Politecnico di Milano

RASD - Requirements And Specifications Document

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Introduction

Problem Definition - PowerEnJoy

The requested System denoted PowerEnJoy, is a car-sharing service that exclusively employs electric Cars.

As a car-sharing service it should allow the use of a Car via Reservation, taking it and bringing it back to determined parking areas and paying for the use made.

The System should allow Users to register so it can authorize them to use the car-sharing services, and allow them to reserve an available Car near their location or on a given address, so they can use it for a ride.

The Users will provided their credentials and payment info so all the transactions for the service use are made automatically by the System.

The System should incentivize Virtuous Behaviors of the Users by providing extra discounts, or fees in case of misconduct, on the current ride. These Virtuous Behavior rules will compensate service expenses for the Cars, specially re-charging costs.

The System should provided these functionalities based on a mobile and web application that can be used by Registered Users to use the PowerEnJoy services. The System should interface as well with the Car so it can obtain important information from it, like location and battery use, and so it can control its locking or unlocking for the use.

Goals

G.1) First-Time Users must be able to register to the System creating an Account.

G.2) Registered Users must be able to login to their Account at any time they want.

G.3) Users can save his/hers credentials in the System.

G.4) A Registered User will be able to make a Reservation of any available Car near his/her current location or from an address that she/he can specify.

G.5) Users that had made a Reservation must be able to notify the System when they are nearby the Reserved Car so the System can unlock it.

G.6) A User that has made a Reservation must be able to cancel it before 1 hour starting from the time when the Reservation was made.

G.7) In case an User hasn't started using the Reserved Car at 45 minutes after the Reservation was made, he/she will be notified that either if the Reservation is not canceled or the Car is not used in 15 minutes, the Reservation will be automatically canceled and a 1 Euro fee will be charged to her/his Account.

G.8) When Users that start using their Reserved Car, they must be able to see their current expenses on the service through a System screen inside the Car.

G.9) The User must be able to know where the safe parking areas are nearby his/her current location or any address that she/he can specify.

G.10) Users must be able to finish their use of the Car when leaving it in a Safe Parking Area and exiting the car. The User will then be charged for the use of the service. The used Car will be locked and freed for Users to be reserved.

G.11) The User will always be notified when any Transaction is made on his Account.

G.12) Notify the Users that are currently using a Car of any available discounts on their ride if they abide by the 'Virtuous Behaviour' rules and of the extra fee in case of not respecting the facilitation of the re-charging of the Car on site. These extra discounts/charges will be applied on the Total fee at the end of the ride. These rules are:

- **G.12.1)** Apply a 10% discount if the User takes at least 2 other passenger into the car.
- **G.12.2)** Apply a 20% discount if the User leaves the Car with the battery at least half-full.
- **G.12.3)** Apply a 30% discount if the User leaves and plugs the Car in a Re-Charging Station.
- **G.12.4)** Apply a 30% extra fee if the User leaves the Car at more than 3KM from the nearest Re-Charging Station.
- **G.12.5)** Apply a 30% extra fee if the User leaves the Car with the battery less than 20% full.

G.13) Users can activate the Money Saving option on their Account to be notified of any nearby Re-Charging station on their arrival destination. Leaving the car at the end of the ride t this station

and plugging it will register as a 'Virtuous Behavior' and will apply and extra discount when charging the User.

Glossary

- **First-Time User:** A User that has not created an Account and thus has not yet been registered by the System. Can have a client version of the application, but he/she can't use the service until Registered.
- **Registered User/Users:** A User that has provided valid credentials and payment informations to create an Account in the System.
- **Account:** Allows the Registered User to authenticate to the System and access the car-sharing service.
- **Car:** An electric motored vehicle registered to the PowerEnJoy car-sharing service and thus interfaced to the System. It can be available for reservation, reserved, ready to use, on use and unavailable.
- **Reservation:** Option for the User to denote their future use of an available Car. Once activated it marks the Car as Reserved and is active until the User starts the use of the Car or until 1 hour after its activation, at which point it's cancelled and an user fee is applied.
- **Ride:** The actual use of the Car by the User. It starts when the User ignites the Car engine for the first time and it ends when the car is parked in a safe area and the User exits the Car.
- **Safe Parking Area:** Pre-defined areas by the System where a Car can be left by the User to be able to finish their ride.
- **Fee:** Amount of money that is due by the User for any of the System services or for any User misbehavior.
- **Transaction:** Any exchange of money made by the System on the User Account, every fee payment is a transaction.
- **Re-Charging Station:** Special stations where the Cars can be left and plugged in to have their battery re-charged. They count as Safe Parking Areas.
- **Virtuous Behavior Rule:** Any of the incentive rules that provide the user with a discount on their current ride if they follow it.

