# Introduction

## 1.1 Purpose

The purpose of this document is to provide a description of the system to be developed. It specifies goals of the system, functional and non-functional requirements and assumptions, other than use cases, possible scenarios and UML diagrams. Also, the system has been modeled using Alloy Analyzer and the code is provided with results of the simulation.

The document is addressed to programmers involved in the developing phase and to the client that has to revise the contract basis for the system development.

## 1.2 Description of the given problem

The aim of PowerEnjoy is to offer a car-sharing service to users, so that they can reserve, use and release electric cars.

The user can register to the PowerEnjoy service by using a mobile application that communicates with a system. To get access to the service the user must provide driving license, ID card and payment details; after system validation, a password will be sent for accessing to the account.

Registered users have complete access to the functions of the application, being allowed to see available cars around them or close to a user specified address and to ask for a reservation. Users are also given the possibility to cancel the reservation.

After the reservation, a one hour time limit is imposed to reach the car, and only once the user gets close, the system unlocks it; the user can enable an option provided to save money. In that case the system designates the place where to park and the user can get a discount if he confirms and parks there.

The user is charged at the end of the rental and the due amount is calculated on the time of the ride; in some cases, depending on the number of passengers, the battery level of the car and the place in which the user parks it, he may get discounts or get some extra charge.

Discounts and extra charge are calculated as follows:

* -10% off if the car has at least two other passengers;
* -20% off if the car is left with more than 50% of the battery;
* -30% if the car is parked and the users plugs it into the power grid;
* +30% if the car is left at more than 3km from the nearest power grid station or with less than 20% of the battery.

The service provided is available in the Italian area and a European driving license is required to register. The system knows the coverage of the service, the valid parking areas (safe areas) and the list of the special parking areas (as a list of coordinates) and accesses users and cars’ locations via their GPS enabled on mobile phones and boards.

Cars that need maintenance for any reason and that are unavailable are not shown on users’ maps.

On the other side, another type of user, operator, has a different access to the service. Their objective is to do interventions and maintenance on cars that are unavailable for the following reasons:

* the car is left with less than 5% of the battery level;
* the car needs maintenance for issues reported through its control unit.

Operators interact with the system through a mobile application providing a login page for their identification, the list of cars in need of maintenance and a function to take them in charge in order to fix the issue. Once the work done, they inform the system and the car becomes available again.

## 1.3 Glossary

* **Car Sharing:** it is a service of car rental where people can use a car reserving it before, use it, usually for very short periods, and then leave it to a parking.
* **User:** it is a person that is registered to the PowerEnjoy Service. It have to be older than 18, and have a valid driving licence to drive cars. It is allowed to reserve PowerEnjoy car using the PowerEnjoy mobile application.
* **Operator:** it is a person with technical skills, such as a mechanic, that fix PowerEnjoy cars and that take PowerEnjoy cars to a special parking area and plug it at Power Plug when their battery is low. Since they are not PowerEnjoy service user, they can't reserve a car and perform any operation users do.
* **App:** It is the short term we use to desine a mobile application.
* **Power Plug:** It is a column with one or more electricity socket where it is possible to plug the car. Each socket has a number written on it and a led, that is green if that plug is available, or it is red if it is not.
* **Safe Area** (also Parking Area): it is parking area that is an area with parking spaces. This spaces are note specially reserved for PowerEnjoy but are shared with all the other divers of the town.We will refers to "Safe area" also with the term "Parking area".
* **Special Parking Area** (also Power Station): it is a parking area reserved exclusively to PowerEnjoy cars where, for each parking space there is an Power Plug where it is possible to plug the parked car. We will refers to "Special parking areas" also with the term "Power Station".
* **Car:** In this document with the word "car" we refer exclusively to PowerEnjoy cars.
* **System:** It's the system that manage all the operation to make the car sharing working, getting informations from external system, and interacting with the user’s terminal, that is mobile application and computer boards.
* **Computer Board:** It is a screen present in each PowerEnjoy car. When the user is in the car, the computer board shows information like the position of the car on the map and the messages sent by the system. From the moment when the user get into the car to when he get out, he use the computer board to interact with the system.
* **Pin:** It is a sysmbol on the map to rapresent the position of something. Usually pins have different symbols dipending on what they rapresent on the map.
* **Save mode:** It is an option that, if activated, show the user some indication to save money during the car renting.
* **Energy Level:** it refers to the level of the battery of a car. It is shown on the car's dashboard.
* **Reservation:** it is a relation that creates between a user and a car that allows the user to start using the car from that moment to 1 hour later. The reservation guarantees that no one else can reserve and use the reserved car till when the reservation doesn't expire.

