CS319 Object-Oriented Software Engineering
Project Deliverable 1 (D1) - S2T7 - agora

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Contents of the Document

Introduction

The Bilkent Information Office (BTO) project is an organization that undertakes the promotion of Bilkent University and carries out this through campus tours and fairs, and the project aims to digitize and automate this process. The current system uses Google Forms for applications and Excel spreadsheets for managing the schedules. As the system goes over manually, this leads to some potential errors and waste of time.

Our project aims to develop an automated system that enables high school prioritization, campus tours, and fairs, and facilitates easier communication between guides. The system will include some features to facilitate the work of the officers in the Information Office throughout the process. It includes basic processes such as tour applications made by high schools, tour approvals made by consultants, tours by guides, feedback collection system in different forms received from actors such as candidate guides, high schools, and guides, tables containing information about guides, payroll tracking for the table for tracking the scoring system. The system will provide viewing and editing access to different responsibilities of different users with customized access and functionality based on each user's responsibilities.

Non-functional Requirements for the Project

User Interface (UI) and Usability

1. Intuitive Navigation

- The system must offer a well-organized, intuitive navigation structure that allows users (coordinators, advisors, guides, candidates) to easily access the functionalities they need within 4 clicks or less.
    - ***Note:*** *Hereafter, the term* ***"a coordinator"*** *will refer to the coordinator, secretary, or director within the Bilkent Information Office. Due to the structure of the application, it has been decided that all of them will share the same access level.*
- For example, an advisor should be able to log in, navigate to "Highschool Application Tracking System" and select a specific tour to confirm it, all within three clicks from the dashboard.

2. Responsive Design

- The platform should be fully responsive, meaning it must work seamlessly across various devices, including desktop computers, tablets, and smartphones. The layout must adapt fluidly to different screen sizes, ensuring the user experience is consistent and user-friendly regardless of the device.

3. Accessibility

- The system must adhere to ***WCAG 2.1 AA standards*** to ensure accessibility for users with disabilities. For example, keyboard navigation should allow users to complete tasks such as form submissions without using a mouse, and screen readers should accurately describe buttons like "Submit Feedback".

4. User Guidance and Error Handling

- For workflows that might be complex (like submitting feedback or scheduling tours), the system should provide clear guidance. This includes tooltips, in-line instructions, and easy access to user help documentation within 2 clicks.
- For instance, when submitting feedback, a tooltip could explain how to fill out each field, and if an error occurs, the system should prompt users with specific corrective instructions, like "Use MM/DD/YYYY for the date".

5. Usability

- The platform should be easy and intuitive for all users, including non-technical users like guides and candidates. Usability testing should ensure that tasks can be completed efficiently with minimal effort, and users should be able to complete their core tasks without needing extensive help or training.

- For example, a guide should be able to log their tour hours in under 30 seconds by selecting the tour, entering the duration, and submitting—all from a single, easy-to-use page (Information Office calls this page the “Puantaj Page”).

6. Customizability

- The platform should allow users to customize their interface based on their preferences. For example, users should be able to choose between light and dark modes, rearrange dashboard widgets, or configure notification settings based on their role and needs.

Security, Privacy, and Compliance

1. Role-Based Access Control (RBAC)

- The system will implement strict access control where users only see data relevant to their roles. For example, a coordinator can view and edit all tour and financial data, while a guide only has access to basic tour details and cannot view sensitive information like IBAN numbers.

2. Logging and Auditing

- All important actions, such as editing high school application forms or tour feedback, must be logged with information about who made the changes and when. For instance, if an advisor modifies tour details, this should be recorded in the log, which is accessible only to authorized personnel.

3. Privacy Measures

- The system should comply with **GDPR** and **KVKK** regulations, ensuring users can manage their data. For instance, if a guide requests their data to be deleted, the system should process this request *within 24 hours*, in compliance with data protection laws.

4. Safety and Dependability

- The system should prevent any actions that could lead to system malfunction or user harm. For instance, it should block unauthorized access attempts and handle errors in a way that doesn’t compromise system integrity or user trust.

