Project Problem #6: You've been asked to help the Rutgers Department of Transportation (DoT) to design a student bus route management system. The DoT wants a system that meets certain performance criteria, e.g., frequency, cost, the maximum time to destination etc. You will need to make sensible necessary assumptions of the budget, the time between campuses, frequency etc., but no student should have to wait more than 30 minutes to get to a class on any campus from any point on the New Brunswick campus.

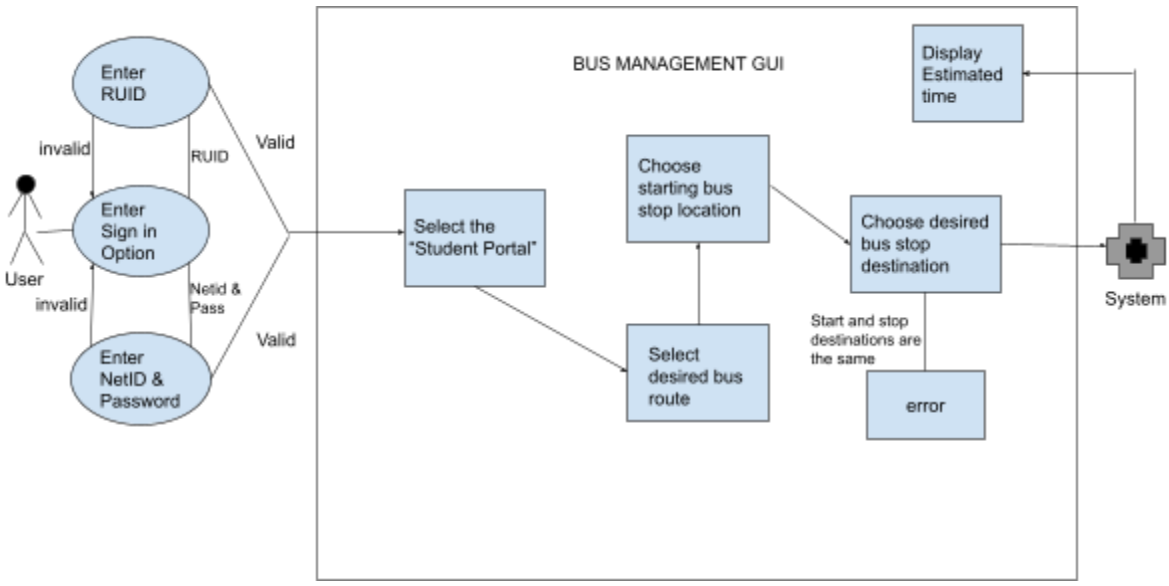
Specification and Requirements Engineering:

- **Specification and User Requirements:**
    - This student bus route management system is designed to display the time of arrival and path between two bus stops at Rutgers University. The user of this app should not have to wait more than 30 minutes to travel between two bus stops for class, events, etc.
- **System Requirements:**
    - System will hold constant access to the Rutgers Bus network to access buses' locations throughout all the campuses
    - An estimated time of arrival and path will be provided to the user from 2 locations (to and from) where they choose.
    - An option to set an alert notification when the desired bus is within 5 minutes to the bus stop
    - A map of the buses on route to see their physical location in the event of heavy traffic and I misinterpreted ETA. (We are measuring ETA by distance and time without considering heavy traffic that could affect ETA)
- **Functional Requirements:**
    - The user should be able to view all buses in route chosen via Google API map
    - The user should be able to view the ETA and route of the buses in route chosen
    - The user should be able to input their starting point location and the destination bus stop they choose
- **Non-functional Requirements:**
    - **Organizational Requirements:**
        - Users need to authenticate themselves by signing in with netid and password or RUID number.
    - **Performance Requirements:**
        - The system should be able to withstand immense throughput from the users and execute in a timely manner.
        - The system should regulate bus scheduling to be at most 30 min apart per bus per route
    - **Safety Requirements**:
        - In the event of an accident or anything that causes route blockage or danger to any drivers or passengers, the system should notify them.
    - **Security Requirements**:
        - To prevent any hacking into the system, authorization via netid/password or RUID is required before using system

