



**POLITECNICO
DI MILANO**

SmartCityAdvisor

Requirements Analysis and Specifications Document

Hasancan Sayılan

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INTRODUCTION

Purpose

This document is gathered with the purpose of describing the functionalities and capabilities of the SmartCityAdvisor project and to collect the necessary data to generate its requirements by using text, charts and diagrams.

This document is specifically made for the students and the professor of the Software Engineering II Course.

Scope

The aim of this project is to create a new environment management system that is the SmartCityAdvisor. The system will fulfill the activities such as calculating the level of carbon dioxide, the number of cars entering the city center and to balance the level of carbon dioxide by having the car population stabilized with some necessary activities.

The system manages the control over the sensors, auctators, large displays and a web/mobile application for citizens to observe the situation and act according to the circumstances. This project has started in May 2017 and will be completed by July 2017.

Goals

The product will have the following goals :

- [G1] The clients can get information whether they can enter the city center or not through web/mobile application.
- [G2] The clients can get information about the parking areas if they are available or not through web/mobile application.
- [G3] The clients can get alternative roads in the city if the city center entrance is limited.

Definitions, Acronyms and Abbreviations

System : The digital manager of all the service.

Client : Regular people, who will receive the notifications through web/mobile applications about the current level of CO₂ and whether they can enter the city center or not. The clients are not required to register or login to the system.

Allowed Entry State : The state where the clients can enter the city center.

Unallowed Entry State : The state where the clients cannot enter the city center.

Traffic Lights : The lights that control the flow of car traffic in the city. With this system, they will also be used in order to balance the level of CO₂

City Center : The city center of the city Milano.

City Zone : The part of the city Milano. There are 9 city zones in total.

Sensors : The eyes and ears of the system in the city that collect information and send a message to the rest of the system such as the level of CO₂ in the air, cars that enter the city center and availability of the parking places in all areas in the city center.

Auctators : The devices that control the traffic lights at the main intersections in the city.

Large Displays : The screens located on the main roads entering in the city from the highways that shows information.

Alternative Route : The secondary route for the clients who wished to go somewhere in the city without using the city center during the unallowed entry state.

Reference Documents

- <https://www.tutorialspoint.com/uml/>
- RASD sample from Oct. 20 lecture.pdf

Overview

The sections that are going to be described in this documents are :

Introduction

This section introduces the document, explaining the purpose of the project along with its scope, definitions, acronyms and abbreviations.

Analysis

This section analyzes the system, explains the functional and non functional requirements, domain assumptions, constraints, scenarios and includes use cases, interfaces, scenarios and diagrams.

Alloy Modelling

This section gives an idea of the project by modelling it using Alloy Modelling Language.

Used Tools

This section gives information about the tools that are used to create the document.

Working Hours

This section gives information about the time that was spent to create this document.

ANALYSIS

Domain Assumptions

- [D1] The sensors around the city can calculate the CO₂ level in the air correctly.
- [D2] The sensors in each city zone and parking areas are placed correctly.
- [D3] The sensors can track the cars entering the city center correctly.
- [D4] The sensors in each city zone sends a message about the CO₂ level in the air to the rest of the system every two hours.
- [D5] The sensors in the parking areas have correct information.
- [D6] The sensors can correctly calculate the availability of the parking places in the city center.
- [D7] The auctators can control the traffic lights correctly.
- [D8] The large displays shows the correct and current information.
- [D9] The web and mobile applications can be downloaded and used without any errors.

Requirements

- [R1] The system should require no registration from the clients.
- [R2] The system should sent notifications to the clients about the entrance to the city center if it is allowed or limited via application.
- [R3] The system should allow/limit city center entrance if the CO₂ level is low/high.
- [R4] The system should make alternative roads in GPS if city center entrance is limited.
- [R5] The system should control the traffic lights depending on the current city center entrance situation.
- [R6] The sensors in the parking areas should send information about the availability of the related parking area to the rest of the system.
- [R7] The system shows all the parking areas in the city center is unavailable if the city center entrance is limited.

