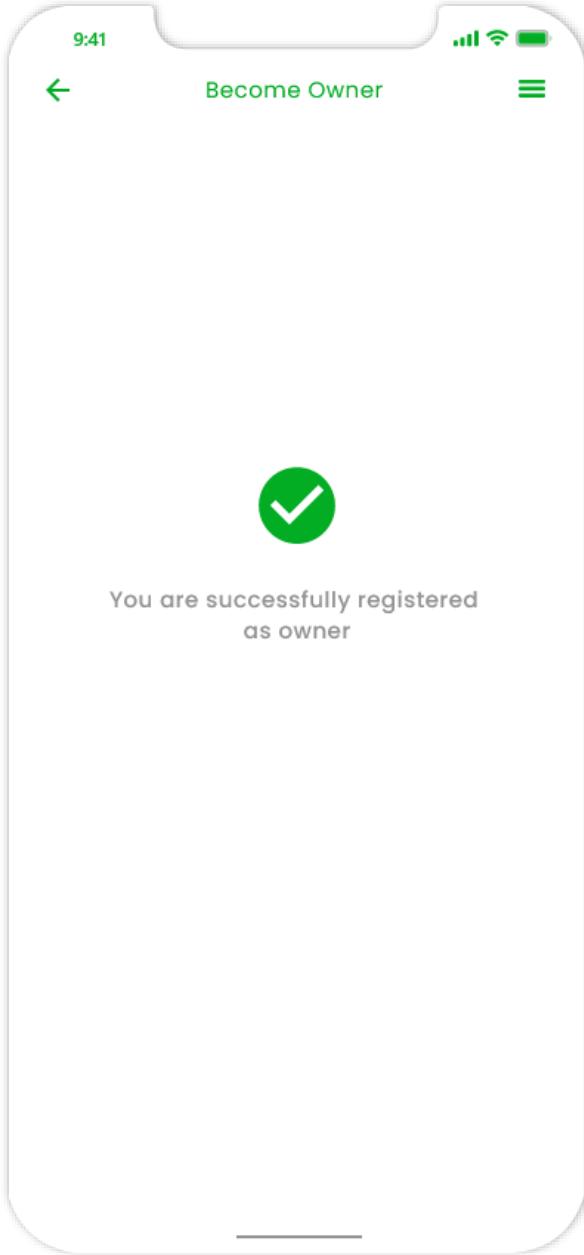


Figure 138 User feedback after registered as owner

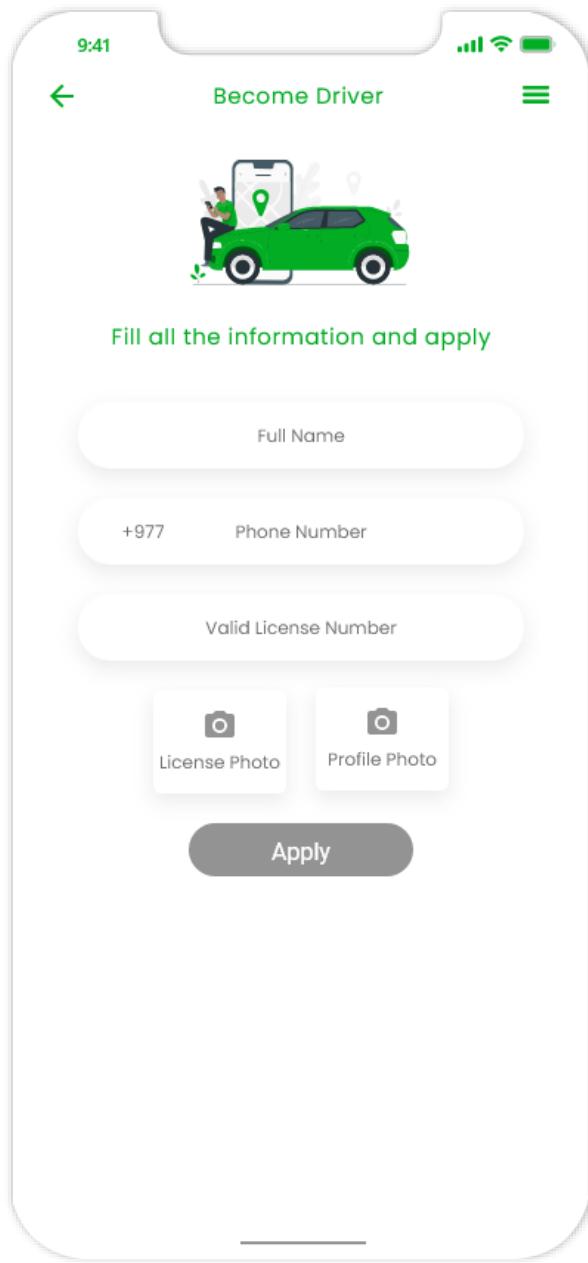


Figure 139 User - Become Driver

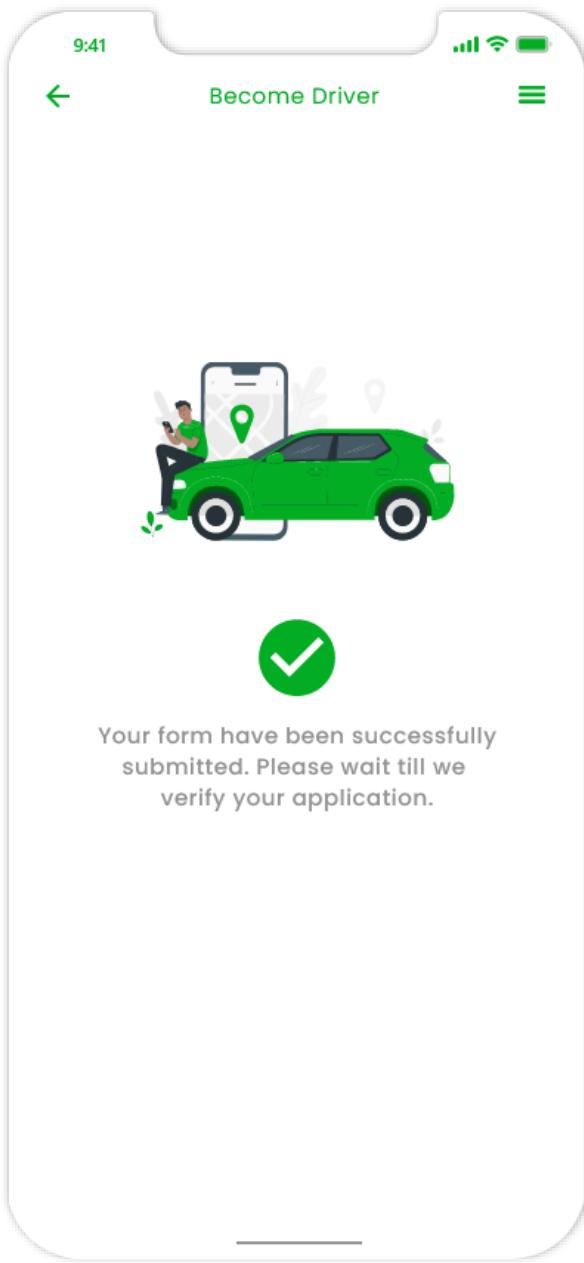


Figure 140 User - Waiting for verification to become driver

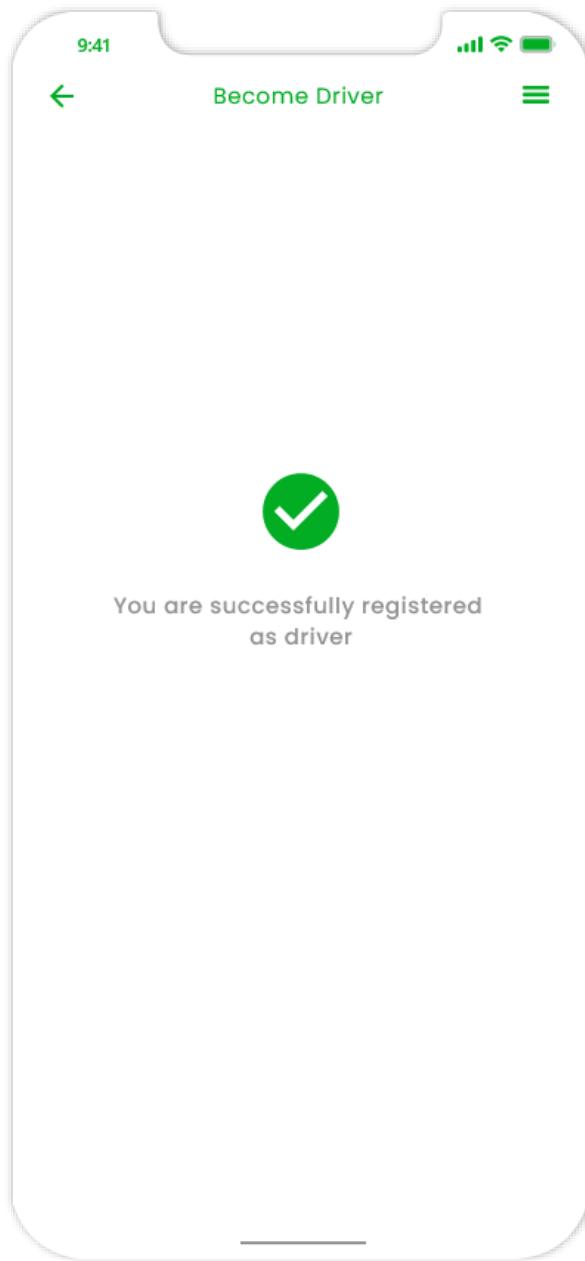


Figure 141 User successfully registered as driver

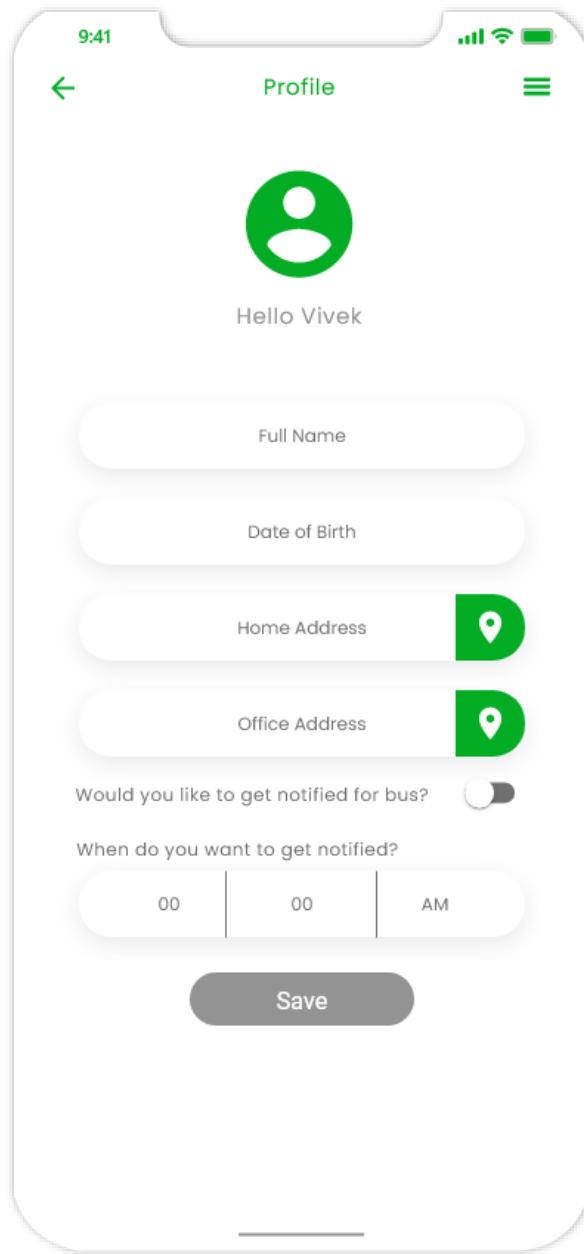


Figure 142 User - Profile

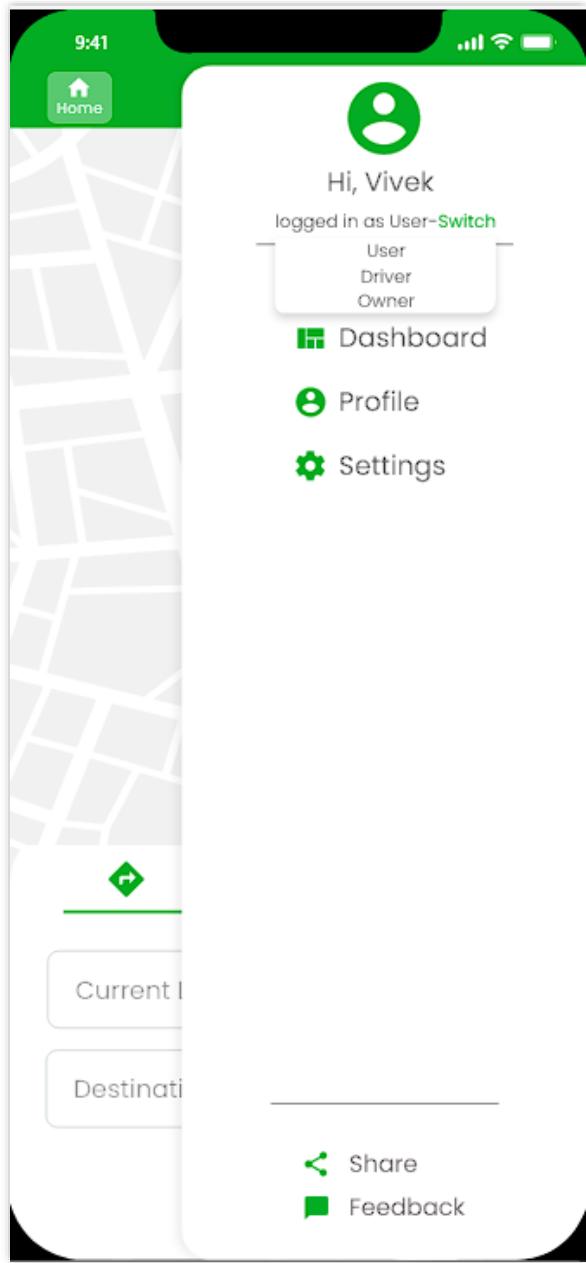


Figure 143 User switching to Owner

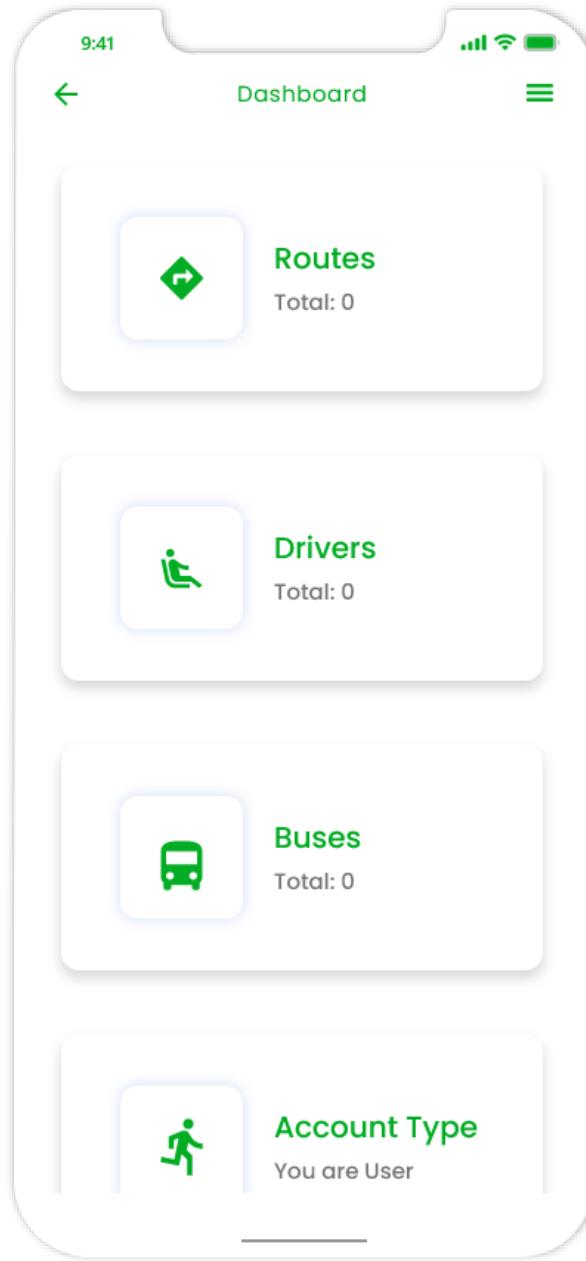


Figure 144 Owner - Dashboard

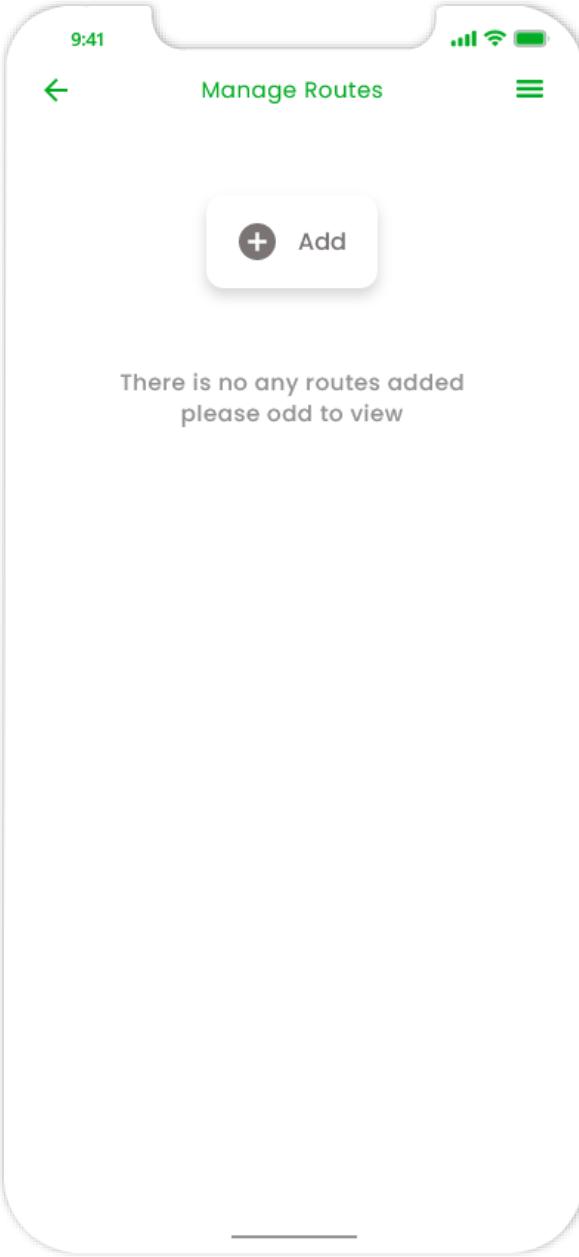


Figure 145 Owner - Manage Routes

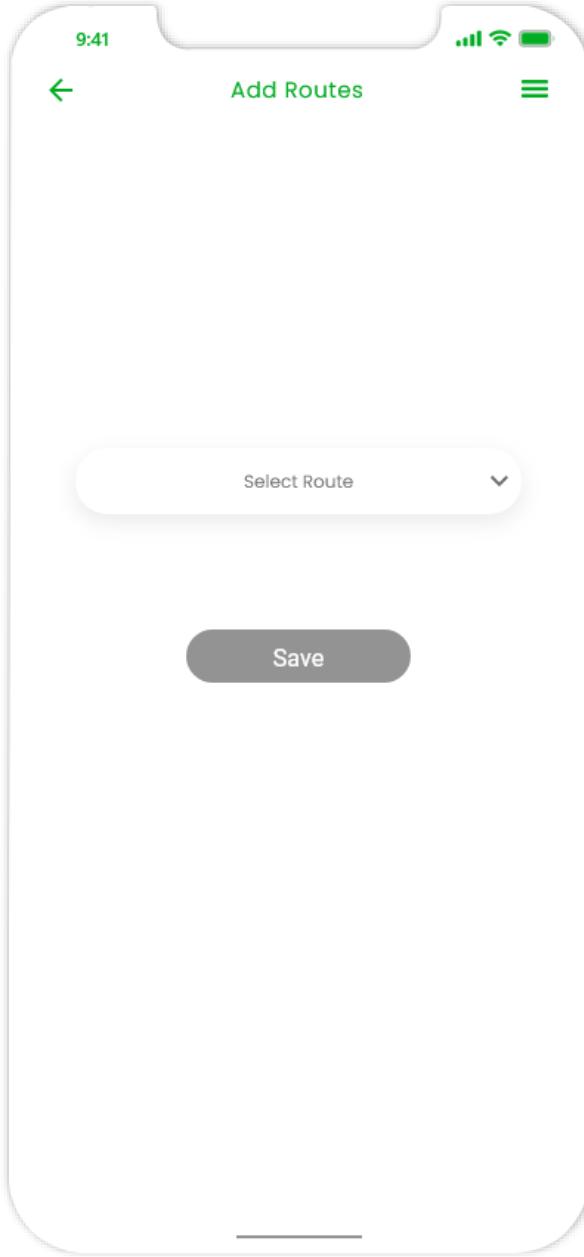


Figure 146 Owner - Add Route

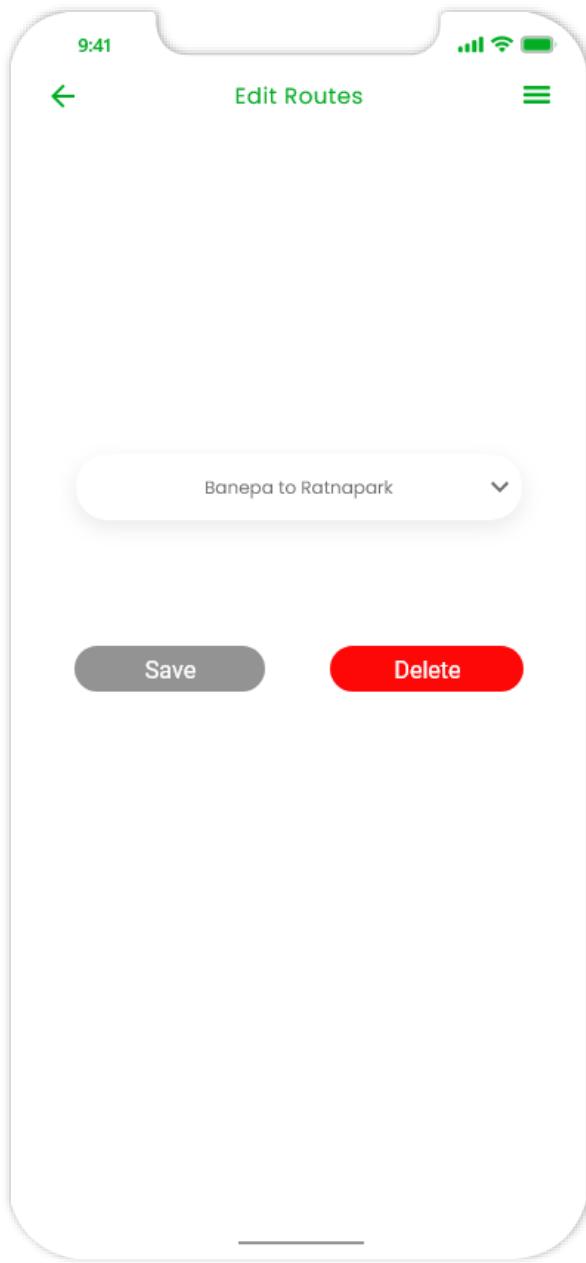


Figure 147 Owner - Edit Routes

