

*Florida Institute
of Technology*

Design Document

Florida Tech Carpool and Park

A mobile application for students to use to find and create carpooling groups.

Team Members:

Austin Phillips – aphillips2022@my.fit.edu

Hunter Smith – hsmith2021@my.fit.edu

Jason Smith – jsmith2022@my.fit.edu

Jacqueline Torres – jtorres2020@my.fit.edu

Faculty Advisor/ Client:

Dr. Philip Chan – pkc@cs.fit.edu

01/29/2024

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1. Introduction

1.1 Scope

The design document presents the framework for the "Florida Tech Carpool and Park" mobile application, aimed at enhancing the commuting experience within the Florida Tech community. By integrating student locations and class schedules, the application will facilitate the creation of effective carpool groups, directly addressing campus parking challenges. It encompasses a thorough analysis of functional and non-functional requirements, as well as the design of the user interface, system architecture, and security measures to ensure both usability and data protection. The overarching goal is to alleviate parking congestion on campus by encouraging a shift towards more sustainable and shared transportation methods.

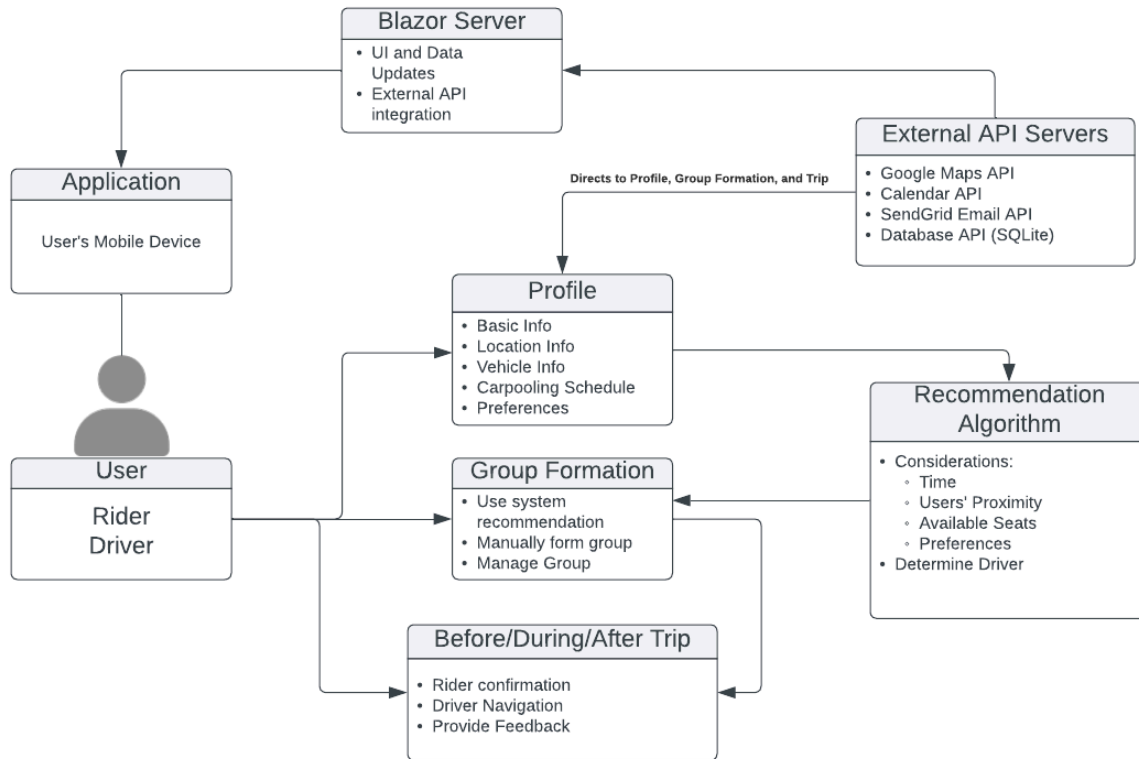
1.2 Overview of the Application

"Florida Tech Carpool and Park" targets the critical issue of campus parking by offering a streamlined solution for students to coordinate carpools. The application features include registration with a Florida Tech email, detailed profile management, efficient carpool scheduling, and instant communication capabilities. By reducing the number of vehicles needing parking through effective carpooling, the app directly addresses parking congestion. It emphasizes a practical, user-friendly approach to improve the campus parking situation, leveraging technology to enhance the daily commute for the Florida Tech community.

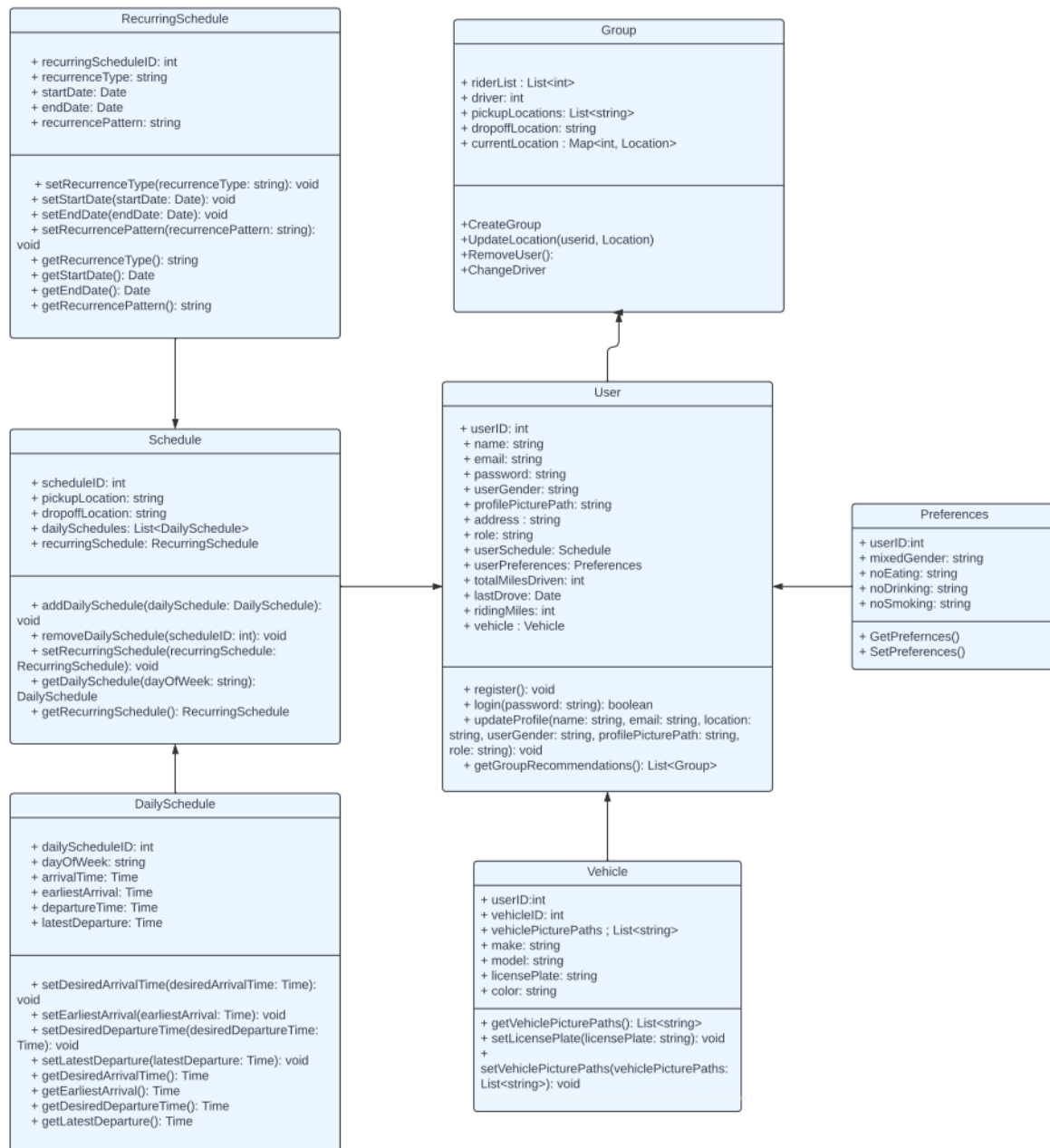
This document lays out a detailed plan for developing the "Florida Tech Carpool and Park" app, aimed specifically at mitigating campus parking issues through the deployment of advanced technical solutions and the strategic application of the Google Maps API. This API will be instrumental in enhancing route optimization and facilitating efficient carpool group arrangements, directly targeting and improving the parking situation on campus by streamlining how students commute and park.

