

POLITECNICO DI MILANO

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Software Engineering 2: PowerEnJoy

Requirements Analysis and Specifications Document

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1. INTRODUCTION

***1.1 DESCRIPTION OF THE PROBLEM***

The PowerEnJoy project aims to develop a car-sharing service run exclusively employing electric cars.

The system will provide a platform available both as a desktop and mobile application by means of which

the users, once registered, will be able to use the car sharing services.

The registration requires the user to provide a valid e-mail address, telephone number and a valid driving license (of type B or higher), as well as some personal information and valid credit card data.

After the verification of the provided data, an e-mail will be sent to the user containing a password that will be used to access the platform.

Any registered user will be able to see on a map of the city the available cars within a certain radius either from their current position or from a selected address. By clicking on an available car on the map the user will be able to reserve it. The reserved car can be then unlocked via the appropriate function on the mobile app.

A pre-defined set of safe areas will be available for parking the cars. A number of these areas will also have power grid stations, providing a mean to recharge the cars.

The main goals of the service are to provide a sustainable and environmentally-friendly car sharing service as well as to promote virtuous behaviors from its users: a number of discounts will be applied to users who carry more than two passengers, leave the car with more than half of if its battery full or park it near to a power grid and take care of plugging it in. On the other hand, users who leave the car more than three kilometers away from the nearest power grid or leave it with less than 20% of its battery will be charged for an additional amount.

***1.2 GOALS***

[G1.0]: Any person is able to register to the service by providing his/her credentials and valid payment info.

[G1.1]: He/she receives back a password with which he/she is able to access the system.

***NOTE***: G1.0 and G1.1 are interpreted as: providing one's credentials and some valid payment condition is sufficient and necessary to register to the system

*ADDITIONAL GOALS EMERGED THROUGH SCENARIO ANALYSIS*

[GA1.0]: Any person registered to the system is able to log in the application.

[GA1.1]: Only a person registered to the system is able to log in the application

[GA2]: Any person registered to the system is able to retrieve his/her password

[GA3]: Any person is able to access the PowerEnJoy website

[G2.0]: The user is able to find the location of all available cars within a certain range from their current location.

[G2.1]: The user is able to find the location of all available cars within a certain range from a specified address.

[G3.0]: The user is able to pick a car among the available ones and reserve it.

***NOTE***: G3.0 is interpreted as: if there are available cars the user can pick any one among them and reserve it, so it does not guarantee anything regarding the presence of available cars. Moreover, the availability of the selected car needs to persist until the moment the user confirms the reservation of a car or interrupts the procedure for it to be considered an available car in this instance.

[G3.1]: A reserved car is not available for renting until one hour has passed from the moment a user reserved it.

~~[G3.2]: After one hour from its reservation, a car becomes available again~~ (NO LONGER IN USE)

***RATIONALE***: G3.2 is formulated in a way which does not completely reflect the desired outcome, since a car is not meant to be available for renting even if an hour has passed from the moment it was reserved if it is currently in use, it has been left with less than 20% battery or it is more than 3km away from the nearest power grid, and therefore it has been substituted with the following goal.

[G3.2] A car becomes available again after one hour has passed from its reservation and it is parked in a safe area less than 3 km away from a power grid having more than 20% of its battery.

[G4]: The user pays 1 EUR if he/she doesn't reach the car he/she rent within 1 hour from the reservation.

***NOTE***: "reach" in this case means that the user has ignited the car the car. This is to prevents the user from avoiding the fee by just opening the car, discouraging negative behavior.

[G5]: The user is able to unlock and open the car he/she rent when he/she is nearby the car.

***NOTE***: a user is a logged in person, therefore he/she is identified by the system through an account and a GPS position. Whether the physical person who opens the car is the same who reserved it is not our concern.

[G6]: From the moment of ignition, the user is charged for a constant amount of money per minute

[G7.0]: The charging of the user stops as soon as the driver parks the car in a safe area and exits from it.

