Smart Navigation Application

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Outline

- Concept of Operations
- Project Management Plan
- Software Requirements Specification
- Test Plan
- High-level Design
- Detailed Design

Concept of Operations

Current System

- Currently no existing system designed to solve this direct problem
- Closest alternative is Google Maps - provides user complete control but is time-consuming and can lead to suboptimal routes

Modes of Operation

- Input - user provides list of activities
- Navigation - application provides list of directions

Operational Features

- Interface for entering activities in order in which they should be performed
- Ordered list of locations the user should visit
- Navigation between consecutive locations
- Ability to detect user’s location as a starting point of the navigation
- Different directions based on user’s mode of transportation (driving, walking, etc.)

Analysis

- Improvements
  - Shorter travel distance
  - Less time making decisions
- Disadvantages
  - Battery Usage
- Limitations
  - Requires smartphone, GPS, and Internet
  - Decisions not based on user’s preferences

Analysis (continued)

- Risks
  - Losing GPS signal could cause navigation problems
- Alternatives
  - Google Maps
  - Internet Search
  - Research places in advance

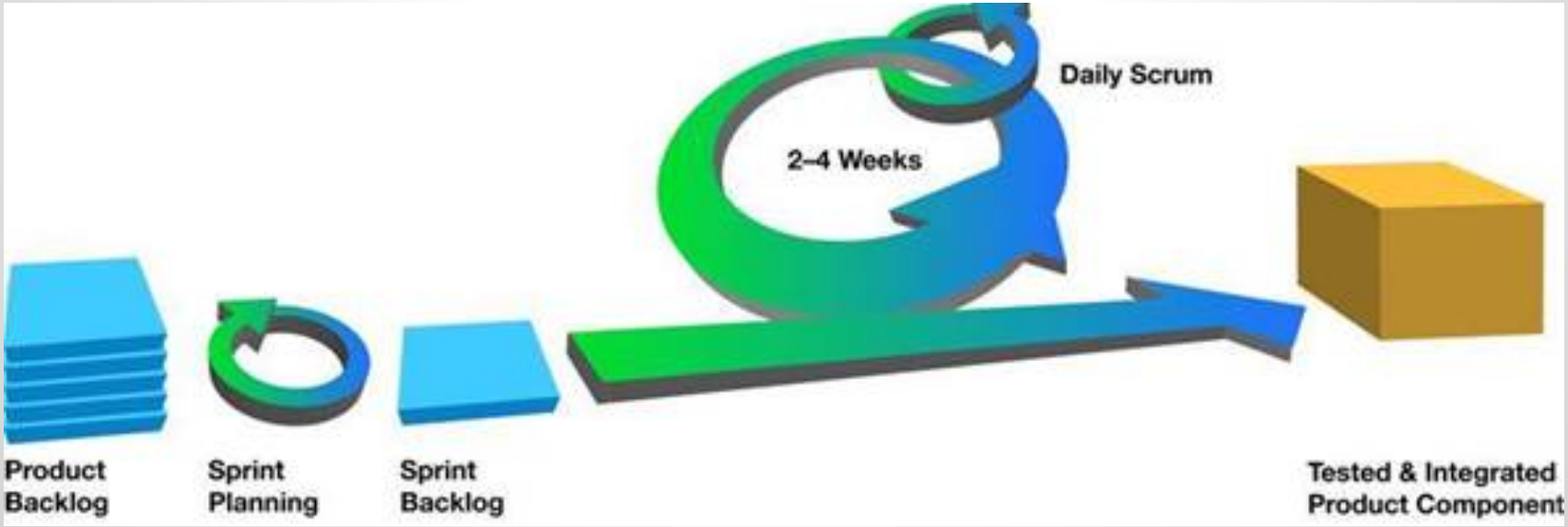
Project Management Plan

Team Organization

- No leader
- Individual roles
  - Evan - Planning meetings
  - Ryan - Taking meeting minutes
- Communication
  - Meetings
  - Webcourses
  - Email