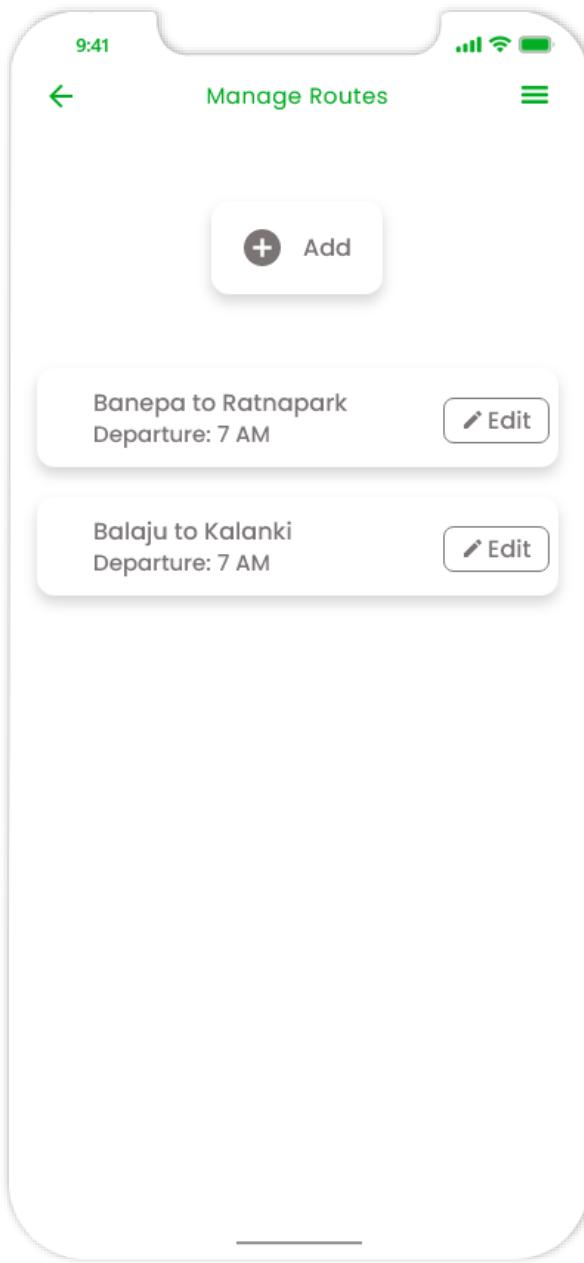


Figure 148 Owner - View added Routes

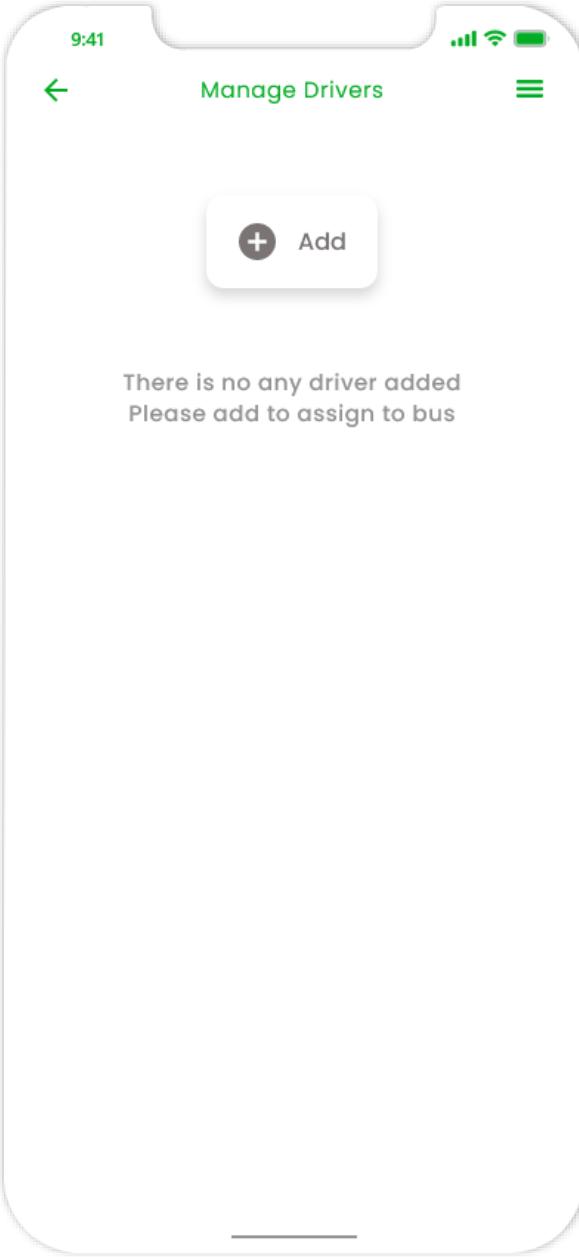


Figure 149 Owner - Manage Drivers

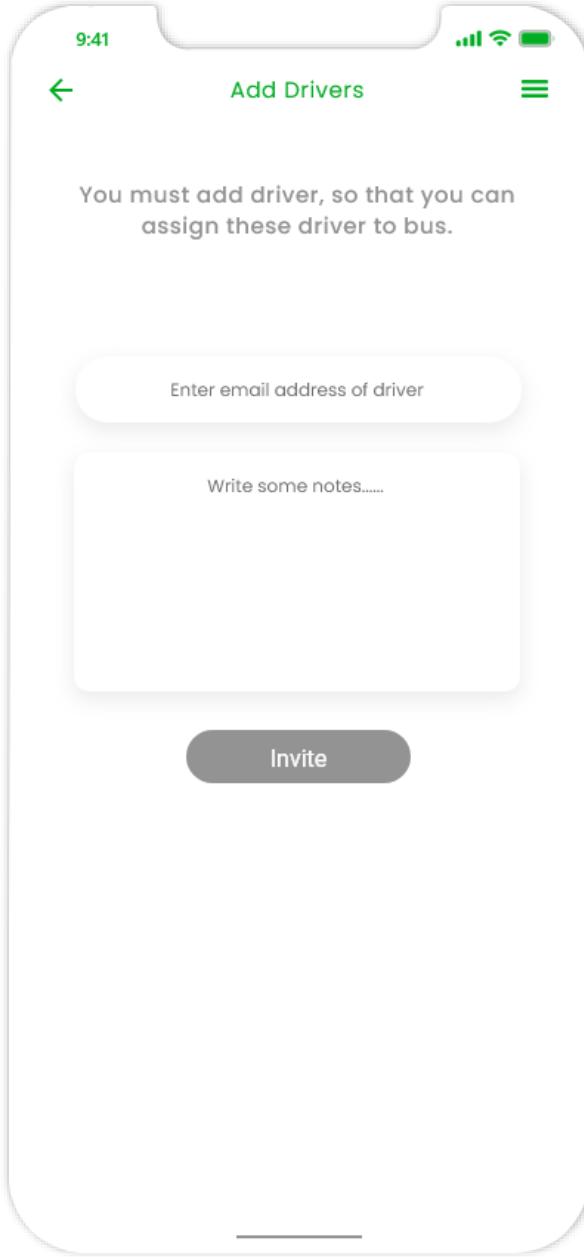


Figure 150 Owner - Add Driver

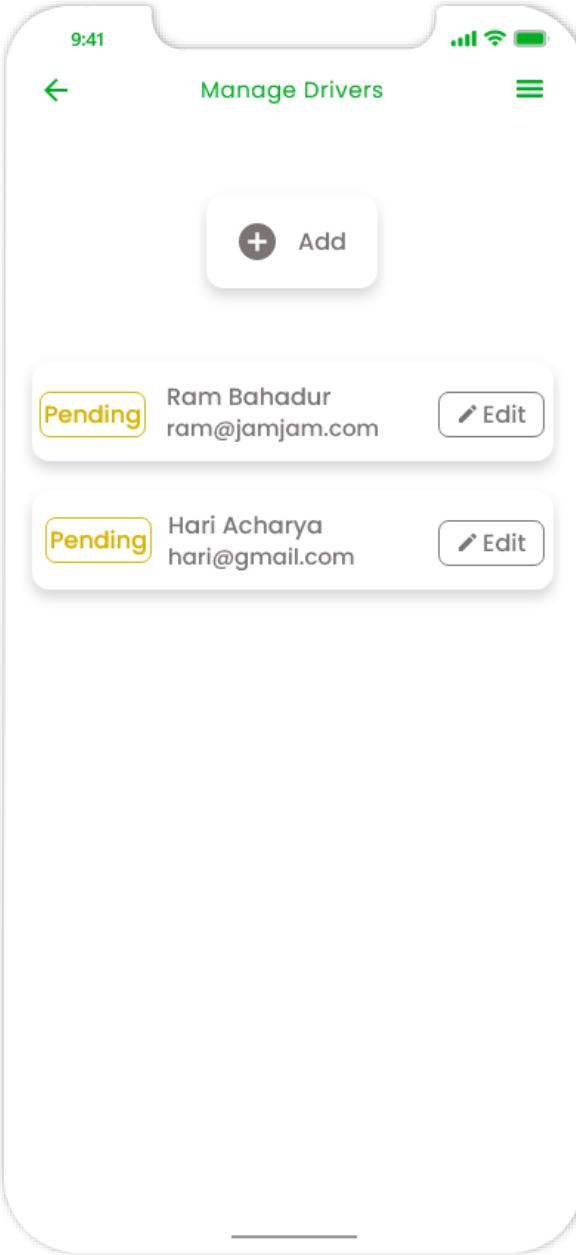


Figure 151 Owner - view pending drives

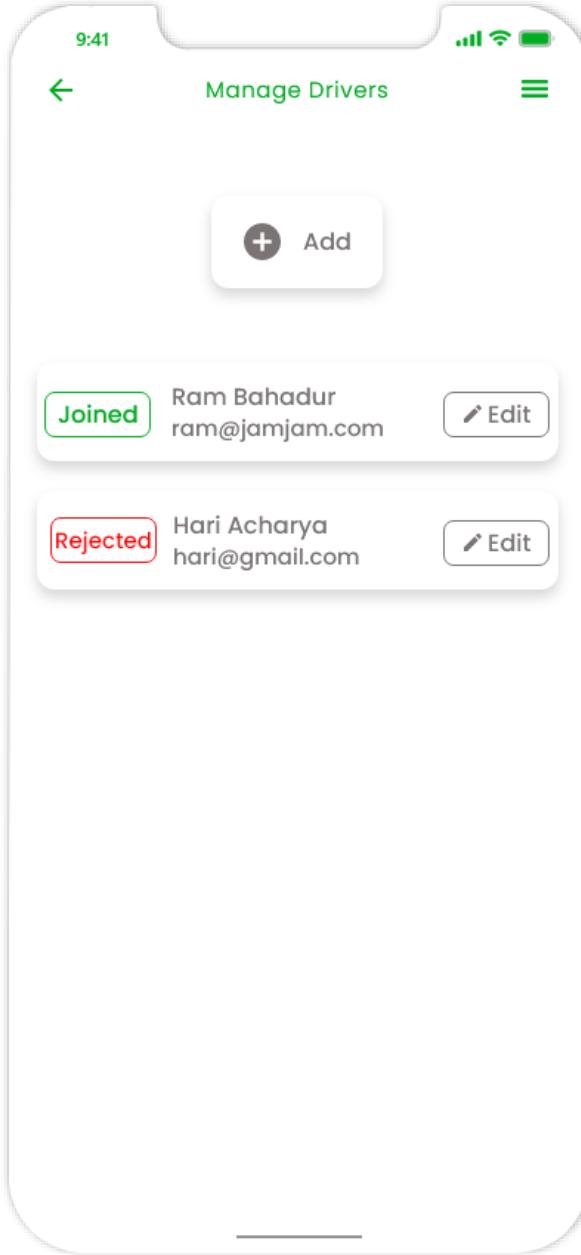


Figure 152 Owner view driver acceptance status

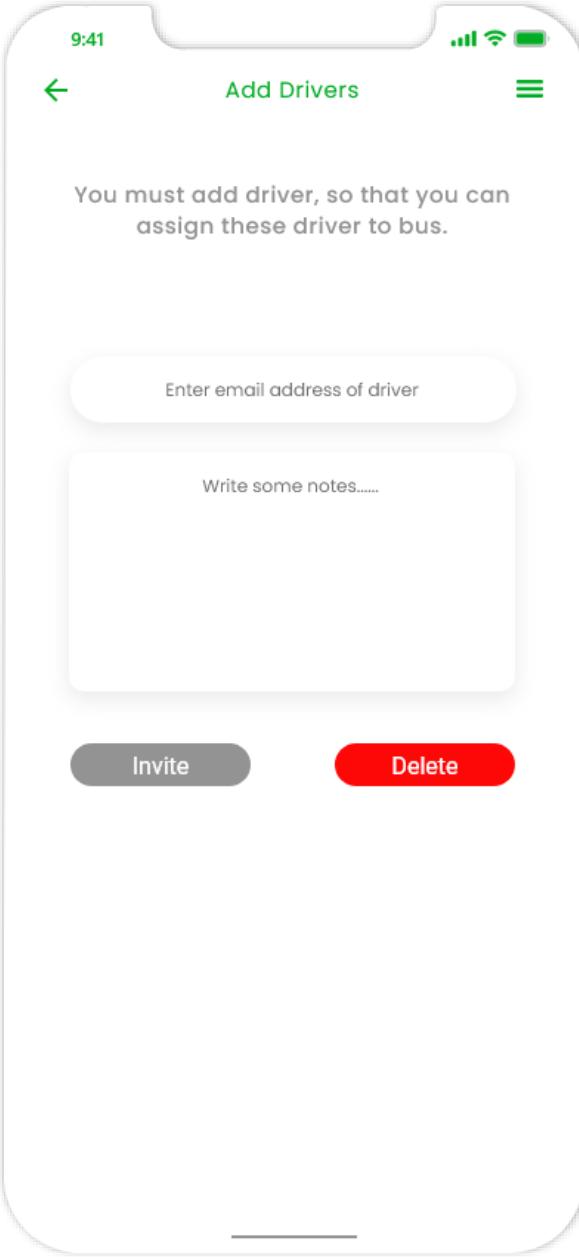


Figure 153 Owner - Edit Driver

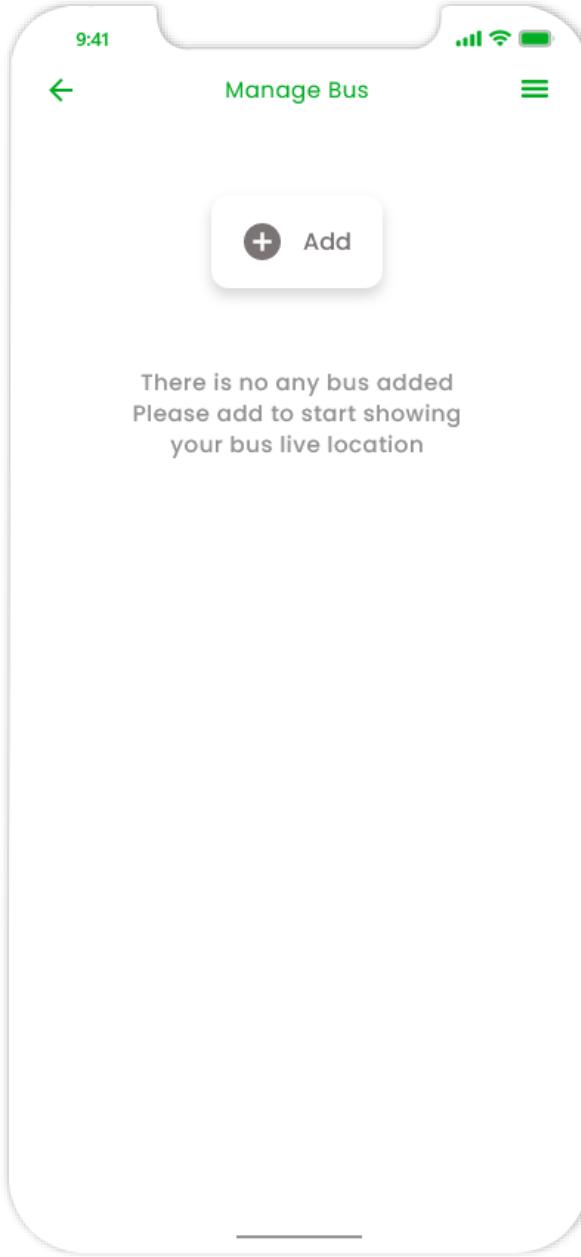


Figure 154 Owner - Manage Buses

9:41

Add Bus

Enter Bus Name

Enter Bus Number

Select Route

Select Driver

Departing Time:

00 | 00 | AM

Bus Photo

Save

Figure 155 Owner add bus

-
- 9:41
- Manage Buses
- Add
- Nepal Yatayat
Ba 5 Kha 3536 Departure: 7 AM
- Nepal Yatayat
Ba 5 Kha 3245 Departure: 7 AM
- Edit
- Edit