- **Status of the Car:** It is the name of a check list made by the cars System at the end of each ride. This check list consists in the status of battery, the number of passengers on the car, if the car is plugged on a recharge station and their localization.
- **App:** Smartphone application that does the interface between the User and the System.
- **Main Page:** A page within the app where a map is showed centered in the users position.

Domain Assumptions

As not all aspects of the given world are considered in the problem definition, the following domain assumptions will be made so they hold for the entirety of the project.

- Once Users have registered with valid payment information, all payments made with their Account will be valid and arrive successfully.
- GPS locations on Users and Cars will always be valid.
- Available Cars will be always in good working conditions.
- Users that have made a Reservation will always be able to follow its status until the end of the ride, meaning that their use of the mobile app will not be interrupted by missing connection or empty battery on their mobile device.
- The Cars will be equipped with weight sensors on each seat so it can detect how many passengers they are on a ride as well as being able to issue seat bealt warnings.
- All Cars on the service will be at least 5 seat Cars so the option to take 2 passengers or more is always available.
- All Available Cars will have at least 20% battery left, all Cars not available because of low battery will be moved by the service personel to a Re-Charge station by the end of the day.
- Reservations take immediate effect so no conflict of concurrency can happen for a Car, it cannot belong to more than one Reservation at once.

Constraints

Stakeholders

Our Main Stakeholder is the PowerEnJoy Car-Sharing Service, owned by Prof. DiNitto, that wants a management System for the main functionalities of its service.

Reference Documents

- Specification Document: Assignments AA 2016-2017.pdf
- IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications (IEEEXplore-SRS-template.pdf)
- Example Documents:
  - RASD sample from Oct. 20 lecture.pdf - myTaxiService
  - RASD esempio.pdf - Management Project Homework

Proposed System

Actors

User

Is the Main Actor of our service. Any person that once Registered can take advantage of the features of the PowerEnJoy service.

CRM

TBD - *we still need to set this actor's goals and requirements.* Customer Relationship Manager, will interface with the User in case of any problem that may arise and can intervene in the System to cancel any Reservation or modify the fee of an User's ride in case of a confirmed major cause.

Requirements

Functional Requirements

G.1) First-Time Users must be able to register to the System creating an Account.

- The System must allow an user that has not created an Account to register by providing valid credentials, an e-mail and payment information.
- The System must sent a password to the Registered User Email that can be used to Log into the Account.

G.2) Registered Users must be able to login to their Account at any time they want.

- The System must allow Registered Users to log into their Account only if they provide their correct e-mail and password.

G.3) Users can save his/hers credentials in the System.

- The System must be able save Users credentials upon theis request.
- When the user choose to save his/her credential they don't need to inform it in every time they open the System.

G.4) A Registered User will be able to make a Reservation of any available Car near his/her current location or from an address that she/he can specify.

- The System must be able to locate the User via GPS.

- The System must allow the Users to enter a determined address, in case they don't want to use their current location to locate the cars in the area.
- The System must be able to locate all available Cars via GPS.
- The System must show the User all the available Cars near the user given location.
- The System must allow the Users to select one of the Cars showed to them to create a Reservation, the selected Car will be marked as reserved.

G.5) Users that have made a Reservation must be able to notify the System when they are nearby the Reserved Car so the System can unlock it.

- While a Reservation is active, the System must allow the User to notify that they are nearby their Reserved Car.
- The System must confirm the notification by checking that the User current location and the Car location coincide.
- The System must unlock the Reserved Car and set it to Ready to Use.

G.6) A User that has made a Reservation must be able to cancel it before 1 hour starting from the time when the Reservation was made.

- The System must check how long has passed from the reservation time, if it less then one hour the user will be able to open the reservation and cancel it without being charged for it.
- The System must confirm the user request and set the car as available again.