2. System Architecture

2.1 System Architecture Diagram



2.2 UML Diagram



*3. User Interface Design

3.1 Register Page

The screenshot displays the 'Register' page of the 'FIT Carpool Group Finder' application. The page features a blue header bar with the application name and a hamburger menu icon. A vertical sidebar on the left contains icons for home, carpooling, group finding, and user profile. The main content area is light gray and contains a white 'Register' form. The form has three input fields: 'Email', 'Password', and 'Confirm Password'. Below these fields is a prominent blue 'Register' button. At the bottom of the page, a small footer note states: 'This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.'

This user interface provides a simple way for users to register an account for the Florida Tech Carpool application. User's will need to provide a valid FIT email and a password that meets the security requirements. User interface will provide feedback if an issue occurs with their input.

3.2 Preferences Page

3.2.1 Rider Information and Preference Input

The screenshot shows the 'Update Group Preferences' page. The top section, 'Basic Info', contains the following fields:

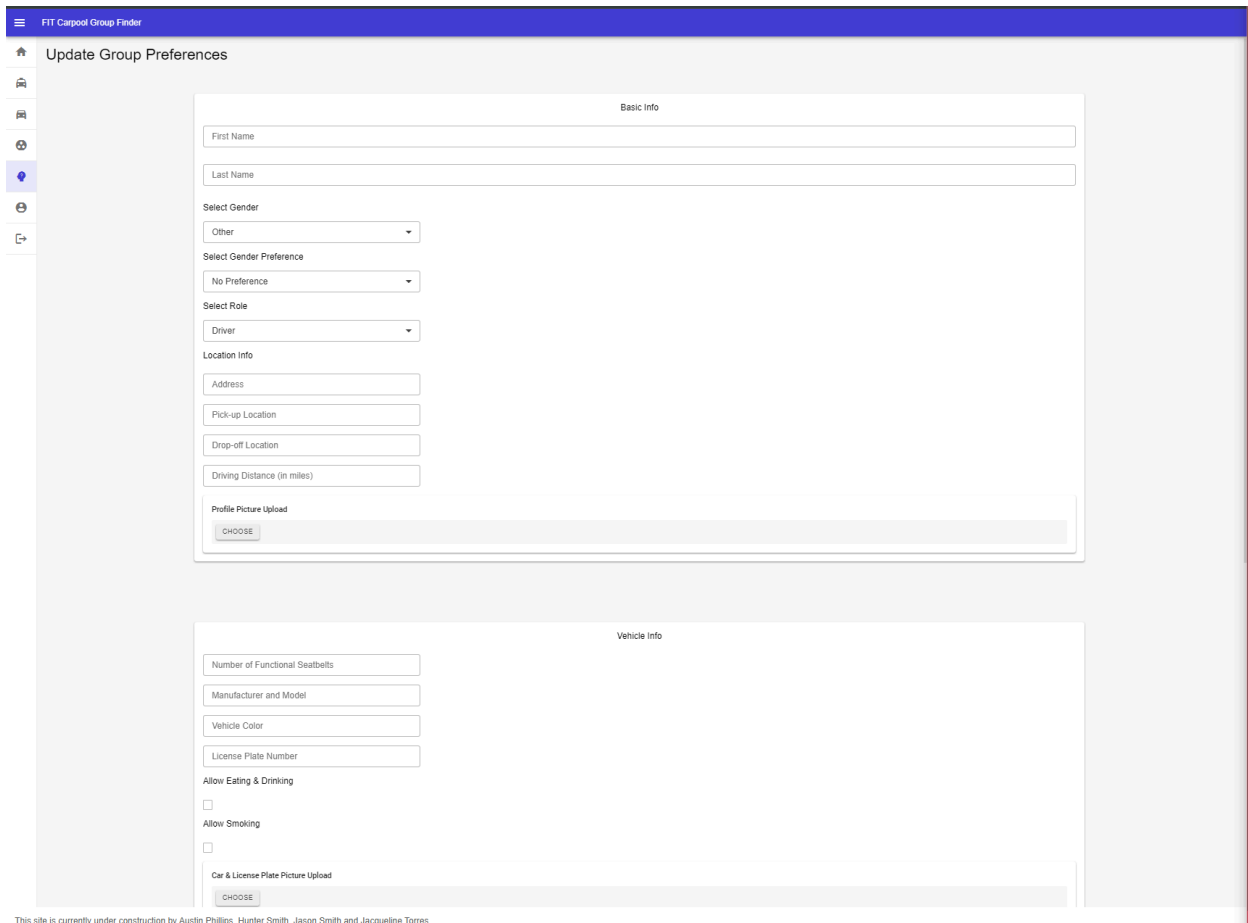
- First Name (text input)
- Last Name (text input)
- Select Gender (dropdown menu, currently set to 'Other')
- Select Gender Preference (dropdown menu, currently set to 'No Preference')
- Select Role (dropdown menu, currently set to 'Rider')
- Location Info section with:
 - Address (text input)
 - Pick-up Location (text input)
 - Drop-off Location (text input)
- Profile Picture Upload (button labeled 'CHOOSE')