Figure 156 Owner view added bus

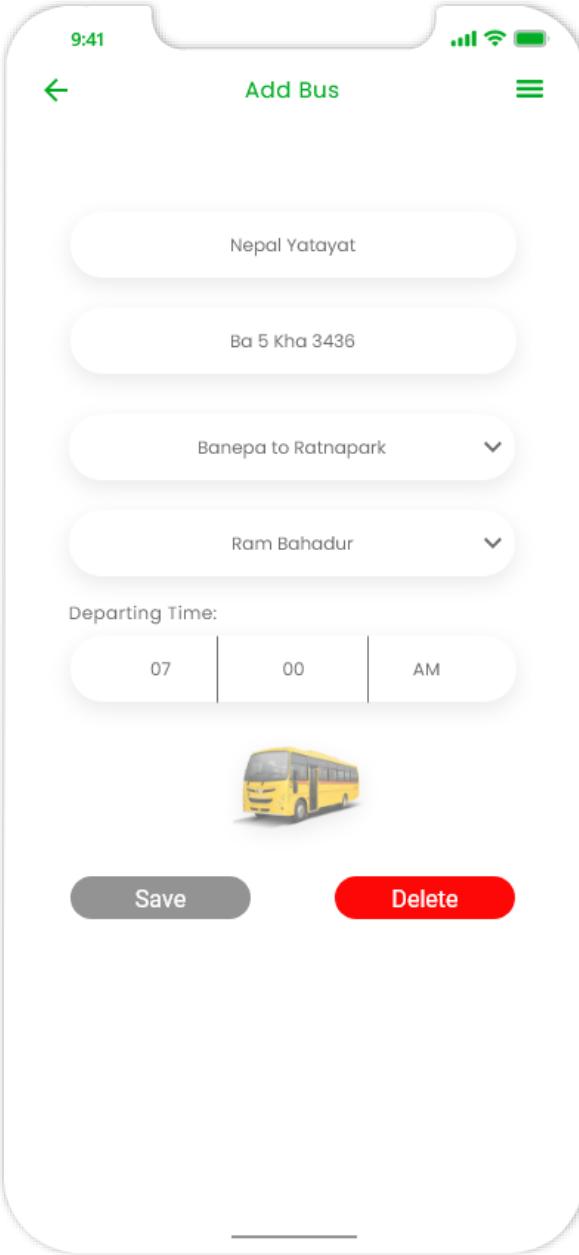


Figure 157 Owner edit bus

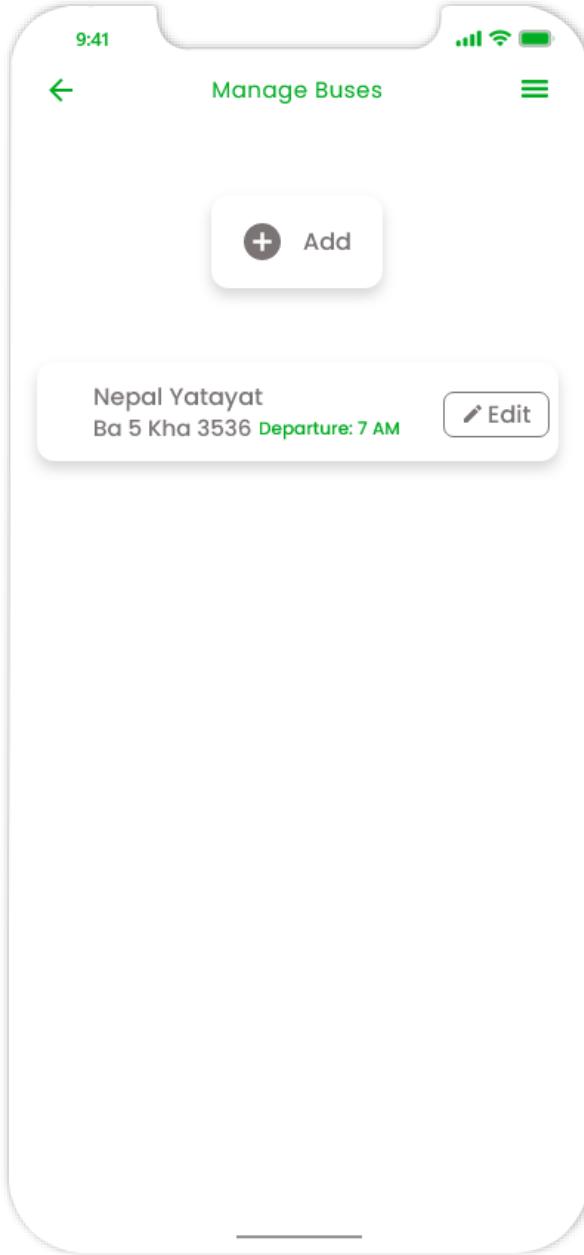


Figure 158 Owner view updated bus

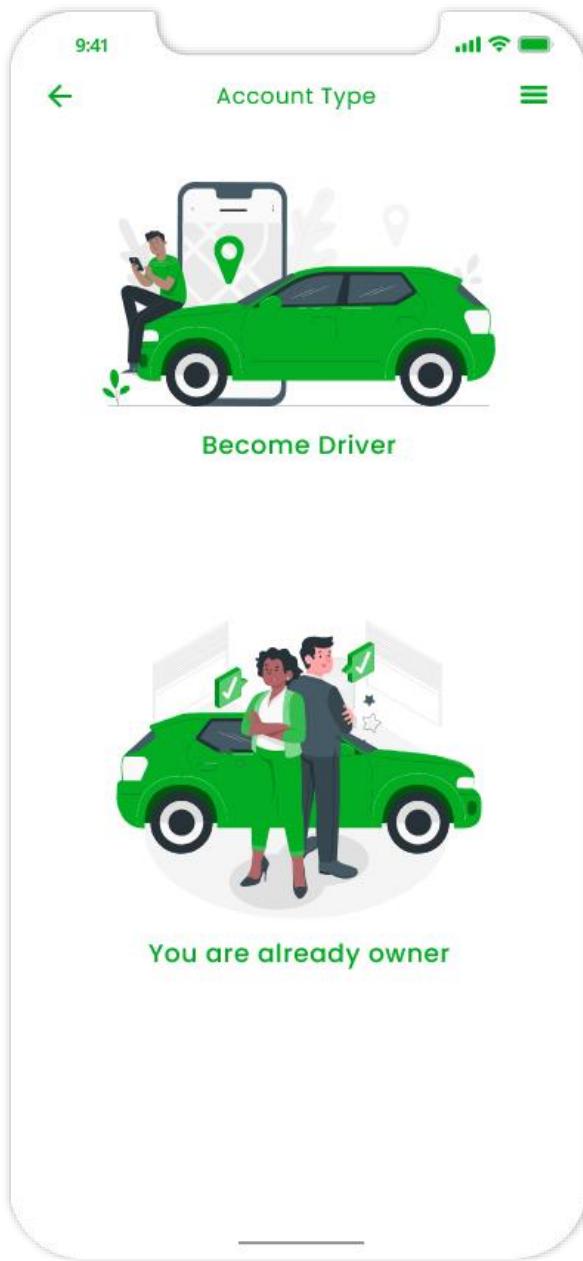


Figure 159 Owner Account type

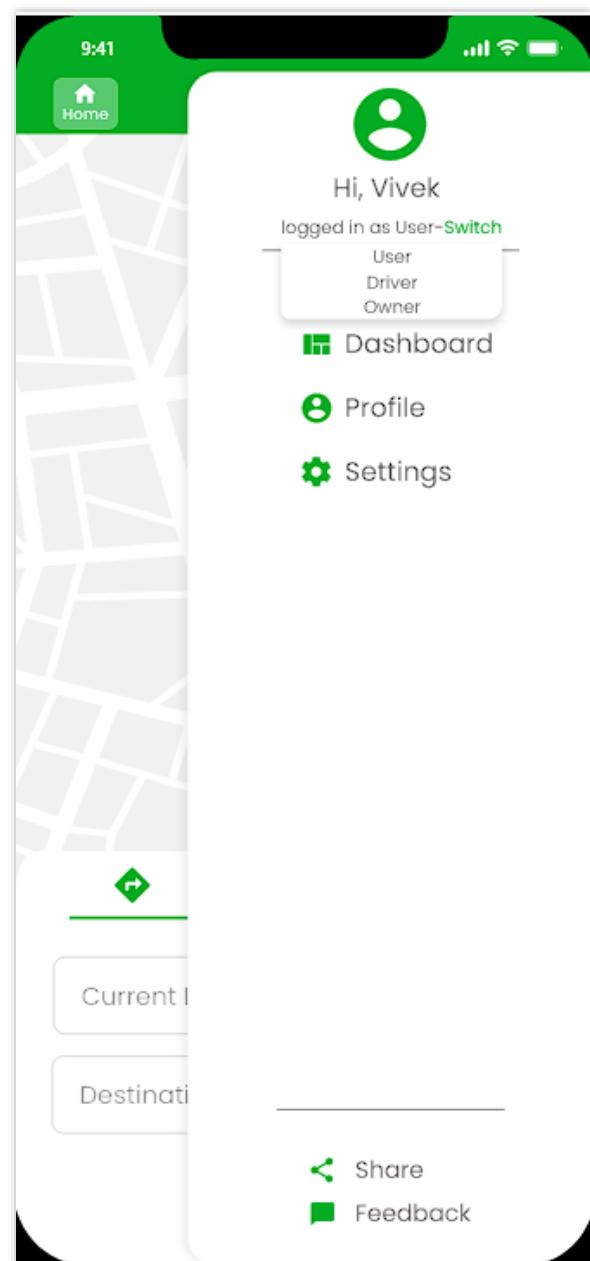


Figure 160 User Switching as Driver

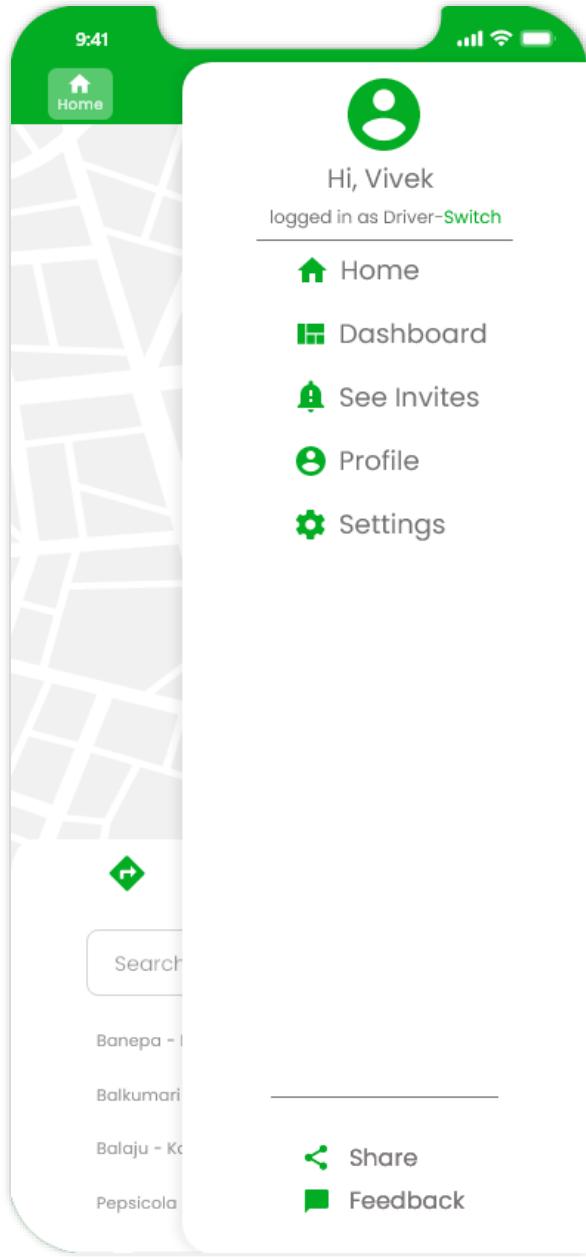


Figure 161 User Logged in as Driver

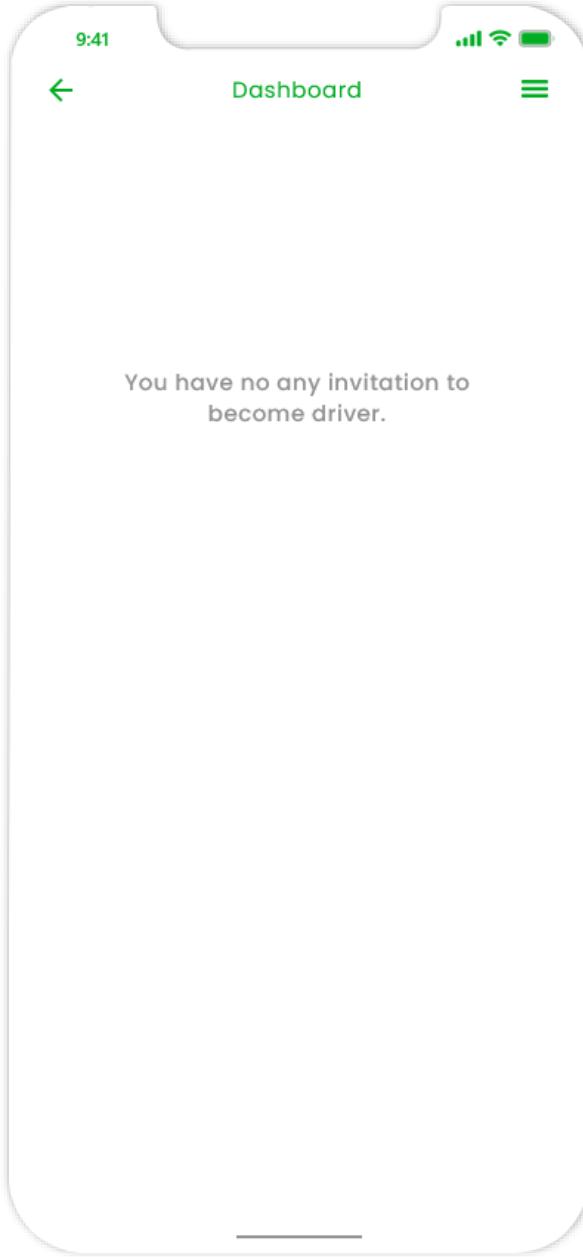


Figure 162 Driver - no invites to become driver

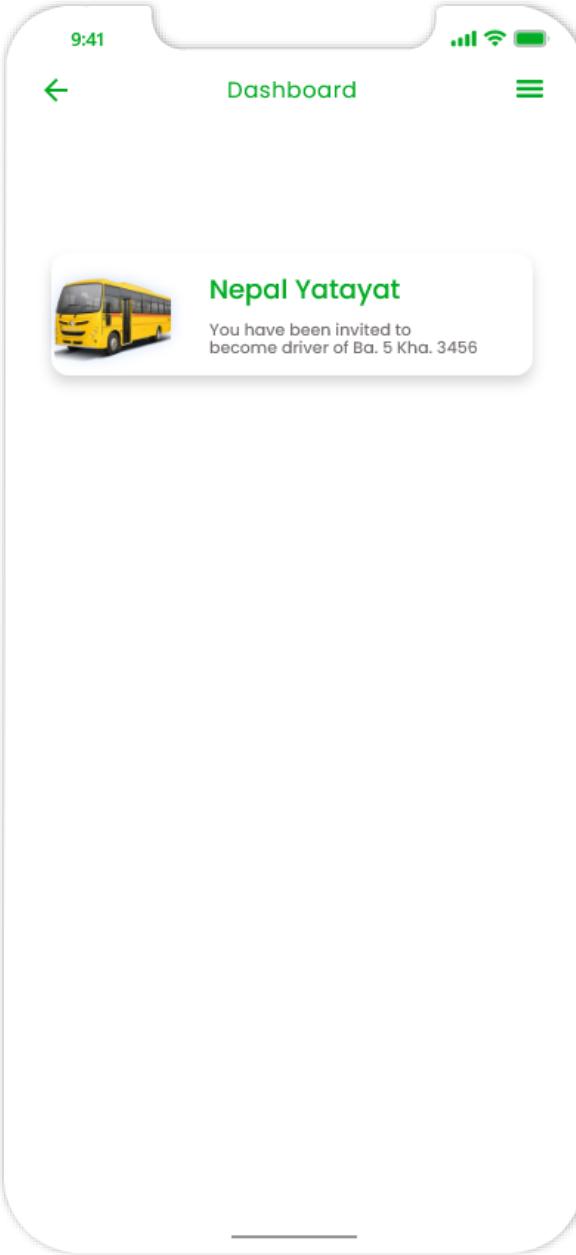


Figure 163 Driver - Invitation to become driver

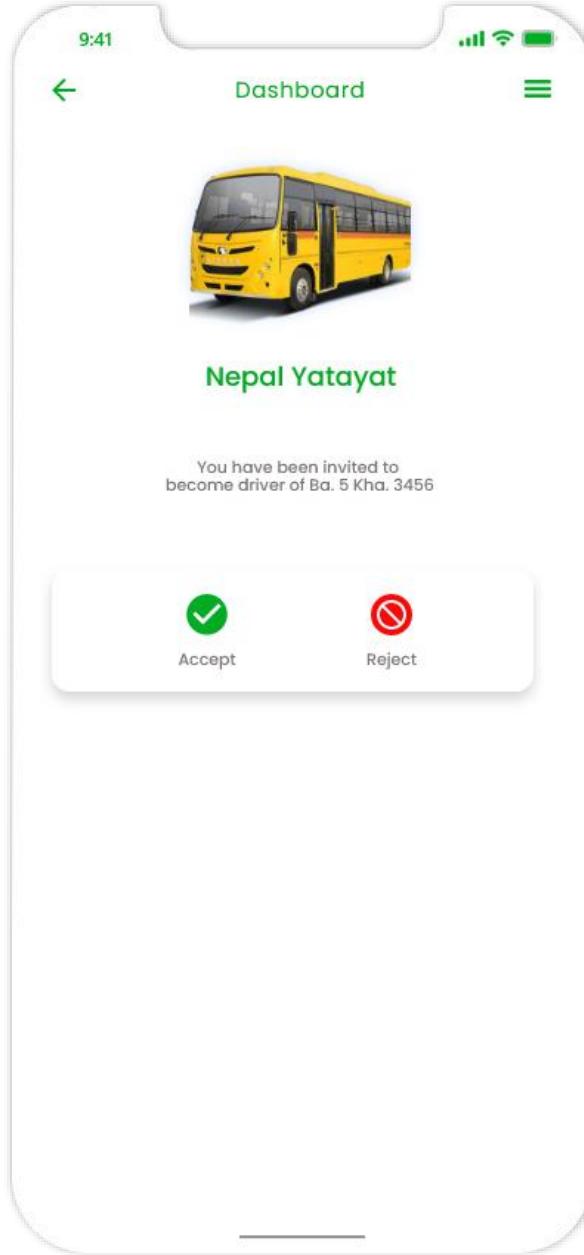


Figure 164 Driver - Viewing invitation details



Figure 165 Driver - accepted invitation

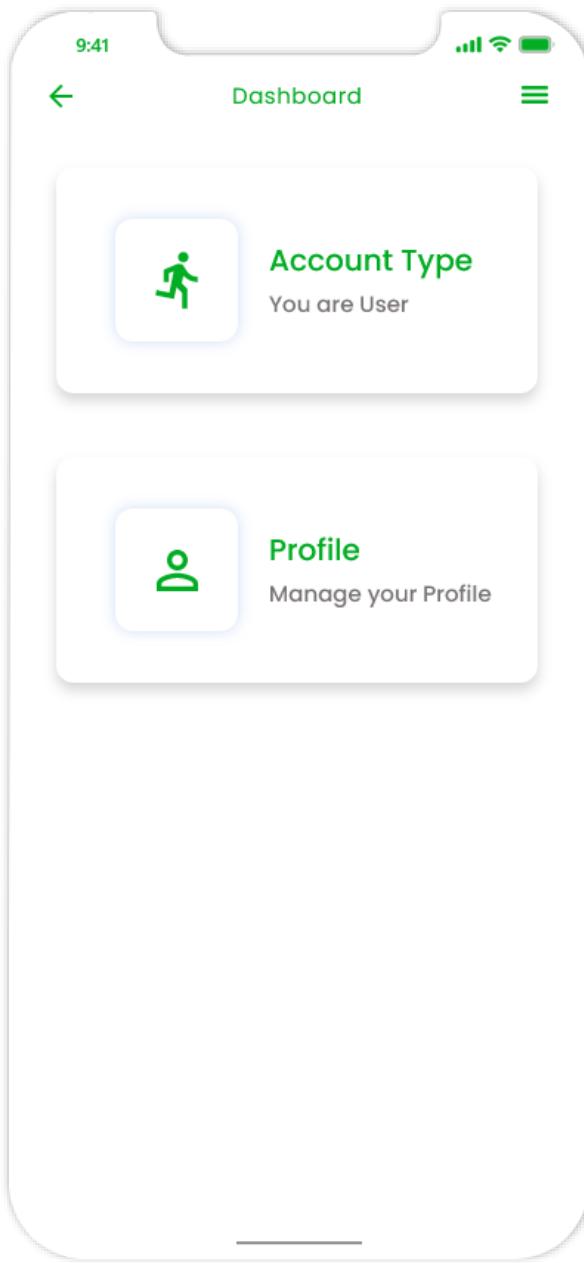


Figure 166 Driver - Dashboard

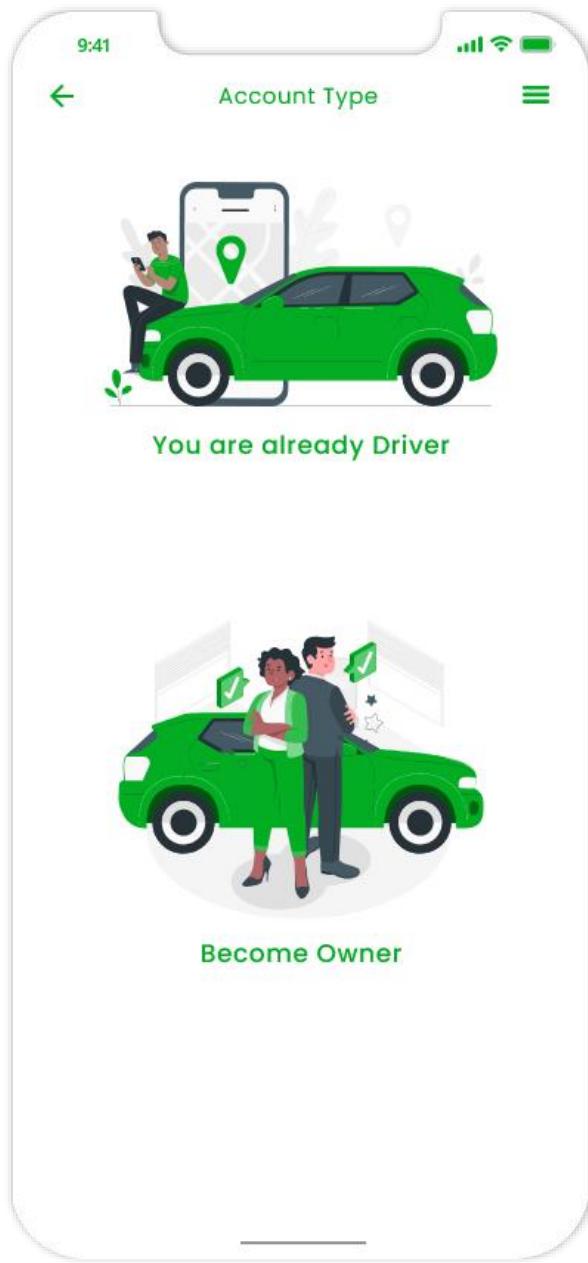


Figure 167 Driver - Account type

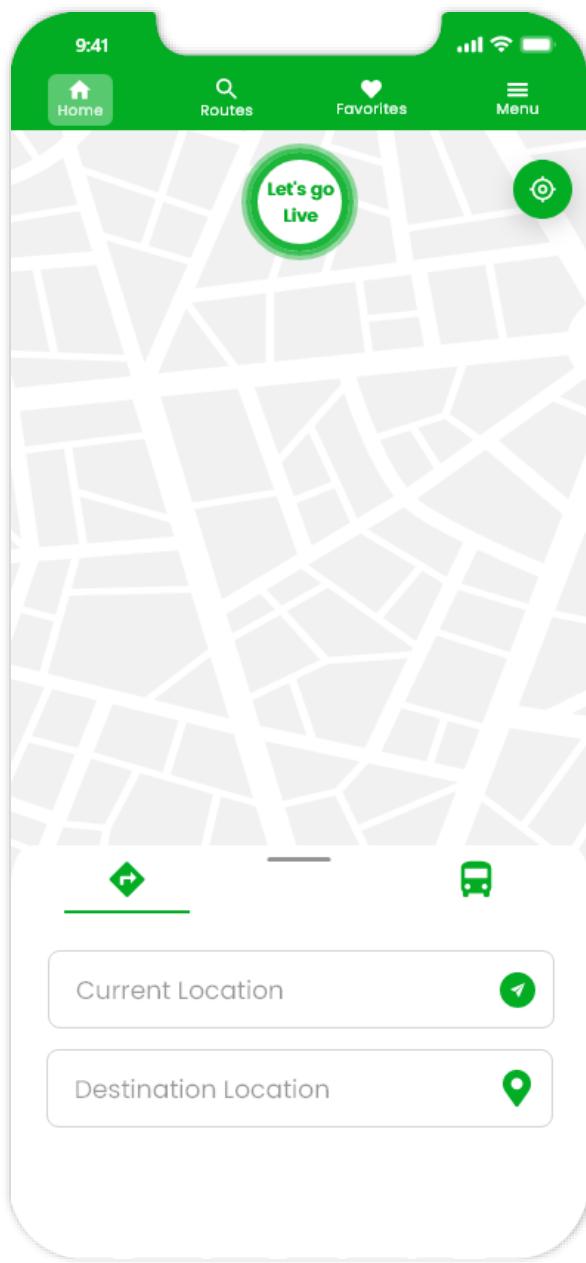


Figure 168 Driver - Driving mode off

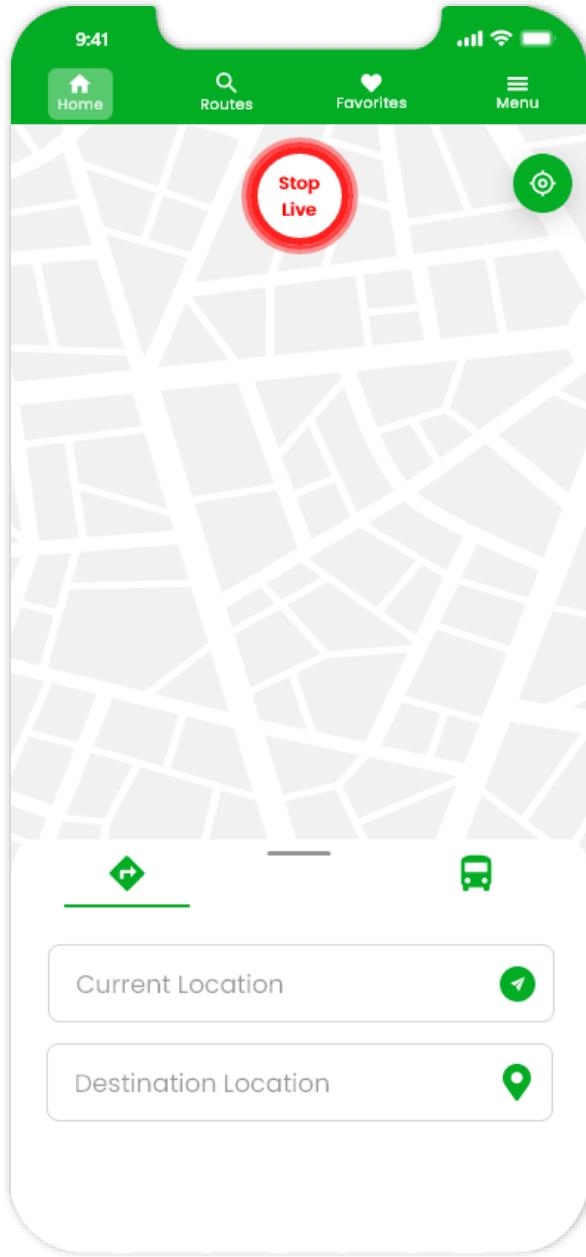


Figure 169 Driver - Driving mode on

Admin App

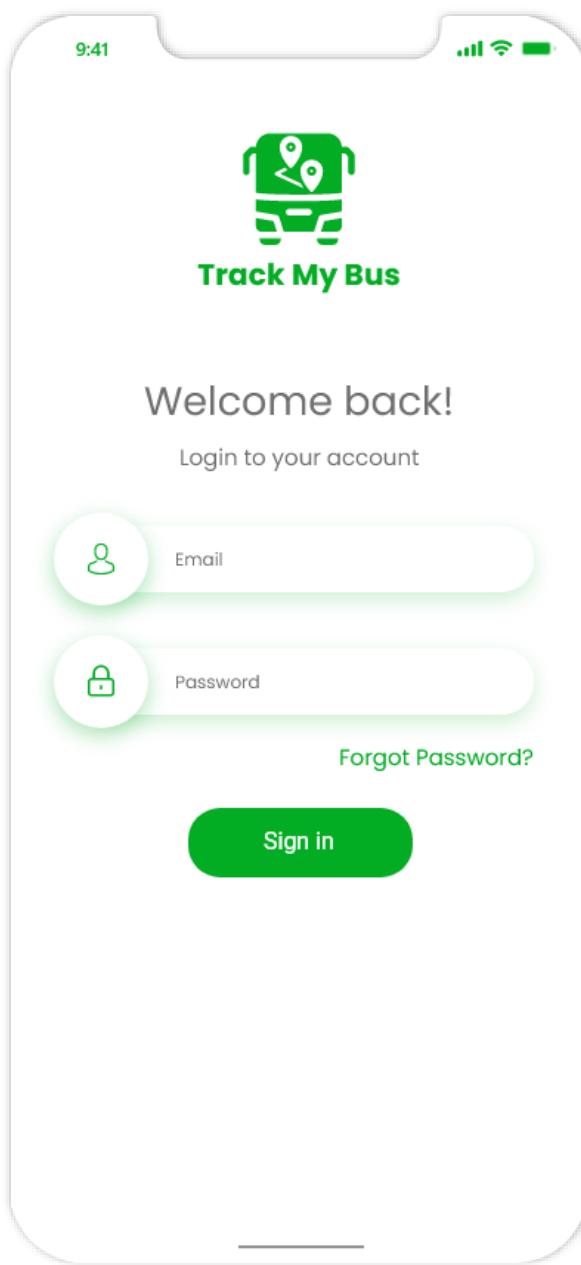


Figure 170 Admin - Login

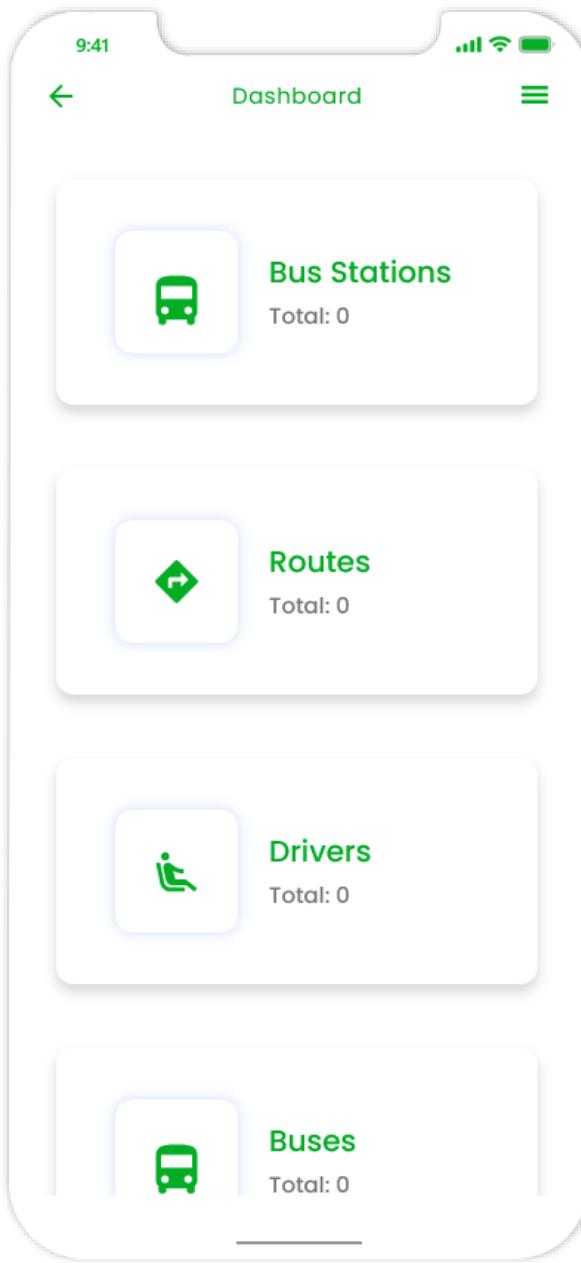


Figure 171 Admin - Dashboard

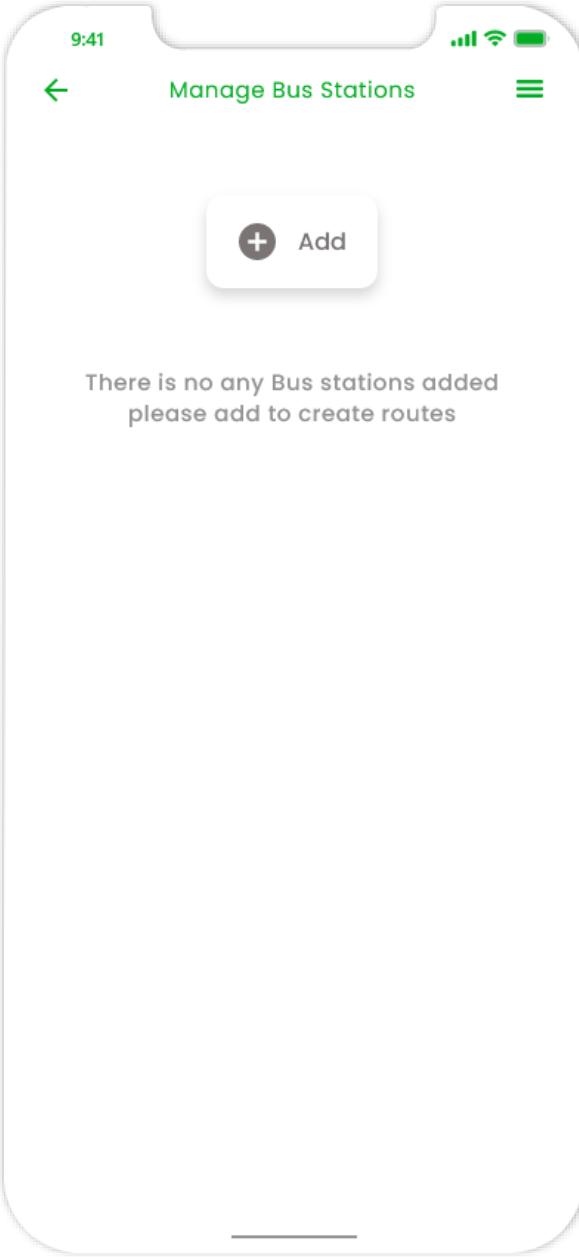


Figure 172 Admin - Manage Bus Stations

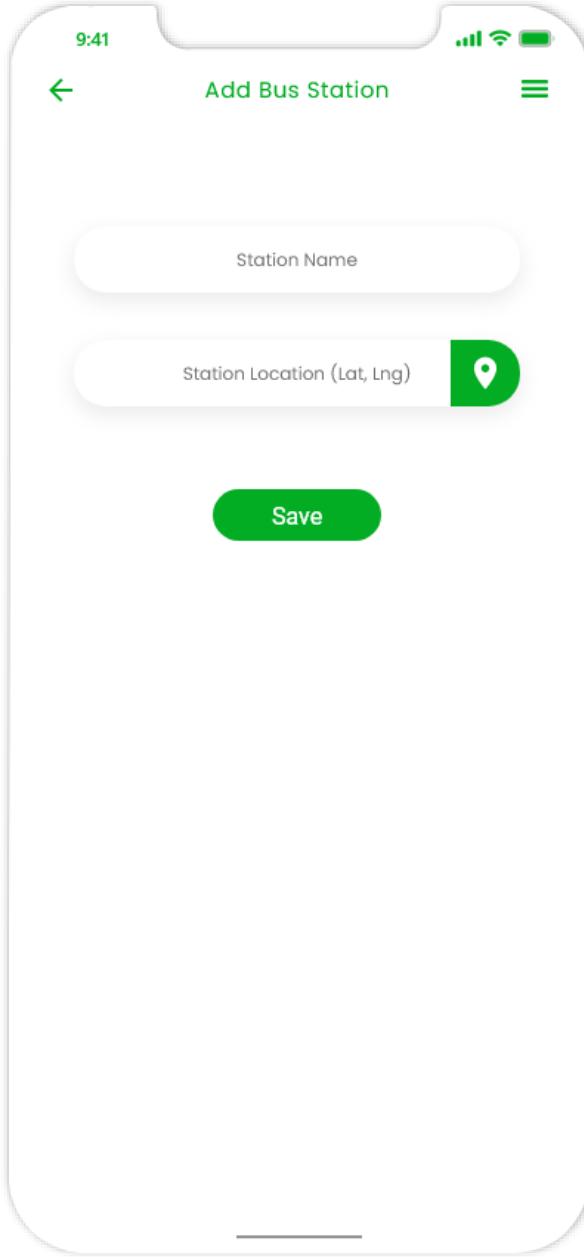


Figure 173 Admin - Add bus station



Figure 174 Admin - Pickup station location

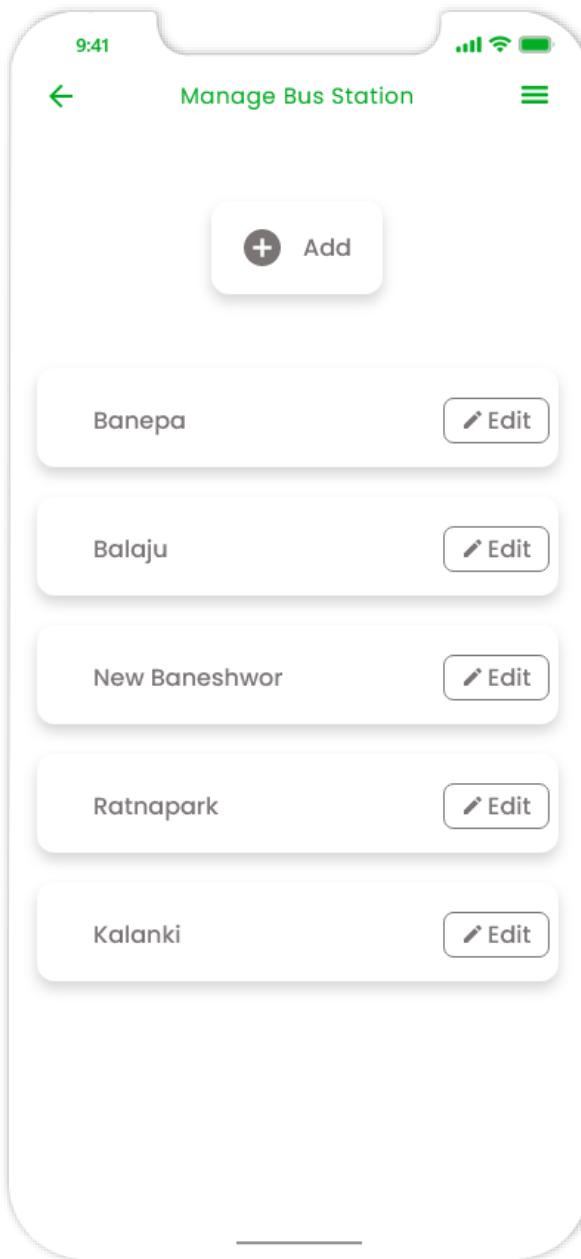


Figure 175 Admin view added bus station

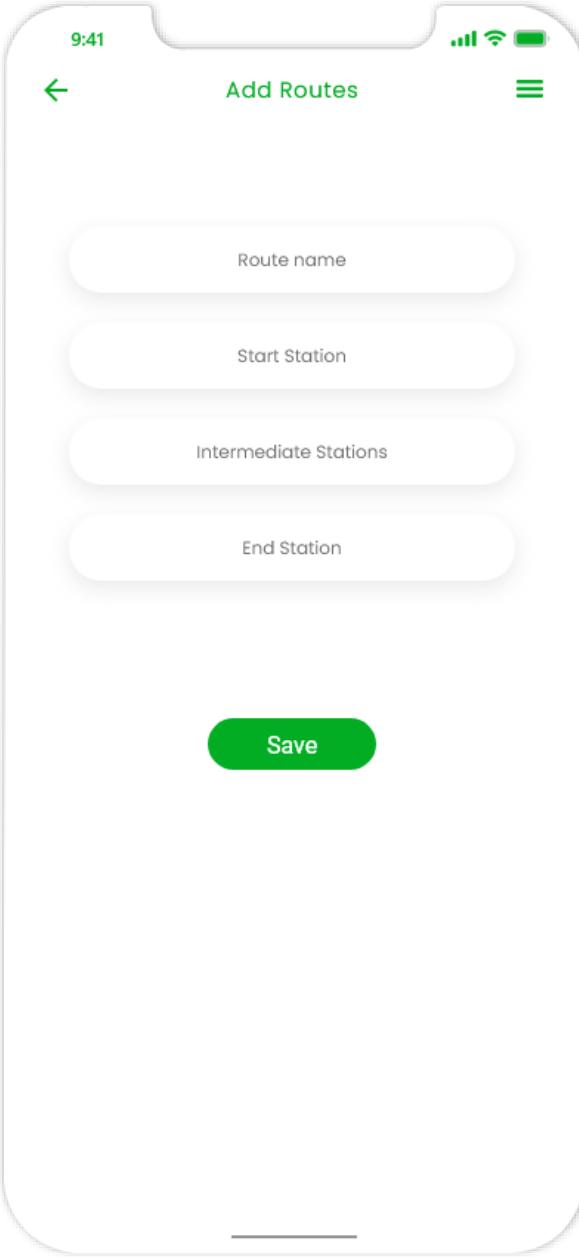


Figure 176 Admin - Add Routes

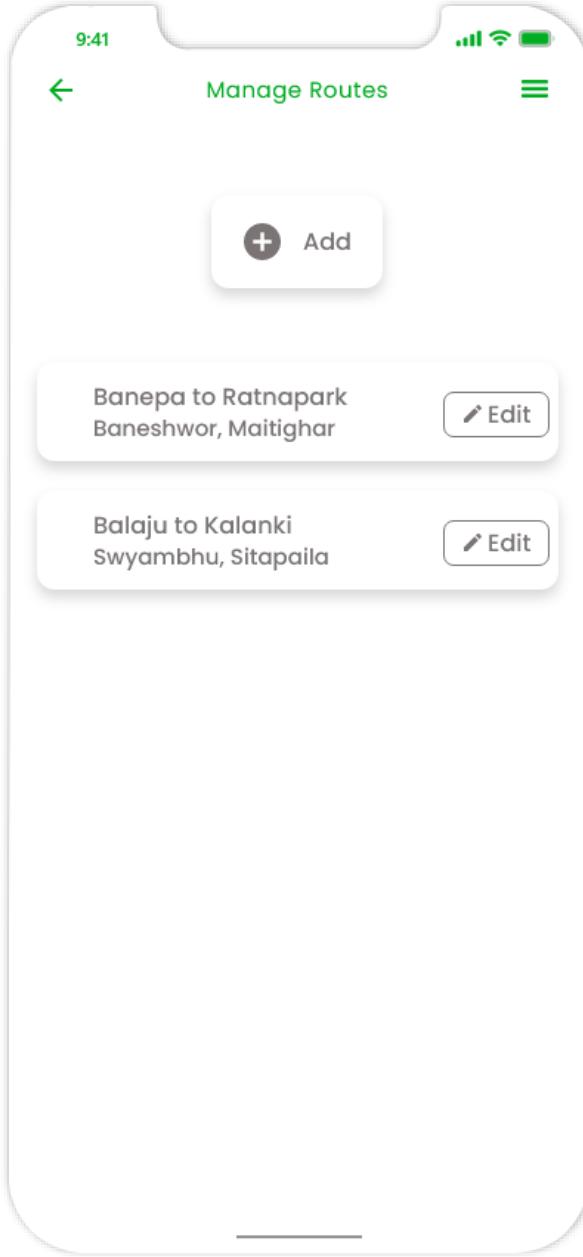


Figure 177 Admin - View Routes

