

# Power EnJoy

Emanuele Ghelfi  
Emiliano Gagliardi

November 1, 2016

# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
1.1	Description of the given problem . . . . .	3
1.2	Glossary and abbreviations . . . . .	3
1.3	Actors . . . . .	3
1.4	Assumptions . . . . .	3
1.5	Domain assumptions . . . . .	4
1.6	Goals . . . . .	4
1.7	Document overview . . . . .	5
<b>2</b>	<b>Overall description</b>	<b>6</b>
2.1	Product perspective . . . . .	6
2.1.1	Payment methods . . . . .	6
2.1.2	Car technology . . . . .	6
2.1.3	Operators, maintenance, malfunctions and damages. . .	6
<b>3</b>	<b>Requirements</b>	<b>7</b>
3.1	Functional Requirements . . . . .	10
3.2	Non-functional Requirements . . . . .	10
3.2.1	User Interface . . . . .	10
3.2.2	Security . . . . .	11
3.2.3	Documentation . . . . .	11
<b>4</b>	<b>Scenario Identifying</b>	<b>12</b>
4.1	Scenario 1 . . . . .	12
4.2	Scenario 2 . . . . .	12
4.3	Scenario 3 . . . . .	12
4.4	Scenario 4 - OPERATOR maintenance . . . . .	12
4.5	Scenario 5 - OPERATOR notification . . . . .	13
4.6	Scenario 6 - USER communicates a malfunction to the system . . .	13
<b>5</b>	<b>UML Models</b>	<b>14</b>
5.1	Use Case Diagram . . . . .	14
5.2	Sequence Diagram . . . . .	14
5.2.1	Login . . . . .	15
5.2.2	Car Reservation . . . . .	16
5.2.3	Search Cars . . . . .	17
5.2.4	Unlock Car . . . . .	18
5.2.5	Communicate Damages And Malfunctions . . . . .	18

# 1 Introduction

## 1.1 Description of the given problem

The purpose of this document is to support the development of a software that manages a car sharing services. The software that will be developed has the aim to make the reservation of cars simple and quick. So the system should provide users with real time information about availability of cars, and their positions. Cars will be parked in some pre-defined parking area, where user can directly get them after the reservation. The service will be provided to user that have made the registration, giving some personal information and data needed to the payment. The price of the ride is computed with a fixed amount of minutes, displayed by the car, and finally charged. To avoid useless reservation, where a user doesn't pick up the car, the system should be able to detect that after a fixed time, re-tag the car available, and charge with a fee the user. Cars must be locked in the safe areas, and unlockable only by users that has made a reservation on them.

## 1.2 Glossary and abbreviations

- VIRTUOUS BEHAVIOUR:
  - Behaviour that makes simple the maintenance of the cars and reservation areas.
  - Behaviour helps to reduce the traffic impact.
  - To park in defined safe areas.

## 1.3 Actors

These are the people that will be involved in the use cases of the software to be developed:

- GUEST: a person that hasn't made the registration to the service.
- USER: a person that has already registered to the system.
- OPERATOR: an employee of the company that takes maintenance of cars and charging area.

## 1.4 Assumptions

There are few points that aren't well specified in the assignment document. This section's purpose is to formalize some facts that complete the specification.

- Also GUESTs are able to search cars, in order to induce them to create an account.

- There are no information about cars' maintenance, so in the document is made the assumption that cars need OPERATOR presence to keep an acceptable status.
- USERS can't delete reservations.
- The system relies on external payment methods. The accepted methods are Mastercard, Visa, PayPal, PostePay.
- If a payment fails for a insufficient money availability of the user, the USER is suspended from the service until the payment is done.
- In order to induce USER to park in safe areas, USER that does not park in safe areas will pay a fee.