## 1.4 Reference Documents

* Specification document: Assignments AA 2016-2017
* IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications.

## 1.5 Overview

The document is organized in four sections:

1. Introduction:
2. Overall Description:
3. Specific Requirements:
4. Appendices:

# 2. Overall Description

## 2.1 Product Perspective

## 2.2 Goals

**User goals**

[G1] The user should be able to register to the system.

[G2] Already registered users should be allowed to login.

[G3] The user should be able to find available cars around him.

[G4] The user should see the battery level of a car before making a reservation.

[G5] The user should be able to reserve a car.

[G6] The user should be granted the access to the reserved car once he reaches it.

[G7] The user should be allowed to cancel a reservation.

[G8] The user should be able to access profile and payment method and make changes.

[G9] The user should be informed of the amount he has been charged of.

[G10] After the rental, the user should be able to inform the system that he is leaving the car.

[G11] The user should be able to see all the parking areas.

[G12] The user should be able to see all the special parking areas.

**Operator goals**

[G13] Operators should be allowed to login to the system.

[G14] Operators should be allowed to see the list of cars that need maintenance and their details.

[G15] Operators should be allowed to notify the take in charge of a car and the end of the maintenance.

## 2.3 Assumptions

* The user interacts with the system using his mobile phone.
* The user has internet access enabled on his phone.
* Each car has GPS sensors (always turned on) providing the right coordinates, sensors to check the number of people sitting, a dashboard showing the status of the battery level and a screen displaying the current charge to users.
* Special parking areas are a subset of safe parking areas and correspond to the ones with power plugs reserved to PowerEnjoy cars exclusively. PowerEnjoy cars can only be charged and plugged in special parking areas.
* Safe parking areas and special parking areas are already defined and identified by coordinates: the system is initialized at start-up time with such a set of areas.
* Only one user at a time can drive a specific car.
* Each car has a maximum number of five seats.
* A car is unavailable for reservations when it has less than 5% of battery level, has technical issues, or it is already in use or reserved by another user. Otherwise, it is available.
* A car that has less than 5% of battery or technical issues needs maintenance.
* Only registrations by users having a European driving licence are supported.
* The car can be driven anywhere in the Italian area.
* User payments are made using credit cards.
* Operators are already registered to the system.
* Discounts can be combined so that their total amount is subtracted to the final charge.
* In case the company receives a fine concerning a bad user behaviour caused by some violation, the user is due to pay it, so the system pays it in advance and then charges the amount to the user.
* The car is ignited using a power button functioning as a Start/Stop button.
* The system can always access to the real-time information of the car, such as its position, the number of people inside it, the battery level, the charging status and control unit information. Depending on this information, the system can manage the status of the car.
* The system can check the availability of power plugs of all special parking areas at any time through a third part system collecting and providing this information. The system can also set the status of a power plug if needed.
* Power plug status can be available or unavailable, identified by the color of a LED on it.
* A user can use a car if and only if he has reserved it in advance.
* A car can be reserved by only one user at a time.
* The system has access to European Union driving licence databases to verify and approve user registration.
* Only registered users can access to system functionalities

# 3. Specific Requirements

## 3.1 External Interfaces Requirements

**User Interfaces**

|  |  |
| --- | --- |
| **Fig. 1** User login | **Fig. 2** User menu |
| **Fig. 3** Map view | **Fig. 4** Car Details |
| **Fig. 5** Reservation countdown | **Fig. 6** Parking Areas view |
| **Fig. 7** Power grid stations view | **Fig. 8** Detail of power grid station |
| **Fig. 9** Final amount charged info |  |

**Operator Interfaces**

|  |  |
| --- | --- |
| **Fig. 10** List of cars with issues | **Fig. 11** Detail of chosen car |

**Software Interfaces**

Operators interact with the system through a mobile application providing a login page for their identification, the list of cars in need of maintenance and a function to take them in charge in order to fix the issue. Once the work done, they inform the system and the car becomes available again.