The bottom section, 'Edit Schedule', shows a calendar for February 2024. The calendar has tabs for 'DAY', 'WEEK', and 'MONTH'. The 'MONTH' tab is selected. The calendar grid shows dates from 28 to 24. The dates 7, 8, 9, 10, 11, 12, 13, and 14 are highlighted in blue, indicating a schedule. The text 'Arrive on Campus' and 'Leave Campus' is visible on these dates.

At the bottom of the page, a small disclaimer reads: 'This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.'

This interface allows users to update and input their basic profile information as well as their preferences for groups they will be matched with. This page will be filled with the current users information if that information is stored in the database

3.2.2 Driver Information and Preference Input



Update Group Preferences

Basic Info

First Name

Last Name

Select Gender

Other

Select Gender Preference

No Preference

Select Role

Driver

Location Info

Address

Pick-up Location

Drop-off Location

Driving Distance (in miles)

Profile Picture Upload

CHOOSE

Vehicle Info

Number of Functional Seatbelts

Manufacturer and Model

Vehicle Color

License Plate Number

Allow Eating & Drinking

Allow Smoking

Car & License Plate Picture Upload

CHOOSE

This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.

This interface allows users to update and input their basic profile information as well as their preferences for groups they will be matched with. This page is the same as the rider page but is dynamically updated with a new section when the user selects they are a driver.

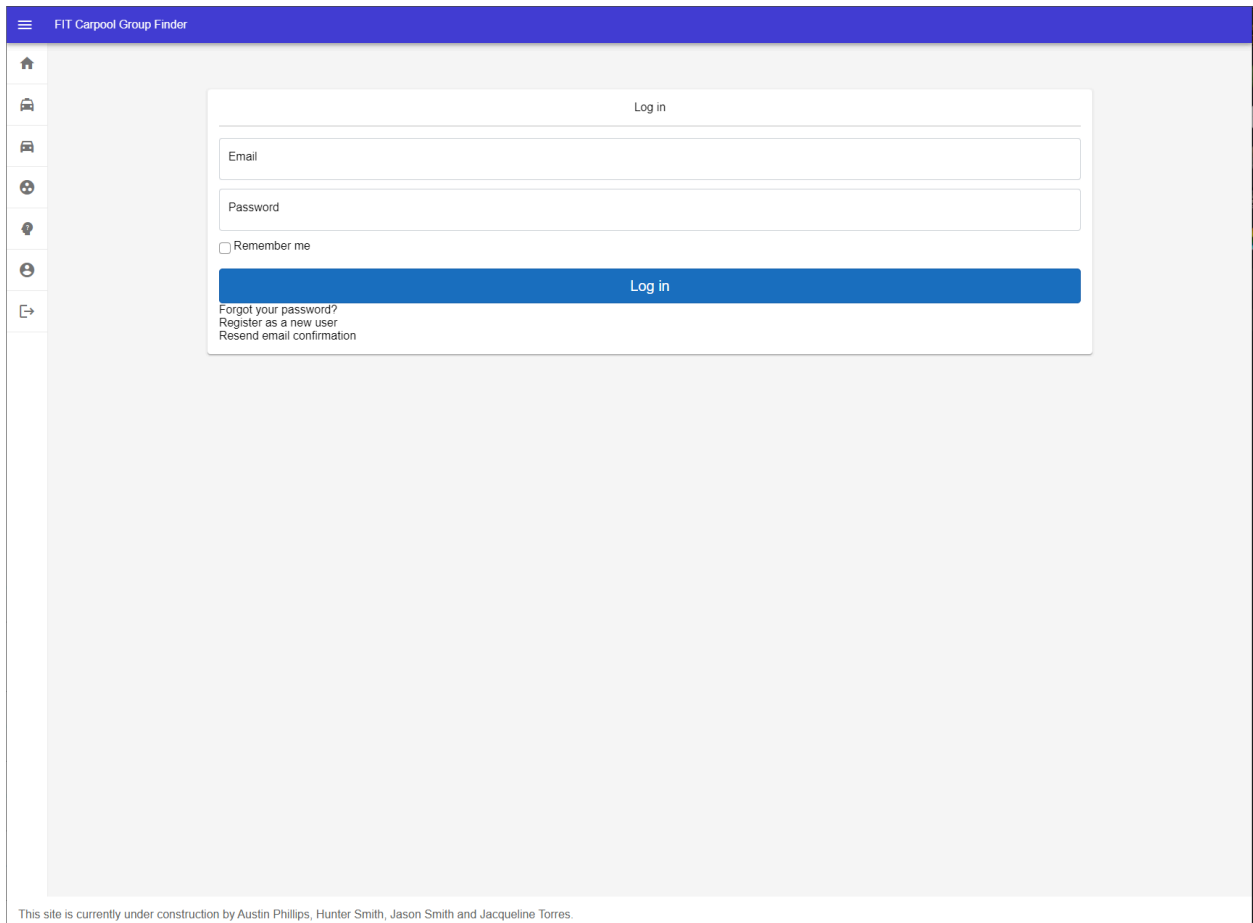
3.2.3 Schedule Calendar

The screenshot displays the 'Edit Schedule' interface. At the top, there is a title 'Edit Schedule' and a date range '2/4/2024 - 2/10/2024'. Below the date range are three view toggles: 'DAY', 'WEEK' (selected), and 'MONTH'. The main area is a calendar grid with columns for the days of the week (SUN, MON, TUE, WED, THU, FRI, SAT) and rows for the time of day (8 AM, 9 AM, 10 AM, 11 AM, 12 PM, 1 PM, 2 PM, 3 PM, 4 PM, 5 PM, 6 PM, 7 PM, 8 PM, 9 PM, 10 PM). The grid shows the following events:

Time	SUN	MON	TUE	WED	THU	FRI	SAT
8 AM				Arrive on Campus	Arrive on Campus	Arrive on Campus	Arrive on Campus
9 AM							
10 AM							
11 AM							
12 PM							
1 PM							
2 PM							
3 PM							
4 PM							
5 PM				Leave Campus	Leave Campus	Leave Campus	Leave Campus
6 PM							
7 PM							
8 PM							
9 PM							
10 PM							

This interface allows users to update their daily and weekly schedule to ensure they are recommended carpooling groups that meet their schedule for arrival and departures. The interface will allow users to set up recurring events to avoid having to manually type the same event multiple times.