Software Life Cycle

- Agile



Standards

- Indentation
  - Allman style
- Naming Conventions
  - PascalCase
  - camelCase
  - ALL_CAPS
- Comments
  - Implementation comments as needed
  - Documentation comments for each class, field, and method

Standards

- Documents
  - Online templates
- Size metric
  - Source lines of code (SLOC)

Development Tools

- Latest versions of Java, Android SDK, and Google APIs
- Configuration Management - GitHub
- Operating system not standardized

Quality Assurance & Risk

- Goals: A variety of real-world testing and user feedback

- Few project specific risks
  - Data integrity
  - Usability

Work Packages and Division

- Initially: UI, Functionality, Documentation
- Further division into: UI Design, Class Development, and Testing
- Individuals responsible for tracking their own progress.

Software Requirements Specifications

Functional Requirements

The mobile application shall allow a user to…

- add one or multiple destinations.
- delete any particular destination(s).
- reorder any particular previously entered destination(s).
- view all entered destination(s) for a particular day.
- navigate, and see the optimal route navigation between successive items in his/her “to do” list.

Interface Requirements

- Google Maps API for navigation directions.

Physical Environment Requirements

- Run Android version 2.3 or later.
- Internet when navigating.

Users and Human Factors Req’s

- Allow any college level user to successfully navigate through the application with ease.

Documentation Requirements

- Online templates

Data Requirements

- Implement a dynamic programming algorithm to identify the optimal route between destinations.

Security Requirements

- There shall be HTTPS encryption of the communication between the system and server.

Quality Assurance Requirements

- The navigation algorithm to identify the optimal route shall complete in under 30 seconds.
- The user interface will always respond to user interactions within 5 seconds

Test Plan

Test Environment

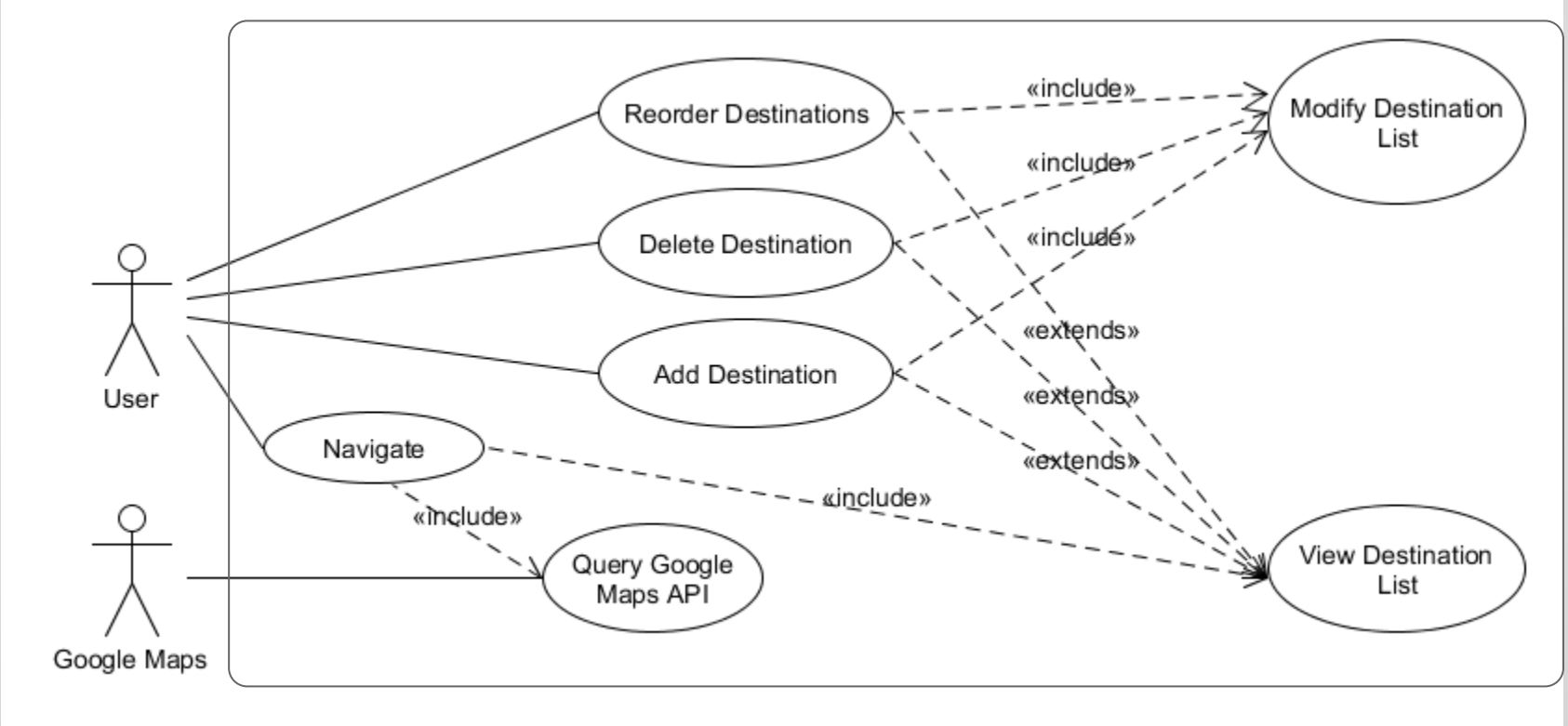
- Unit Testing
  - Code base
  - GitHub
- Integration Tests
  - Android emulator