G.7) In case an User hasn't started using the Reserved Car at 45 minutes after the Reservation was made, he/she will be notified that either if the Reservation is not canceled or the Car is not used in 15 minutes, the Reservation will be automatically canceled and a 1 Euro fee will be charged to her/his Account.

- After 45 minutes from the reservation time has passed, the System must send a notification to the user's registered smartphone warning that he/she has 15 minutes left to pick up the car or to cancel the reservation.
- After the full hour has passed and the reservation is still active, the System must cancel the reservation, block this user account for the next hour and charge the fee of 1 Euro for not picking up the car.

G.8) When Users start using their Reserved Car, they must be able to see their current expenses on the service through a System screen inside the Car.

- The car System must keep track of the gross fee to be paid by the user.
- As soon as the car ignites, the car System must start showing the fee on the computer monitor and keep it this way until the user is finished using the car.

G.9) The User must be able to know where the safe parking areas are nearby his/her current location or any address that she/he can specify.

- The System must be able to show, when requested, a map with the safe parking zones and points with eletricity plugs .

G.10) Users must be able to finish their use of the Car when leaving it in a Safe Parking Area and exiting the car. The User will then be charged for the use of the service. The used Car will be locked and freed for Users to be reserved.

- The System must verify if the car is parked in a Safe Parking Area. If the car isn't located in one, the System must notify the user on the screen of the car that it's not possible to finish the ride.
- The System must show a message on the car's screen asking if the user want to finish the ride or if want to continuing the use of the car.
- The user must answer to the request. If the user want to keep using it, the System will set the car as reserved for one hour. Nevertheless in terms of payment the System will charge the same amount of money in the final Transaction as if the car has been in a ride. If the user does not want to use the car the System will finish ride.
- Upon the user leaving of the car the System must lock the car and consider the user's answer to whether set the car as available or reserved.

G.11) The User will always be notified when any Transaction is made on his Account.

- The System must notify the user of every Transaction made on his Account by email. Further information related to the ride as the Route, charged Fees, o must compose the email.

G.12) Notify the Users that are currently using a Car of any available discounts on their ride if they abide by the 'Virtuous Behaviour Rules' and of the extra fee in case of not respecting the facilitation of the re-charging of the Car on site. These extra discounts/charges will be applied on the Total fee at the end of the ride.

- The System must notify the user on the cars screen of the any information related with a discount or extra fee.
- The System must calculate at the end of the ride if any discount or extra fee is applicable. These fees are

G.12.1) Apply a 10% discount if the User takes at least 2 other passenger into the car.

- The System must read from the status of the Car the number of passengers and if it's 2 or more, apply the 10% discount to the ride fee.

G.12.2) Apply a 20% discount if the User leaves the Car with the battery at least half-full.

G.12.5) Apply a 30% extra fee if the User leaves the Car with the battery less than 20% full.

- The System must read from the status of the Car the amount of battery left and if it's 50% or more apply the 20% discount else if it's less than 20% apply the 30% extra fee.

G.12.3) Apply a 30% discount if the User leaves and plugs the Car in a Re-Charging Station.

- The System must detect from the status of the Car if it's plugged in to a Re-Charging Station and if it is, apply the 30% discount.

G.12.4) Apply a 30% extra fee if the User leaves the Car at more than 3KM from the nearest Re-Charging Station.

- The System must read from the status of the Car its current location and the distance to the nearest Re-Charging Station, if it is more than 3KM then applay the 30% extra fee.

- The System must apply these discounts or extra fees at the end of the ride over the total fee.

G.13) Users can activate the 'Money Saving'a option on their Account to be notified of any nearby Re-Charging station on their arrival destination. Leaving the car at the end of the ride at this station and plugging it will register as a 'Virtuous Behavior' and will apply and extra discount when charging the User.

- Users must be allowed to enable the Money Saving option on their accounts at any time they choose.
- The System must allow the user to input his/her destination at any time of the ride whether on the app or on the cars screen.
- Upon the final destination of the user the System must direct the end of the ride considering a uniform distribution of parked cars of the System, the nearest charging station in relation with the address informed and the availability of these charging stations.