Performance and Efficiency

1. System Response Time

- All user requests, such as submitting forms or querying the database, should be processed within **2 seconds 90% of the time**. For example, when a coordinator

requests for pending tours, the results should be displayed almost instantly, ensuring a smooth and responsive experience.

2. Page Load Speed

- The platform must ensure that all pages load within **3 seconds** on a standard broadband connection of **5 Mbps**. For instance, when a guide logs in and navigates to their dashboard, the page showing their assigned tours should fully load in less than 3 seconds which avoids any noticeable delays.

3. Data Processing

- High school application forms must be processed by the system's prioritization algorithm within **5 seconds** of submission. For example, when a school submits a campus tour application, the system should *quickly sort and prioritize* the request based on predefined criteria, ensuring the application status is updated in real-time.

4. Efficiency

- The system should optimize its use of resources like memory and processing power to ensure smooth operation, especially during high traffic times. For instance, even when 50+ users (guides, coordinators, etc.) are actively using the system, there should be no significant performance drops or system slowdowns.

5. Responsiveness and Performance

- The system must provide quick feedback to user interactions, ensuring low latency during key operations. For example, when a candidate guide submits feedback for a completed tour, the system should immediately show a confirmation message, indicating successful submission without delays.

Reliability and Availability

1. System Availability

- The platform must maintain an uptime of **99.9%**, ensuring users can access it with minimal interruptions, even during peak usage times like the high school application season. For example, a coordinator should be able to manage tour schedules and guides should access their assignments without experiencing system downtime, especially during busy periods like the summer tour season.

2. Backup and Recovery

- Automated backups must occur every **12 hours**, with the system capable of recovering from a failure within **1 hour** (Recovery Time Objective - RTO). For example, if there's a system outage during tour scheduling, the platform should restore full functionality within an hour, ensuring no data or tours are lost in the process.

3. Error Handling and Fault Tolerance

- The system should gracefully handle errors by providing clear messages (e.g., “Network error, please try again in 2 minutes”) and continue functioning in the event of partial failures. For instance, if the real-time communication platform between guides experiences an issue, it should not affect other features like tour scheduling or feedback submission.

Scalability and Flexibility

1. Horizontal Scalability

- The system must scale horizontally to support up to **500 concurrent users** without degrading performance. For example, during peak times such as when multiple high schools are submitting applications or guides are logging in to view tours, the platform should continue to perform efficiently, even with hundreds of active users.

2. Data Scalability

- The system must handle an increasing volume of high school applications and user data without performance loss, initially supporting approximately **1,000 schools** and scaling to **5,000**. For example, as the number of schools applying for campus tours grows, the system should be able to efficiently manage the increasing data load, allowing coordinators and advisors to prioritize and approve applications quickly.

3. Modular System Design

- New features, such as additional reporting tools or new tour categories, should be added as independent modules without significant changes to existing ones. For example, if a new type of event like “virtual campus tours” is introduced, it should be implemented as a separate module without disrupting existing functionality.

Maintainability and Supportability

1. Modular Architecture

- The system should be built using a modular architecture which would allow each feature (e.g., Puantaj Page, High School Application Tracking System) to be updated independently. For example, if the Puantaj system requires an update or bug fix, this can be applied without affecting other critical functionalities like high school application tracking.

2. Version Control

- A popular version control system like **Git** must be used for all code changes, enabling rollbacks in case of critical issues. For instance, if a new update introduces

a problem with tour scheduling, the development team should be able to revert to the previous stable version within minutes to minimize downtime. Git will also be beneficial for other types of branching and modular development of features.

3. Code Documentation

- All system modules should be thoroughly documented to make maintenance and team handovers easier. For example, if a new developer joins the project, they should be able to quickly understand how the tour approval algorithm works by referring to the updated and detailed documentation.

Ethical and Environmental Requirements

1. Ethical Requirements

- The system must handle all user data ethically, ensuring it is not shared or misused without consent. For example, when a guide submits feedback or personal details, the system should clearly inform them about how their data will be used, complying with GDPR and other relevant data privacy laws.