Test Cases

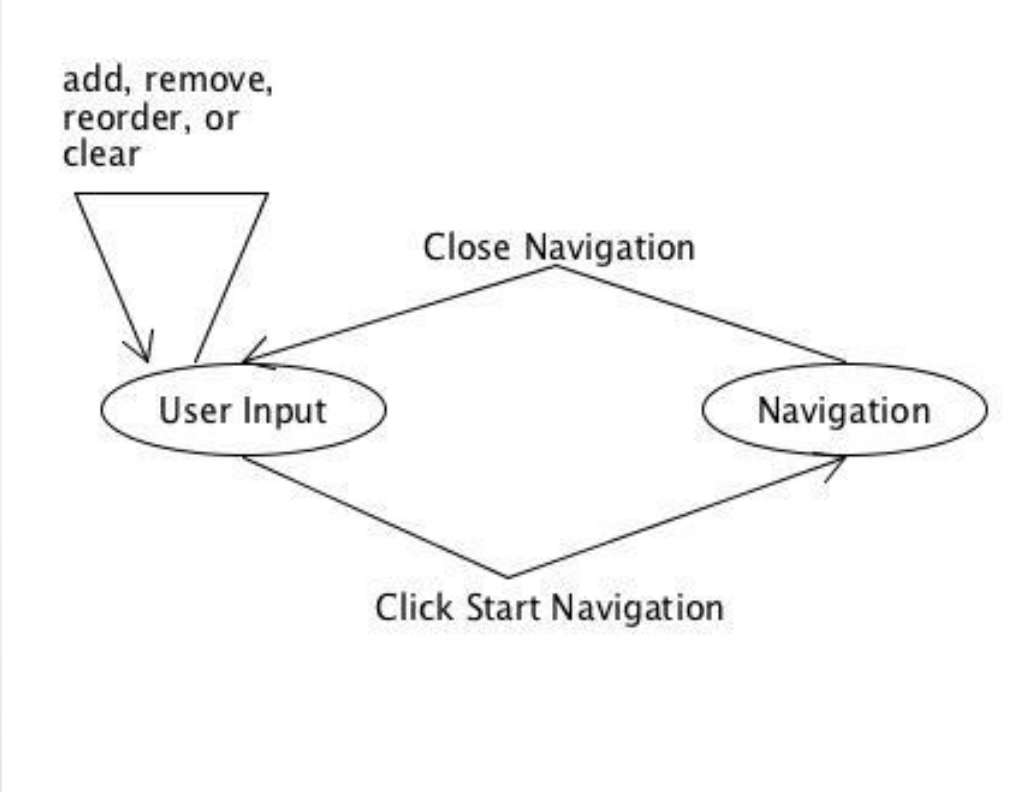
- 1 simple location in area
- 5 locations in area
- Too many locations
- Description too long
- Location out of range