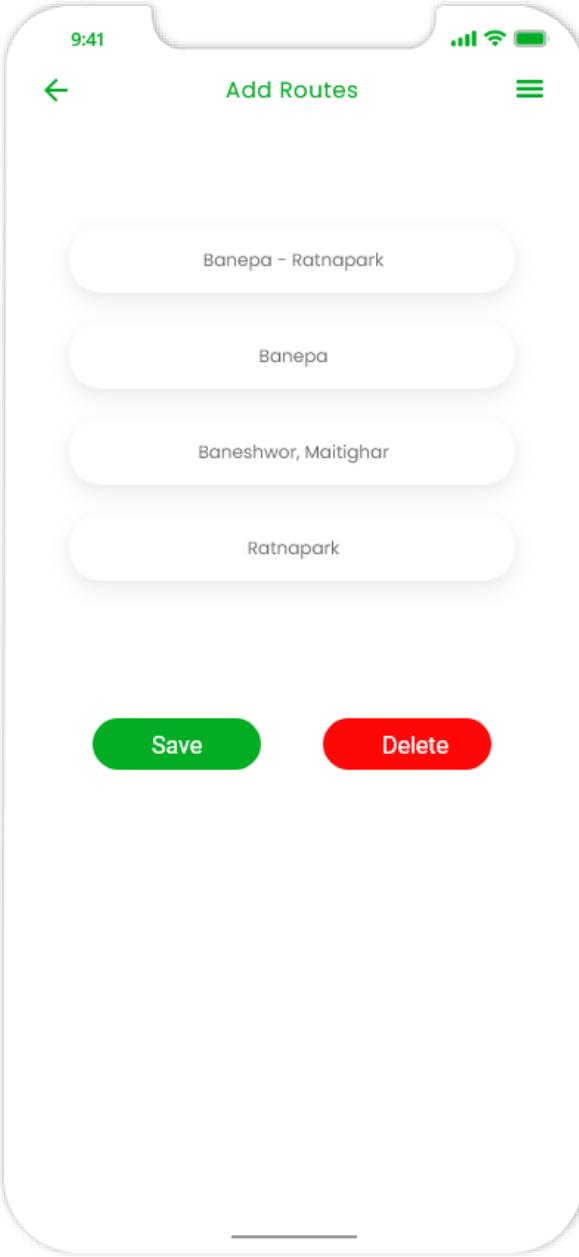


Figure 178 Admin - Edit route

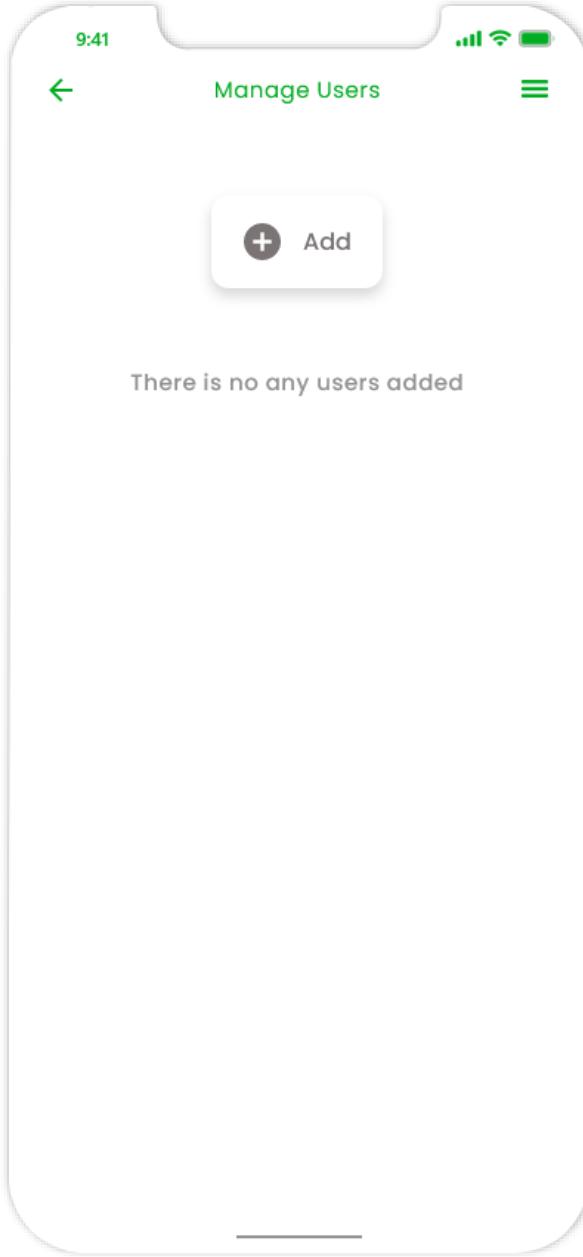


Figure 179 Admin - Manage User

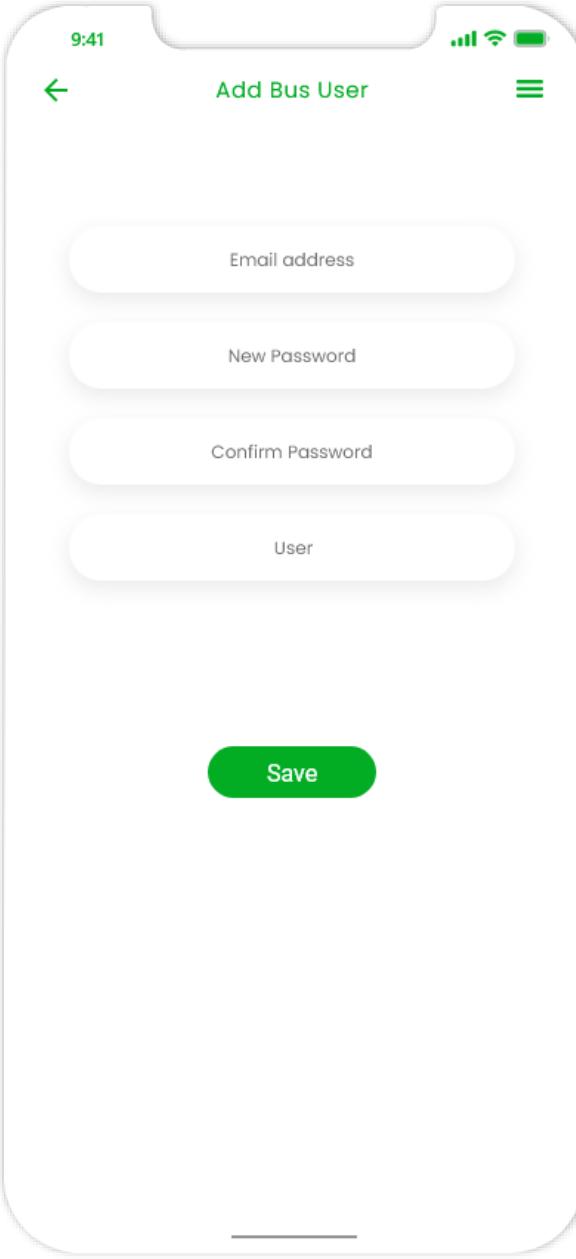


Figure 180 Admin - Add Bus user

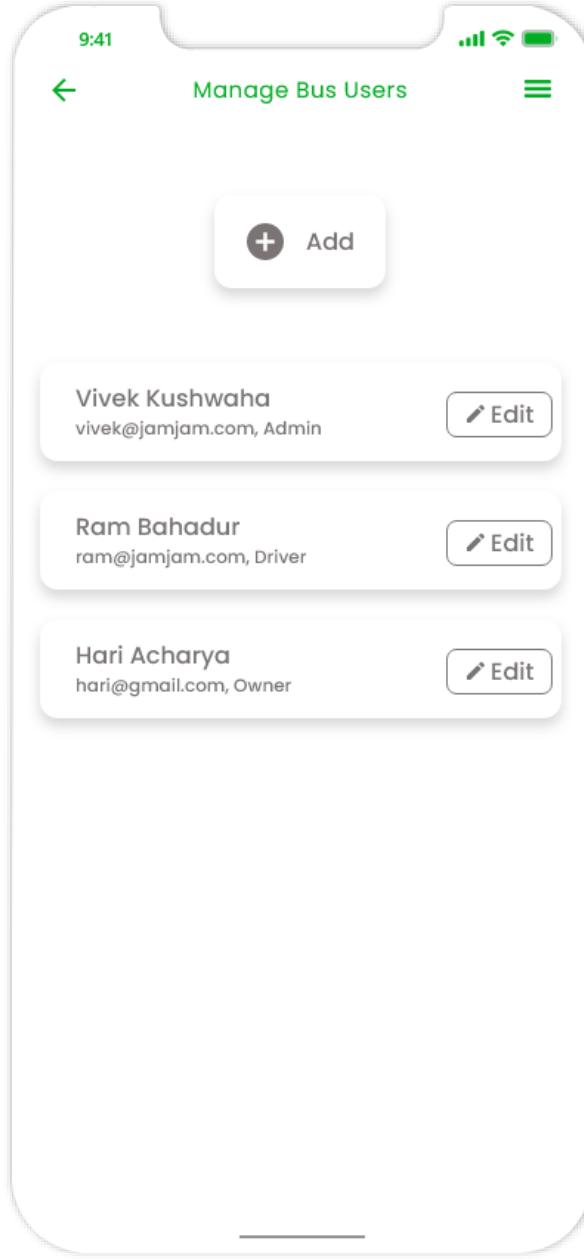


Figure 181 Admin - Manage bus user

User Evaluation of the second prototype

High fidelity prototype is very important to design before developing actual product, because it allows users, tester, and developer to have feelings of actual product; how it will work, look, and feel. It allows product designer to get actual detailed feedback from users, so that they can make necessary changes. Users test the product on high-fidelity prototypes to see whether the interface is intuitive, if they can study hypotheses, and if the design meets accessibility requirements for people with various sorts of visual impairments ([Shuhalii, 2020](#)).

Methodology

To test the high-fidelity prototype Guerilla Usability testing framework were used, Guerrilla testing is a technique for getting user feedback by bringing a design or prototype into the public place and asking visitors for their feedback. New concepts can be tested quickly and cheaply thanks to its simplicity, making it a viable UX testing method ([Chesters, n.d.](#)). To setup and perform the testing following methods were used.

Choosing location and setup

Before the testing began, the location was chosen, and **all** the necessary equipment was set up, including a camera, tripod, laptops, mobile, and a screen recorder.

Outreach and user screening