2. Environmental Efficiency

- The platform must be optimized to minimize its environmental impact, ensuring efficient use of computing resources. For instance, by optimizing the database and code to reduce unnecessary processing power, the system will consume fewer server resources, contributing to lower energy consumption and supporting sustainability goals.

Tech Stack

Frontend

React

React is a widely used front-end framework maintained by Facebook. It has strong community support and detailed documentation. Some of the key features of React:

- React uses a component-based architecture, which means developers can create reusable UI elements. It's like having a box of LEGO pieces – the same pieces can be used to build different structures, saving time and reducing errors.
- Efficient updates: React uses a Virtual DOM, which is like a blueprint of the webpage. When changes occur, React compares this blueprint to the actual webpage and only updates what's necessary. This makes the app faster and smoother for users.
- Easy to learn syntax: React uses JSX, which lets developers write HTML-like code directly in JavaScript. This makes the code more readable and intuitive, especially for those already familiar with HTML.
- One-way data flow: React manages data in a predictable way, flowing in one direction. This is like a river flowing downstream – it's easier to track where data is coming from and going to, making debugging simpler.

TypeScript

TypeScript adds static typing to JavaScript, catching errors early and improving code quality and maintainability.

- Improved teamwork: When working with others, TypeScript acts like a contract between developers. It clearly defines what kind of data should be used where and reduces misunderstandings.
- Catch errors early: TypeScript is like a spell-checker for code.

Redux

React state management can get complicated easily as the application grows over time. Redux is a solution that scales well for large applications.

- Central data storage: Redux provides a single place to store all the app's data, making organization easier.
- Great for complex apps: As the app grows more complex, Redux helps keep things organized.

- Predictable state changes: With Redux, data in the app changes in a very structured way. It's like having a clear, step-by-step recipe for updating the app's information, making it easier to understand and debug.

Backend

Node.js with Express.js

Express.js is a minimal and flexible web application framework built on top of Node.js. It comes with built-in solutions like middleware, multer, passport, and routing to ease development.

- Lightweight and flexible: Express.js is simple but powerful, allowing developers to add only the needed features without introducing too much complexity.
- Easy routing: Express makes it simple to direct web traffic to the right place in the application.
- Middleware support: Extra functionality can be easily added to the app using middleware. Think of it as a production line where steps can be added or removed as needed, customizing how the app handles requests and responses.
- Database-compatible: Express works well with any database of choice.
- Fast performance: Built on Node.js, Express is designed for speed. It can handle many users at once efficiently.