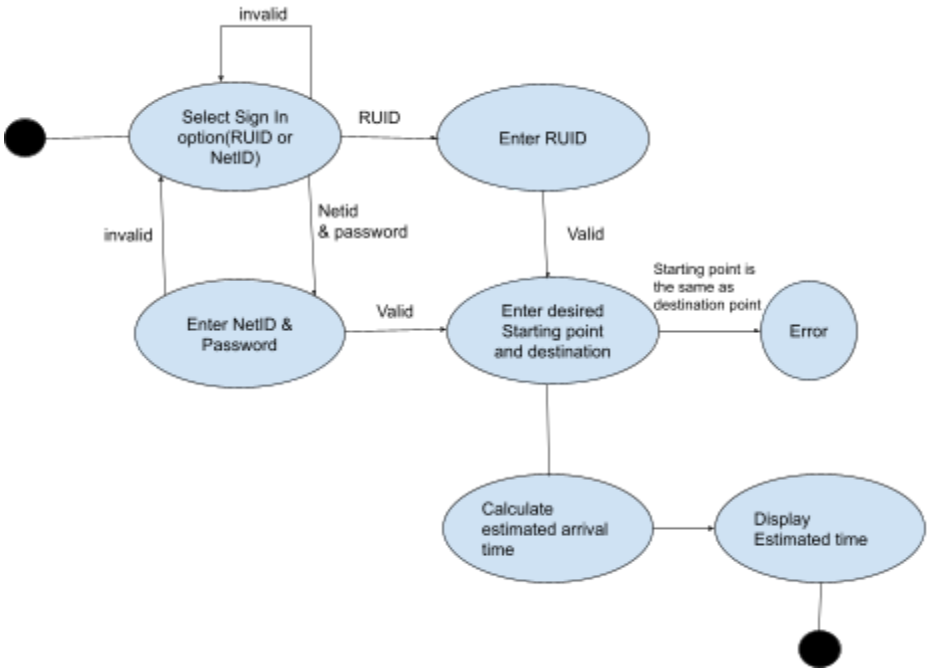
    - The system should remain available for the operating hours for buses (7 am - 3 am)
- **Domain Requirements:**
    - Utilizes the Google API
- **Usability Requirements:**
    - Should be easy to use and easy to understand without a learning curve (User simplicity)

Systems Modeling

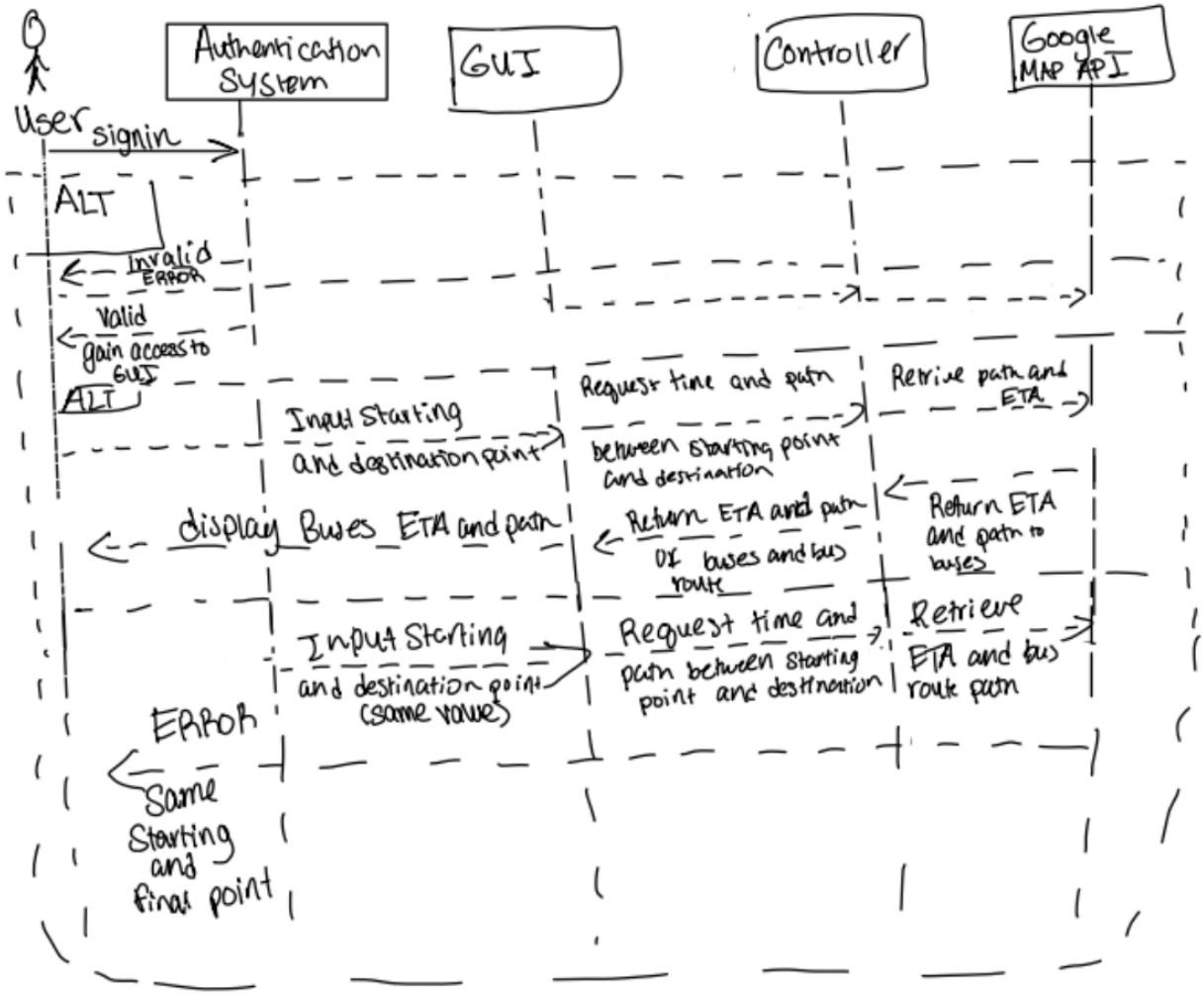
Use Case Diagram:



Activity Diagram:

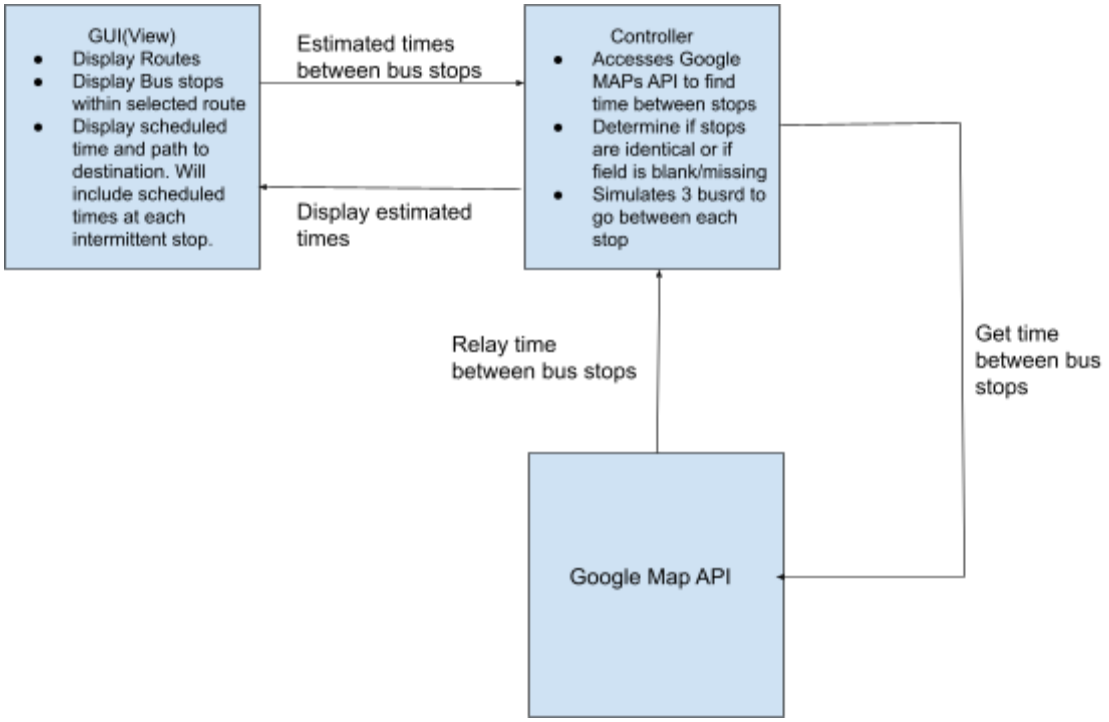


Sequence Diagram

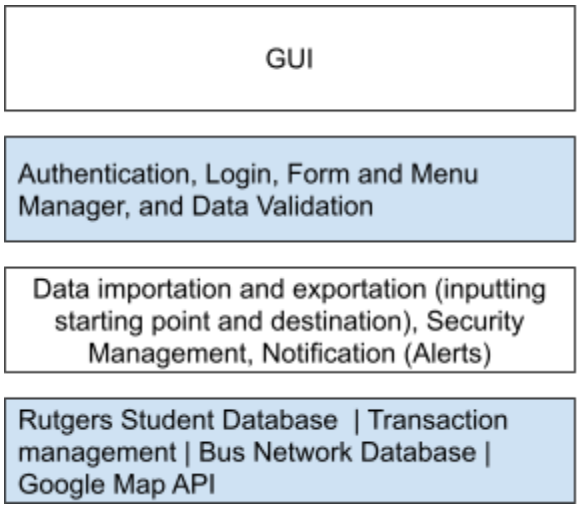


Architectural Design:

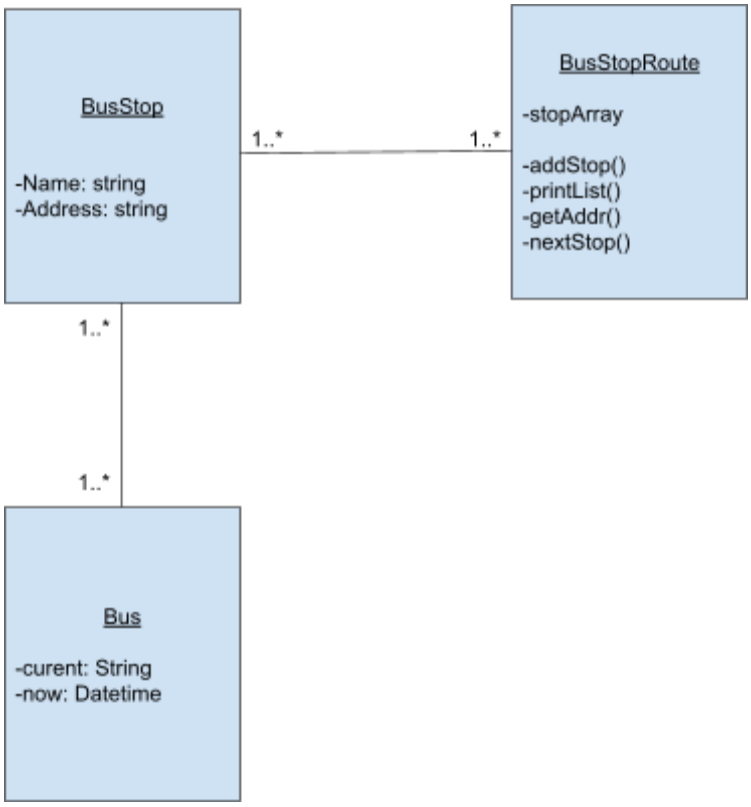
MVC Diagram



Layered Architecture Diagram:

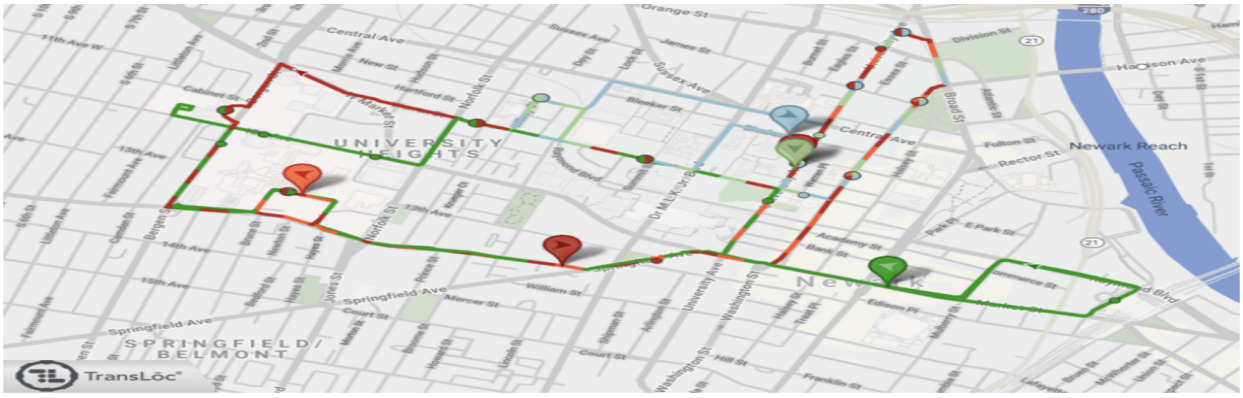


Class diagram



Design and Implementation:

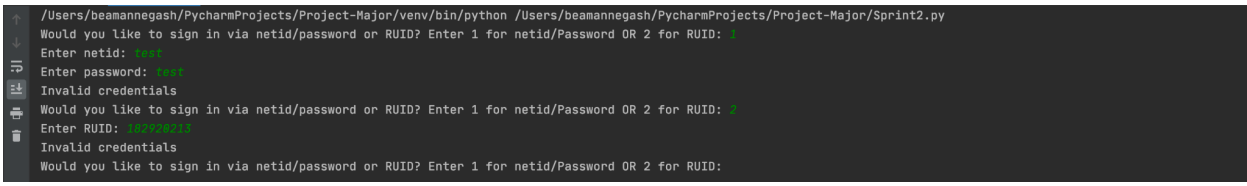
- User will sign-in to be authenticated via netid/password or RUID
- User will input their starting point
- User will input their destination
- User has the option to be alerted 5 min before the bus reaches their starting point
- System should display ETA of bus(es) arriving to user starting point
- System should display a map of the buses on route



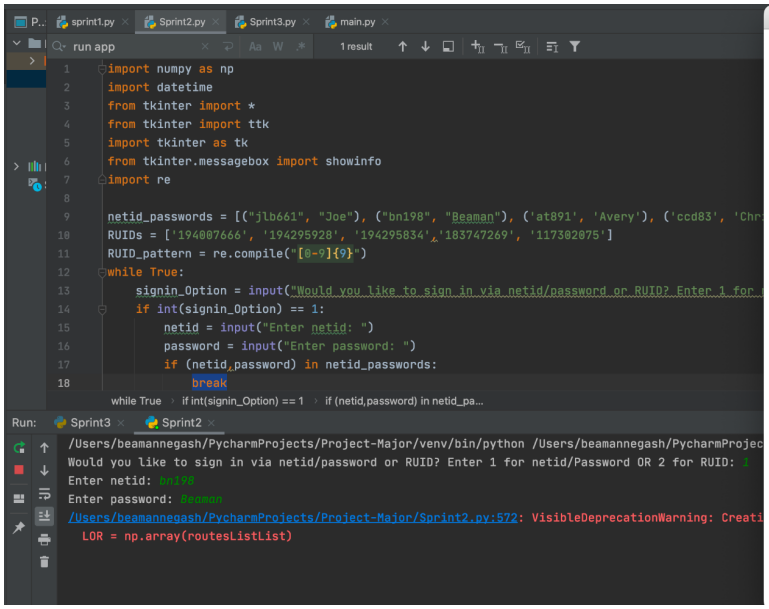
Software Testing (across all levels):