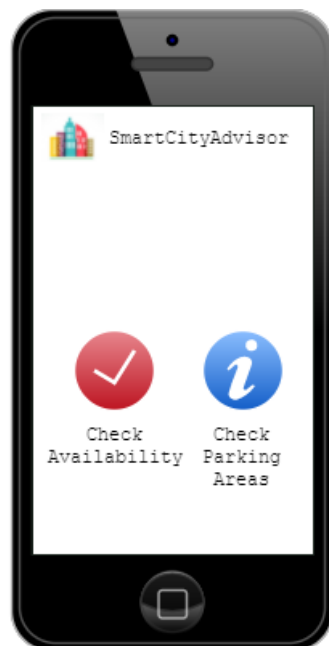
Functional Requirements

1. [G1] The clients can get information whether they can enter the city center or not through web/mobile application or large displays.
 - The system should require no registration from the clients.
 - The system should allow/limit city center entrance if the CO₂ level is low/high.
 - The system should sent notifications to the clients about the entrance to the city center if it is allowed or limited via application.
2. [G2] The clients can get information about the parking areas if they are available or not through web/mobile application.
 - The sensors in the parking areas should send information about the availability of the related parking area to the rest of the system.
 - The system should allow/limit city center entrance if the CO₂ level is low/high.

- The system shows all the parking areas in the city center is unavailable if the city center entrance is limited.
3. [G3] The clients can get alternative roads in the city if the city center entrance is limited.
- The system should allow/limit city center entrance if the CO₂ level is low/high.
 - The system should control the traffic lights depending on the current city center entrance situation.
 - The system should make alternative roads in GPS if city center entrance is limited.

Non-Functional Requirements

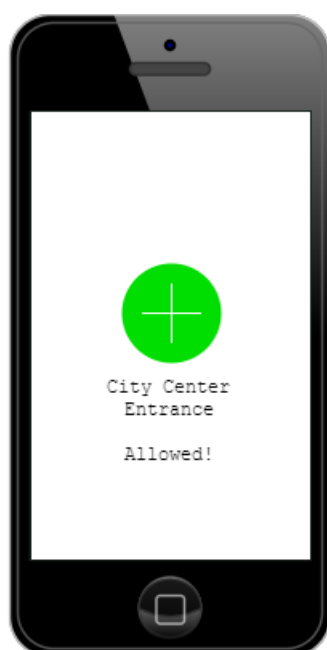
Mobile Application Interface



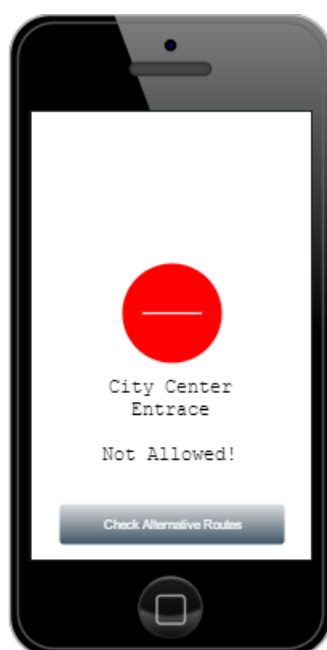
Default Mobile Application Interface



Checking Parking Areas Interface
Green Pin = Available
Red Pin = Unavailable



Checking Availability Interface 1
(Allowed)