High-Level Design

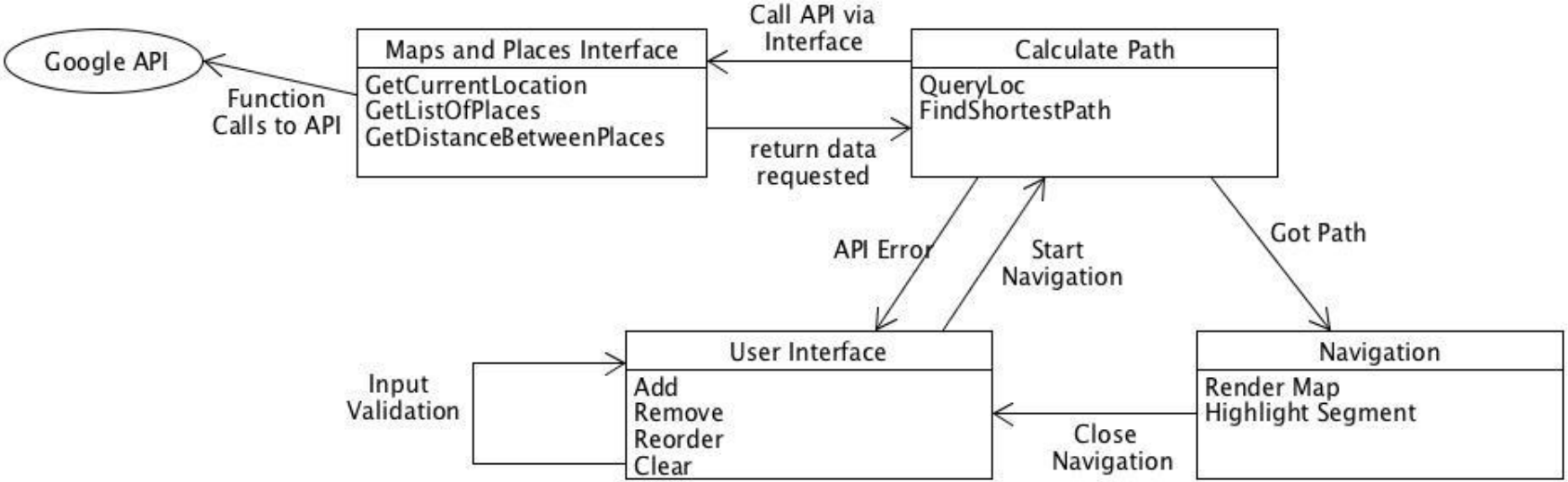
Use Case Diagram



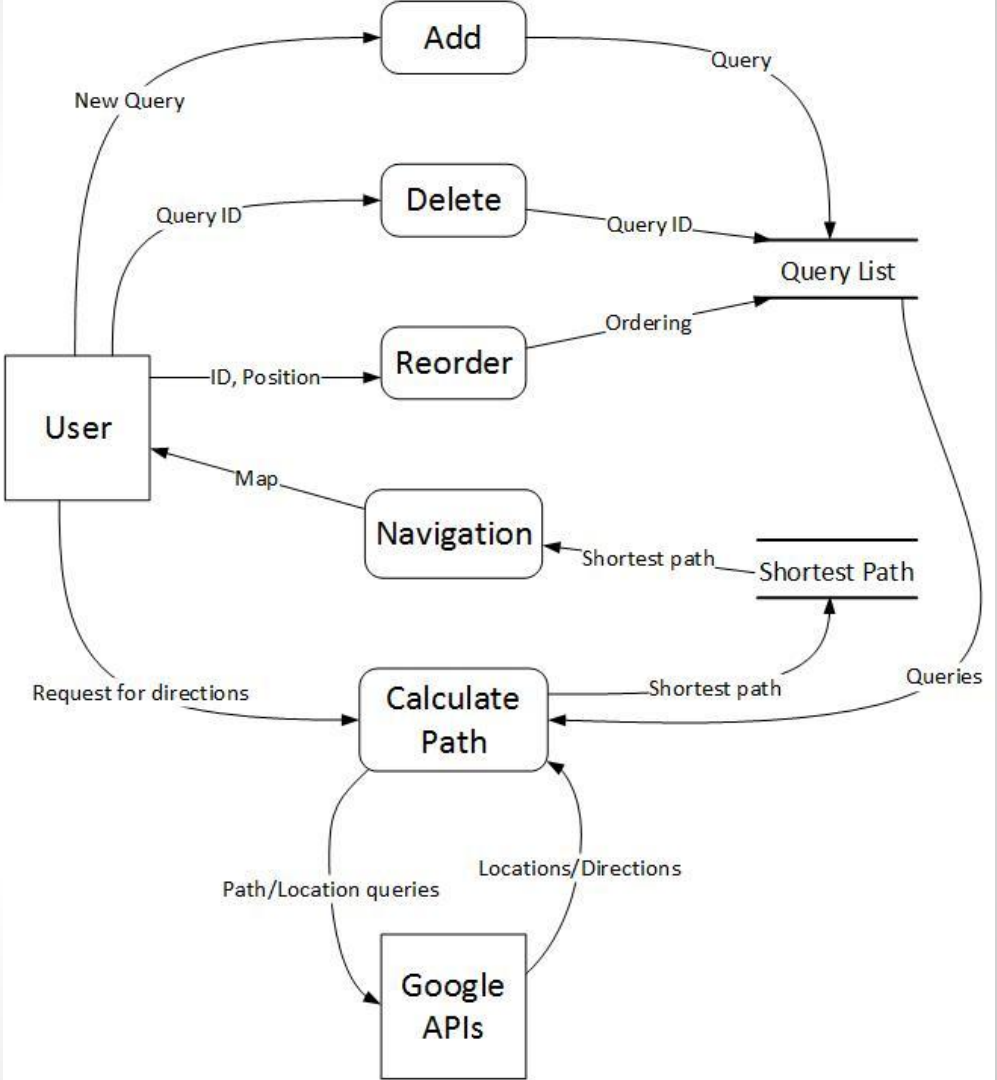
State Diagram



Module Diagram



Data Flow Diagram