Database

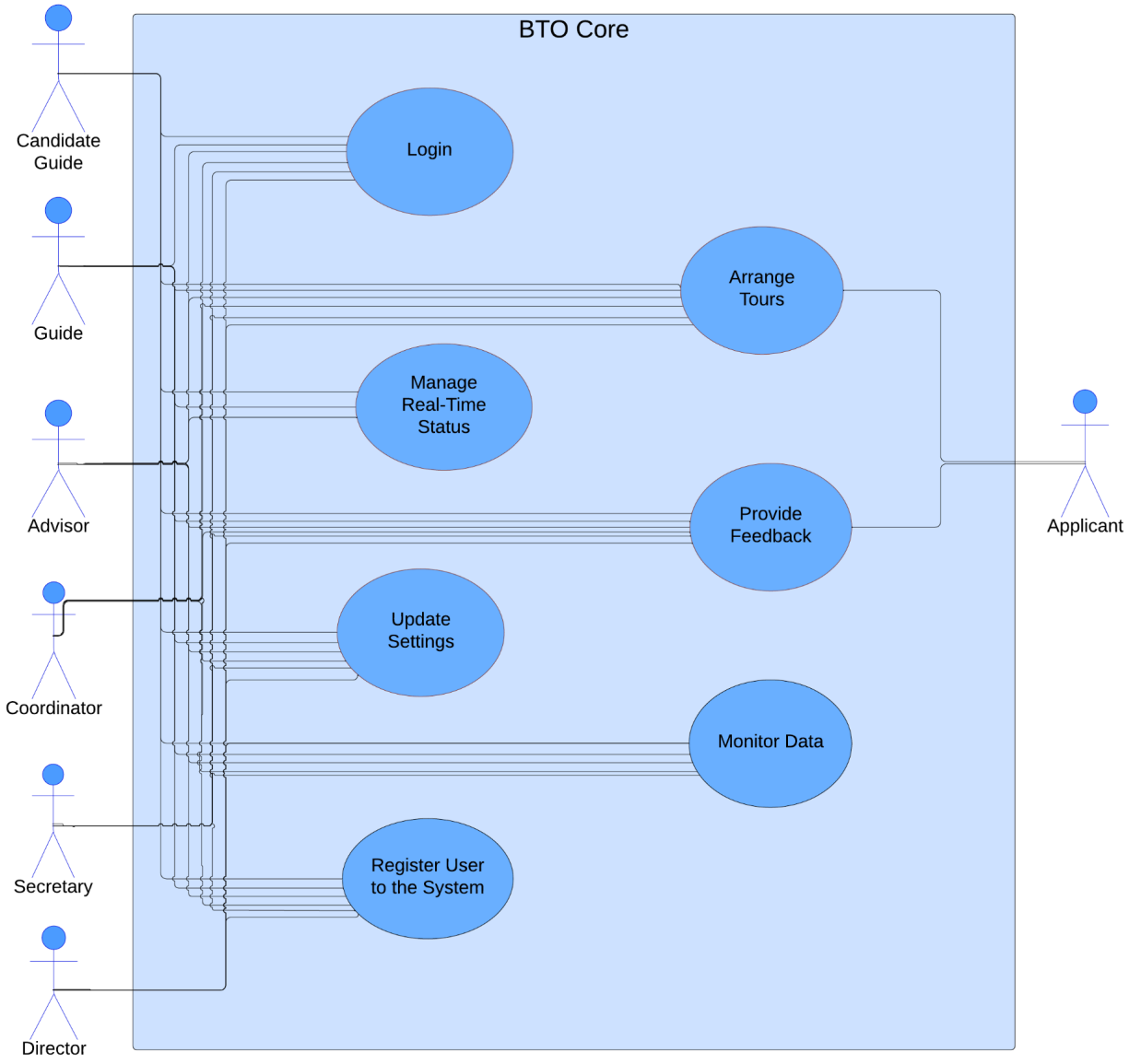
PostgreSQL

PostgreSQL is a widely used, powerful open-source relational database system. Some of its key features are:

- Reliable and stable: PostgreSQL is known for its reliability.
- Scalable: As an application grows, PostgreSQL can grow with it.
- Supports modern data types: PostgreSQL can work with newer types of data like JSON. This means it can adapt to changing data needs.

