Team Papaya - ViewPark
Analysis Models

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Document Overview

This document provides a detailed overview of the analysis models created by team Papaya for our project. It includes updates on the current state of the project, including updates on the project plan. The risk management plan is also updated, noting any key changes, risks added or removed, and updates on risk probabilities. Additionally, the requirements are updated, including any key changes to the use cases added, changed, or removed, changes to the activity diagram, and requirements added, changed, or removed. This document also includes our team's data models, domain objects, class diagrams, process models, data flow diagrams, as well as our system sequence diagrams.

Project Update

Overview

Over the course of this project, Team Papaya has continued to gather information on design concepts to shape our ideas into a final product. And though we are still in the process of nailing down the low-level specifics of our product, our goal remains the same, to identify the availability of parking lots. The following are any notable updates to our planned product, features, or interface:

- We have decided to abandon the feature of using a user-rating system combined with our historical data of parking lot availability to skew our forecast of parking lot availability in the future. We have decided to do this because after closer inspection, this idea seems generally convoluted and could be very difficult to implement inside of the scope of this project, as well as potentially destructive to the accuracy of our product. Instead, we are solely going to rely on historical data gathered from parking lot images, to generate our forecasts.

- We have decided that (time permitting), we would like our product to have a web interface. We have decided to use a web interface because it is extremely versatile, and is in line with our collective vision of the finished product.

Project Plan Updates

Overview

For all deliverables during our project, we have continued to use Trello to assign and manage tasks between group members. And since deciding that multiple people can be assigned to one task based on the size of said task, as well as deciding on a task delegator to formally assign tasks, our project plan has remained mostly the same.

Risk Update

Overview

Our risk management plan has remained mostly the same, but since our decision of assigning a task delegator, we have added the risk of our delegator potentially failing to effectively assign tasks to group members.

Requirements Update

Overview

Based on feedback, we have removed the CRUD Account use case, since this is not a use case. We have instead replaced it with the following use cases:

- Create account.
- View account information.
- Edit account information.
- Delete account.

Data Models

Overview

During the requirements gathering phase and the initial stages of the analysis models, the set of domain class objects for ViewPark were identified through an iterative approach amongst team members and feedback from the instructor and other classmates. Refer to figure 1.0 ViewPark's domain class diagram.

From building the class diagram for ViewPark, from a user's perspective, Team Papaya learned that utilizing user parking session information, such as the lot that the user parked at and parking duration, to adjust the availability metric and forecast, may incorrectly skew both outputs reproducing inaccurate information, hence, Team Papaya chose to discard this method.

Domain Objects

ViewPark's data model consists of series of fundamental domain class objects, and their attributes, that pertain to a list of refined use cases and required system processes that provide a basic functionality for the users, such as;

- Account
    - Name
    - User Type
    - Email
    - Registration Date
    - Lot Preference
    - Password
- Availability
    - Time
    - Date
    - ParkingLot
    - Fullness
- Parking Session
    - Parking Lot
    - Start Time
    - End Time
    - Date
    - Account
- Forecast
    - Estimated Fullness
    - Parking Lot
    - Forecast Time
    - Forecast Date
- Parking Lot
    - Type
    - Spots
    - Images
    - Availability
    - Forecast Overview
    - Capacity