User testing was conducted in public places and on college premises. Users were approached and asked if they were interested in testing the application. Those who were interested were given prepared tasks to test using a mobile device or a computer with screen recording turned on, and they performed the testing.

Gathering information and user feedback

Crew members were instructed to gather information while testing the application and After each successful test, user were asked to provide feedback and recommendations.

Software

Adobe XD, a prototyping tool with several features such as component, component state, and lots of useful plugins, was used to design a clean and minimal looking product.

Environment

Softwarica College was chosen to do the testing because users were more likely to found and agree to test the application. Testing was also conducted at a chicken station, where two of the users tested the product. Five people were chosen from these locations, and their profile information is shown in the table below.

Participants

High Fidelity Testing - Participants				
Participants Name	Age	Gender	Education	Transportation (Private/Public)
Nona Pandya	21	Female	Ethical Hacker	Public
Shristhi Gautam	22	Female	Computer Science	Private
Sumit Yadav	24	Male	BBA	Public
Pashupati Kushwaha	29	Male	Chartered Accountant	Private
Aadarsh Singh	13	Male	6 class	Public

Figure 182 High Fidelity testing participants' profile

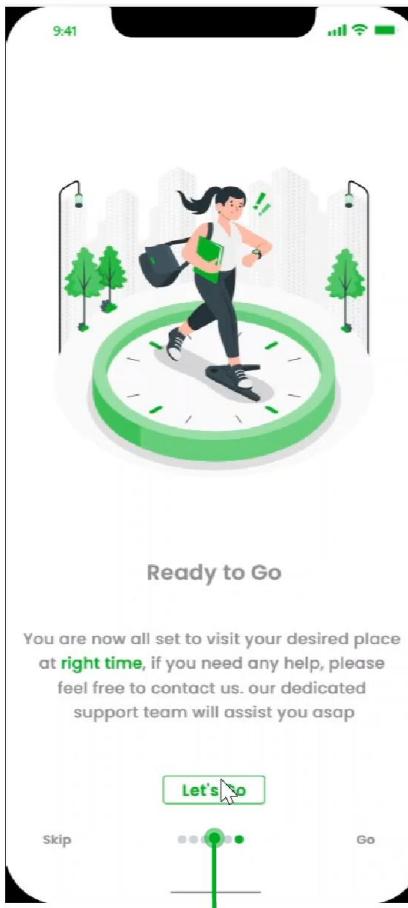
Scenarios

While testing the high-fidelity prototype of application following task were performed by user which are listed below with their reaction recorded.

Task 0

High Fidelity Testing - Tasks

Task 0: Open Public bus tracking app