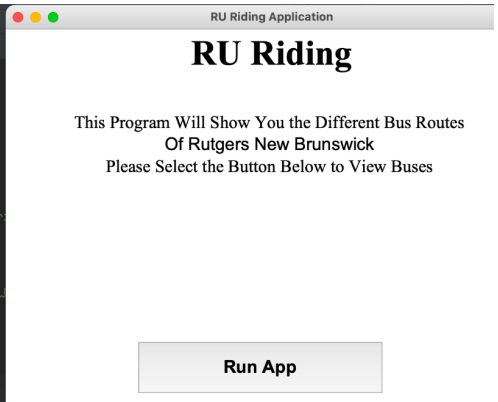
- **Program should first ask User for Security Authentication. This is in the form of either NetID/Password combination, or RUID**

```
/Users/beamannegash/PycharmProjects/Project-Major/venv/bin/python /Users/beamannegash/PycharmProjects/Project-Major/Sprint2.py
Would you like to sign in via netid/password or RUID? Enter 1 for netid/Password OR 2 for RUID:
```

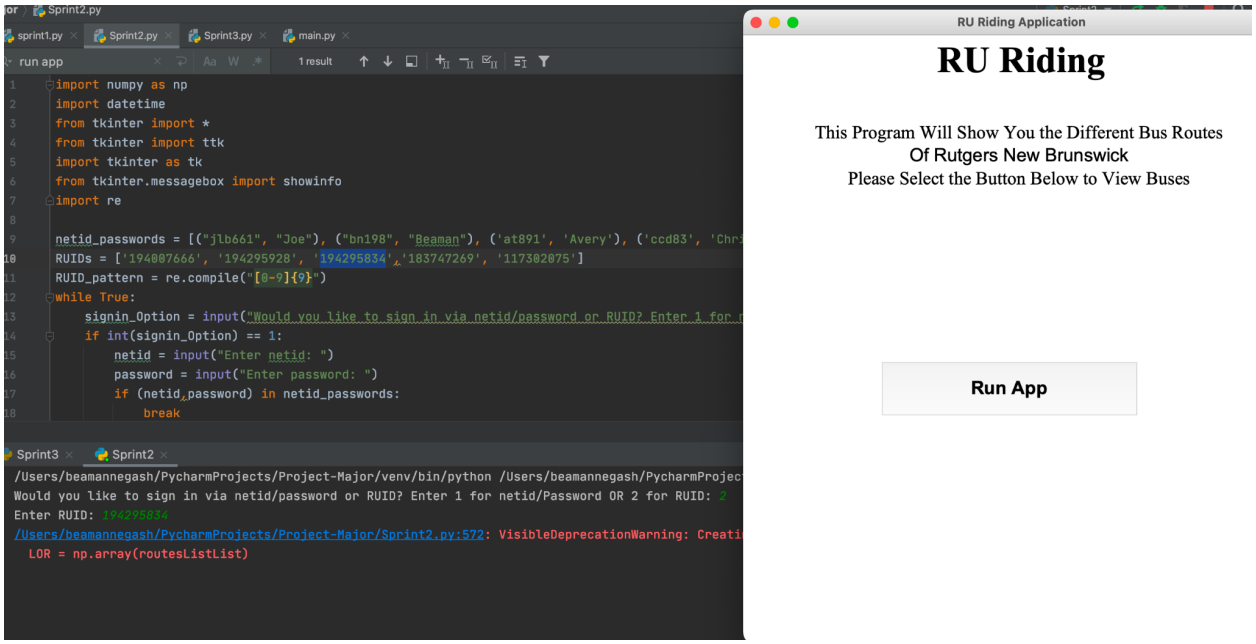
- **If user puts in incorrect NetID/Password or incorrect RUID, it will alert user credentials are invalid and re-ask user for Sign In credentials**
  - 

- **Signing In with valid NetID/Password Credentials causes Homepage GUI to open**