3.3 Login Page

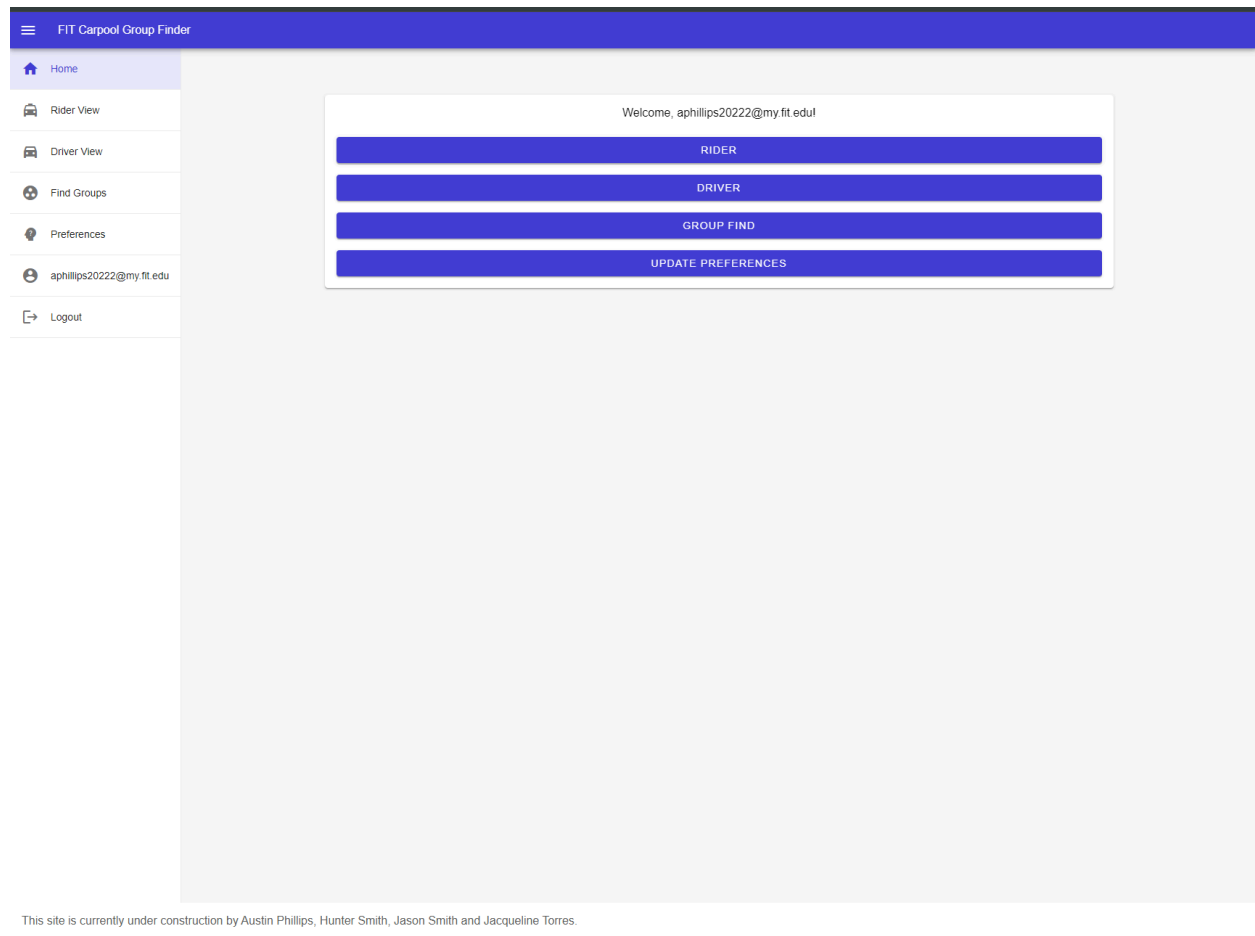


The screenshot displays the login interface for the FIT Carpool Group Finder. A blue header bar at the top contains a hamburger menu icon and the text "FIT Carpool Group Finder". On the left, a vertical sidebar lists icons for home, carpooling, groups, a puzzle piece, a person, and an external link. The main content area features a white "Log in" form. This form includes input fields for "Email" and "Password", a "Remember me" checkbox, and a prominent blue "Log in" button. Below the button, there are links for "Forgot your password?", "Register as a new user", and "Resend email confirmation". A footer note at the bottom of the page states: "This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres."

This page provides a way for users to login to already registered accounts, reset their password and register if needed.