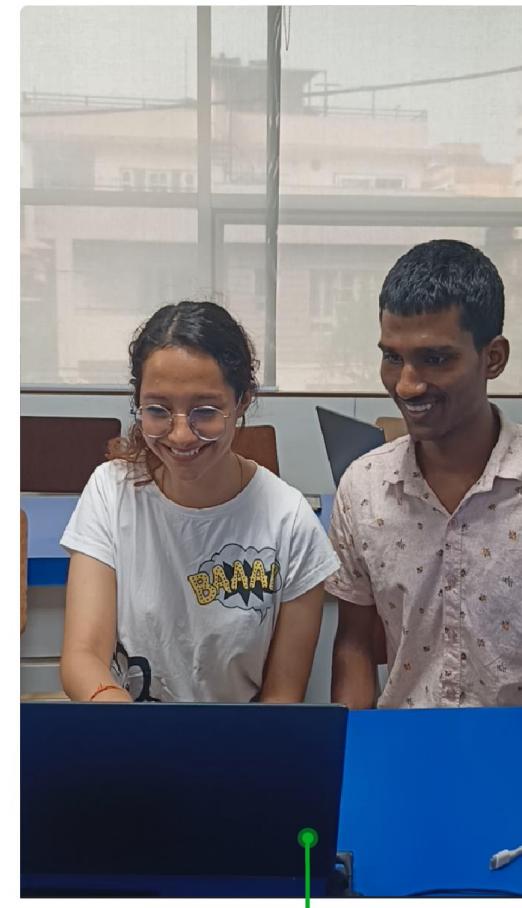
Ready to Go

You are now all set to visit your desired place at **right time**, if you need any help, please feel free to contact us. our dedicated support team will assist you asap

Let's Go

Skip Go

Performing Task



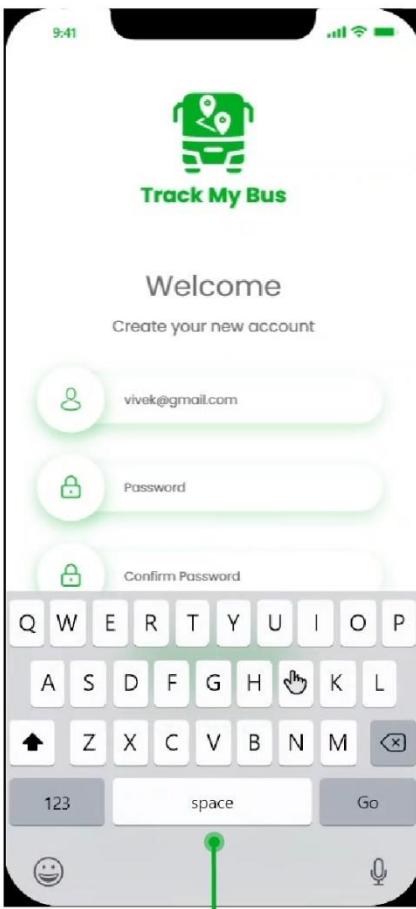
User Reaction

Figure 183 High Fidelity Testing - Initial task

Task 1

High Fidelity Testing - Tasks

Task 1: Register yourself & Login



Performing Task



User Reaction

Figure 184 High Fidelity Testing - Task 1

Task 2

High Fidelity Testing - Tasks

Task 2: Track bus by location (Source & Destination)



Performing Task

A mockup of a mobile application interface. At the top, there are navigation icons: Home, Routes, Favorites, and Menu. Below that is a search bar with the placeholder "Ratnapark". The main area shows a map with a green route line starting from "Ratnapark" and ending at a red dot. A callout bubble says "Click on bus to select". There are three bus stops labeled: "sinemangal Arrives in 7 min", "Jodibuli Arrives in 18 min", and "Kotashwar Arrives in 7 min". Each stop has a small bus icon and a red line indicating its path. A cursor arrow points towards the "sinemangal" stop. At the bottom, there are icons for location, compass, and bus.



User Reaction

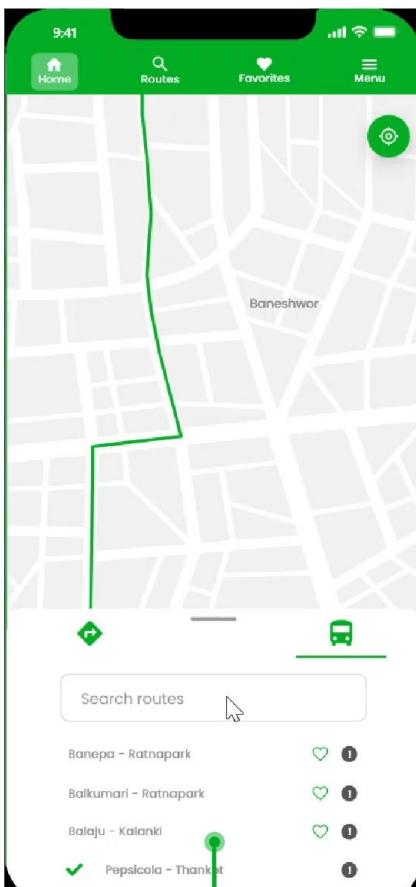
A photograph of a young woman with dark hair and glasses, wearing a white t-shirt with a graphic that includes the word "BAAAAD". She is sitting at a desk and looking intently at a laptop screen. A green dot is overlaid on the image, pointing to her eye area, likely indicating where she is looking or interacting with the screen.