- Parking Spot
  - Parking Lot
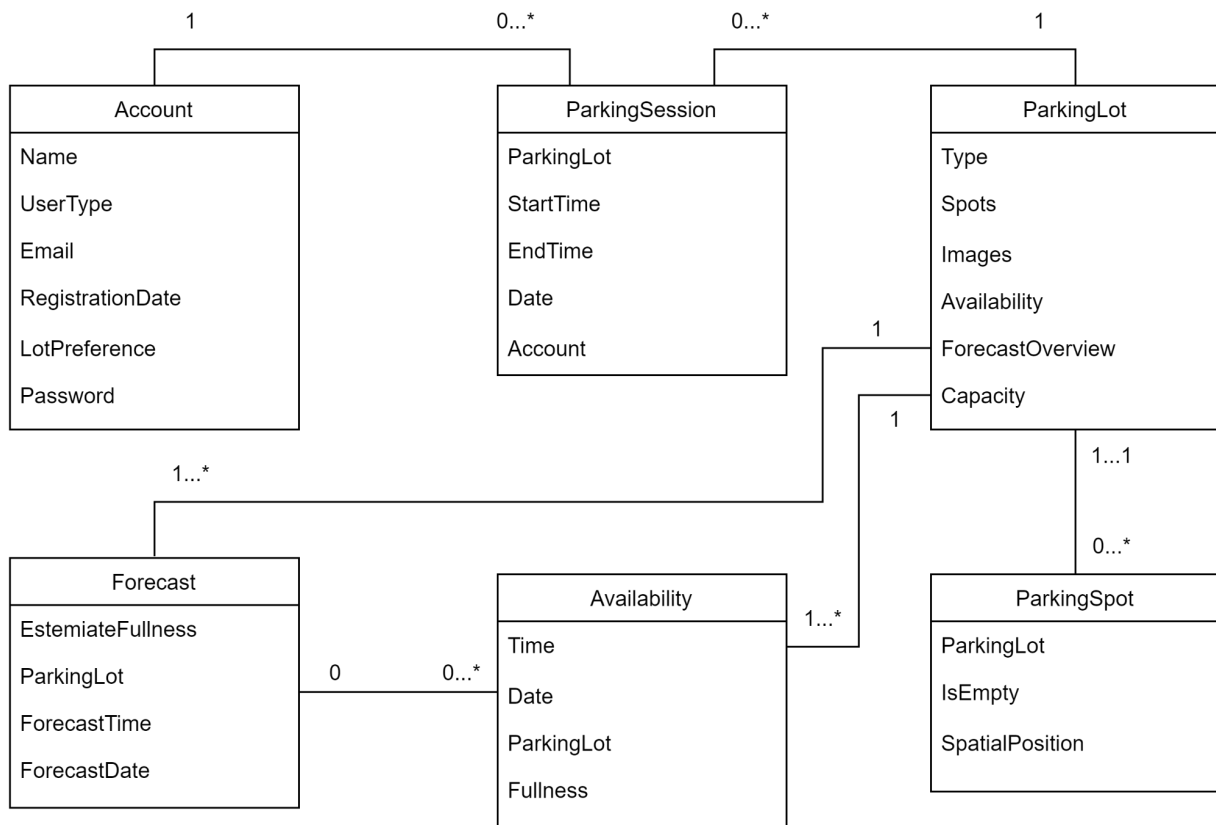 - Is Empty
  - Spatial Position

Class Diagram

Figure 1.0 Domain Class Diagram

Figure 1.0 above shows that an account can only have one parking session at any given time, a parking session can also only happen in any one given parking lot, a parking lot can only have one availability at a given time, there are multiple parking spots per parking lot, and multiple forecast can be generated form previous availabilities from a given a parking lot.
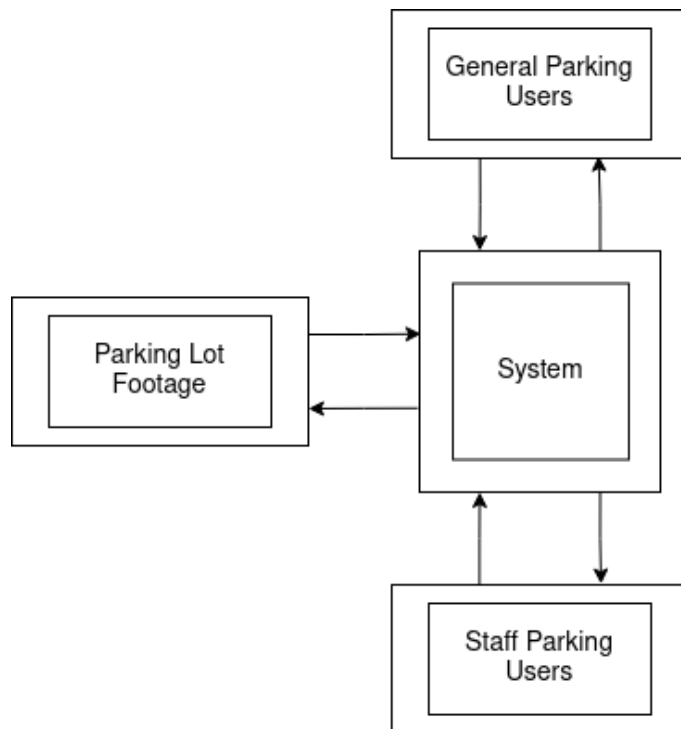
Process Models