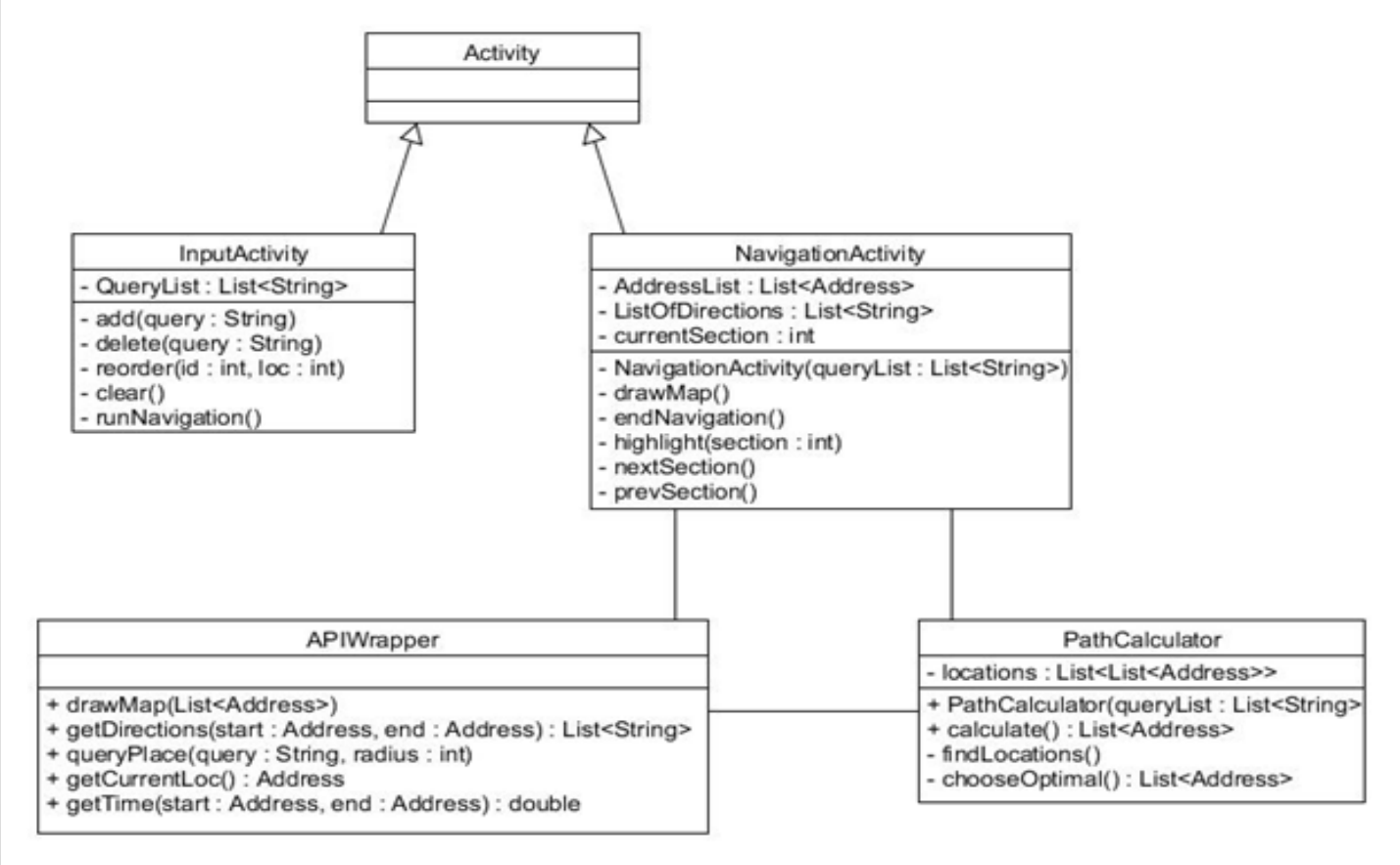


Design Issues

- Pipes-and-Filter Architecture
- Functional Decomposition Design
  - 2 distinct steps (enter list/navigation)
- Technical Difficulties - Testing GPS
- Performance, Reusability, Reliability, Robustness

Detailed Design

Class Diagram

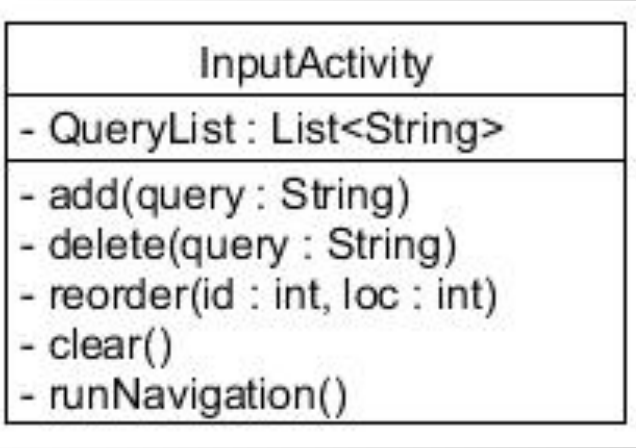


Input Activity

Record user input, storing it as a list of “query” strings.