***NOTE***: G7.0 is interpreted as: if the car is parked in a safe area and the driver and all the passengers exit from it, the user stops being charged (as a simple implication)

[G7.1]: The car is automatically locked as soon as the driver parks the car in a safe area and exits from it.

[G8]: A discount of 10% is applied on the last ride if the driver took at least two passengers onto the car and no higher discount or any extra fee can be applied.

[G9]: If a car is left with more than 50% of its maximum battery available, a discount of 20% is applied on the last ride and no higher discount or any extra fee can be applied.

[G10]: A discount of 30% is applied on the last ride if a car is left at special parking areas where they can be recharged and the driver takes care of plugging the car into the power grid and no higher discount or any extra fee can be applied.

[G11.0]: If a car is left at more than 3 kilometers from the nearest power grid station, the user is charged for an extra corresponding to 30% of the amount charged for the last ride.

[G11.1]: If a car is left with less than 20% of its maximum battery available, the user is charged for an extra corresponding to 30% of the amount charged for the last ride.

***1.3 DOMAIN PROPERTIES***

[D1.0]: The credentials provided by the person at the moment of his/her registration are always correct, and always belong to the person carrying out the procedure.

[D1.1]: The credentials provided by the user while editing his/her profile are always correct.

[D1.2]: The validity check for the payment info delegated to the external payment service is always correct.

[D1.3]: The external payment service always charges the user for the exact amount of charging requested by the system.

~~[D2]: The user has always enough money to pay for the ride~~ (DEPRECATED)

[D2]: The user is always able to receive the e-mail after a finite number of tries

[D3.0]: The GPS coordinates of the cars received by the system always correspond to the actual positions of the cars.

[D3.1]: The GPS coordinates of a user received by the system always correspond to the actual position of the user.

~~[D4]: If a person enters a car in the driver seat, also ignites it~~ (DEPRECATED)

[D5]: Every road traffic offence received by the company is forwarded to the user who last rent the car before the offence occurred.

[D6]: An employee is always able to retrieve a dislocated car within 24 hours

[D7.0]: If the sensors in the car detect other passengers, human passengers are on board

[D7.1]: If the sensors in the car detect no one inside, there are no people in the car

[D8]: Power grid stations are always operational

[D9]: A car must be parked or dislocated to be plugged in a power grid station.

//possible domain assumption

[D10]: The company is notified of car incidents

***1.4. GLOSSARY***

*non registered person:* as far as our system is concerned, we consider only those people who possess a smartphone with GPS functionalities.

*user*: person who uses the application and the services provided by PowerEnJoy.

*driver*: person who enters a car in the driver seat.

*system*: the server side software providing the core functionalities of the application.

*application or app*: the client side of the software present on the user’s phone.

*registration*: iter through which the user can create a personal account in order to access the services of the application.

*credentials*: set of information provided by the user during the registration. These include: the user’s first name, family name, gender, “Comune” of birth, “Provincia” of birth, his/her “Codice Fiscale”, his/her identity card number, date of release and date of expiration, a valid driving license (B or higher or equivalent) a valid e-mail address and a mobile phone number.

*payment info:* a valid credit card number, verification value (CVV), expiration date and the holder’s full name.

*external payment service:* a software system which allows the company to charge the users.

*car:* electric powered vehicles owned by PowerEnJoy.

*range:* distance value selected by the user.

*available car:* a car that can be reserved by a user for a future ride.

*reserved car:* a car that cannot be reserved and can only be used by the one who performed its reservation.

*‘in use’ car:* a car is in this state from the moment it is turned on by the user who reserved it until the moment such user exits from it while the car is in a safe area, which causes it to automatically close.

*parked car:* a car that is left in a safe area by the driver.

*dislocated car:* a car that is left in a non-safe area by the driver.

*retrieve a car:* action performed by an employee that can be described as follows:

-the employee is notified that a car has been left outside of a safe area

-the employee reaches the car, possibly manually recharges it and drives it back to a safe area.

*safe area:* legal parking spots according to the driving regulations within a limited area defined by the system administrator.