Figure 1.1 Level 0 DFD

Through the development of process models, we have gained insights into the workings of our system, such as how different components interact and how the system's processes should be designed. The creation of Data Flow Diagrams has helped us identify the flow of data throughout the system, while the System Sequence Diagrams have allowed us to pinpoint which actions trigger specific processes. These models have helped us get a visual understanding of our system enabling us to better comprehend its complexities
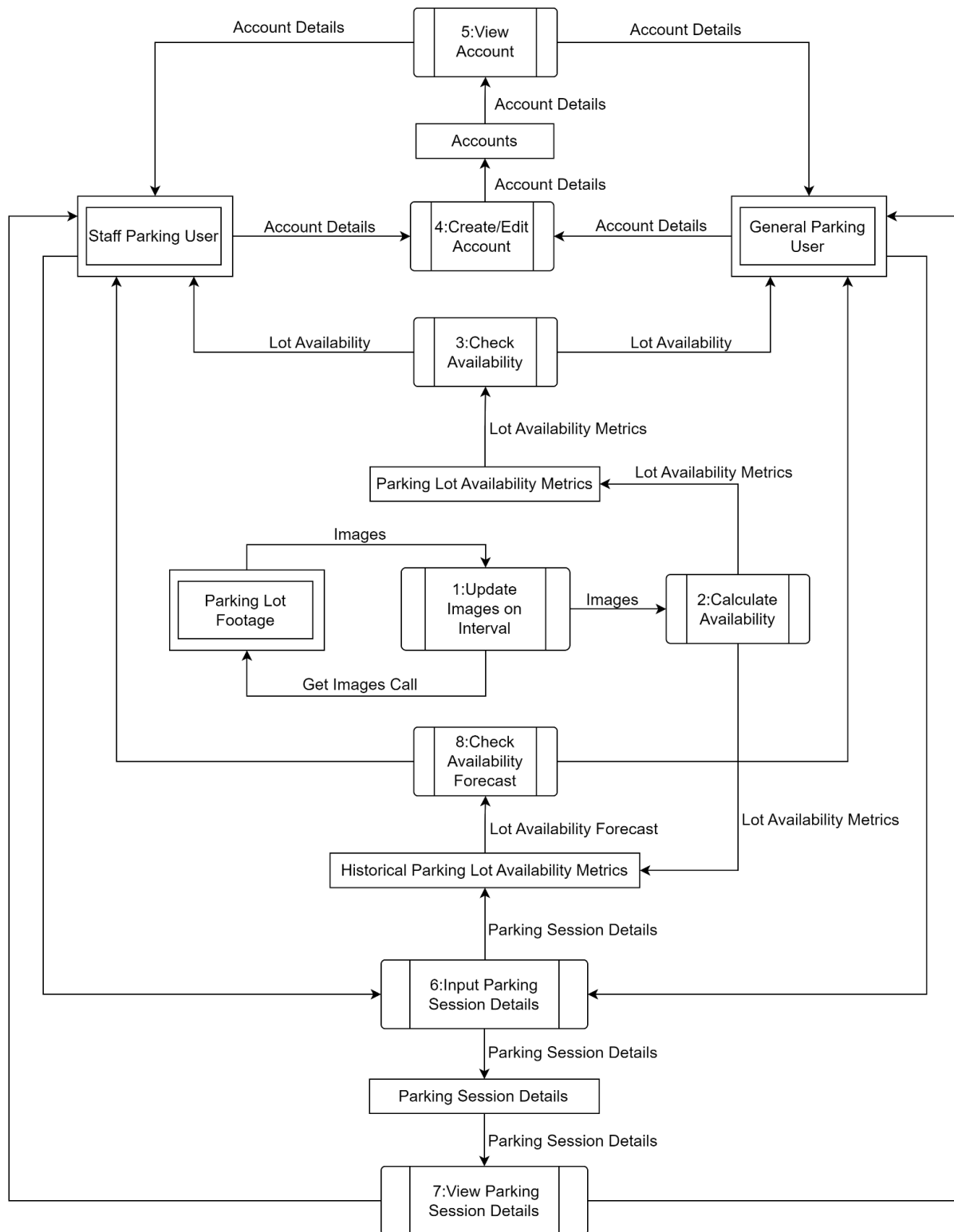
Data Flow Diagram