Figure 185 High Fidelity Testing - Task 2

Task 3

High Fidelity Testing - Tasks

Task 3: Track Bus by Route



Performing Task



User Reaction

Figure 186 High Fidelity Testing - Task 3

Task 4

High Fidelity Testing - Tasks

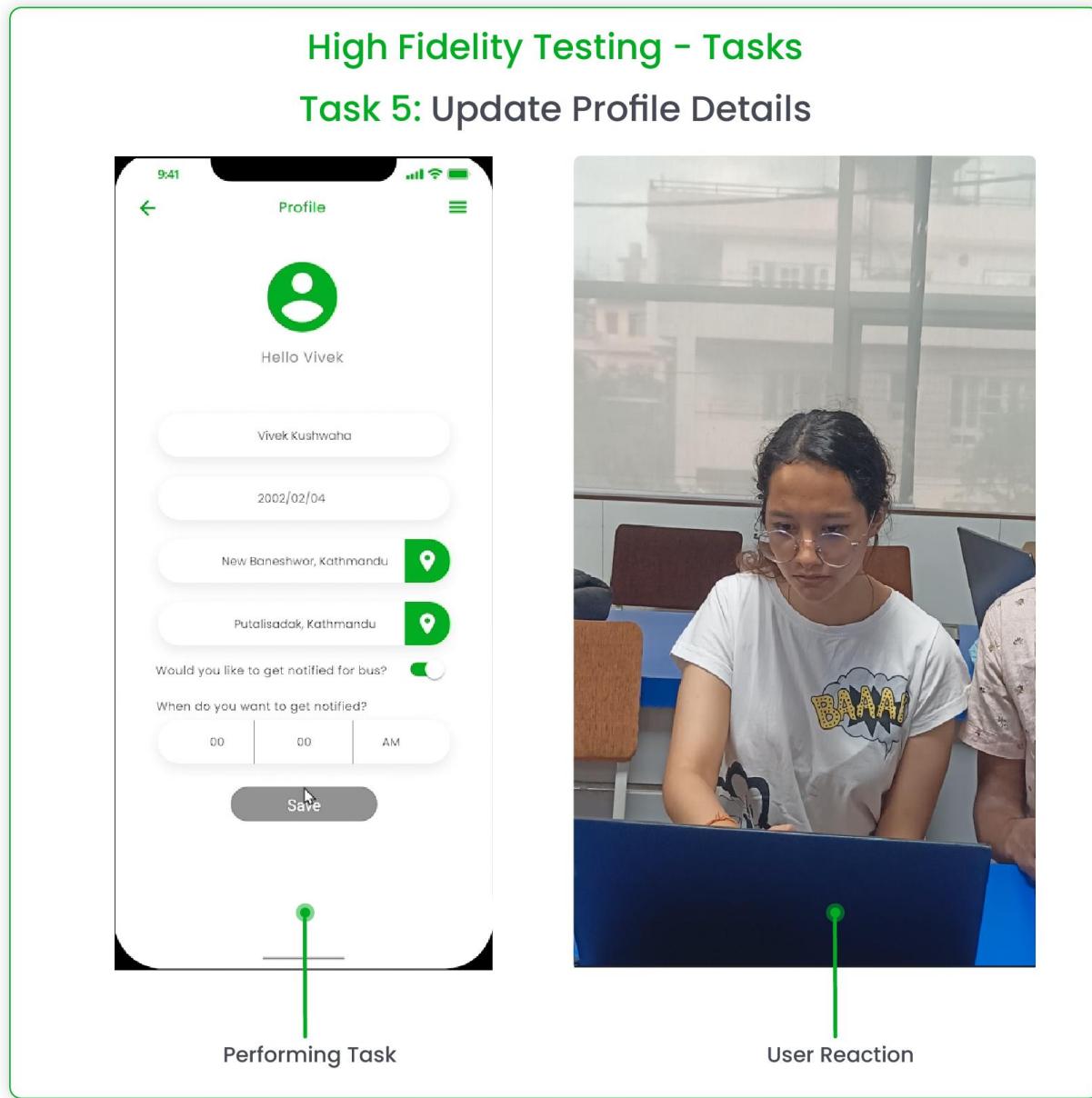
Task 4: Change Password

Performing Task

User Reaction

Figure 187 High Fidelity Testing - Task 4

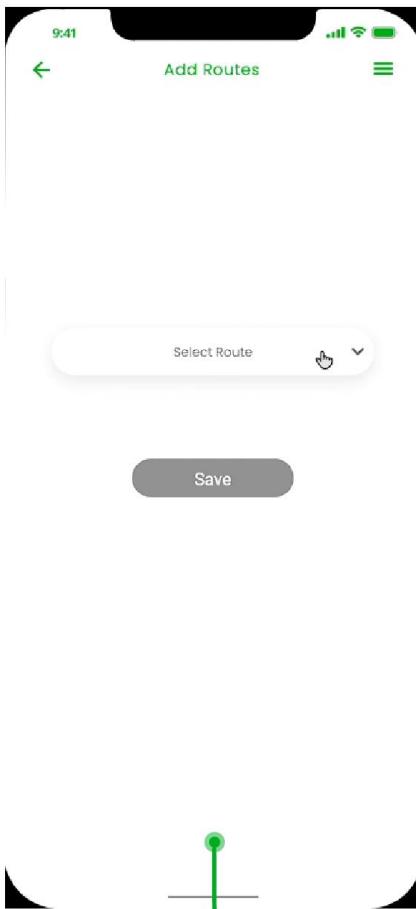
Task 5



Task 6

High Fidelity Testing - Tasks

Task 6: Login with owner and add route, driver & Bus



Performing Task



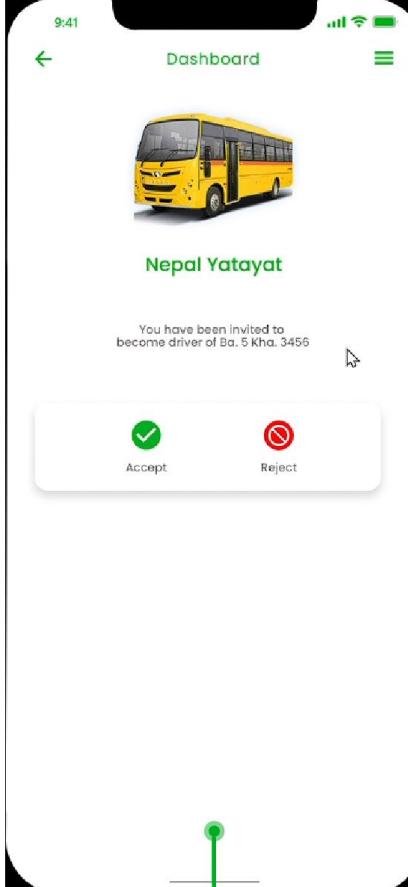
User Reaction

Figure 189 High Fidelity Testing - Task 6

Task 7

High Fidelity Testing - Tasks

Task 7: Login with driver account and accept bus invitation



9:41

Dashboard

Nepal Yatayat

You have been invited to become driver of Ba. 5 Kha. 3456

Accept Reject

Performing Task



User Reaction

Figure 190 High Fidelity Testing - Task 7

Task 8

High Fidelity Testing - Tasks

Task 8: Allow Tracking

The image is a composite of two parts. On the left, there is a screenshot of a mobile application interface titled "High Fidelity Testing - Tasks". The app has a green header bar with icons for Home, Routes, Favorites, and Menu. Below the header is a map showing a street grid. In the center of the map is a red circular button with the text "Stop Live". To the right of the map is a green circular icon with a gear symbol. At the bottom of the screen are two input fields: "Current Location" with a checkmark icon and "Destination Location" with a location pin icon. Below these fields are two green arrows pointing upwards, labeled "Performing Task". On the right side of the composite image is a photograph of a young woman with dark hair and glasses, wearing a white t-shirt with the word "BAAAD" printed on it. She is sitting at a desk and looking at a blue laptop screen. A green arrow points upwards from the bottom of the laptop towards her, labeled "User Reaction". The background of the photograph shows a window with a view of buildings outside.

Figure 191 High Fidelity Testing - Task 8

Task 9

High Fidelity Testing - Tasks

Task 9: Login with admin then add bus station

The image shows a smartphone displaying an application interface titled "Add Bus Station". The screen contains fields for "Station Name" (set to "Banepa") and "Station Location (Lat, Lng)", along with a "Save" button. Below the phone is a vertical green line with a dot at the top, labeled "Performing Task". To the right of the phone is a photograph of a person wearing glasses and a white t-shirt, sitting at a desk and looking at a laptop screen. A vertical green line with a dot at the top is positioned next to the person, labeled "User Reaction".

Performing Task

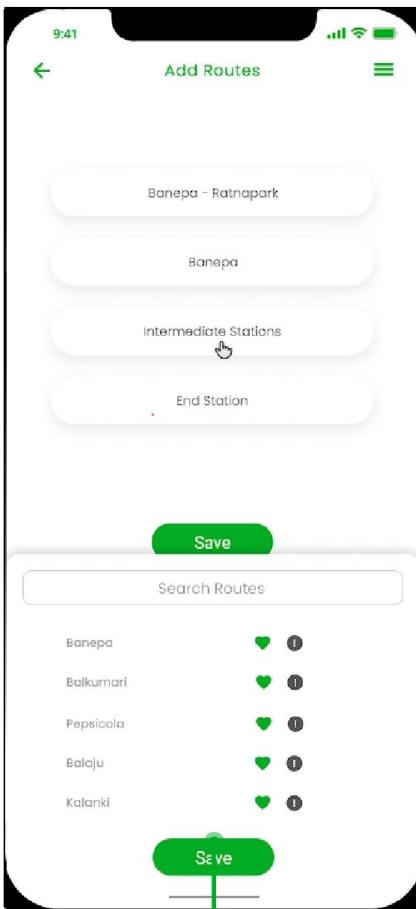
User Reaction

Figure 192 High Fidelity Testing - Task 9

Task 10

High Fidelity Testing - Tasks

Task 10: Add Bus Route



Performing Task



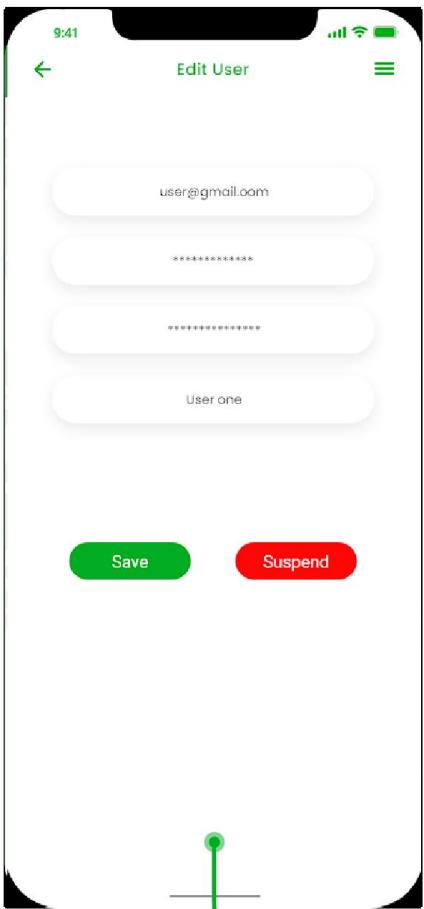
User Reaction

Figure 193 High Fidelity Testing - Task 10

Task 11

High Fidelity Testing - Tasks

Task 11: Suspend User



Performing Task



User Reaction

Figure 194 High Fidelity Testing - Task 11

Results

Many application issues were discovered after testing the application with real users; some tasks were difficult than others, and users asked assistance while performing the tasks. Various testing metrics were evaluated to uncover the design flaw, and in the later subsection, observations are made on those metrics.

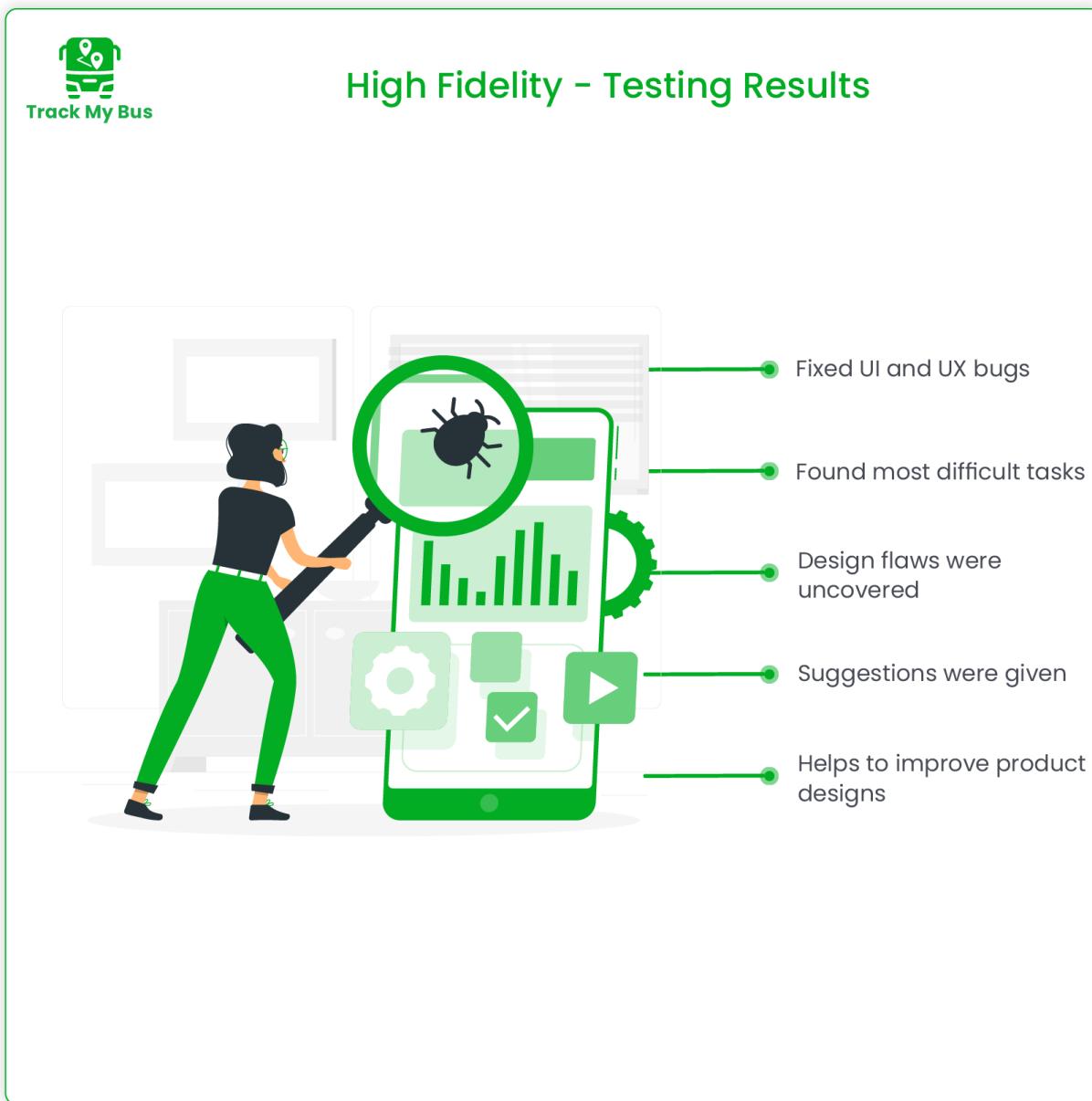


Figure 195 High Fidelity - Testing Results

Observation

Time on tasks

By determining time on task of user, it can be helpful to analyze which task consumed more time where it was not expected to take. After product designer can tweak the UX based on user recommendation and feedbacks.