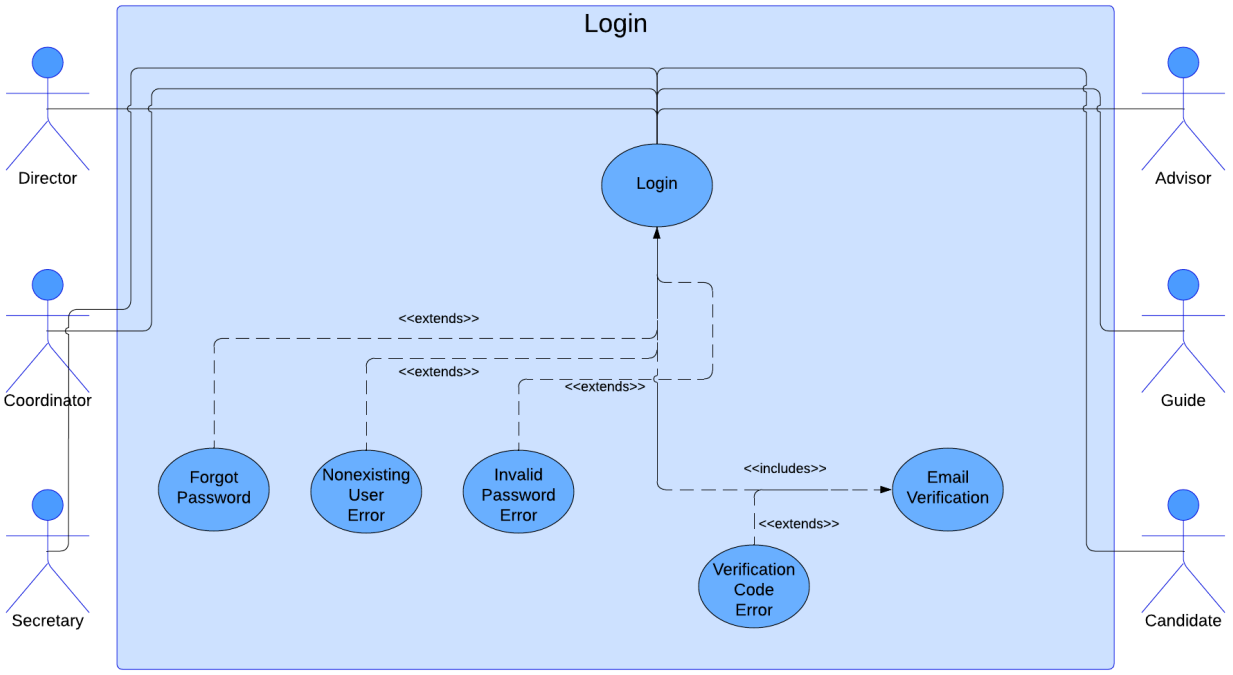
Use Case Diagrams

1. Level 0 Diagram

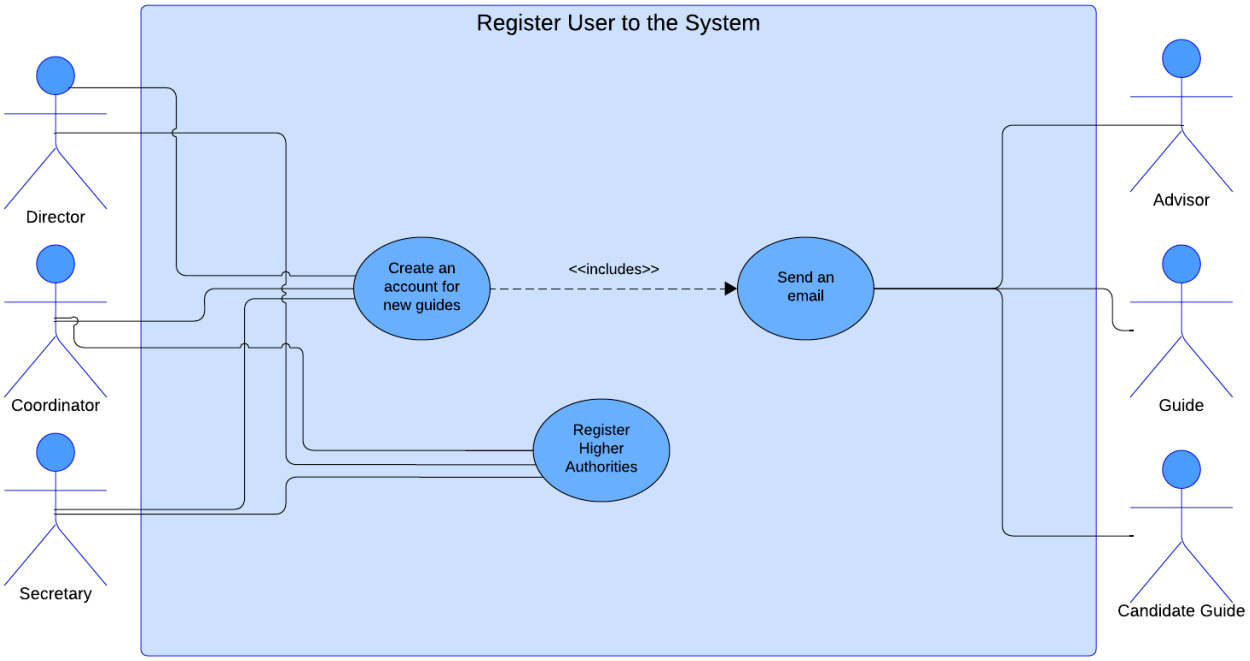