Non Functional Requirements

User Interface

Documentation

System Architecture

Hardware Consideration

Incident Handling

Security

Scenario Identifying

Scenario	Carol is a First-Time User
Actor	User
Background conditions	Carol do not have an Account but she wants to create one.
Flux of events	•Carol selects the sign-up option on the App; •The System shows a form where Carol can insert her data; •Carol inserts her credentials, email and the payment information and finishes the process; •The System checks the consistence of the data; •The System informs Carol of the success of the registration;
Exit conditions	System confirms the creation of a new user and send an email to the user's email address informing the password and confirming the registration.
Exception	Carol inserts data that the System can not validate. System can not finish operation until Carol inserts the correct data.

Scenario	Alex wants to reserve the nearest car
Actor	User
Background conditions	Alex is Registered User. He is a heavy user of the service, and to save time he had saved his credentials in the app to open it without the need of a login.
Flux of events	•Alex open the App; •The System redirects to the Main Page; •By experience Alex manually search in the map for the nearest car; •Alex find one car select and reserves it; •The System reserve the car; •Alex walks in the direction of the location of the reserved car;
Exit conditions	The System confirms the reservation of the car that Alex had selected.
Exception	The saved credentials are not valid and the login fail. The car that Alex selects is already reserved and the System can not effectuate the reservation.

Scenario	Francesco wants to login to see available cars without doing a reservation
Actor	User
Background conditions	Francesco is a Registered user. He is a new user and want to explore the functions of the System.
Flux of events	•Francesco open the app and login; •Francesco try to find a car manually searching in the map, but he does not like of searching by himself; •Francesco open the side menu and find the option Search for a car, he selects it; •The System automatically search for the nearest car based on Francesco's location; •The System find the finds a car and trace the route in the map of the App's map; •Francesco satisfied to know this functionality of the app and closes it without reserving a car;
Exit conditions	The System allows the user to search for the available cars without the need of a reservation.
Exception	The login fail. The System does not find available cars and cant return results for the search.

Scenario	Mario is doing overtime. He knows that the metro stops at 0h so he wants to reserve a car near the metro station. He'll exit at 0h20.
Actor	User
Background conditions	Mario is a Registered user. He uses the System occasionally.
Flux of events	•Its 23h50. Mario open the App and login; •The System redirects to the Main Page where there is an option to inform an address to find a car; •Mario inform the address of the metro; •The System return the metro station location; •Mario see the available cars selects one and reserve it;
Exit conditions	The System reserves the car selected by the user and assure reservation for a period of one hour.
Exception	The login fail. There is no available car in the address that Mario and he does not reserve a car.

Scenario	Angela is walking back home when she sees a car parked by her side. She wants to unlock it to drive back home.
Actor	User
Background conditions	Angela is a Registered user. She did not make a reservation of the car that she wants to drive.
Flux of events	•Angela open the App and do the login; •The System redirects to the Main Page; •Angela immediately finds the car, that is beside her location; •She selects the car and request a reservation; •The System reserves the car; •Angela proceeds to unlock the car in the App; •The System checks the reserve and the current position of the User and the Car; •The System unlocks the car and set it for Ready to Use mode; •Angela get in the car and drives home;
Exit conditions	System reserves the car and unlock it upon User location.
Exception	The login fail. The car that is besides Angela is already reserved so she cant reserve the car for her use in the moment.

Scenario	Sarah wants to cancel a reservation
Actor	User
Background conditions	Sarah is a Registered User. She does not need to get the car anymore so she wants to cancel the reservation that she made 30 minutes ago.
Flux of events	•Sarah open the App and do the login; •Sarah selects in the menu of the App the option 'My reservation'; •The System shows Sarahs reservation; •Sarah see the status of the reservation; •Sarah selects the option of canceling the reservation; •The System checks the time that Sarah did the reservation, verifies that is possible to cancel the ride and proceeds to do this operation;
Exit conditions	The System verifies if the reservations time is under 1 hour if so the user can cancel the reservation.
Exception	The login fails. Sarah tries to cancel the reservation after one hour period of reservation and System does not allow Sarah cancel the reserve.