## 1.5 Domain assumptions

- [D1] Cars positions provided by GPS are accurate,
- [D2] The USER and GUEST position provided by GPS are accurate.
- [D3] Cars provide remote communication API
- [D4] Cars provide screen to display current charge to user.
- [D5] Cars can detect how many passengers are on it.
- [D6] Cars can detect if they are plugged.
- [D7] Cars can detect their battery level.
- [D8] Cars can detect information about maintenance needs.
- [D9] If a USER detect a malfunction communicate it.
- [D10] If an OPERATOR is notified by the system about a maintenance need, he take care of that.
- /\*se un utente apre sale, va dove vuole andare e non si schianta\*/
- /\*non danno in giro la password\*/

## 1.6 Goals

The objectives of the software to be developed are the following:

- [G1] USERS must be able to reserve a car and use it.
  - [G1.1] USER should be able to reserve a car.
  - [G1.2] USER should be able to unlock reserved car when they are close to it.

- [G1.3] USER should be aware of how much they are going to pay during the ride.
- [G2] The reservation of two (or more) cars at a time must be forbidden.
- [G3] USER and GUEST must be able to search cars.
  - [G3.1] USER should be able to search **car** near  its position.
  - [G3.2] USER should be able to search **car** near a selected position.
- [G4] Induce USER to keep a VIRTUOUS BEHAVIOUR.
  - [G4.1] A discount of 10% should be applied to rides with at least two passengers.
  - [G4.2] If a car is left with no more than 50% battery empty, a discount of 20% should be applied to the last ride.
  - [G4.3] If a car is left at more than 3 km from the nearest charging area, the system should charges 30% more on the last ride.
  - [G4.4] If a car is left with more than 80% battery empty, the system should charges 30% more on the last ride.
  - [G4.5] If a car is left in a charging area and the user plugs the car into the power grid, a discount of 30% should be applied to the last ride.
  - [G4.6] If a car is **not** picked up within one hour from the reservation, the USER should  e of 1 EUR.
  - [G4.7] If a payment fails for a insufficient money **availability**  of the USER, the USER should be suspended from the service until the payment is done.
  - [G4.8] If a USER parks in an area that is not a safe area, the USER should pay a fee.
- [G5] USER have to pay an amount of money based on the ride's duration.
- [G6] Guarantee a ready maintenance of cars.
  - [G6.1] OPERATOR must be able to do car mantainance, knowing their position and status.
  - [G6.2] USER must be able to communicate to the system cars damages and malfunctions.

## 1.7 Document overview

/\*here we will describe the document contents organization\*/

## 2 Overall description

### 2.1 Product perspective

In this section the system boundaries are described, like the interfaces provided by external systems that the software to be developed will use in order to provide the required functionalities.



#### 2.1.1 Payment methods

In order to manage in a good way the payment process, and to ensure a well managing of exceptional situations like users unavailability of money USERS, the software to be developed relies on external transactional system. So the system doesn't care about how the payments are done, but only that the USER has provided one of the payment methods defined in the assumption section.



#### 2.1.2 Car technology

The software to be developed will use the technologies provided by a system already present on cars, in order to carry out the needed actions. The used API provides a secure connection between cars and the central system via internet, and the following commands that the central system can impose on car:

- Lock: locks the car doors.
- Unlock: unlocks the car doors.
- Get position: the car sends to the central system its position.
- Get status: the car sends to the central system detailed information about his current status.

#### 2.1.3 Operators, maintenance, malfunctions and damages.




The cars availability depends heavily on the presence of a staff that does cars maintenance. So the software to be developed relies on the presence of the staff in order to guarantee availability of cars, and provide to operators informations that helps the cars maintenance. Operators will manage damages to cars and consequence for the responsible, so the system will only help the OPERATORS in maintenance, and guarantee a way to communicate malfunction and damages.



### 3 Requirements

In order to satisfy goals in section [Section Goals] under domain assumptions in Section [Section domain Assumption] we've derived requirements for our system.