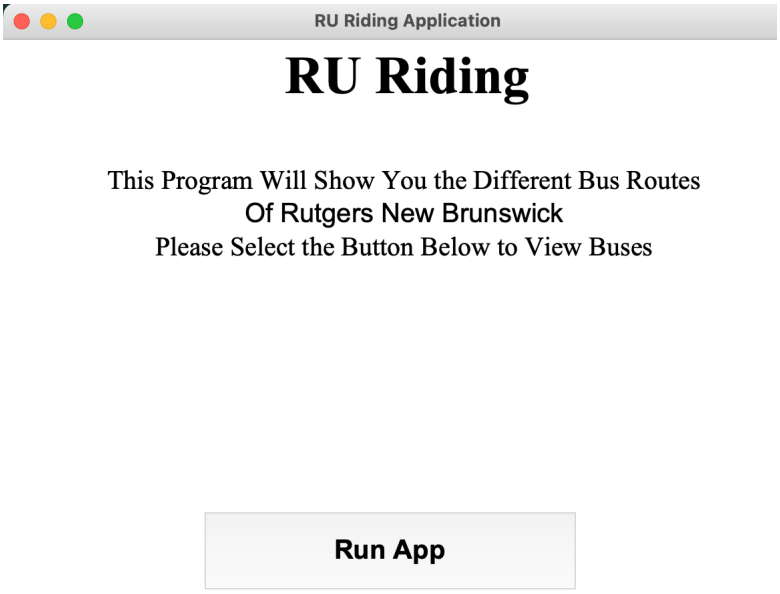




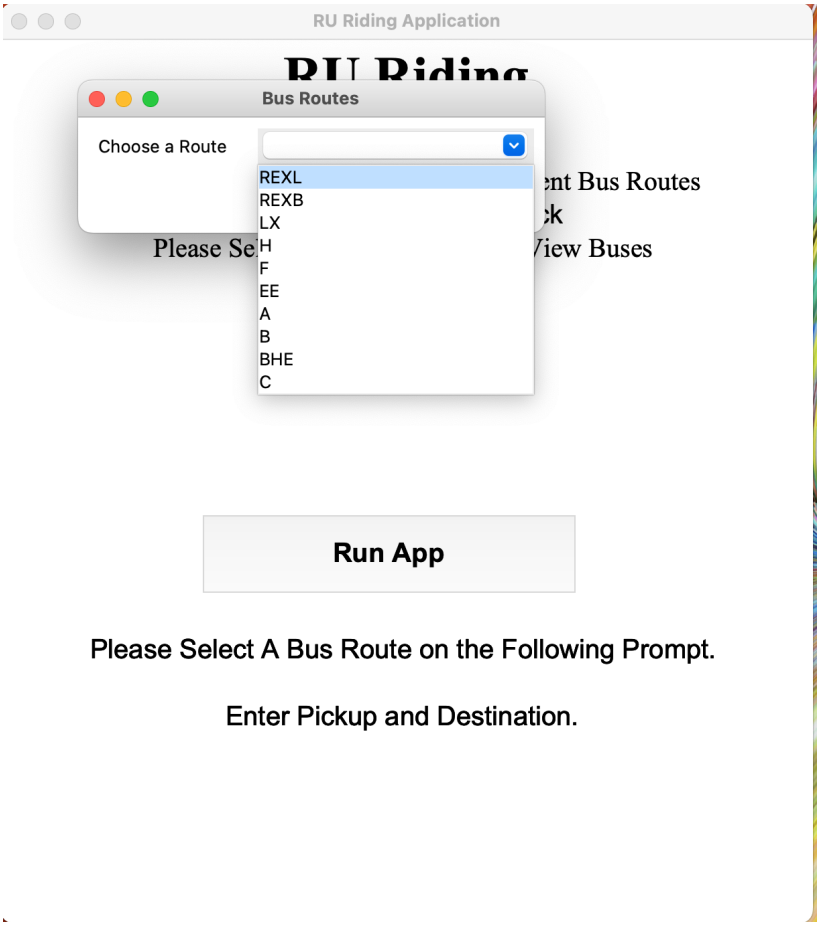
- **Signing In with valid RUID Credentials causes Homepage GUI to open**



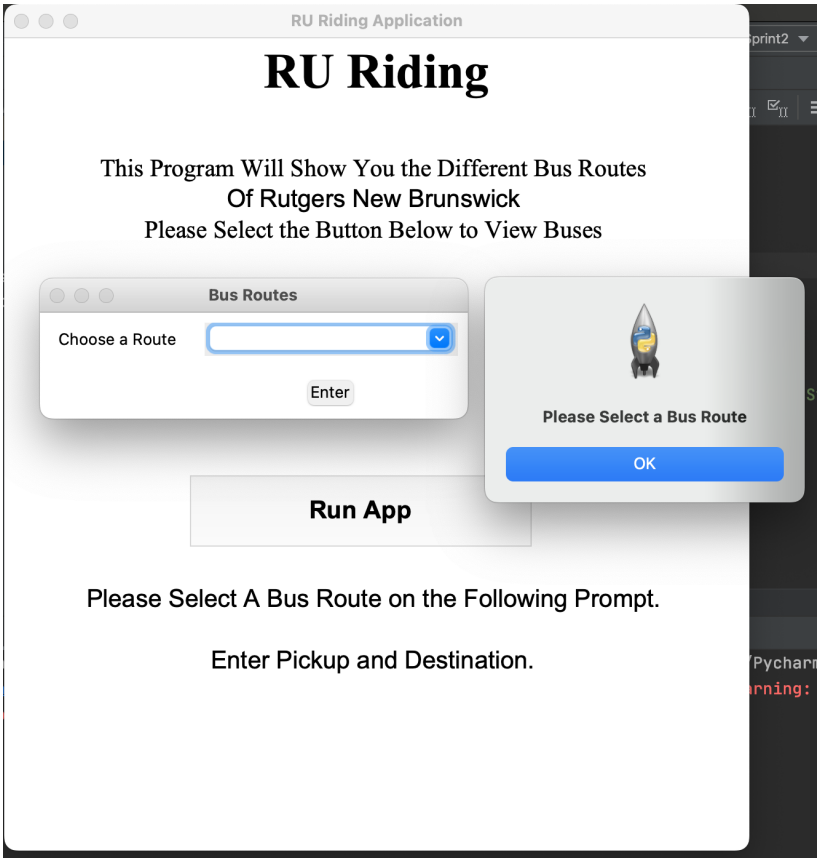
- **Homepage GUI opens when Security Authentication is cleared**



