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Software Engineering 2: “TAXInseconds”
Requirements **A**nalysis
and
Specifications **D**ocument

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1 Introduction

1.1 Purpose

This document represents the Requirement Analysis and Specification Document (RASD). It aims at explaining the domain of the system to be developed and the system itself in terms of functional requirements, nonfunctional requirements and constraints. It also provides several models of the system and typical use cases. It is intended for all the developers who will have to implement the system, the testers who will have to determine if the requirements have been met and the system analysts who will have to write specifications for other systems that will relate to this one. It is also intended as a contractual basis thus being legally binding.

1.2 Actual System

The government of the city wants to optimize its taxi service with a completely new application. Therefore, we assume there are no previous systems to take into account.

1.3 Scope

The aim of the project TAXINSECONDS is to provide a new application to optimize the taxi service of the city that will be accessible via browser, mobile or public APIs.

The application will be available to the users in web and mobile forms and will have public APIs in order to expand and improve the service with additional features.

The city managed by TAXINSECONDS is divided in zones of 2 km² each and every zone has its own queue of taxis. The queues are automatically computed by the system with the information it receives from the GPS of the taxis.

Taxi drivers can be available or not. Only available taxi drivers can be in a queue. When a taxi driver changes her state from not available to available the system automatically adds her to the queue of the zone she is currently in, based on the information of the GPS of her taxi.

Users that are not registered can only see the estimated time of arrival of the nearest taxi with TAXINSECONDS.

Registered users can also request a taxi or make a reservation for a taxi. Reservations can only be made at least two hours before the ride and must be done specifying the starting location, the destination and the meeting time. Requests, instead, only need the starting location and the destination.

When a request is made, the first taxi driver of the queue of the starting location's zone is notified for accepting or rejecting it. If the taxi driver rejects it her state is automatically put on unavailable by the system. If a taxi driver doesn't accept or reject the request within 1 minute, it will be passed on to the next taxi driver in the queue and the first one will be moved to the end of the

queue. If there are no available taxis in the zone of the request the system will propagate the request to the closest available taxi.

When a request is accepted, the user that has made the request receives a notification from the system informing her of the code of the incoming taxi and the estimated time of arrival.

When a reservation is made, the system confirms it to the user and allocates a taxi 10 minutes before the meeting time. If a taxi for that zone is not available the closest available taxi will be notified. When a taxi driver accepts the reservation, the user receives from the system the code of the incoming taxi. If a taxi driver doesn't accept or reject the reservation within 1 minute, it will be passed on to the next taxi driver in the queue and the first one will be moved to the end of the queue.

Requests can be cancelled before they have been accepted by a taxi driver while reservation can be cancelled until 10 minutes before the meeting time.

1.4 Goals

- Provide an easy way to request a taxi.
- Provide an easy way to reserve a taxi.
- Guarantee a fair management of the taxi queues.
- Create an extensible system that allows expansion and interactions with other services.

1.5 Definition and Acronyms

1.5.1 Definitions

- *Guest*: a person that has to sign up or log in the system.
- *Secure Channel*: a communication channel to ensure privacy and authenticity for both the server and the clients
- *Logged in user*: a person that has already signed up and logged in the system.
- *Administrator*: a person authorized to modify the list of taxi drivers stored by the system.
- *Request*: a call from a registered user who needs a taxi immediately.
- *Meeting time*: the date and time in which the registered user needs the taxi in case of reservation.
- *Reservation*: a booking of a taxi at a certain meeting time.
- *State of a taxi driver*: the state the taxi driver is currently in. It can be available or not available. Taxi drivers can be in a queue if and only if they're available.

- *Closest available taxi*: if there are no taxis in the zone of the request or of the reservation, the system automatically finds the closest available taxi choosing the one with the smallest estimated time of arrival from the taxi queues of the other zones.

1.5.2 Acronyms

- **ETA**: estimated time of arrival: the time, estimated by the system, that the closest available taxi will take to get to the starting location of the ride.
- **CAT**: closest available taxi (see definition in the previous paragraph).
- **API**: application programming interface is a set of routines, protocols, and tools for building software applications on top of this one.
- **MAD**: maximum allowed delay; the maximum time, calculated by the system according to its information about distance and traffic, that a taxi driver has to get to the starting location of a request.

1.6 Actors

- *Guest*: guests are able to sign up, login or ask the system for an ETA.
- *Registered users*: after successfully logging in, registered users can request or reserve taxis or ask the system for an ETA.
- *Taxi drivers*: after successfully logging in, taxi drivers are able to set their current state as available or not and to accept or refuse requests.
- *Administrator*: after successfully logging in, the administrator will be the only user allowed to edit the taxi drivers list stored by the system.