*‘nearby’ the car:* a user is ‘nearby’ the car when he/she is distant from the car less than 10 meters.

*special parking area:* part of safe area in which user can recharge the electrical car.

*power grid station:* little tower that provides electrical current situated in a special parking area that allows the user to recharge a car.

***1.5. ASSUMPTIONS OF THIS DOCUMENT***

[T1]: We have in mind that our target customer has a smartphone which supports GPS related services

[T2]: We assume that the actual transaction with the payment service provider is performed only once, at a later time

after the end of the ride

[T3.0]: We assume only the highest-percentage discount to be applied on a ride.

[T3.1]: Any extra charge prevents any discount from being applied on a ride.

[T3.2]: All the extra charges are applied cumulatively, but not multiplicatively.

***1.6. CONSTRAINTS***

***1.7. PROPOSED SYSTEM (SYSTEM-TO-BE)***

***1.8. STAKEHOLDERS IDENTIFICATION***

***1.9. REFERENCE DOCUMENTS***

**2. ACTORS IDENTIFICATION**

The actors interacting with our system are the following:

*User:* a person who is logged into our system and can use all the services provided

by the application and the car sharing service.

*PowerEnJoy employee:* a person who works for the company and, among other things, is responsible

for the retrieval of cars parked outside of the safe areas.

*Non registered person:* a person who is browsing PowerEnJoy's website looking for information on the service

or a person who is using the app but is not yet registered.

**3. REQUIREMENTS**

***3.1. FUNCTIONAL REQUIREMENTS***

*Non registered person*

***3.2. NON-FUNCTIONAL REQUIREMENTS***

***3.2.1. USER INTERFACES***

***3.2.2. DOCUMENTATION***

***3.2.3. ARCHITECTURAL CONSIDERATIONS***

**4. SCENARIO IDENTIFICATION**

*TRIP TO THE SUPERMARKET*

Yesterday Betty brought her car to the mechanic to change the front tires. Today she needs to go to the supermarket, which is approximately 5km away. Since she notices that today there is a strike of public transport she chooses to use the new electric car-sharing system provided by PowerEnJoy. So she takes her smartphone and opens the PowerEnJoy application. From the menu, she chooses "Find a car", checking the option "From my position",

and sets the maximum distance within which she would like to find a car to 500 meters. There are 2 cars within 500 meters and Betty reserves the nearest one.

After a while, she arrives at the car and she is able to unlock it through the proper button "Unlock the car". After getting in the car, she ignites it pushing the "Start" button next to the steering wheel.

Betty arrives at the supermarket 10 minutes later. She parks the car in the supermarket parking lot and 30 seconds after she exits the car, the system locks automatically the car tagging it as "available" again.

*TRANSFER STUDENT*

Giulia has come from her hometown Pescara to Milano to attend university, and since her family could not afford to buy another car just for her, she thought that her effort towards obtaining a driving license would have gone to waste. Her new friends tell her that she should consider registering to a car sharing service, and so after a bit of search on the web she reads about PowerEnJoy. The curiosity towards electric powered cars and the potential benefits that the service could provide to her daily life lead her to decide to register to the service, so she downloads the app to her smartphone and installs it.

After starting the app a sign in/sign up screen appears, so she selects the sign up option and starts filling in the required information.

After double-checking that her identity card's number and her Codice Fiscale are typed correctly, as well as the data of her driving license, she proceeds to the next step of the registration process.

At this point the system asks Giulia to provide a valid credit card to associate to her account. Luckily her parents just recently gave her a visa credit card for her living expenses, so she promptly inserts the credit card number and CVV. The system replies confirming that the payment information she provided are indeed valid, and so her registration is almost complete: upon agreeing to the terms of services confirmation e-mail is sent to her, she opens her mail box and she writes down the password that the system has sent her, and then tries to log in the application.

The e-mail and password provided are correct and so Giulia can start using PowerEnJoy.

*CINEMA WITH FRIENDS*

Stefano Chiara and Marco have decided to go see a movie tonight, and since is Marco's turn to drive today, he has decided to reserve a PowerEnJoy for himself and his friends.