High Fidelity - Time on Tasks						
Tasks	User 1	User 2	User 3	User 4	User 5	Average time
Task 1	16 seconds	18 seconds	20 seconds	31 seconds	15 seconds	20 seconds
Task 2	19 seconds	22 seconds	28 seconds	20 seconds	32 seconds	24 seconds
Task 3	30 seconds	23 seconds	34 seconds	55 seconds	43 seconds	37 seconds
Task 4	29 seconds	21 seconds	43 seconds	29 seconds	46 seconds	34 seconds
Task 5	55 seconds	31 seconds	29 seconds	32 seconds	43 seconds	38 seconds
Task 6	108 seconds	97 seconds	120 seconds	87 seconds	119 seconds	106 seconds
Task 7	123 seconds	53 seconds	49 seconds	67 seconds	40 seconds	66 seconds
Task 8	40 seconds	32 seconds	39 seconds	23 seconds	15 seconds	30 seconds
Task 9	45 seconds	43 seconds	35 seconds	54 seconds	67 seconds	49 seconds
Task 10	87 seconds	56 seconds	36 seconds	63 seconds	52 seconds	59 seconds
Task 11	30 seconds	41 seconds	37 seconds	56 seconds	30 seconds	39 seconds

Figure 196 High Fidelity - Time on tasks

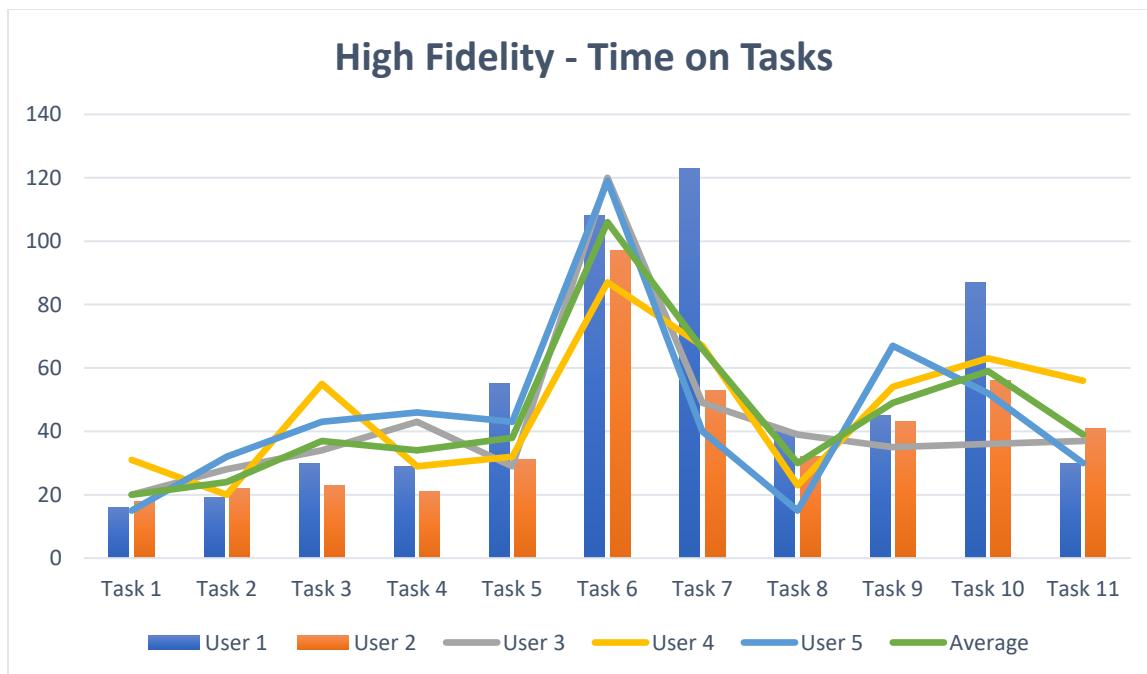


Figure 197 High Fidelity - Time on Tasks

Task completion rate



Users Tasks	User 1	User 2	User 3	User 4	User 5	Result
Task 1	Yes	Yes	Yes	Yes	Yes	100%
Task 2	Yes	Yes	No	Yes	Yes	80%
Task 3	Yes	No	Yes	Yes	Yes	80%
Task 4	Yes	Yes	No	Yes	Yes	80%
Task 5	Yes	Yes	Yes	Yes	Yes	100%
Task 6	Yes	Yes	Yes	Yes	No	80%
Task 7	Yes	Yes	Yes	No	Yes	80%
Task 8	Yes	Yes	Yes	Yes	Yes	100%
Task 9	Yes	Yes	Yes	Yes	No	80%
Task 10	Yes	Yes	Yes	Yes	Yes	100%
Task 11	Yes	No	Yes	No	Yes	80%

Figure 198 High Fidelity - Task Completion Ratio

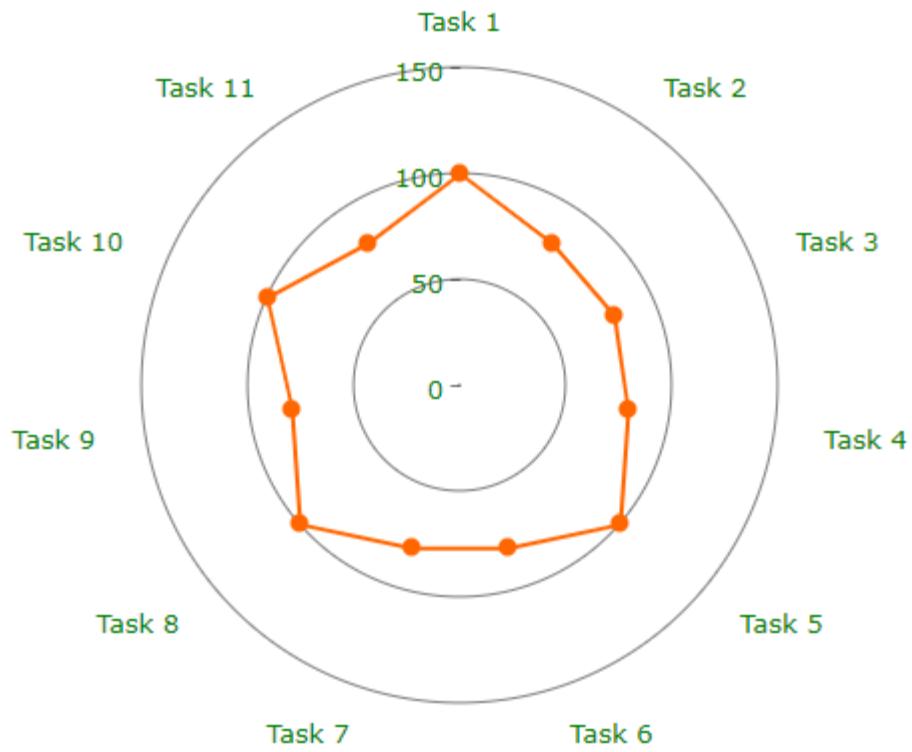


Figure 199 Task Completion rate chart

Efficiency



High Fidelity - Number of Action to Complete Task

Users Tasks	User 1	User 2	User 3	User 4	User 5	Average
Task 1	10	12	11	13	13	12
Task 2	12	11	10	14	12	12
Task 3	9	11	8	9	8	9
Task 4	11	14	18	9	7	12
Task 5	18	16	16	15	20	17
Task 6	35	45	39	47	51	43
Task 7	23	21	22	19	22	21
Task 8	3	8	3	7	5	5
Task 9	56	48	54	46	51	51
Task 10	12	12	14	9	8	11
Task 11	8	7	13	6	19	11

Figure 200 High fidelity - Numbers of action to complete tasks

High Fidelity - Number of action to complete task

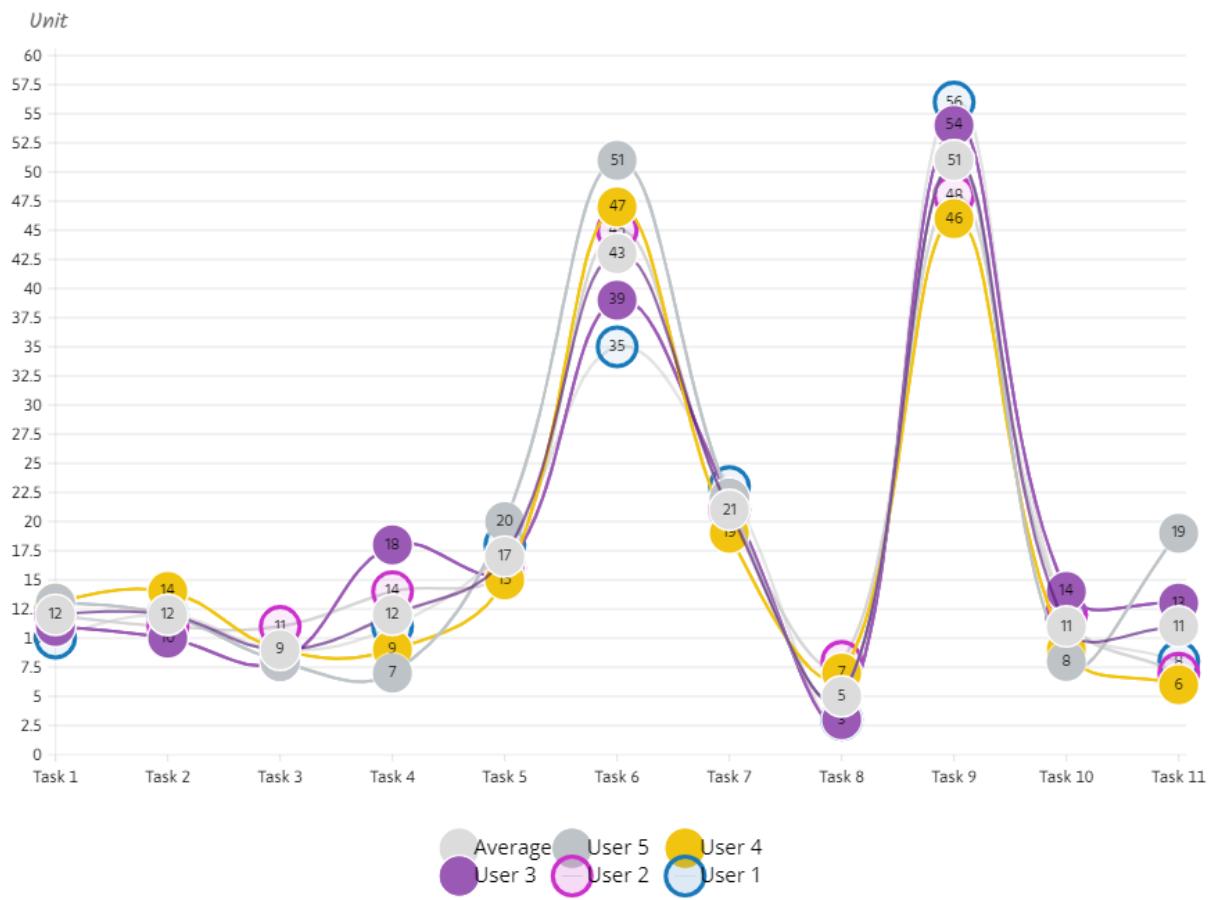


Figure 201 High Fidelity - Number of actions to complete task

Learnability



Users Tasks	User 1	User 2	User 3	User 4	User 5	Total
Task 1	0	0	0	0	0	0
Task 2	2	0	2	0	0	4
Task 3	1	0	0	0	0	1
Task 4	0	0	1	1	0	2
Task 5	0	1	0	1	2	4
Task 6	2	1	0	1	4	8
Task 7	1	1	0	0	0	2
Task 8	0	0	0	0	1	1
Task 9	1	3	0	1	1	5
Task 10	0	0	0	0	0	0
Task 11	0	0	1	0	0	1

Figure 202 High fidelity -Number of ask for help



Figure 203 Total number of helps requested per task

User Analysis of the Features/Functionalities



High Fidelity – User analysis of features/functionalities

User 2	Features or Functionalities	Average Scale																				
1	Onboarding screens are informative to get to know about app	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
1	2	3	4	5	6	7	8	9	10													
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>													
2	Color and contrast of application is clear and it looks good	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
1	2	3	4	5	6	7	8	9	10													
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>													
3	User interface of application is clean and minimal	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
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4	Icons and infographics on application are clear and relevant	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
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5	Navigation drawer is accessible and easy to use	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
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6	It is easier to switch between different user mode	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
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7	App gives sign after each successful action	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
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8	It is easy to schedule bus	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
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9	Track bus by route is quick and easy	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
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10	Track bus by location and destination is useful feature	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
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11	Adding location and route as favorite is useful	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
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12	How much likely will you recommend this app to others	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>					
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13	How often will you use this app (0 being never, 10 being everytime whenever I will need to go outside)	<table border="1"> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td> </tr> <tr> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td><td><input type="checkbox"/></td> </tr> </table>	1	2	3	4	5	6	7	8	9	10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					
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Feedback and Recommendations:

While testing specific tasks, usability test feedback and recommendations can be used to get an idea of how real customers liked various sections of the product. It is useful to identify whether the product is well liked by the user or not and how it may be improved by taking into consideration the suggestions made by the users.

Feedback

User feedback is critical for improving the product's UI and UX, as this product is designed by keeping the user at center. User feedback will assist designers and developers in understanding how to make the product more usable and efficient. All users were encouraged to share what they enjoyed about the app and what they thought should be improved in the latest iteration. After collection of data, it was discovered that several improvements are required, which are stated below.

- ❖ Font size to switch user type needed to increase
- ❖ It's hard to find from where user can be switched
- ❖ Didn't want to provide their home address and office address
- ❖ Need to schedule multiple timing to get notification.
- ❖ It's difficult to find search panel is draggable if it is closed.

Recommendation

It's not mandatory that everything has been covered in the current design; it's possible that a critical function is missing from the application, and user recommendation can help fill in those gaps. The following are some user-recommended features that can add value to the application.

- ❖ Get notification of upcoming bus once enabled, even if user is offline.
- ❖ To allow track bus within some radius.
- ❖ Show how much time it will take to reach destination
- ❖ Have option to let Vibrate or Rings if bus arrived at destination or source.
- ❖ Ability to check if there is seat vacant in bus.
- ❖ Show how much average fare is to reach the selected location.

Data analysis

After analyzing all the data, it was found that task 6 took longer than expected, and most of the users requested assistance with it, thus it must be improved. In addition, task 9's user experience must be improved because its learnability is poor, and it was not performing well while testing.

Conclusion of High Fidelity:

High fidelity testing was extremely helpful in identifying moderate and serious UI and UX flaws that needed to be addressed for the app to work successfully in the real world with actual users. It allowed product designers to have a closer look at how the product will look and function after development, while developers will find it easier to develop the application based on the design, and there will be limited chances to change the design during the development phase.

Conclusion

In this report, the user interface and user experience of a public bus tracking system were designed, allowing users to track buses based on their desired location and routes. Usability testing was required so that the product could work as intended in the real world. While designing the product, every design principle was considered, and low and high-fidelity prototypes were produced to test the functionality and features of the application by actual users, with the low-fi prototype being tested using the Wizard of Oz method and the hi-fi prototype being tested with random users using the Guerilla testing method. Data was collected based on various testing metrics such as time on task, user reaction to task, number of actions, and task completion rate and later it was analyzed where critical UI and UX bugs were identified that needed to be fixed in order to make the application usable, memorable, and user centered.

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Appendix

Video URL

<https://drive.google.com/drive/folders/1LExcA29nsB4uesu-uEX813oB7ebXRjdy?usp=sharing>

Prototype Link

<https://drive.google.com/drive/folders/1To5Z6eXzy1IQC9wRZWms08mafEbhich?usp=sharing>

Environment



Figure 204 At Softwarica College premises



Figure 205 People Spotted

Users



Figure 206 Approaching the User



Figure 207 Performing Test



CU_ID: 1026917

Consent form

Usability test consent form

Please read and sign this form.

In this usability test:

- You will be asked to perform certain tasks on a computer.
- We will also conduct an interview with you regarding the tasks you performed.

Participation in this usability study is voluntary. All information will remain strictly confidential. The descriptions and findings may be used to help improve the Kinect application. However, at no time will your name or any other identification be used. You can withdraw your consent to the experiment and stop participation at any time.

If you have any questions after today, please contact Bibekanand Kushwaha at
anandkushwaha2074@gmail.com

I have read and understood the information on this form and had all of my questions answered

Name: Dipesh Singh



Subject's Signature

Date : 2021/09/06

Usability test consent form

Please read and sign this form.

In this usability test:

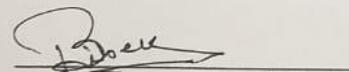
- You will be asked to perform certain tasks on a computer.
- We will also conduct an interview with you regarding the tasks you performed.

Participation in this usability study is voluntary. All information will remain strictly confidential. The descriptions and findings may be used to help improve the Kinect application. However, at no time will your name or any other identification be used. You can withdraw your consent to the experiment and stop participation at any time.

If you have any questions after today, please contact Bibekanand Kushwaha at
anandkushwaha2074@gmail.com

I have read and understood the information on this form and had all of my questions answered

Name: Bibek Subedi



Subject's Signature

Date : 2021/09/06

Usability test consent form

Please read and sign this form.

In this usability test:

- You will be asked to perform certain tasks on a computer.
- We will also conduct an interview with you regarding the tasks you performed.

Participation in this usability study is voluntary. All information will remain strictly confidential. The descriptions and findings may be used to help improve the Kinect application. However, at no time will your name or any other identification be used. You can withdraw your consent to the experiment and stop participation at any time.

If you have any questions after today, please contact Bibekanand Kushwaha at
anandkushwaha2074@gmail.com

I have read and understood the information on this form and had all of my questions answered

Name: Indra Singh

Indra

Subject's Signature

Date : 2021/09/06

Usability test consent form

Please read and sign this form.

In this usability test:

- You will be asked to perform certain tasks on a computer.
- We will also conduct an interview with you regarding the tasks you performed.

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If you have any questions after today, please contact Bibekanand Kushwaha at
anandkushwaha2074@gmail.com

I have read and understood the information on this form and had all of my questions answered

Name: Riya Ranjit

Riya

Subject's Signature

Date : 2021/09/06

Usability test consent form

Please read and sign this form.

In this usability test:

- You will be asked to perform certain tasks on a computer.
- We will also conduct an interview with you regarding the tasks you performed.

Participation in this usability study is voluntary. All information will remain strictly confidential. The descriptions and findings may be used to help improve the Kinect application. However, at no time will your name or any other identification be used. You can withdraw your consent to the experiment and stop participation at any time.

If you have any questions after today, please contact Bibekanand Kushwaha at
anandkushwaha2074@gmail.com

I have read and understood the information on this form and had all of my questions answered

Name: Bimlesh Yadav

Bimlesh Yadav

Subject's Signature

Date : 2021/09/06