Scenario	Paulo is late to pick up the reserved car.
Actor	User
Background conditions	Paulo is a Registered User. He had reserved a car. It has passed 45 minutes.
Flux of events	•Paulo have 15 minutes left to pick the reserved car; •The System emits an alert in the App informing that Paulo is running out of time; •Paulo sees the alert and rushes into the location where the car is parked;
Exit conditions	The System emits an alert when the period of the cars reserve is ending.
Exception	The alert fails. Paulo don't see the alert. Paulo couldn't make to the car in 15 minutes and the System automatically cancel the reservation, charges 1 euro of Paulo's account and will not allow Paulo to reserve a car for 1 hour.

Scenario	Hugo is about to finish a ride.
Actor	User
Background conditions	Hugo is a Registered User. He was driving into a unknow direction.
Flux of events	•At some point Hugo decides to stop the car; •He finds parking spot and proceeds to park the car; •Hugo finishes the maneuver and turn off the car; •The System verifies if the parking spot is in some Safe Park Area and proceeds to finish the ride; •The System shows an interface on the cars screen asking if Hugo will finish the ride; •Hugo selects that he will finish the ride; •Hugo left the car; •The System finish the ride and lock the car;
Exit conditions	The System verifies the Status of the car and proceeds to finish Hugo's ride sending to his email the information of the ride as the route and the transaction.
Exception	Hugo park the car in a no Safe Park Area, and the System can not finish the ride.

Scenario	Marina wants to use the System in the most economical way.
Actor	User
Background conditions	Marina is Registered User and she had saved her credentials on the app. She had just unlocked the car and is about to begin the ride.
Flux of events	•Marina has a previous knowledge of the Money Saving option so when she got in the car she informs in cars screen map her destination; •The System calculates the optimal destination considering the distribution of the cars in the city, the available plugs and the destination address; •The System return options of parking spots to Marina; •She considers these options and selects one. She starts the ride following the GPS route of the cars screen; •Mariana drives to the destination; •Marina turn of the car; •The System show a question on the cars screen asking if Marina will finish the ride; •Marina selects that she will finish the ride; •The System show a message on the saying that Marina is besides the plug and advice to connect the car to the plug; •Marina left the car and proceeds to connect the plug into the car; •The System finish the ride and lock the car;
Exit conditions	The System verifies the Status of the car and proceeds to finish Marina's ride sending to his email the information of the ride as the route and the transaction.
Exception	The System can not return a destination due the lack of the available Re-Charging Stations in relation with the distribution of the cars.

Scenario	The Car that Julia was driving had mechanical problems during the Ride.
Actor	User, CRM operator
Background conditions	Julia is Registered User and she had saved her credentials on the app. She was driving a Car when it suddenly stops.
Flux of events	•Julia open the App; •She selects the option Problems with the Car; •The System immediately provides an option whether to chat or call to an CRM operator; •Julia chooses to call and the System redirects to the dialing process; •The calling established a connection of Julia and the CRM operator; •Julia describe the situation to the CRM operator; •The CRM operator finishes the Julias ride, check if there is any extra charging in the Transaction of the riding and set the car as unavailable; •Julia finishes the call and left the car;
Exit conditions	The CRM operator directs the relation when between the User and the System in such events and is enable to finish the ride and to set the car as unavailable.
Exception	The saved credentials are not valid and the login fail. The connection between the CRM operator and the User fails. The CRM operator could not identity the problem with the Car.

UML Modeling

Use Case Diagram

Use case Diagram represents all the situations available to Users explained in the Scenarios.