To do so, Marco selects the "Find a car" option on the app and checks the option "From address", which allows him to reserve a car near his and his friends' usual meeting point. Even though Stefano was a bit late, they all manage to arrive where the car is in time. As soon as his friends are all present, Marco uses the "Unlock the car" option on the app on his smartphone and they all get in the car before the reservation expires. At this point Marco ignites the car through the button near the steering wheel and he heads towards his destination. It is quite a long trip to the movie theatre, and unfortunately the battery of the car was already at 60% so by the time they reach their destination the battery of the car is at 35%. At this point Marco parks the car in a proper parking spot at the movie theatre and everyone exits the car. Marco checks on his smartphone to see how much the ride has cost him, and finds out that the presence of his friends has netted him a 10% discount.

*JOB INTERVIEW*

Giovanni has a job interview today, and since he has just recently registered to PowerEnJoy he decides to reserve a car near his house, to drive to the place where the interview will be held. He opens the PowerEnJoy app and looks for a car from his current position up to 1 km away and finds one nearby, so he gets there and unlocks the car using the option provided by the application. After igniting the car he starts driving and realizes the mistake he has made: there are a lot of people on the road today and it is getting late. He finally reaches his destination, but an even worse problem presents itself, that is to say there are no parking spots to leave the car. Knowing full well that he is in the wrong, he decides to park the car illegally, hoping to get away with it. After he exits the car a notification informs him that an extra fee has been applied to his ride, since he decided to park in a non-safe area.

*ABANDONED CAR*

Giorgio's shift starts as he meets up with his colleague Mario, and he receives a notification telling him that a car has been left in a non-safe area. Seeing how there are no other urgent matters that require their attention, Giorgio and Mario decide to head there immediately. Giorgio uses the app provided by the company to signal that he intends to head there to avoid the deployment of more cars than needed. After entering the company's car, they insert the code representing the car to retrieve in order to obtain the necessary information about the car's location through their car's navigator. They bring an extra battery with them to recharge the car and drive to the location. As soon as they arrive there they recharge the car and Giorgio unlocks it with the app and drives it back to a safe area where Mario picks him up once again.

*TRIP TO THE COMPANY*

Clare needs to be at her company's conference room within two hours in order to attend the monthly company meeting. Today the mayor of Milan has announced a car ban in order to reduce the amount of pollution in the air. Given that the nearest bus stop is ten minutes away on foot from her house, she decides to rent a PowerEnJoy electric car to get to the company, since during the car ban electric cars can circulate, in virtue of being considered non-polluting machines.

Opening the PowerEnJoy app, through the proper "Find a car" functionality, she finds a couple of cars just next to her home, one or two minutes away on foot.

After reserving the nearest one she waits about twenty minutes before reaching the car to drive towards her company.

Unfortunately, ten minutes after her reservation, Daniel - her boss - texts her that the meeting has been postponed by a week. Therefore, Clare has booked a car that she will never use. As stated the PowerEnJoy's terms of service, if a user's reservation expires and he/she doesn't pick up the car within one hour from the reservation, he/she will pay a fee of 1 EUR. As expected, one hour after the reservation of the car, the system deducts 1 EUR from Clare's credit card.