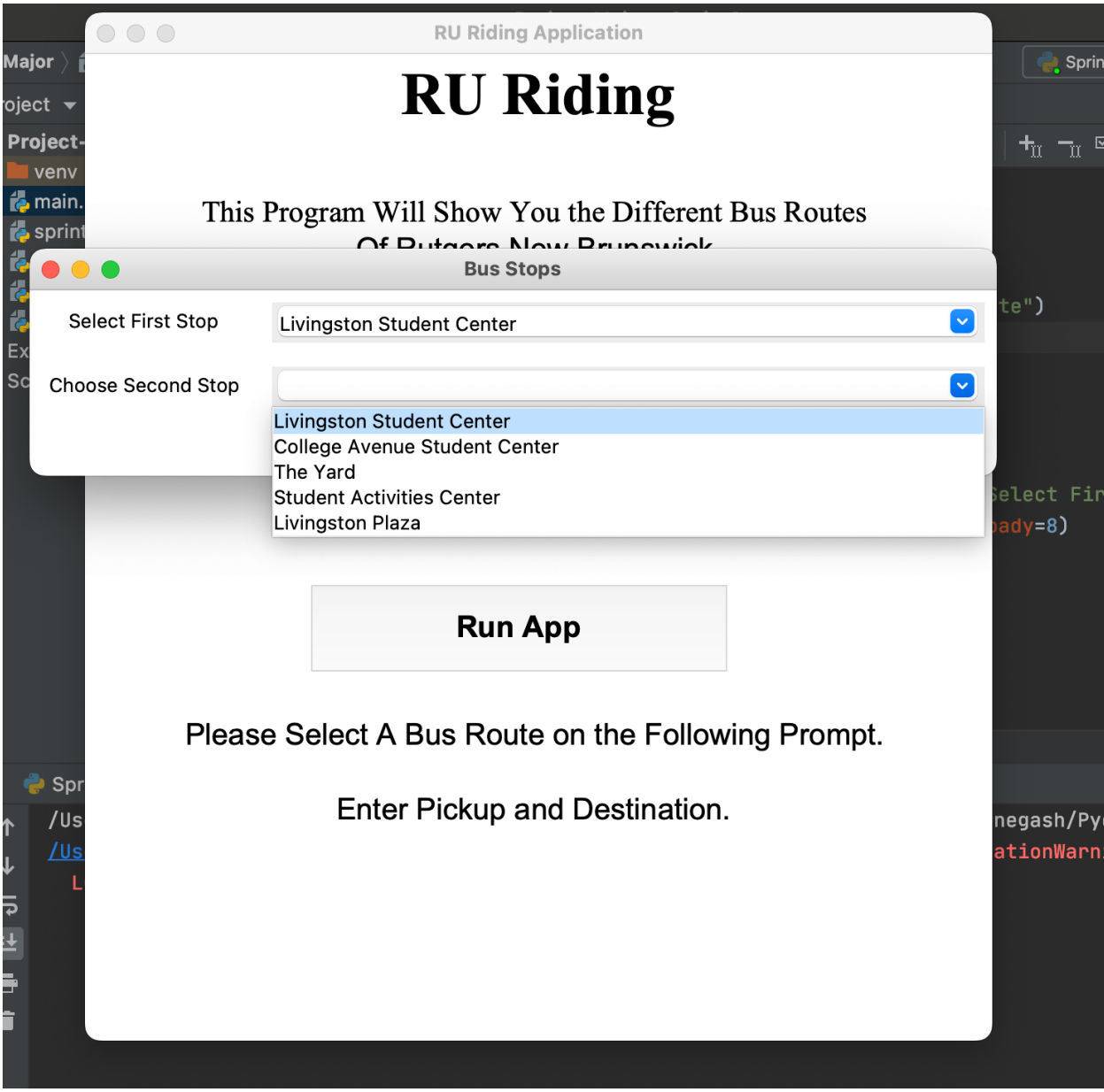
- When pressing Run Application button, testing to ensure that Routes GUI popups while also writing new text on the Homepage GUI
    - Dropdown should appear listing all the possible bus routes you are able to take