Figure 1.2 Level 1 DFD

DFD Description:

Processes:

- Create/Edit Account:
  This process enables users to create or modify their accounts. The process involves collecting user account details as input, validating the input data, and storing it in the Accounts datastore.

- View Account:
  This process enables users to view their account information. The process involves retrieving account details from the Accounts datastore and displaying it to the user.

- Check Availability:
  This process enables users to view the current availability of all of the parking lots tracked by the system. The process involves retrieving lot availability metrics from the Parking Lot Availability Metrics datastore and displaying the availability of each parking lot to the user.

- Check Availability Forecast:
  This process enables users to view the predicted future availability of a parking lot tracked by the system. The process involves retrieving historical lot availability metrics from the Historical Parking Lot Availability Metrics datastore, calculating the predicted future availability of the parking lot, and displaying the predicted availability of a selected parking lot to the user.

- Update Images on Interval:
  This process automatically updates the images used to calculate the parking lot availability on a preset interval. The process involves sending a get images call to the Parking lot Footage entity and retrieving new images of each parking lot.

- Calculate Availability:
  This process calculates the availability of each parking lot using the images. Once the Update Images on Interval process retrieves the images they are sent to this process where the availability metrics are calculated using OpenCV and are stored in the Parking Lot Availability Metrics datastore.

Figure 1.1 Level 1 DFD

- Input Parking Session Details:
  This process enables users to input their estimated parking duration and what parking lot they parked at. This information is then stored in the Parking Session Details datastore and is used to predict the future availability of parking lots.

- View Parking Session Details:
  This process enables users to view their current parking session details. The process involves retrieving the user's parking session information from the Parking Session Details datastore.

Entities:

- General Parking User
  This entity refers to users who park solely in the general lots at VIU. They contribute data to the system by creating and editing their account, and creating and editing parking sessions for general lots. They require data from the system regarding the current and future general lot availability, or viewing their account or parking session information.

- Staff Parking User
  This entity refers to users who have the ability to park in either the General or Staff lots at VIU. They contribute data to the system by creating and editing their account, and creating and editing parking sessions for either staff or general lots. They require data from the system regarding the current and future general and staff lot availability, or viewing their account or parking session information.

- Parking Lot Footage
  This entity refers to the images or camera footage being supplied to the system on image update intervals. When the system is updating the current parking lot availability, the system requires current images from this entity of a parking lot to use for image processing.

Data Stores:

- Accounts
  This data store holds information about all user accounts.

- Parking Lot Availability Metrics
  This data store holds information regarding the current parking lot availability, for all lots.

- Historic Parking Lot Availability Metrics
  This data store holds information regarding the historic parking lot availability for all lots. All calculated parking lot availability metrics (such as the percentage full a lot is at a given time on a given day) is stored for future use when calculating the availability forecast for a given parking lot.

- Parking Session Details
  This data store holds information about all parking sessions from all users. Parking sessions are created by users after they find a parking spot in a parking lot, and contains information regarding the time, duration, lot, and user who created the session.

System Sequence Diagrams

Use Case Overview

- Create Account

  Users can create a personal account within the parking availability app.

- View Account Information

  Users can view their personal account information at any time.

- Edit Account Information

  Users can update their personal account information as needed.

- Input Parking Information

  Users can input their parking information into the app for tracking and for parking forecast prediction.

- Edit Parking Information

  Users can modify their parking information as needed.

- View Parking Information

  Users can view their parked car information for their parking session.

- Set Lot Preference

  Users can set their preferred parking lot(s).

- Check Parking Availability Forecast

  Users can check the future availability of parking spots for VIU parking lots, as pertains to their parking permits (general or staff).