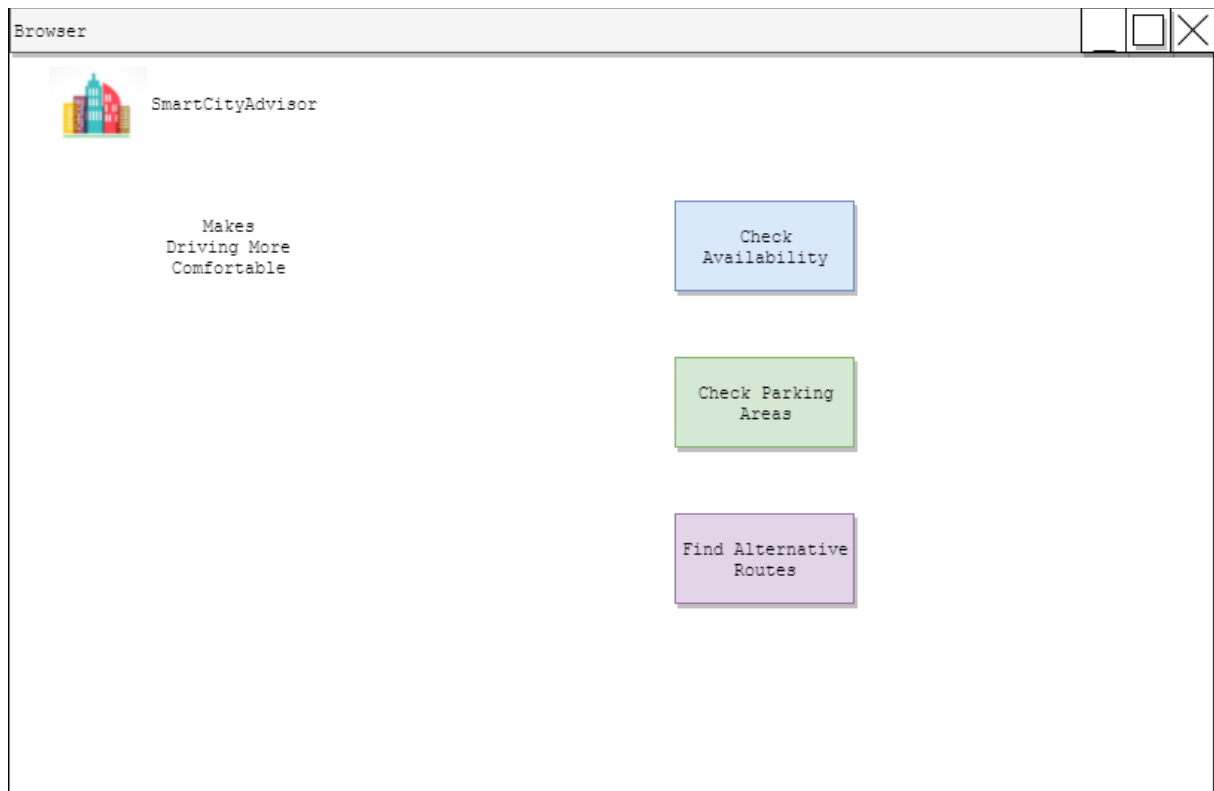


Checking Availability Interface 2
(Not Allowed)