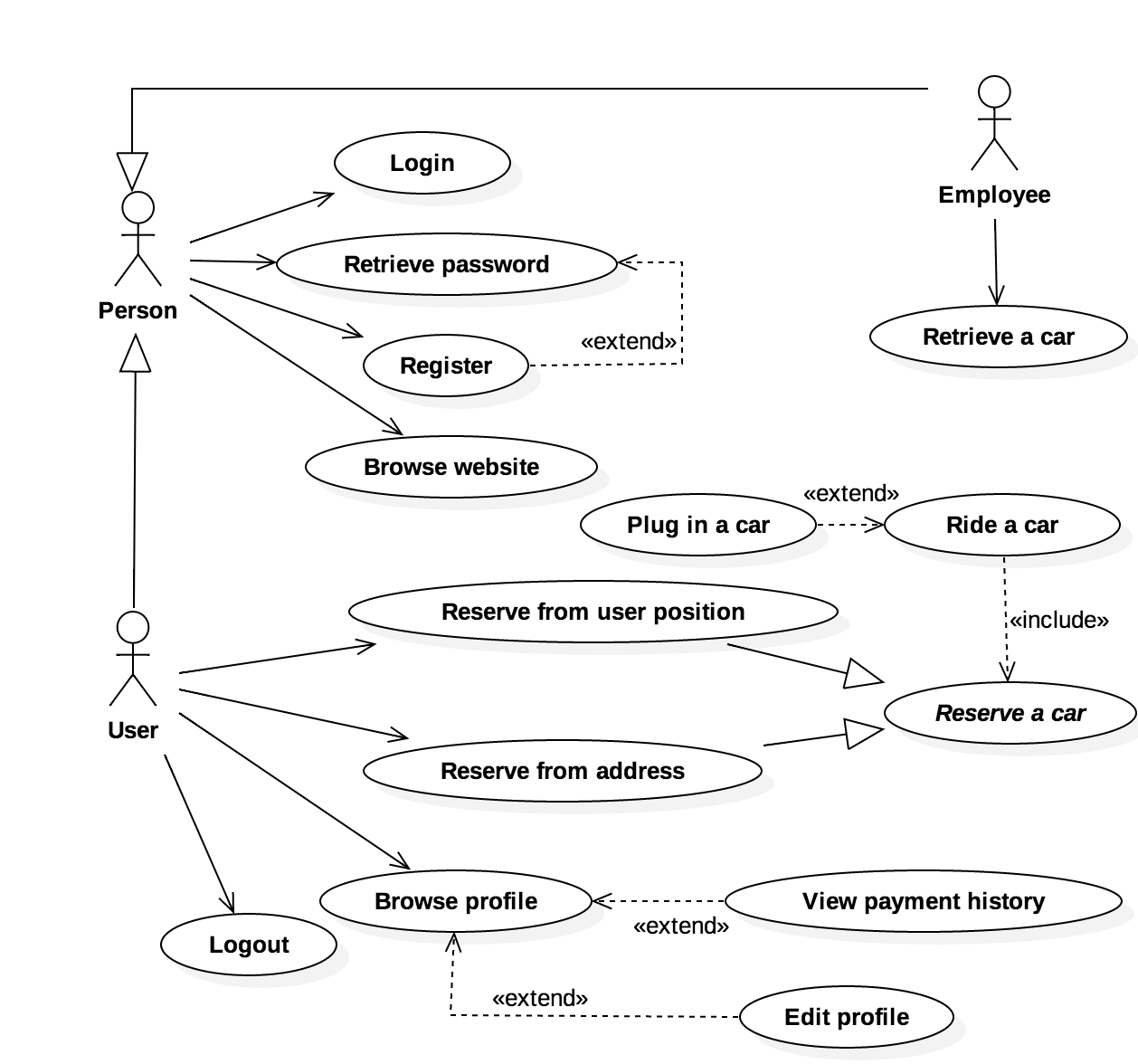
*USUAL WEDNESDAY OF WORK*

Usually Franco uses public transportation to go to work, but since on Wednesdays he needs to go to a different building which is not well served by the subway and he does not have a car, he registered to PowerEnJoy to be able to go there by car.

So as he does every week Franco reserves a car through the appropriate function on the app, checking the "From my position" option. Then he reaches the car and unlocks it through the "Unlock the car" option, ignites it and drives to work. The place where he needs to go is near a PowerEnJoy power grid station, so he checks that there are currently available power grids there through the "See charging stations near me" function, sees that there are indeed available parking spots at the usual place, and parks there, also taking care of plugging the car in, which nets him a 30% discount on the ride.

**5. UML MODELS**

***5.1. USE CASE DIAGRAM***

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***5.1.2. USE CASE DESCRIPTION***

***5.2. CLASS DIAGRAM***

***5.3. SEQUENCE DIAGRAM***