2. Level 1 Diagrams

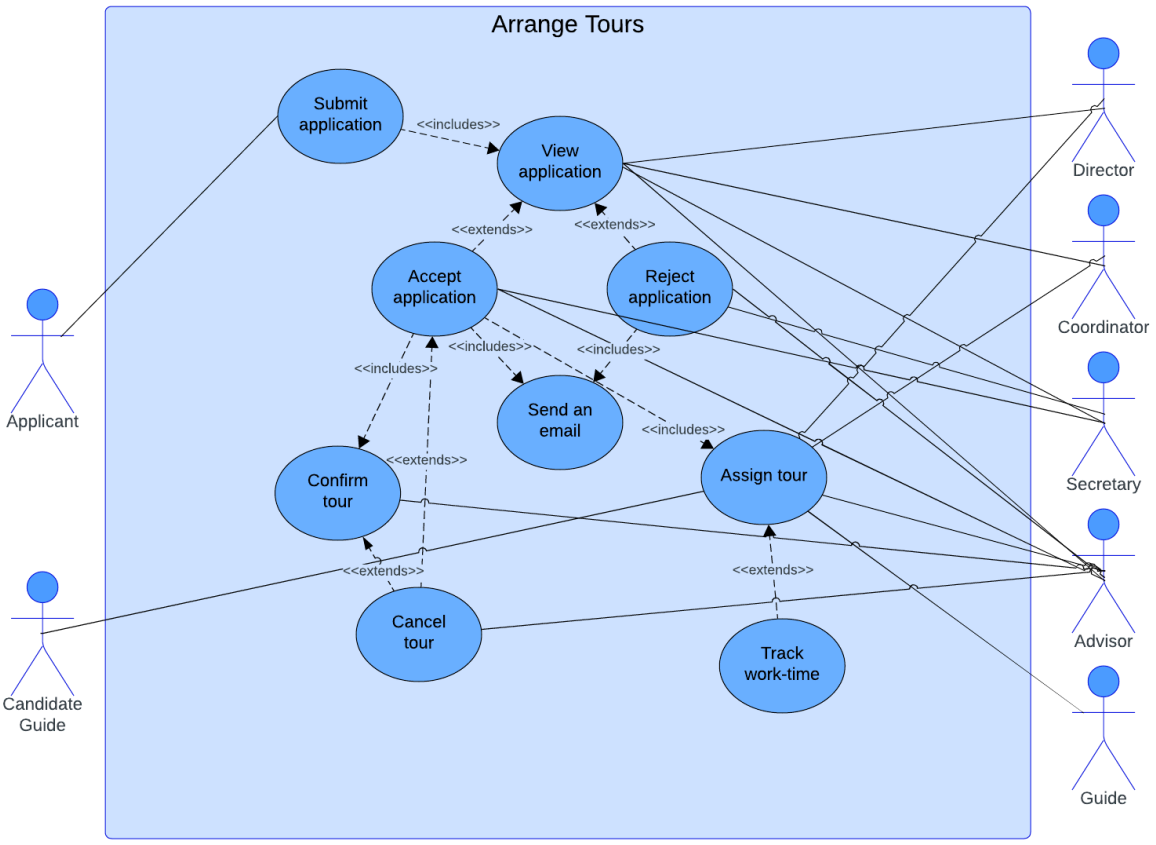
2.1. Login



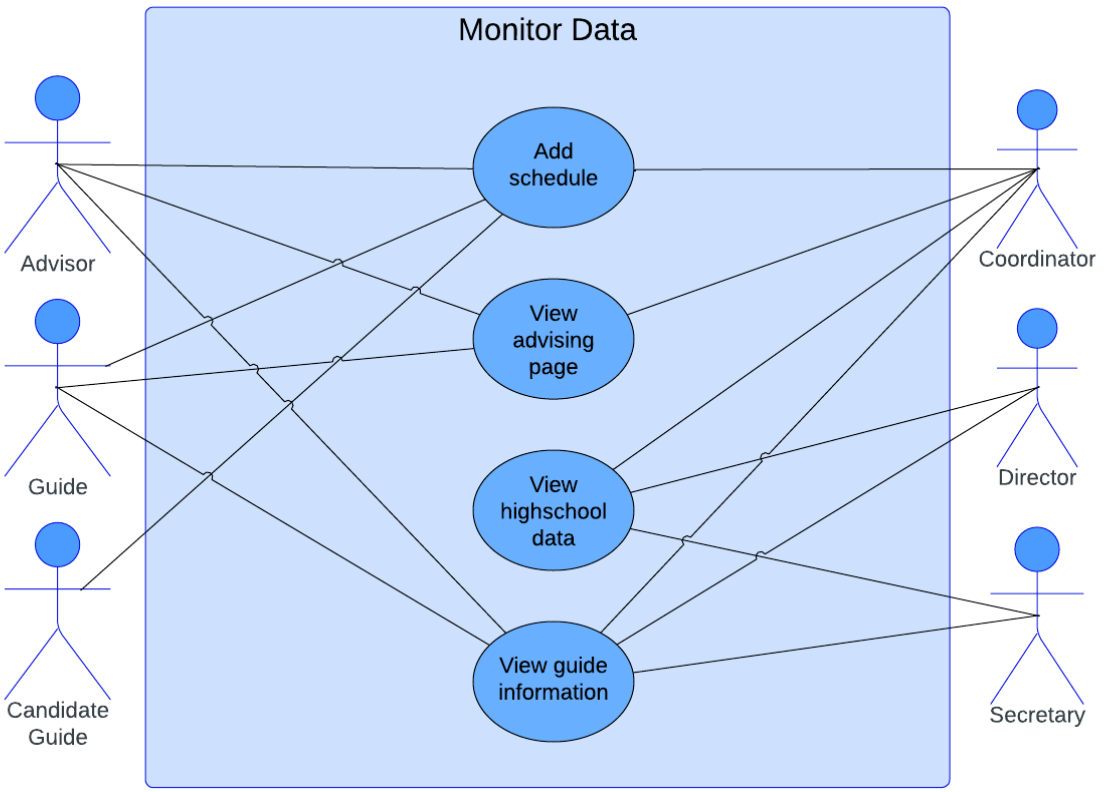