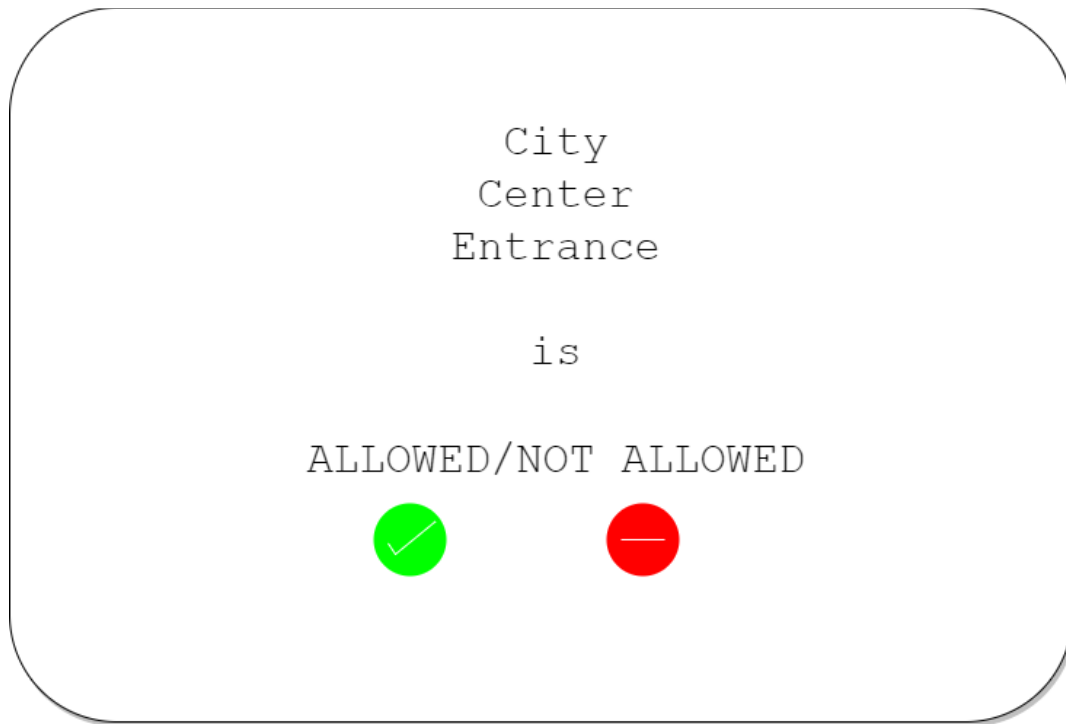


Checking Alternative Routes

Web Application Interface



Large Display Interface



Scenarios

Scenario 1:

The twin brothers, Michael and Marcus travelled to Rome from Boston to see their old friend Susan. After meeting with Susan, she told them that she had a meeting in Bovisa, Milano and asked them to join her. They agreed to go and the next day they started driving to Milano. The brothers and Susan entered Milano from south-east of the city using the highway. They calculated the shortest path is from the city center but in the beginning of the city entrance from highway they saw a huge screen displaying information about the entrance to the city center. According to the screen, they understood that the car population and CO₂ level in the city center are in critical numbers and the entrance is not allowed. Instead of going to the center, they used an alternative road and arrived in Bovisa.

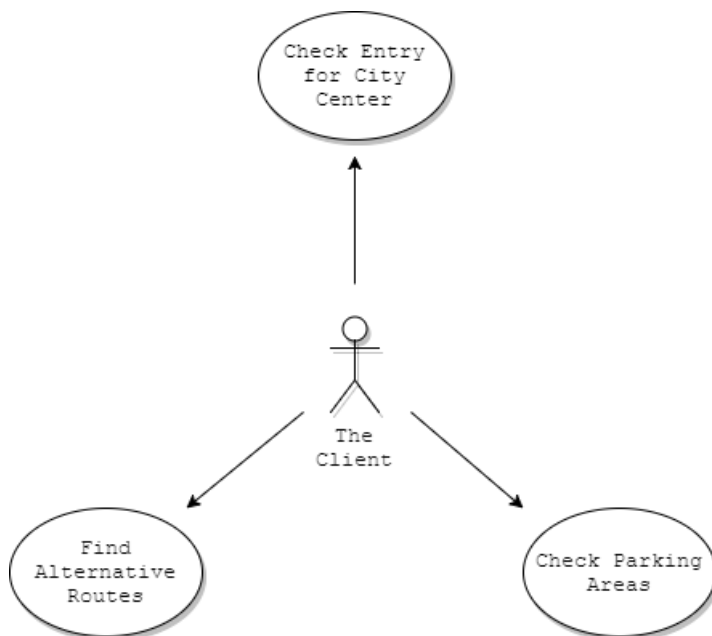
Scenario 2:

The fashion designer Andrea is living near the Leonardo Campus of Politecnico Di Milano. For a fashion show, he needs to go to Duomo. He searches for a good place to have lunch near the place where the fashion show is going to happen and finds a good place to eat. When he was spending some time with his computer and reviewing some designs he made, he remembered to check the web application of SmartCityAdvisor and finds out that the entrance is not allowed at the moment. He changes his idea and goes to the restaurant near his home for lunch where he eats almost every day. After lunch, he checks his mobile application and realizes that the entrance has been allowed thus he rides to Duomo for the fashion show.

UML Models

Use Case Diagram

For use case diagram, we have only one actor that is



Use Case Description

The Client checks entry for the city center

Name : The Client checks entry for the city center

Actor : Client

Entry Condition : There are no entry conditions

Flow of Events :

1. The client opens the web or mobile application.
2. The client clicks on the “Check Availability” button in the mobile application or the “Check Availability” button in the web application.

Exit Condition :

1. If the entrance is allowed, the client gets information about the situation with the positive sign image on a green background in the screen along with a “City Center Entrance Allowed!” text in the mobile or web application.
2. If the entrance is not allowed, The client gets information about the situation with the negative sign image on a red background in the screen along with a “City Center Entrance Not Allowed!” text in the mobile and web application

Exceptions : The client can also gets the information on a large display located in the city entrances from highway with a tick symbol on a green background meaning the city center entrance is allowed or with a negative sign on a red background meaning the city center entrance is not allowed.