## 3.2 Functional Requirements

**User goals**

[G1] The user should be able to register to the system:

* The user must enter all his personal data, ID card data and driving licence information.
* The system should validate the data entered by asking the external system for driving licence verifications.
* If correct, the system should provide to the user a password to access the service.

[G2] Already registered users should be allowed to login:

* The user should be allowed to enter login information.
* The system should validate entered data and allow the access if all is correct.

[G3] The user should be able to find available cars around him:

* The system can check user coordinates accessing GPS on user's phone.
* The system should provide a map on which available cars are identified by a symbol showing the correct position.

[G4] The user should see the battery level of a car before making a reservation:

* The system should provide information about the car when the user picks one of the available, before reserving it.

[G5] The user should be able to reserve a car:

* The user should be able to select one of the cars to see its status and reserve it.
* The system should make the car unavailable to other users once the user confirms his choice.
* The system should retain the reservation for an hour and cancel it when the time limit is reached. In this case a 1 EUR fee should be charged.

[G6] The user should be granted the access to the reserved car once he reaches it:

* User should be able to notify the system that he has reached the car.
* The system should check user coordinates to compare them with car's ones and unlock it if the distance is less than 10m.

[G7] The user should be allowed to cancel a reservation:

* The system should offer an option to the user to cancel the reservation.
* Once the reservation is cancelled, the user should be able to access again to the map with available cars.

[G8] The user should be able to access profile and payment method and make changes:

* The system should provide a personal profile to the user with his information and give the possibility to apply changes.

[G9] The user should be informed of the amount he has been charged of:

* The system should calculate the total charge after subtracting all the accumulated discounts.
* The system should notify the user about the final amount of the reservation and how it was calculated.

[G10] After the rental, the user should be able to inform the system that he is leaving the car:

* The user should have a way to notify the system he has finished using the car.
* The system should verify the status of the car and check the parking.
* If all is correct the system should lock the car and make it available again.

[G11] The user should be able to see all the parking areas:

* The system should provide a map on which parking areas are identified.

[G12] The user should be able to see all the special parking areas:

* The system should provide a map on which special parking areas are identified by a symbol showing their correct position.

**Operator goals**

[G13] Operators should be allowed to login to the system:

* The operator should be allowed to enter login information.
* The system should validate entered data and allow the access if all is correct.

[G14] Operators should be allowed to see the list of cars that need maintenance and their details:

* The system should provide a list of cars that need maintenance and show all details.

[G15] Operators should be allowed to notify the take in charge of a car and the end of the maintenance:

* The system should provide a way to take in charge a car.
* The operator should be able to notify the system that the maintenance has finished.

## 3.3 Scenarios

**Scenario 1**

Alice gets out with friends but when she wants to come back home there are no buses, so she decides to take a PowerEnjoy car. She opens the application (she's already logged in) and on the map, she checks for the closest available car. She finds some and she decides to reserve one, that's 10 min from her by feet. When she arrives at the car, she presses the button to pickit up and after a few seconds the car opens. She starts driving. When she arrives home, she parks in the first available parking space and presses the button to notify she's leaving the car. Since that parking space is in a safe are, the reservation is correctly concluded. She closes the door and she waits till the car locks.

**Scenario 2**

Rob should go to a restaurant not easily reachable by public transport. Then he decides to take a PowerEnjoy car. He opens the app and he notifies that the closest available car is 10minutes from him by metro. He decides to take it anyway. Unfortunately, there are some traffic problems with the underground, then he decides to take a bus to get to the car. At that time, there is too much road congestion in his town, and the bus is late. The battery of his mobile phone is low and when he gets off the bus his phone turns off. Now Rob will not be able neither to pick up the car nor to cancel the reservation, then he will pay 1€ fee.