1.7 References

- The document with the assignment for the project
- The IEEE Standard for SRS

1.8 Overview

This document is structured in three parts:

- **Introduction**: gives an high-level description of the software purposes and context.
- **Overall Description**: gives a general description of the application, focusing on the context of the system, going in details about domain assumptions and constraints. The aim of this section is to provide a context to the whole project and show its integration with the real world.

- **Specific Requirements:** this section contains all of the software requirements to a level of detail aimed to be enough to design a system to satisfy said requirements, and testers to test that the system actually satisfies them. It also contains the detailed description of the possible interactions between the system and the world with a simulation and preview of the expected response of the system with given stimulation. (Details are given with Alloy specifications and UML diagrams)

2 Overall description

2.1 Product perspective

The TAXINSECONDS application will be released as a web application and as a mobile application. There are no existing systems to integrate it with. It will provide a total of 4 main interfaces:

- For both type of users
 - Registered users
 - Guests
- For taxi drivers
- For administrators
- A non graphical interface for APIs

2.1.1 User Interfaces

2.1.2 System interfaces

2.1.2.1 Hardware Interfaces

- Owned by the users and taxi drivers:
 - Any GPS-capable device running Android 4.0+ or iOS 6+
 - Any computer able to run an HTML5-compatible browser
- Owned by the company:
 - The server on which the core of the application will run, and to which the applications, the web UI and the API-related clients will connect to.
 - Two machines optimized for a stateful firewall use
 - A machine with the DBMS

2.1.2.2 Software Interfaces

- Database Management System (DBMS):
 - Name: MySQL.
 - Version: 5.1.73
 - Source: <https://www.mysql.com/>
- HTTP/HTTPS server:
 - Name: Nginx
 - Version: 1.8.0
 - Source: <http://nginx.org/>
- PHP interpreter:
 - Name: PHP
 - Version: 5.3.3
 - Source: <https://secure.php.net/>
- Operating System:
 - Name: CentOS
 - Version: 7.1–1503
 - Source: <https://www.centos.org/>

2.1.2.3 Communication Interfaces

Protocol	Application layer Protocol	Port	Scope
TCP	HTTP	80	Upgrade to a secure connection over HTTPS
TCP	HTTPS	443	The web interface or the mobile apps
TCP	HTTPS/JSON	443	The APIs
TCP	HTTPS	443	The web interface or the mobile apps
TCP	DBMS over SSL	3306	Communication between the webserver and the DBMS

2.1.2.4 Memory constraints

- Primary memory:
 - for both taxi drivers' and clients's mobile devices at least 500MB
 - for the web application 1GB or more is suggested
 - for the server it is suggested to use a cloud service in order to resize memory according to traffic
- Secondary memory:

- mobile devices will need to have 50MB of free space on the device
- the web application requires no secondary memory
- for the server it is suggested to use a cloud service in order to resize memory according to traffic

2.1.2.5 Operations

2.2 Product functions

2.3 User characteristics

The TAXINSECONDS application is intended for all users who are at least 18 years old.

2.4 Constraints

2.5 Assumptions and dependencies

2.5.1 Domain Assumptions

- All taxi drivers who intend to use the service will have a mobile phone with one of the supported mobile OSs
- The taxi drivers will grant the system the rights to handle their taxi codes
- Taxi drivers' phones will always have an internet connection while TAXINSECONDS is running
- Users will have access to the internet
- In order to help the client to select the current location a phone with GPS capability will be required
- Users will enter a valid email address during registration
- Users will enter valid credit card data during registration
- Users allow the app to access their credit in order to pay for the service
- The Owner of the app will have to build or rent an always-on DBMS and host for the Server-Side part of the app
- Users who have requested or reserved a taxi will always be present when the taxi arrives.
- There is always at least an available taxi to fulfil a request or a reservation

3 Specific requirements

3.1 Functional Requirements

On the user side:

- For non logged in users (on both the WEB and Mobile interface):
 - The system will be able to calculate the ETA.
 - The system will provide a registration functionality
 - The system will provide a login functionality
- For logged in users (on both the WEB and Mobile interface):
 - Provide information about taxis queues and availability
 - The system will store the username, password, email and credit card data of every user
 - The system will provide a functionality to request a taxi at the given starting location
 - The system will provide a functionality to reserve a taxi at the given starting location and meeting time
 - The system will provide a functionality to modify the personal data of the user
 - The system will provide a logout functionality
 - The system will provide a functionality to notify users of the code of the incoming taxi
 - The system will provide a functionality to notify users of the ETA of the incoming taxi
 - The system will provide a logout functionality
- Through the API:
 - Get the queue status for a given position
 - Get the ETA for a taxi for a given position
 - Establish a Secure Channel
 - Using a Secure Channel and valid credentials:
 - * Place a request for a given starting location
 - * Place a reservation for given starting location and meeting time
 - * Require the system to send a push message for updates about the status of a previous request

On the taxi driver side:

- If credentials have been invalidated a “reset password” procedure will be mandatory