The client checks for alternative routes

Name : The Client checks for alternative routes

Actor : The client

Entry Condition : City center entrance is not allowed

Flow of Events :

1. The client clicks on the button “Check Alternative Routes” on the mobile application or “Find Alternative Routes” on the web application.
2. The clients points the final destination on the map.

Exit Condition : Through gps, the screen shows the client the most appropriate way to reach the final destination with a green line and without entering the city center.

Exceptions : There are no exceptions.

The Client checks for parking areas

Name : The Client checks for parking areas

Actor : The Client

Entry Condition : There are no entry conditions.

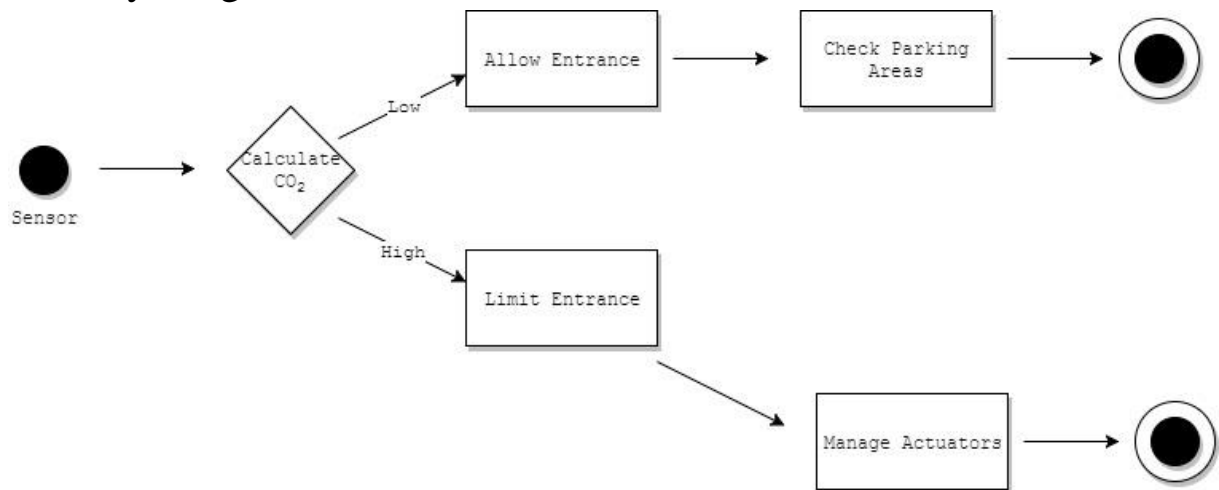
Flow of Events :

1. The client opens the web or mobile application.
2. The client clicks the button “Check Parking Areas” on the mobile application or “Check Parking Areas” on the web application.

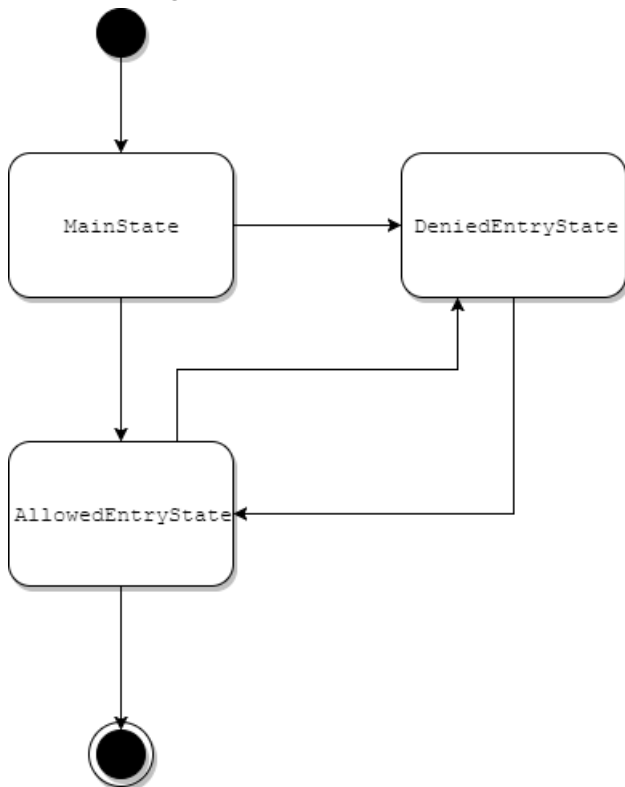
Exit Condition : The client gets information about the availability of the parking areas in the city center that is if the parking area is pinned with a green pin it is available and if the parking area is pinned with a red pin it is unavailable.