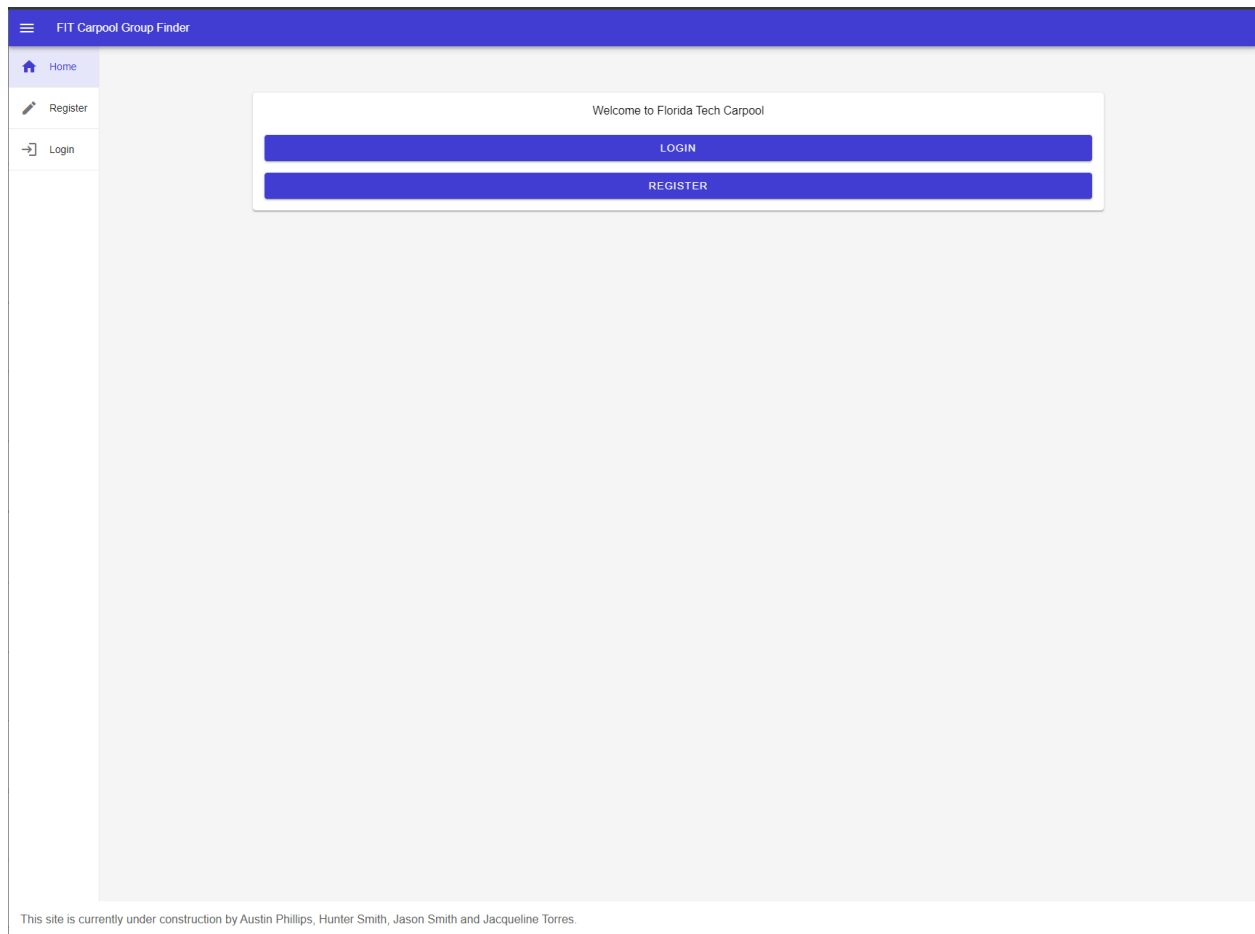
3.3 Home Page

3.3.1 Authenticated User Home Page



This page provides links to the 4 key pages that require the user to be authenticated to use. Serves as a landing page after a user logs in.

3.3.2 Unauthenticated User Home Page



This page provides users direct links to login and register to the application. This page will be the landing page for users when they first attempt to use this web application.

3.4 Account Information Pages

3.4.1 View Trip Statistics

The screenshot displays the 'Manage your account' interface for the FIT Carpool Group Finder. The left sidebar contains navigation links: Profile (selected), Email, Password, Two-factor authentication, and Personal data. The main content area is titled 'Profile' and includes a form for updating user information. The form fields are: Username (displayed as 'aphillips20222@my.fit.edu'), Email, Password, and Phone number (displayed as '3016028508'). A blue 'Save' button is positioned below the phone number field. Below the form, trip statistics are listed: Total Miles Driving: 212 miles, Total Trips Driving: 15 trips, Total Miles Riding: 32 miles, Total Trips Riding: 2 trips, and User Feedback Rating: 4 stars (represented by four yellow stars).

Profile

Username
aphillips20222@my.fit.edu

Phone number
3016028508

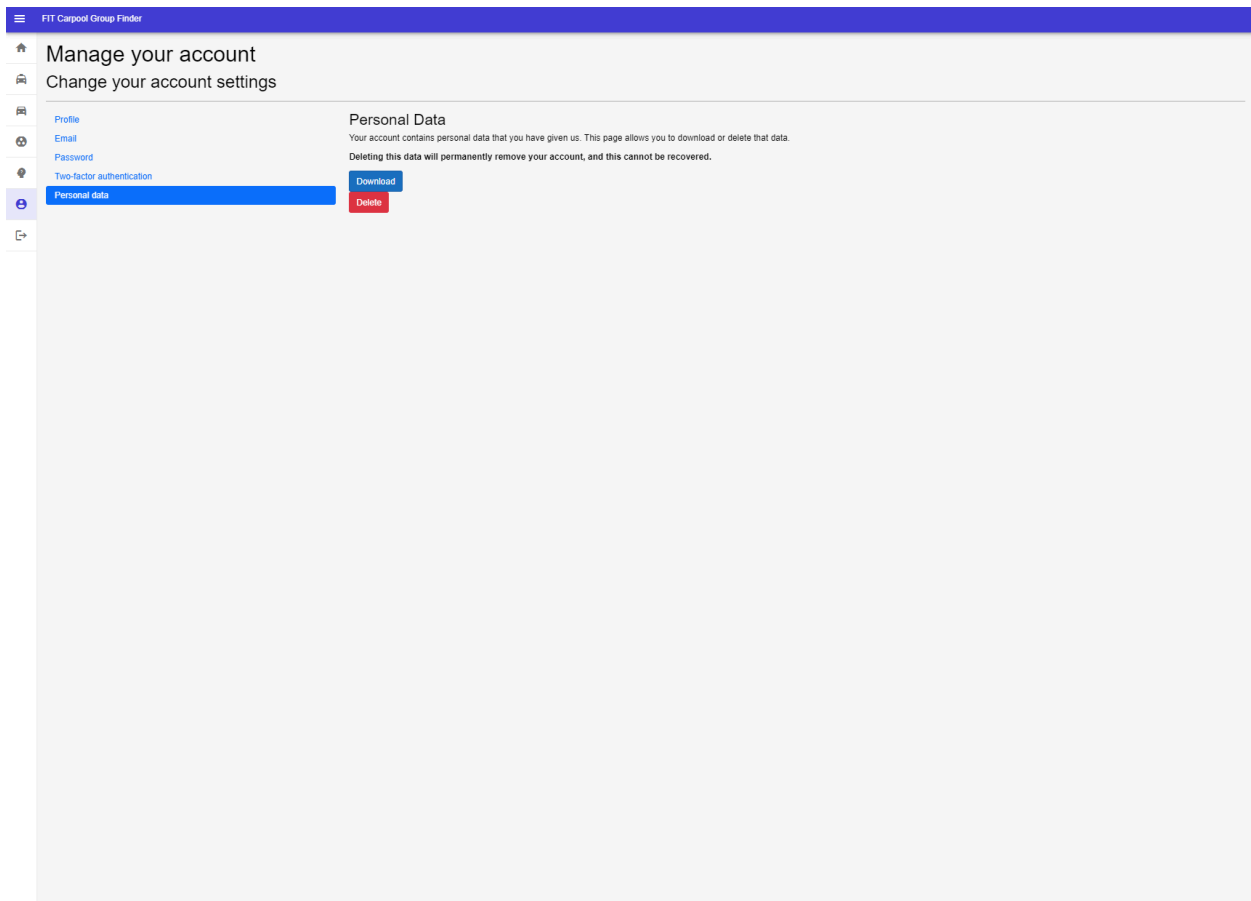
Save

Total Miles Driving: 212 miles
Total Trips Driving: 15 trips
Total Miles Riding: 32 miles
Total Trips Riding: 2 trips
User Feedback Rating
★★★★☆

This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.