**Scenario 3**

Alex is at the restaurant with his girlfriend, and they're are eating the dessert. He knows they will be out of the restaurant in half an hour, then he decides to have a look at the PowerEnjoy application on his phone. He notices that there is an available car just in front of the restaurant, then he immediately reserves it before someone else do it. When they pay the amount, Alex's girlfriend proposes him to have a walk around there. Then Alex opens again the app and decide to cancel the reservation.

**Scenario 4**

Omer is getting out of work when he noticed that is raining cats and dogs. Then he decided he would prefer to take a PowerEnjoy car to get back home, if there is one nearby. He founds one and he reserve it. In a few minutes, he is near the car, he opens it and he drives home. Unfortunately, he forgot that the credit card he connected to PowerEnjoy is almost empty and when he let the car close, the system notifies him that the payments fails. The application shows him the total amount that he has to pay, the last four number of his credit card and the deadline for the payment. From now till when he pays the amount, he won't no longer able to reserve a car. The day after he put some money into the card connected to PowerEnjoy, he goes into the specific area for missing payment of the application and ask to retry. This time the payment is successful and the system notice him that he is again allowed to reserve a car.

**Scenario 5**

Klarissa is a student and she like to save money. By night, even if busses are cheaper, she prefers to move by car because she thinks it will be safer. Like every weekend, she's out with her friends, and now it's time to get back home. Her friends don't live far from her, and since they are only in 4, she offers them to bring them all home too, this way she knows she will have the 10% off. She finds a car close to them and she reserve it. The car has the 40% of energy, then she will not receive this kind of discount but anyway it's enough to bring everyone home. When she gets into the car, she activates the save mode, and then she enters his address. The system shows the possible special parking areas close to her destination and she chose one that is just 300mt from home. The computer board inform her that it has reserved the charging columns 4 at the selected special parking area. She drives her friends their own home and then she goes to the selected special parking area and she plug the car in the right energy tower. When she closes the car, she gets notified on her phone that she achieved a total discount of 40%, then she only spent 2€! Not bad!

Constrains

**Regulatory policies**

**Hardware limitations**

**Interfaces to other applications**

**Parallel operation**

Proposed system

Identifying stakeholders

Reference documents

Specification Document: Assignments 1 and 2 (RASD and DD).pdf

IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications.

Examples documents:

MeteoCal\_RASD\_example2.pdf

RASD Example SWIMv2.pdf **–** RASD\_meteocal-example1.pdf

Actors identifying

Requirements

Functional requirements

**Taxi drivers:**

**Clients:**

Non-functional requirements

**Client interface mobile**

**desktop**

**Taxi driver interface**

**Documentation**

**Architectural consideration**

Scenario identifying

Scenario 1

Scenario 2

Scenario 3

Scenario 4

Scenario 5

Scenario 6

Scenario 7

Uml models

Use case diagram

Figure 3: use case diagram

Use case description

**Taxi driver logs in**

**Name :** Taxi driver logs in

**Actors :** Taxi driver

**Entry conditions :** There are no entry conditions.

**Flow of events :**

The taxi driver arrives at the homeActivity of the mobile application.

The taxi driver inputs his taxi driver code (his ID) and his password.

The taxi driver clicks on the log in button.

The system redirects the taxi driver to his personal activity.

**Exit conditions :** The driver is successfully redirected to his personal page. **Exceptions :** The code and password furnished by the taxi driver are not correct. In this case, the system does not redirect the taxi driver to his personal activity but notifies him that an error has been made and allows to input his code and password again.

**Client requires a taxi for a later reservation**

Class diagram

Sequence diagrams

Activity diagrams

State diagrams

Alloy modeling

Model

Alloy result

World generated

Future development

Used tools

The tools we used to create this RASD document are:

DIA: for uml models

Github: for version controller

Pencil: for mockup

Gedit and ReText: to write MarkDown with spell check

Pandoc: to create pdf

Alloy Analizer 4.2: to prove the consistency of our model.

Hours of work

Sergio Caprara

Soheil Ghanbari

Erica Tinti

Changelog