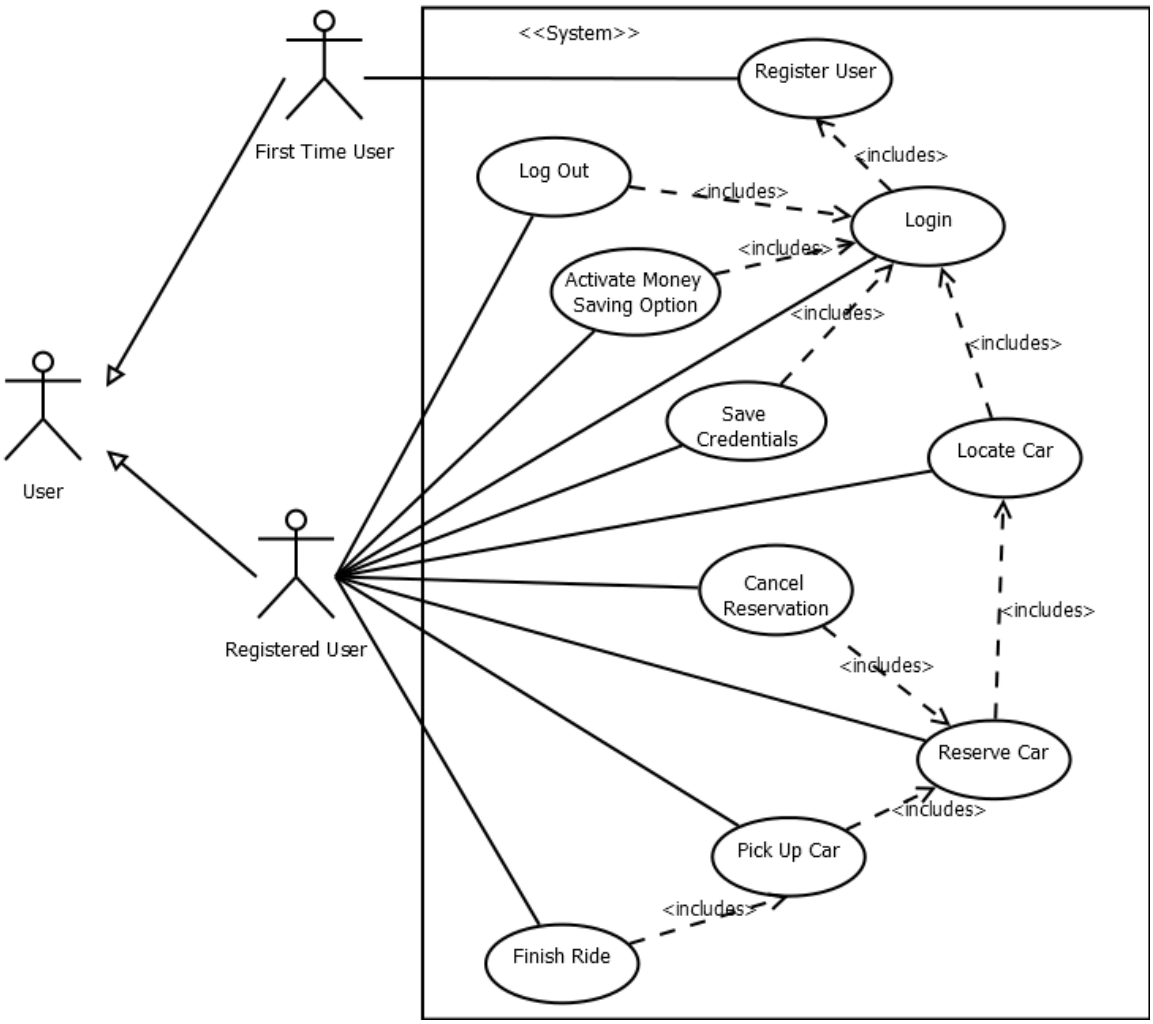

Figure 1: Use Case Diagram

Class Diagram

Sequence Diagram

Statechart Diagram

Activity Diagram

Alloy Modeling

Used Tools

The Tools used to develop this RASD document were:

- **GitHub:** for Version Control
- **Dia Diagram Editor:** for UML Diagrams
- **Alloy Analizer 4.2:** for Alloy Modelling and proving consistency
- **TeXworks:** for LaTex editing of this Document

Hours of Work

Date	Domenico	Caio	Matheus
25/10/16	30m	30m	30m
26/10/16	1h	-	-
27/10/16	-	-	-
28/10/16	2h.30m	4h.30m	4h.30m
29/10/16	1h	-	-
30/10/16	-	-	2h
31/10/16	-	2h	-
01/11/16	-	-	2h
02/11/16	2h	-	-
03/11/16	2h	3h	3h
04/11/16	-	-	2h
05/11/16	1h	-	6h
06/11/16	-	-	6h
07/11/16	2h	-	6h
08/11/16	-	-	-
09/11/16	-	-	-
10/11/16	-	-	-
11/11/16	-	-	-
12/11/16	-	-	-
13/11/16	-	-	-