This page provides users a view into their total riding and driving miles as well as the total feedback score. This page also allows users to modify profile information such as their cellphone number.

3.4.2 Remove Account

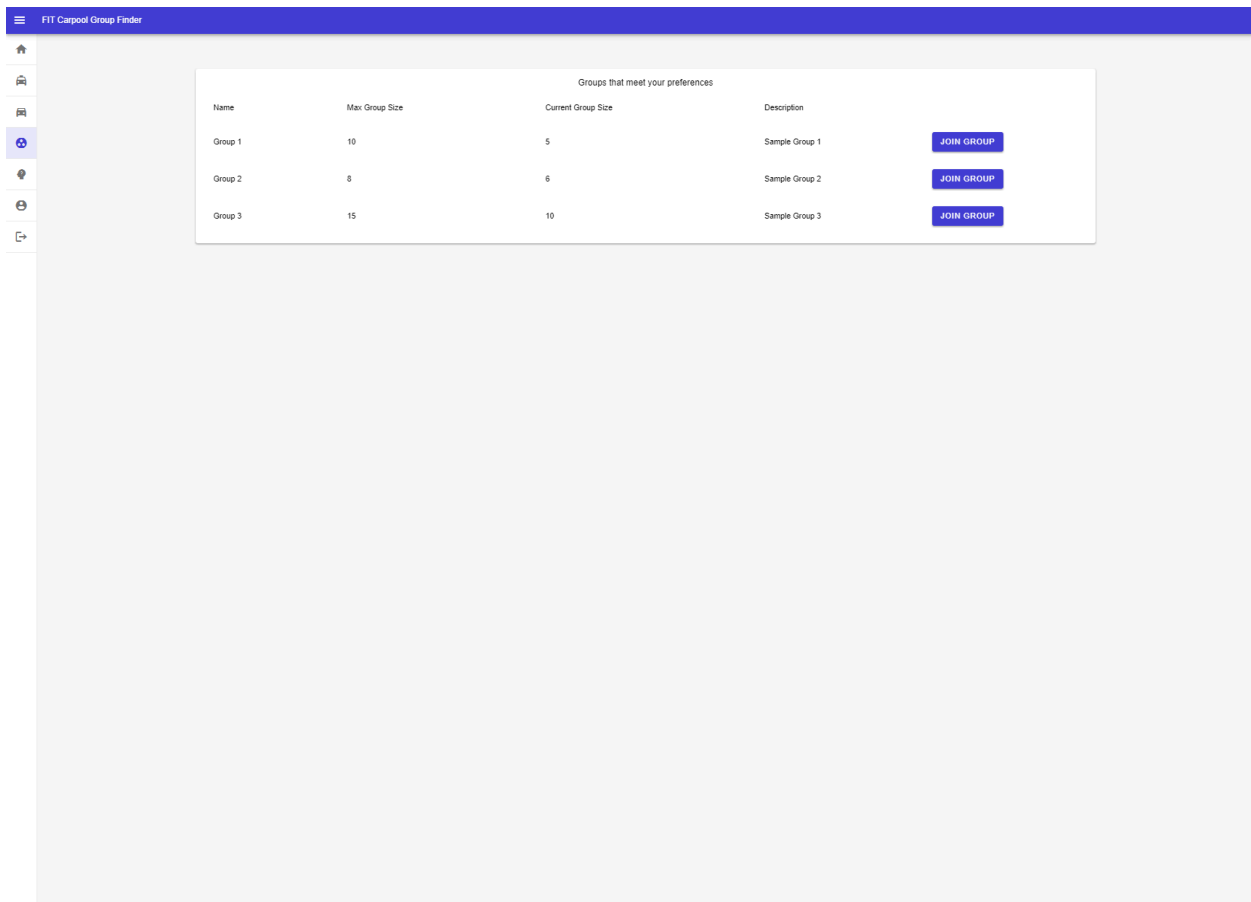


This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.

This page provides users a way to download and delete their account information from the application.

3.5 Group Look up page

3.5.1 View Trip Statistics



The screenshot displays the 'FIT Carpool Group Finder' web application. A blue header bar at the top contains the title and a hamburger menu icon. On the left, a vertical sidebar lists navigation options: Home, Search, My Groups, and a highlighted 'Groups' option. The main content area features a white box titled 'Groups that meet your preferences'. Inside this box is a table with four columns: 'Name', 'Max Group Size', 'Current Group Size', and 'Description'. Three sample groups are listed, each with a 'JOIN GROUP' button to its right.

Name	Max Group Size	Current Group Size	Description	
Group 1	10	5	Sample Group 1	JOIN GROUP
Group 2	8	6	Sample Group 2	JOIN GROUP
Group 3	15	10	Sample Group 3	JOIN GROUP

This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.

This page provides users a view into their recommended groups based on their profile preferences. This page will display an option to view group member information as well as join the listed group.

3.6 Rider and Driver Pages

3.6.1 Driver Page

Overall Finish Time: 6:00 PM

Pickup Locations:

- 123 Main St, City, State, Zip ETA: 8:03 PM
- 456 Elm St, City, State, Zip ETA: 8:07 PM
- 789 Oak St, City, State, Zip ETA: 8:13 PM

[GENERATE DIRECTIONS](#)

The map shows a route starting from the pickup locations (marked with red dots) and ending at the destination (marked with a red car icon). The route is highlighted in blue. The map includes labels for various locations such as Canova Beach Park, Paradise Beach, Rio Villa, DoubleTree Suites by Hilton Melbourne, Ocean Park, Publix Super Market at Indialantic, Indialantic, Melbourne, Melbourne Beach Pier, Melbourne Beach, Riverview Heights, Florida Institute of Technology, Melbourne Library, Publix Super Market at Melbourne, Annie Laurie Gardens, Indian River Bluff, Loveridge Heights, Ballard Park, EAUCLIFF, Solid Lips, and Canova Beach. The map also shows major roads like US-1, US-1, and US-1.