- [G1.1] USER should be able to reserve a car:
  - [R1] The system can modify car's status (available, occupied, in use).
  - [R2] The system shall be able to know car's status.
  - [R2] The system shall reserve a car only if the car is available.
  - [R3] The system shall be able to associate a car to the USER who has reserved it.
- [G1.2] USER should be able to unlock **reseved** car when they are close to it.
  - [R4] The system shall know cars' location according to cars' GPS.
  - [R5] The system shall know user's location according to his GPS.
  - [R6] The system shall provide a functionality to unlock the car.
  - [D1]
  - [D2]
  - [D3]
- [G1.3] USER should be aware of how much they are going to pay during the ride.
  - [R7] The system shall be able to calculate ride's cost based on duration.
  - [R8] The system shall be able to communicate to the car ride's cost.
  - [D4]
- [G2] The reservation of two (or more) cars at a time must be forbidden.
  - [R7] The system shall reserve a car only if the user hasn't already reserved another car.
  - [R3]
- [G3.1] USER or GUEST should be able to search car near his position.
  - [R4]
  - [R5]
  - [R9] The system shall provide the closest cars to user's position.
- [G3.2] USER or GUEST should be able to search car near a selected position.



- [R4]
  - [R5]
  - [R10] The system shall provide the closest cars to position provided by the USER.
- [G4.1] A discount of 10% should be applied to rides with at least two passengers.
  - [R11] The system shall be able to detect if  there are at least two passengers in the car.
  - [D5]
  - [R12] The system shall be able to apply a discount on the ride.
- [G4.2] If a car is left with no more than 50% battery empty, a discount of 20% should be applied to the last ride.
  - [R13] The system shall be able to know the battery level of the car.
  - [R12]
  - [D7]
- [G4.3] If a car is left at  than 3 km from the nearest charging area, the system should charge % more on the last ride.
  - [R4]
  - [R13]
  - [R14] The system shall be able to apply a charge on the ride.
  - [R15] The system shall be able to calculate distance between car's position and the nearest charging area.
- [G4.4] If a car is left with more than 80% battery empty, the system should charges 30% more on the last ride.
  - [R13]
  - [R14]
- [G4.5] If a car is left in a charging area and the user plugs the car into the power grid, a discount of 30% should be applied to the last ride.
  - [R15] The system shall be able to detect if the user has plugged the car into the power grid.
  - [R12]
  - [R4]
  - [D6]
- [G4.6] If a car is not picked up within one hour from the reservation, the user pays a fee of 1 EUR.



- [R16] The system shall be able to monitor car’s reservations.
  - [R17] The system shall be able to know if a user has picked up a car.
  - [R2]
- [G4.7] If a payment fails for a insufficient money availability of the USER, the USER should be suspended from the service until the payment is done.
  - [R18] The system shall take care of the result of the payment.
  - [R19] The system shall suspend USER that can’t afford the payment.
  - [R20] The system shall unsuspend a USER when his old undone payment is done.
- [G5] USER have to pay an amount of money based on the ride’s duration.
  - [R7]
  - [R21] The system shall charge an extenernal payment service with doing the payment.
  - [R9]
  - [D4]
- [G6] Guarantee a ready maintenance of cars.
  - [G6.1]
  - [G6.2]
  - [D9]
  - [D10]
- [G6.1] OPERATOR must be able to do car mantainance, knowing their position and status.
  - [R22] The system shall offer a backend panel to Operator
  - [R23] The system shall notify the operator when a car in his competence area needs some kind of maintenance.
  - [D7]
  - [D8]
  - [R1]
  - [R2]
- [G6.2] USER must be able to communicate to the system cars damages and malfunctions.
  - [R24] The system shall offer a functionality that let USERS to communicate malfunctions and damages.

### 3.1 Functional Requirements

After having defined main features of our system we can identify some functional requirements grouped under each defined actor:

- GUEST, he can:
  - Sign up.
  - Search for a car near his location.
  - Search for a car near a selected location.
- USER, he can:
  - Log in.
  - Reserve car.
  - Use a reserved car (unlocking it).
  - View his profile (also his discounts). 
  - Modify his profile.
  - View his recent reservations.
  - Search car near to his location.
  - Search car near a selected location.
  - Communicate malfunction or damages to the system.
- OPERATOR, he can:
  - View car's status (Id  ry and location).
  - Receive notification when a car need to be charged.
  - Set a car as available or under maintainance.