- Check General Parking Availability

  Users can check the availability of parking spots for any of the general lots at VIU at any time.

- Check Staff Parking Availability

  Staff users can check the availability of parking spots for any of the general lots at VIU at any time.

General User SSD - Check Parking Lot Availability
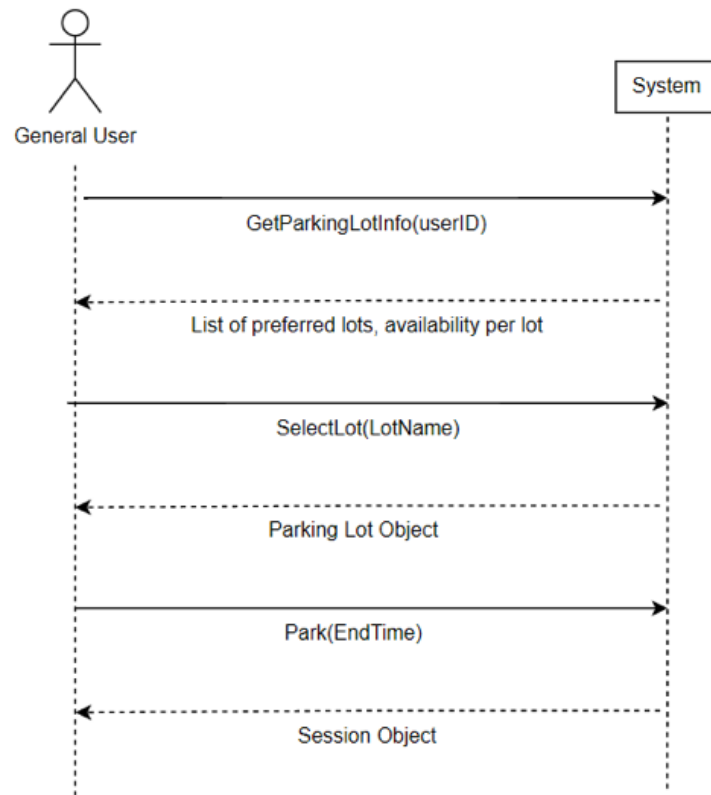
Staff User SSD - Check Parking Lot Availability
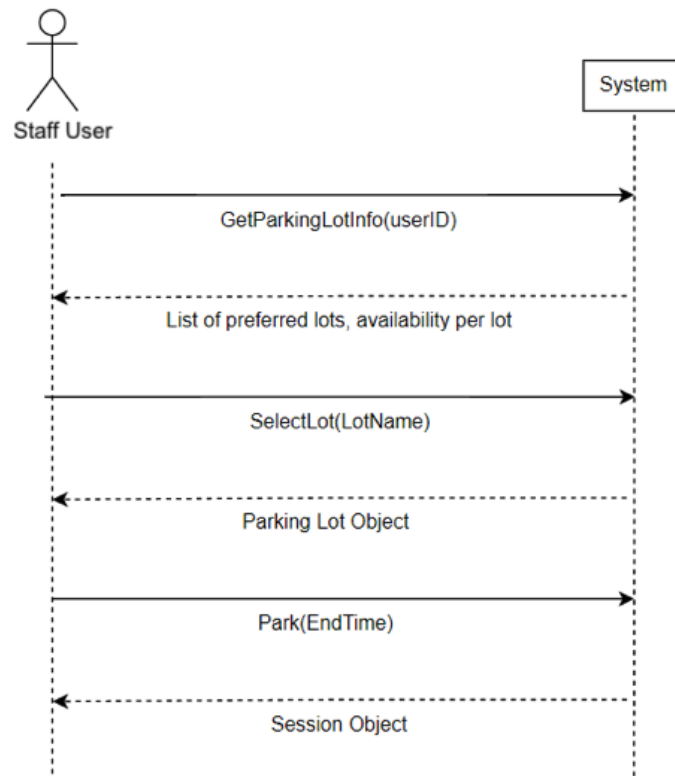
For both the General and Staff users, the most important use case was deemed to be Check Parking Lot Availability. The primary purpose of the application is to be able to know how full a parking lot is by viewing lot information in the app, and this use case serves that purpose.