2.2. Register Users to the System



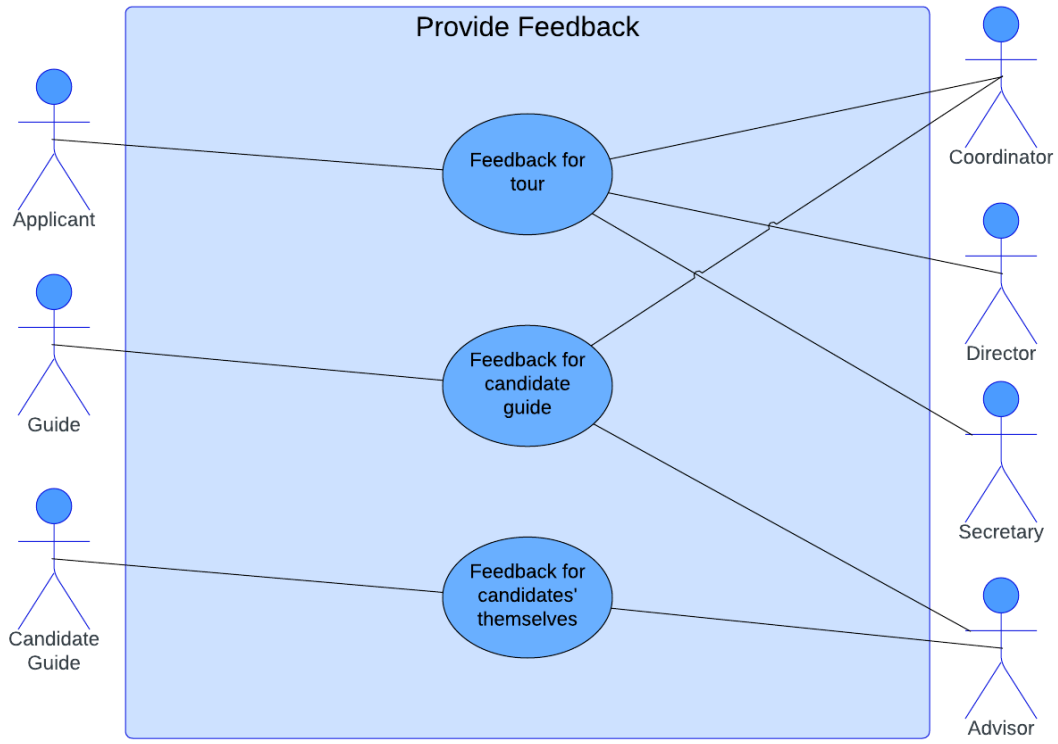
2.3. Arrange Tours