### 3.2 Non-functional Requirements

#### 3.2.1 User Interface

In order to make PowerEnJoy available for many people as possible a Cross-Platform application has to be developed, with a Framework like Xamarin this way could be developed a single application and then could be deployed on Windows Phone, Android and iOS. A Web Application has also to be developed in order to allow people to use our system in many way as possible. The User Interface needs to be as user friendly as possible, a user that uses for the first time Power EnJoy should be able to learn in a few seconds how to make use of it.

Here are presented a few screen of the app to provide an example.

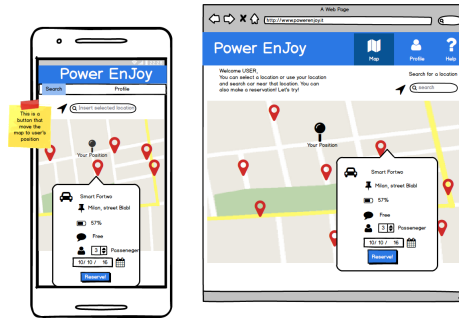


Figure 1: Map UI

### 3.2.2 Security

The system has to satisfy an high level of security regarding the communication protocol with the cars.

The communication with the cars needs to be encrypted in order to avoid unauthorized unlocks and use. Furthermore the system should have the way to stop cars when used in an unauthorized way.

Regarding the security of payment, the system doesn't care about it because it relies on external payment system.

Another critical security point is the managing of user's information: all user informations need to be encrypted before being sent.

### 3.2.3 Documentation

These documents will be released in order to well-organize the work in the way to obtain the best quality-cost ratio as possible:

- **RASD**: Requirements Analysis and Specification Document, to well-understand the given problem and to analyze system's boundaries and goal. RASD is also important to understand system's requirements and specifications in order to reach the goals.
- **DD**: Design Document, to define the structure of the system, its tiers, and the interaction between them.
- **ITPD**: Integration Test Plan Document, to describe the planning to accomplish the integration test. This document is supposed to be written before the integration test really happens. Moreover this document needs to explain to the developer team what to test, in which sequence, which tools are needed for testing and which need to be developed.
- **PP**: Project Plan, aims at defining a planning for the project. It regards in particular the estimation of effort and cost, the scheduling for project's task and the allocation of resources to tasks.



## 4 Scenario Identifying

### 4.1 Scenario 1

Paul, a businessman, has to go to Milan by train in order to participate to an important meeting.

As the office where they have to meet is 5 km far (away?) from the railway station and taxis are too much expensive, he decides to use *PowerEnJoy* from his smartphone. He notices, thanks to the map on the app, that there is a parking area next to the railway station with a lot of available cars. He then reserves one of these electric cars so that, as soon as he arrives there, he'll be able to reach the office very quickly and in a green way.

### 4.2 Scenario 2

Paul is a student that goes to Politecnico University in Milan. He lives in a city near Milan but unfortunately train's schedule is very prohibitive: he should wake up at 5 o'clock in the morning in order to arrive on time at the lecture that starts at 8:00.

He found out about *PowerEnJoy* from two of his friends in his city that attend to the same University. They decide to use together car-sharing service so they can have save much money using the two passengers discount.

Since their city is full of electric-car they every day make a reservation of a car and go to the University together.

In this way they save money and also are much more comfortable in reaching the University.

### 4.3 Scenario 3

Paul has just learnt about *PowerEnJoy*.

This evening he has to go to dinner with his girlfriend, Sarah, so he decides to try it. Then he downloads the app and looks for cars near his location. He finds many cars, he's about to reserve one of them but reservation is not permitted to guests.

For this reason he has to sign up: following the application instructions he provides his personal informations, his driving license and he specifies his payment method.

After that he's able to reserve the car for special occasion.

### 4.4 Scenario 4 - OPERATOR maintenance

Jonathan is doing his periodical check of the car in his competence area. He finds out that a dishonest user has left a car with a broken light, without communicate that. So Jonathan, by his maintenance service system, makes the car unavailable and starts to solve the maintenance problem.