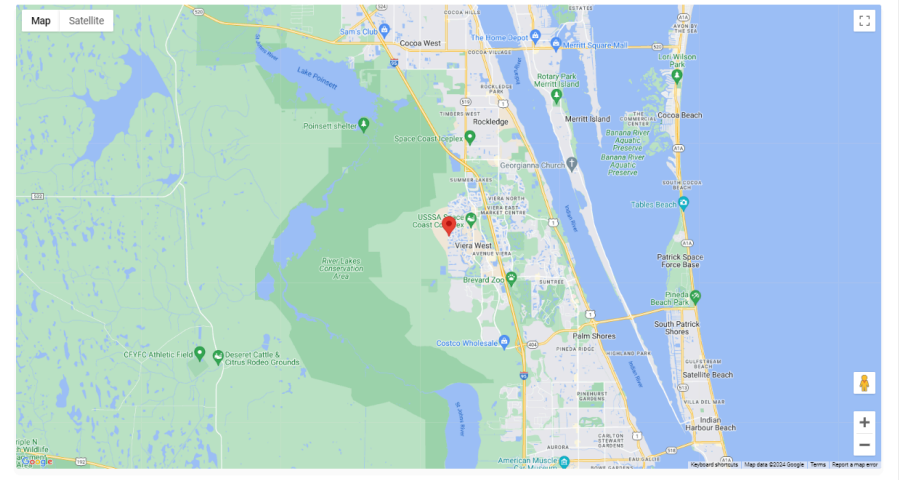
This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.

This page provides the driver a list of the pickup locations for the current trip as well as a link to generate directions that will open in google maps if the application is installed or go to the google maps webpage if it is not.

3.6.2 Rider Page

FIT Carpool Group Finder

Driver Location:
Melbourne, FL

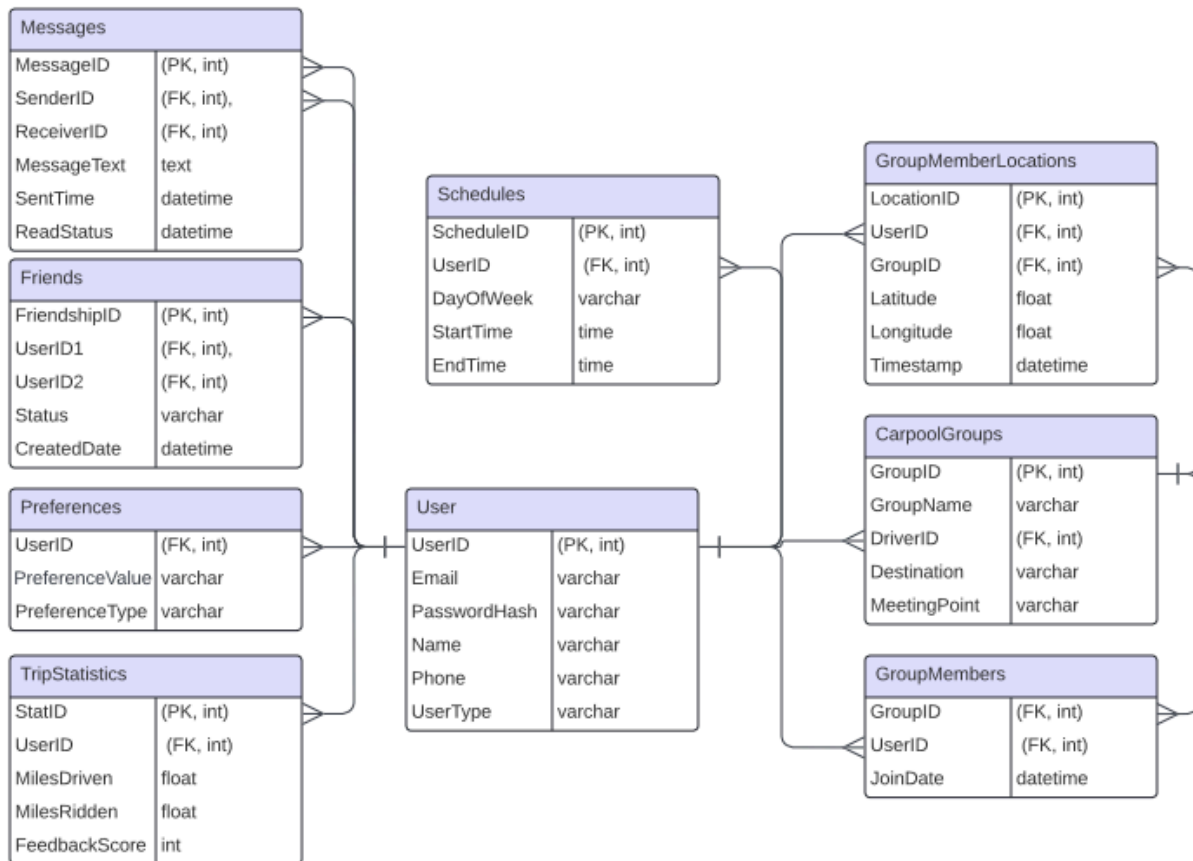


This site is currently under construction by Austin Phillips, Hunter Smith, Jason Smith and Jacqueline Torres.

This page provides the rider a google maps view of where the driver is located.

4. Database Design

4.1 ER Diagram



4.2 User Table

4.2.1 User Table Schema

UserID (Primary Key): A unique identifier for each user.

Email: The user's Florida Tech email address.

PasswordHash: A hashed version of the user's password for security.

Name: The user's full name.

Phone: The user's phone number.

UserType: Distinguishes between riders and drivers.

4.2.2 User Table Description

This table is the backbone of the application, storing essential information about each user. It differentiates between drivers and riders, ensuring that users can be matched accordingly. The Email field is crucial for notifications and communication, while PasswordHash ensures security. UserType is vital for distinguishing roles within the application, enabling specific functionalities for drivers and riders.

4.3 CarpoolGroups Table

4.3.1 CarpoolGroups Table Schema

GroupID (Primary Key): A unique identifier for each carpool group.

GroupName: The name of the carpool group.

DriverID: A reference to the Users table for the group's driver.

Destination: The destination address for the carpool.

MeetingPoint: The designated meeting point for group members.