Exceptions : If the city center entrance is not allowed, the client will always see parking areas with red pins meaning that they are unavailable.

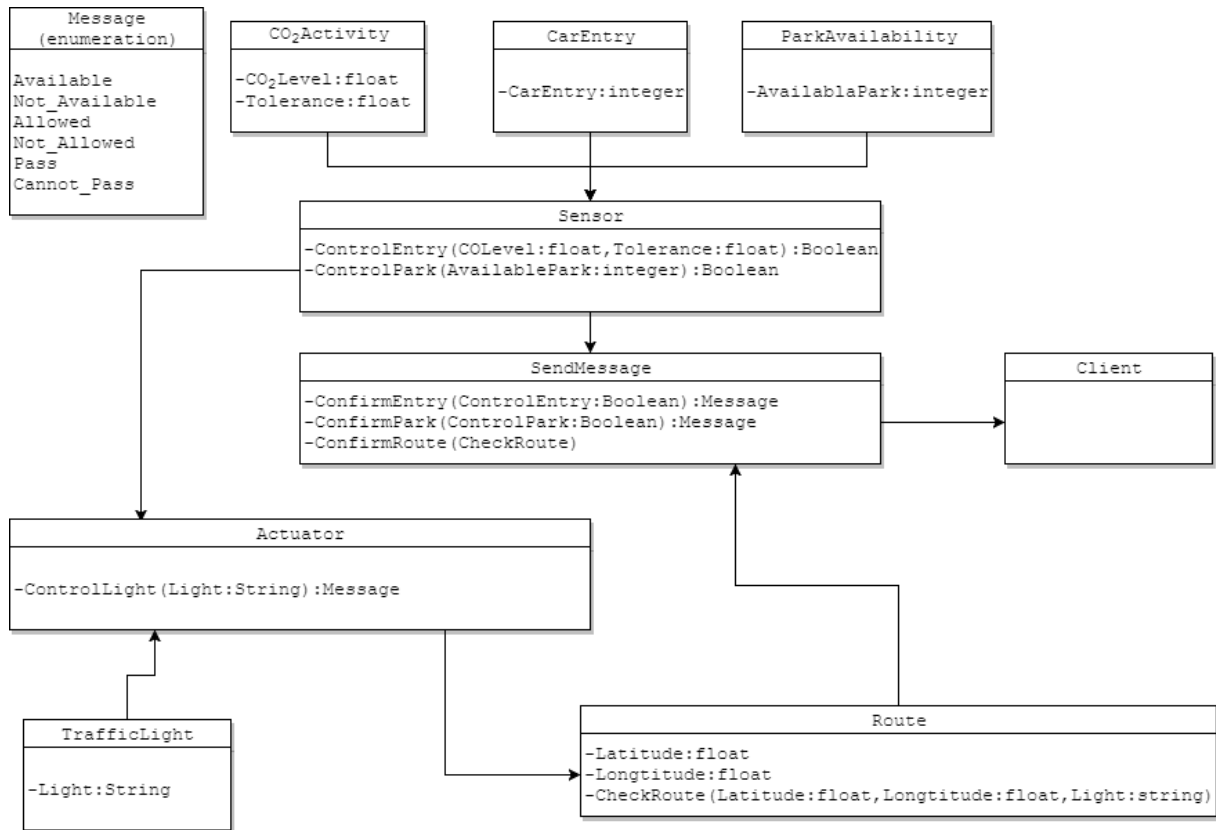
Activity Diagram



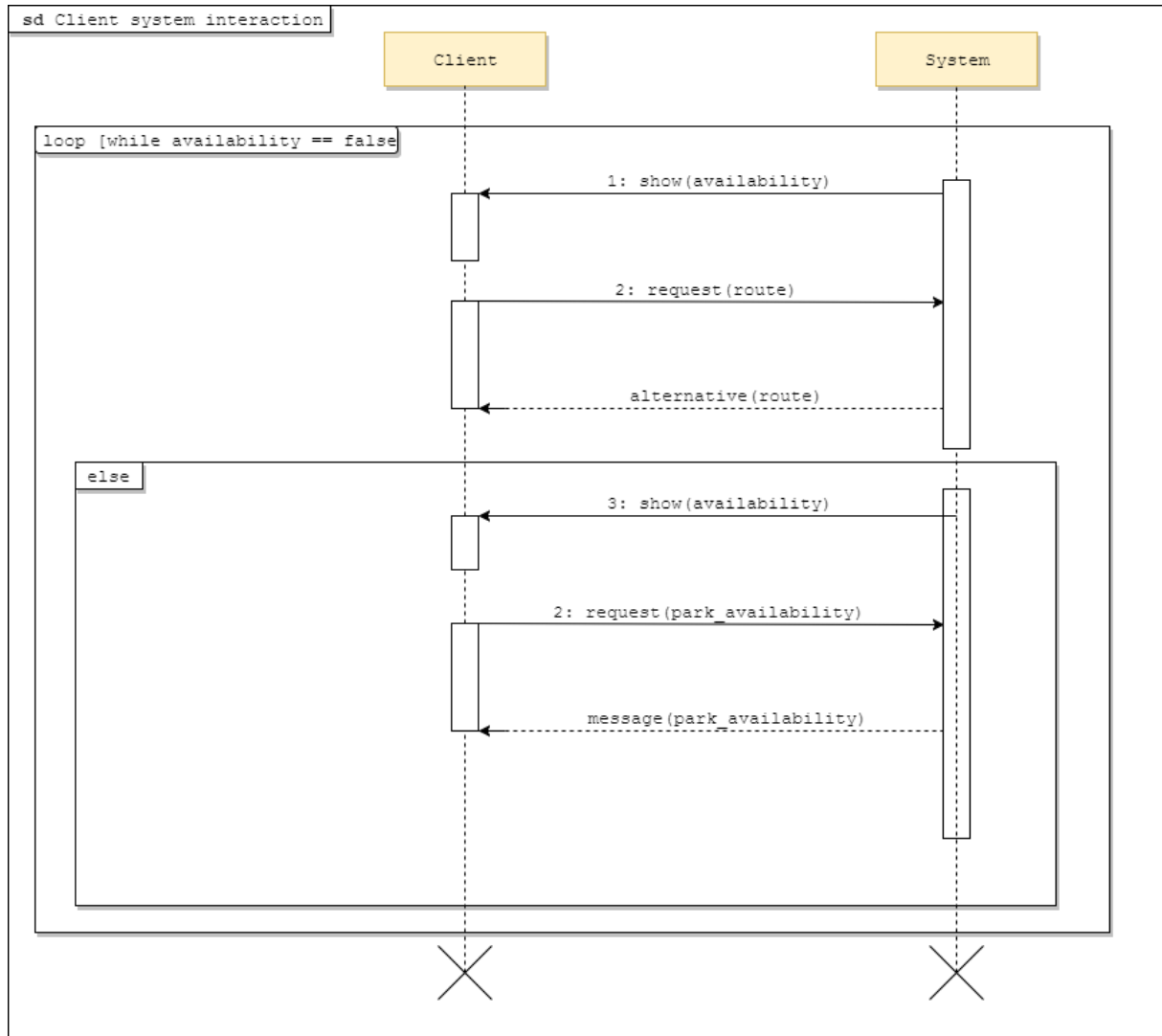
State Diagram



Class Diagram



Sequence Diagram



ALLOY MODELLING

[IN PROGRESS]

USED TOOLS

The following tools have been used to create this RASD document:

- www.draw.io : To create uml models
- Github : To upload documents
- Lyx : To create documents
- Microsoft Word : To create documents.

WORKING HOURS

Hasancan Sayılan

- 09/05/17 : 30m
- 11/05/17 : 2h
- 14/05/17 : 2h
- 18/05/17 : 10h
- 19/05/17 : 1h
- 20/05/17 : 7h
- 21/05/17 : 3h
- 22/05/17 : 10h