#### 4.5 Scenario 5 - OPERATOR notification

Amy is driving an electrical car reserved with *PowerEnJoy*. Always she is very late today, and she notices that, if she wants to arrive in time, she won't manage to bring the car at the station where it can be charged. So she decides to park the car as close as possible to her destination. After she has parked, the OPERATOR Jonathan, receives a notification on his maintenance service view, that tells where the car just left by Amy is that it is almost completely discharged. Now Jonathan can go to the car and make it again available for the next customer.

#### 4.6 Scenario 6 - USER communicates a malfunction to the system

Amy is driving an electrical car reserved with *PowerEnJoy*. Arrived at her destination, she starts parking maneuver, but she hurts a pole, doing a damage to the machine. Amy is an honest person, and following the application instruction she communicates to the system that she has damaged the car. The system will communicate to an OPERATOR about the damage.

## 5 UML Models

### 5.1 Use Case Diagram

With the Use Case Diagram are highlighted the main **function** of our system and the interaction between ACTORS and the related Use Case.

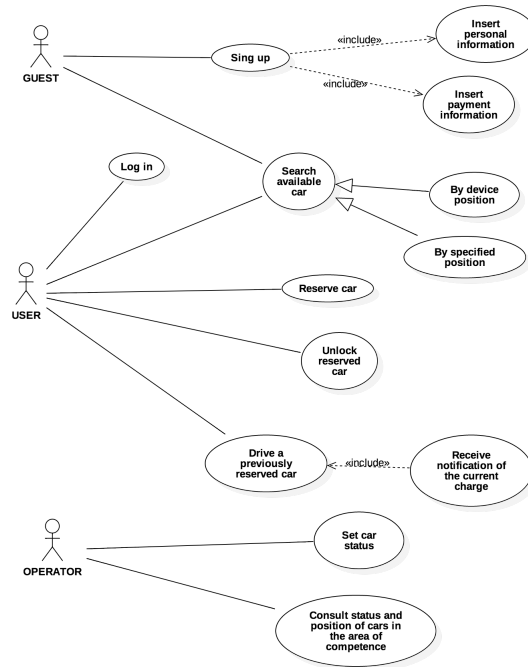


Figure 2: Use Case Diagram

### 5.2 Sequence Diagram

With Sequence Diagram are highlighted the main function of the system and the High-Level sequence of actions that focuses on the way in which happens the interaction between ACTORS and system.