Users can:

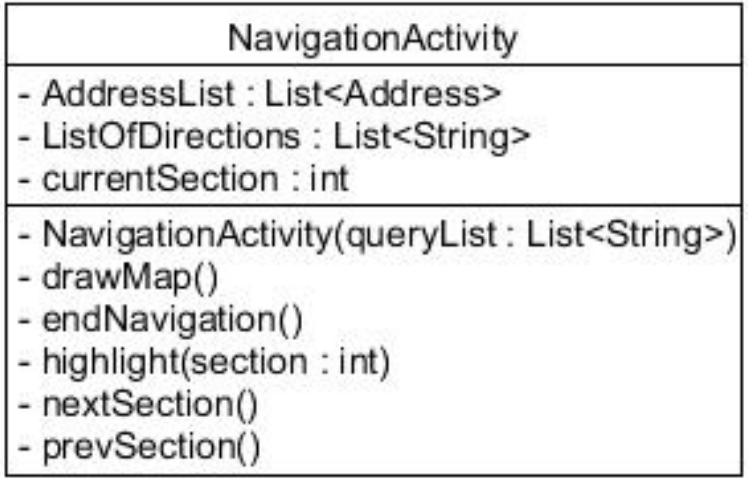
- Add items
- Delete items
- Reorder items
- Clear all items



Pressing submit sends the list of queries to the Navigation Activity.

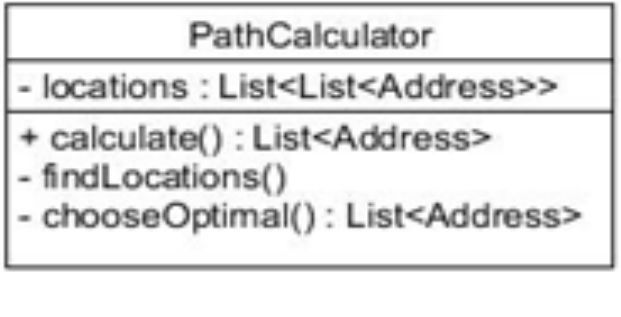
Navigation Activity

- Provides directions to locations
- Updates based on user's status
- User can view individual sections of the trip
- Gives option to return to input mode



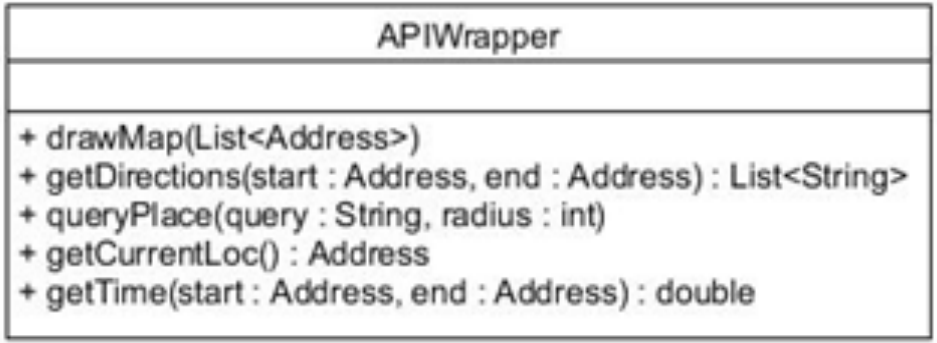
Path Calculator

- The PathCalculator class is given a list of queries
- It calculates the shortest path to visit places that match the queries in order



API Wrapper

- Contains wrapper functions for Google's API
- Uses Maps and Places API



Requirements Trace

InputActivity class:

- add one or multiple destinations.
- delete any particular destination(s).
- reorder any particular previously entered destination(s).
- view all entered destination(s) for a particular day.

NavigationActivity class

- navigate, and see the optimal route navigation between successive items in his/her “to do” list.

InputActivity and NavigationActivity classes:

- The user interface will always respond to user interactions within 5 seconds

Requirements Trace

PathCalculator class:

- Implement a dynamic programming algorithm to identify the optimal route between destinations.
- The navigation algorithm to identify the optimal route shall complete in under 30 seconds.

APIWrapper class:

- utilize Google Maps API for navigation
- HTTPS encryption of communication between system and server

Questions?