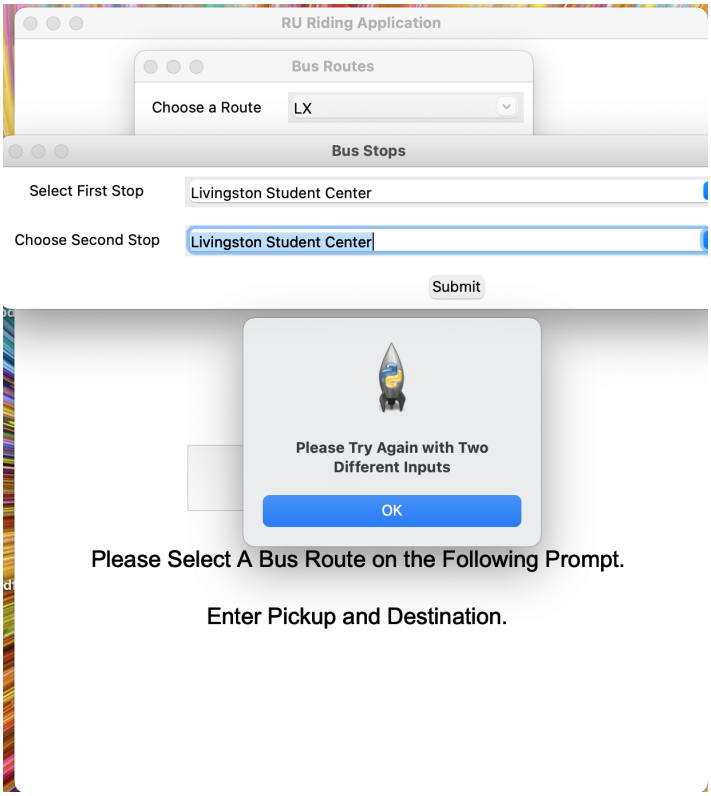
- **If no option is selected for a Route and user presses Enter, an alert should appear**



- **User can Select a route from a list of buses, showing all possible starting and ending locations from that specific route**



- **Selecting a Bus Route with the same Start and End Locations will cause a popup alert to appear**



Evaluation:

- Investigated how to implement users requirements
- Through multiple diagrams we determined the ideal and step my step systems the code should follow
- Created Secutiry Authentication system that stops non students from getting Rutgers Bus Information
- Created GUI Window that allows user to select Bus and starting location/destination
- Clear plan of what the desired code should accomplish
- Need to implement Google Distance Matrix API and integrate it within the GUI

Project Management:

Risk Management

Description	Impact	Probability	Severity	Mitigation
Team members may not submit code on time or are unresponsive	Deadlines for sprints will have to be pushed. Other team members	Moderate	Serious	Check up periodically before sprint deadline on how everyone is progressing

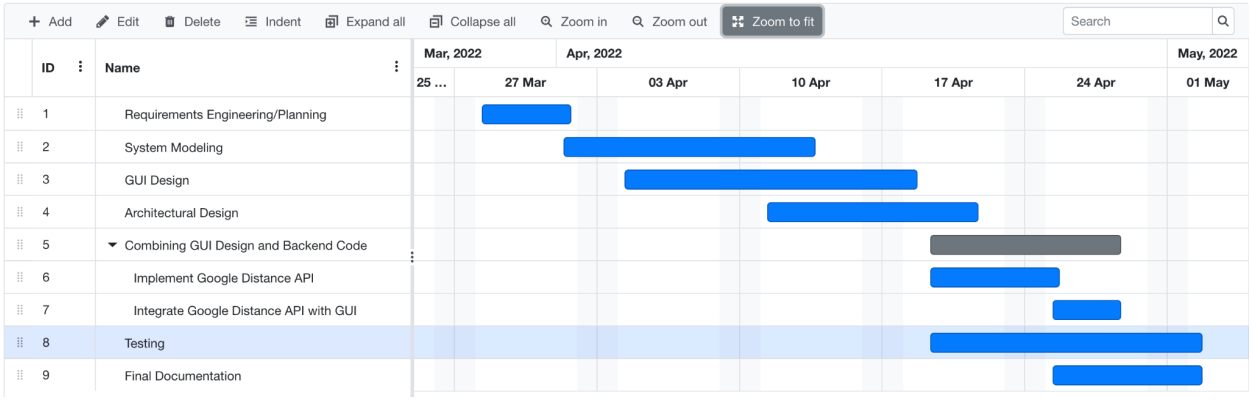
	may need to take up extra work to finish the project on time			with their assignment
The estimated time for this sprint is underestimated	This would affect the quality of the sprint or it would change the schedule for production of the software	Moderate	Tolerable	Checking up periodically on the progress of each task will help the group adjust the deadlines faster if necessary
Group members do not have the requisite experience to work on their tasks	Team members would have to learn skills before starting to code their task	Moderate	Tolerable	Tasks should be started early so that team members can learn the skills required to complete the task

Effort to make system dependable (Availability and Security)

By making sure that our system is constantly available during the operating hours of buses we make our system more dependable, providing service to users. By using an authentication component to the system, we prevent misusers from accessing our system and only allow Rutgers students and faculty to ride the buses.

Advanced SWE Solution (Reuse):
By reusing the code we have for the GUI using Python's tkinter module and system authentication component we eliminated the time consuming task of rewriting the code and avoided unnecessary potential bugs or errors.

Gantt Chart



Plan

With the bulk of the GUI already complete, we need to implement the Google Distance Matrix API and integrate it within our GUI. By doing this, our product will be able to work to user requirements, allowing the user to find information about the Rutgers Bus System. Also need to flesh out some of the code so that its better organized and easier to scale in case of new bus lines/removal of bus lines.