### 5.2.1 Login

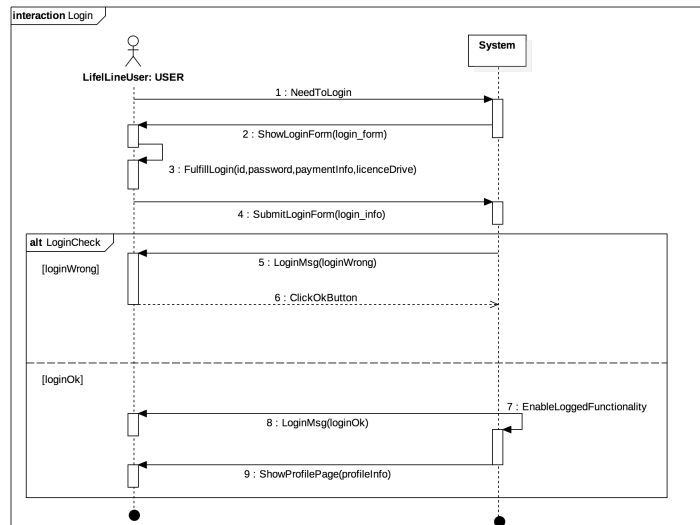


Figure 3: Login

## 5.2.2 Car Reservation

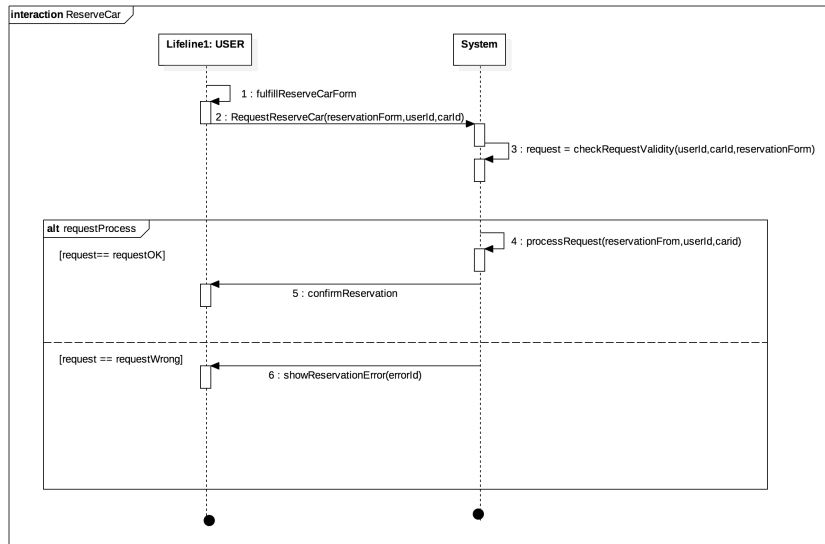


Figure 4: Car Reservation



### 5.2.3 Search Cars

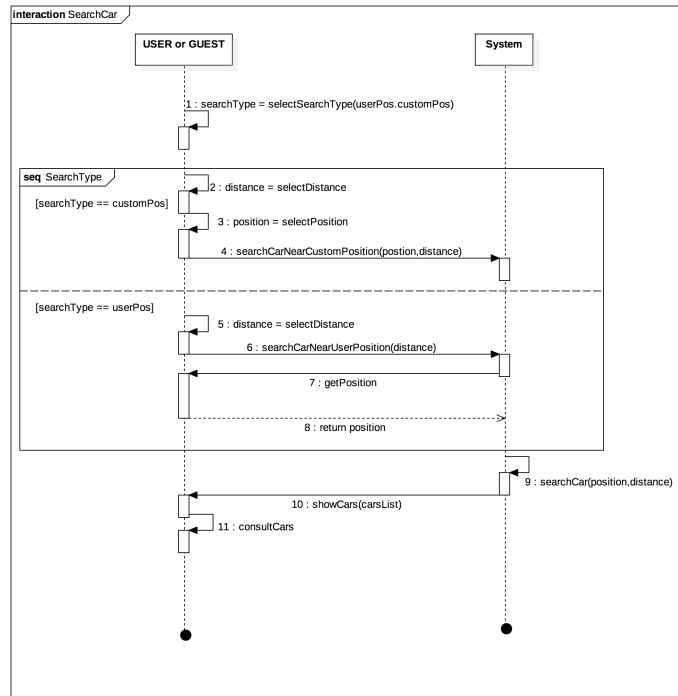


Figure 5: Search for a car

### 5.2.4 Unlock Car

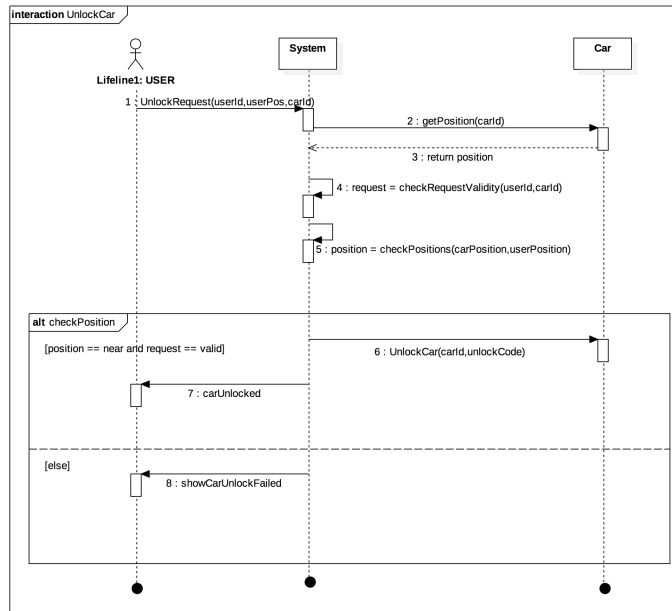


Figure 6: Unlock Car

### 5.2.5 Communicate Damages And Malfucntions