4.3.2 CarpoolGroups Table Description

Central to organizing the carpool system, this table holds information on each carpool group, including the designated driver and destination. The GroupName helps users identify and choose relevant groups, while Destination and MeetingPoint ensure clarity on logistics. The driver's link through DriverID allows for easy access to driver details and accountability.

4.4 GroupMembers Table

4.4.1 GroupMembers Table Schema

GroupID (Foreign Key): Linked to the CarpoolGroups table.

UserID (Foreign Key): Linked to the Users table.

JoinDate: The date when the user joined the group.

4.4.2 GroupMembers Table Description

Facilitating the dynamic joining and leaving of carpool groups, this table links users to their respective groups, tracking membership over time with JoinDate. This setup allows for historical data analysis and understanding user behavior within groups.

4.5 Schedules Table

4.5.1 Schedules Table Schema

ScheduleID (Primary Key): A unique identifier for each schedule entry.

UserID (Foreign Key): Linked to the Users table.

DayOfWeek: The day of the week for the schedule.

StartTime: The start time for the user's availability.

EndTime: The end time for the user's availability.

4.5.2 Schedules Table Description

Key to matching availability among users, this table records when users are available to participate in carpools. By detailing DayOfWeek, StartTime, and EndTime, the application can efficiently match drivers and riders with compatible schedules, optimizing carpooling opportunities.

4.6 TripStatistics Table

4.6.1 TripStatistics Table Schema

StatID (Primary Key): A unique identifier for each statistic entry.

UserID (Foreign Key): Linked to the Users table.

MilesDriven: The total miles driven by the user (if a driver).

MilesRidden: The total miles ridden by the user (if a rider).

FeedbackScore: An aggregate score based on feedback from other users.

4.6.2 TripStatistics Table Description

A valuable resource for feedback and improvement, this table tracks the distance covered by users and the feedback scores. MilesDriven and MilesRidden help in calculating environmental impact and allowing the system to recommend a driver for a group, while FeedbackScore is essential for maintaining a high-quality community by encouraging positive behavior and identifying areas for improvement.

4.7 Friends Table

4.7.1 TripStatistics Table Schema

FriendshipID (Primary Key): A unique identifier for each friend connection.

UserID1 (Foreign Key): Linked to the Users table, representing one user in the friendship.

UserID2 (Foreign Key): Linked to the Users table, representing the other user in the friendship.

Status: Indicates the status of the friendship (e.g., pending, accepted).

CreatedDate: The date when the friendship was initiated.

4.7.2 Friends Table Description

This table manages the social aspect of the application by allowing users to connect with each other as friends. It supports friend requests and tracking the status of these connections, enhancing the community feel of the app and enabling users to easily organize carpools with people they trust.

4.8 Messages Table

4.8.1 Messages Table Schema

MessageID (Primary Key): A unique identifier for each message.

SenderID (Foreign Key): Linked to the Users table, indicating the message sender.

ReceiverID (Foreign Key): Linked to the Users table, indicating the message recipient.

MessageText: The content of the message.

SentTime: The timestamp when the message was sent.

ReadStatus: Indicates whether the message has been read.

4.8.2 Messages Table Description

This table manages the social aspect of the application by allowing users to connect with each other as friends. It supports friend requests and tracking the status of these connections, enhancing the community feel of the app and enabling users to easily organize carpools with people they trust.

4.9 GroupMemberLocations Table

4.9.1 GroupMemberLocations Table Schema

LocationID (Primary Key): A unique identifier for each location entry.

UserID (Foreign Key): Linked to the Users table, indicating the user's location.

GroupID (Foreign Key): Linked to the CarpoolGroups table, associating the location with a specific carpool group.

Latitude: The latitude of the user's location.

Longitude: The longitude of the user's location.

Timestamp: The timestamp when the location was recorded.

4.9.2 GroupMemberLocations Table Description

This table is critical for real-time tracking of group members during active rides, enhancing safety and coordination within carpool groups. It allows users to see the locations of their group members, facilitating easier pickups and ensuring that everyone is on schedule. This feature is particularly useful for large campuses or complex routes.

4.10 Preferences Table

4.10.1 Preferences Table Schema

UserID (Primary Key): Links to the Users table, uniquely identifying each user's preference record.

PreferenceValue: Specifies the user's preference setting, stored as text.

This table stores customizable user preferences, enhancing the application's usability and personalization. Each record corresponds to a user's specific setting, such as their preferred notification method or app theme. By linking directly to the Users table via UserID, the Preferences table ensures that user settings are easily accessible and modifiable, contributing to a tailored user experience within the app. This setup allows for a flexible and user-centric approach to app customization, ensuring that preferences are accounted for in the system's broader functionality.

4.9.2 GroupMemberLocations Table Description

This table is critical for real-time tracking of group members during active rides, enhancing safety and coordination within carpool groups. It allows users to see the locations of their group members, facilitating easier pickups and ensuring that everyone is on schedule. This feature is particularly useful for large campuses or complex routes.

5. Algorithms

5.1 Group Recommendations

The algorithm for creating group recommendations in the "Florida Tech Carpool and Park" application involves matching users based on their schedules, locations, and preferences. Below is a pseudocode outline of this process:

```
function generateGroupRecommendations(userID):
    userPreferences = getUserPreferences(userID)
    userSchedule = getUserSchedule(userID)
    potentialGroups = []

    for each group in CarpoolGroups:
        if not isUserInGroup(userID, group.GroupID) and
isGroupMatchingPreferences(group, userPreferences):
            groupMembers = getGroupMembers(group.GroupID)
            compatibilityScore = 0

            for each member in groupMembers:
                memberSchedule = getUserSchedule(member.UserID)
                if isScheduleCompatible(userSchedule,
memberSchedule):
                    compatibilityScore += 1
```

```
        if compatibilityScore > threshold:
            potentialGroups.append(group)

    sort potentialGroups by compatibilityScore in descending order
    return potentialGroups

function isUserInGroup(userID, groupID):
    // Check if the user is already a member of the group
    return exists in GroupMembers where UserID == userID and GroupID
    == groupID

function isGroupMatchingPreferences(group, userPreferences):
    // Compare group details with user preferences
    return matches preferences

function getUserSchedule(userID):
    // Retrieve user's schedule from Schedules table
    return schedule

function isScheduleCompatible(userSchedule, memberSchedule):
    // Determine if two schedules have overlapping times for
    potential carpooling
    return boolean

function getGroupMembers(groupID):
    // Retrieve all members of a group
    return members

function sort(potentialGroups, key):
    // Sort groups based on a key (e.g., compatibilityScore)
    return sortedGroups
```