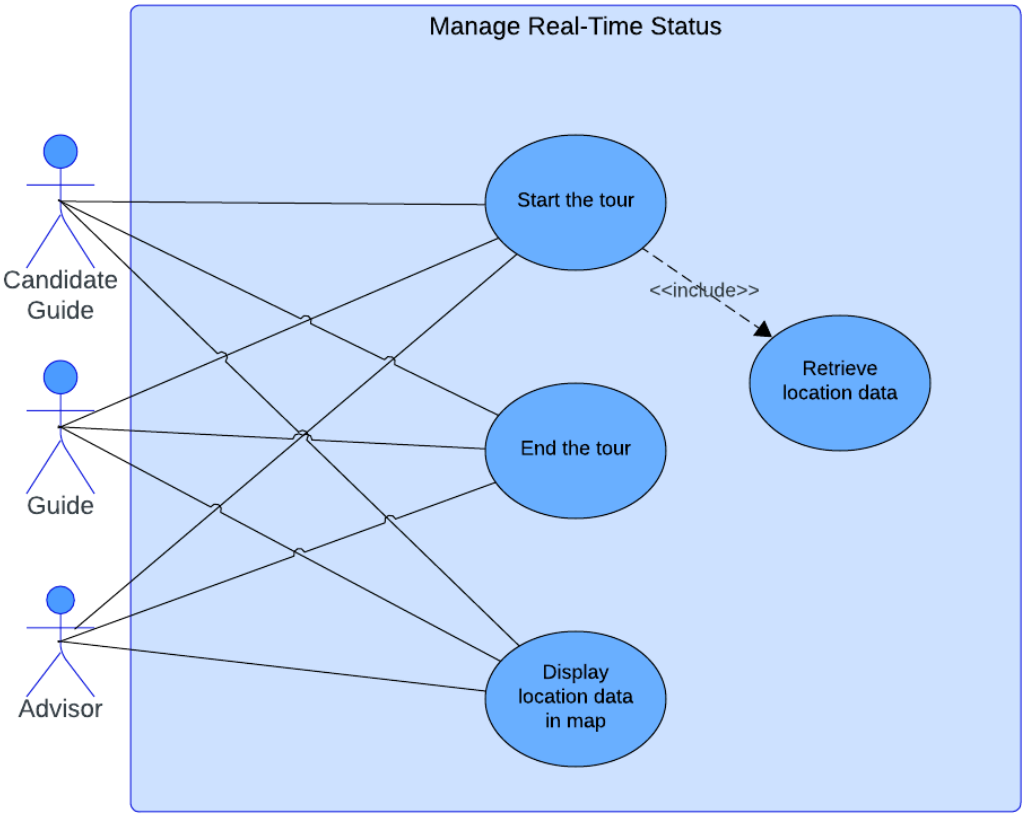
2.4. Monitor Data



2.5. Provide Feedback



2.6. Manage Real-Time Status



2.7. Update Settings