POLITECNICO
MILANO 1863

“PowerEnJoy”
Requirements Analysis and Specification Document

Software Engineering 2

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Introduction

The aim of this project is to specify in detail a new digital management software for PowerEnJoy, a car-sharing service that employs electric cars only.

We need to bridge the gap between the world (cars and passengers) and our system (servers, databases, etc.). The users will be able to access the system functionalities through a **web and a mobile application**, and a **dedicated touchscreen** installed in every car.

A **central system** will manage the cars and the reservations, and will communicate with the cars through the Internet. The system will follow the cars' movements thanks to the GPS tracker installed in every car. Furthermore all cars will be equipped with a great variety of **sensors** to check the cars' status at any time.

Introduction

The RASD document is first and foremost a description of the project for all interested stakeholders and a reference for future development, but can also be used as a basis for legally binding agreements.

The aim of this project is to specify in detail a new digital management software for PowerEnJoy, a car-sharing service that employs electric cars only.

Product Function

The PowerEnJoy application will offer many different functionalities; specifically, the goals we want to accomplish are the following:

- [G1] Guests must be able to register as users by choosing a username and providing their personal data, driving license and payment information. They will receive a password at the email address they specified.
- [G2] Users must be able to login with the username/email inserted and the password received on registration.
- [G3a] Users must be able to find the location and battery charge of all the available cars within a certain distance from their current location.
- [G3b] Users must be able to find the location and battery charge of all available
- cars around a specified location.
- [G4] Users must be able to reserve a car for up to one hour before they pick it up. If they don’t take the car before the time expires they are charged a fixed fee of 1 EUR.
- [G5] Users must be able to cancel a reservation if they decide to not actually use the car.

Product Function

- [G11] The system must lock the car automatically after the user exits the car.
- [G12] The system must provide a money saving option to the user, proposing a suitable power grid station near the user's final destination. The user will get a discount if they park the car there and plug it in the power grid.
- [G13] The stations proposed by the system with the money saving option must be chosen in a way that ensures a uniform distribution of cars in the city.
- [G14] The system must apply a discount of 10% on the last ride if the user took at least two other passengers onto the car.
- [G15] The system must apply a discount of 20% on the last ride if the car is left with more than 50% of remaining battery charge.
- [G16] The system must apply a discount of 30% on the last ride if the car is left at special parking areas where they can be recharged, and the user takes care of plugging the car into the power grid.

Product Function

- [G17] The system must charge 30% more if the car is left at more than 3 km from the nearest power grid station or with less than 20% remaining battery charge.
- [G18] Users with outstanding bills cannot have access to the cars and reservations until the bills are paid.
- [G19] Users with outstanding bills should have a way to pay them.
- [G20] Available cars should actually be available to the user and in good conditions (i.e. not dirty, damaged, and/or with low battery).

Assumptions and Dependencies : Car hardware

Every car must have:

- a reliable GPS tracker;
- a mobile Internet connection (for example a 3G or 4G connection);
- sensors to collect data from the engine and the battery;
- an electronic switch to lock and unlock the doors;
- a weight sensor on each seat;
- a touchscreen to offer a dedicated interface to users;
- a GPS navigator to show the position of the power grid stations to the user and guide him;
- an internal system to control these components and communicate with the central system;
- a unique QR code printed on the outside of the car.

Assumptions and Dependencies

Web application dependencies The web application needs an Internet connection to work, for example to connect to the database and find available cars.

Mobile application The mobile application will need at least

an Internet connection to receive data from and communicate with the central system. Access to the device's location is not mandatory, but is needed to provide the "find available cars near me" functionality. The mobile device will need a QR scanner to unlock the cars.

Power grid stations Power grid stations must have a sensor on each plug to know if it's free or in use, and an Internet connection to communicate this information to the system.

Assumptions and Dependencies

Perfect signal The car's data connection is always working and stable. The car's GPS signal is always available and precise.

Predefined data The system has a predefined list of all the safe areas and their locations, list that can be changed by the people in control of the system. Likewise, the system has a predefined list of all the power grid stations, their locations and the number of plugs present in each station.

No idle users After unlocking a car users turn on the engine shortly after (i.e. the user doesn't stand in the car idly for long periods of time). We'd prefer if this happened rarely, because users aren't charged until the engine is ignited. We suppose that users want to get to their destination as soon as possible.

Assumptions and Dependencies

Users leave the car after parking When a user ends a ride or parks temporarily, we assume that the users and all the passengers have already exited the car when the last door is closed and the lock timeout expires. This keeps the user or the passengers from getting stuck in the car when the system locks it automatically.

No cheating on the weight sensors When the weight measured by a seat weight sensor exceeds a certain threshold, we suppose that a person is present on that seat (and not an object).

Cars are recharged An external agency is entrusted with the task of recharging cars with low or dead batteries. The task of recharging cars doesn’t involve our system, except for when a car is flagged as available again.

Assumptions and Dependencies

Users report problems Users always report dirty or damaged cars they find. Moreover, we trust users to never submit false reports.

Problems are fixed If a car is reported for a problem, an external agency is entrusted with the tasks of cleaning, repairing or fixing the car's problem. After the problem is fixed the agency marks the car as available in the system manually.

Theft is handled independently There is an office in charge of handling the cases when a car is flagged or reported as stolen. We suppose they're autonomous and don't need to interact with the system.

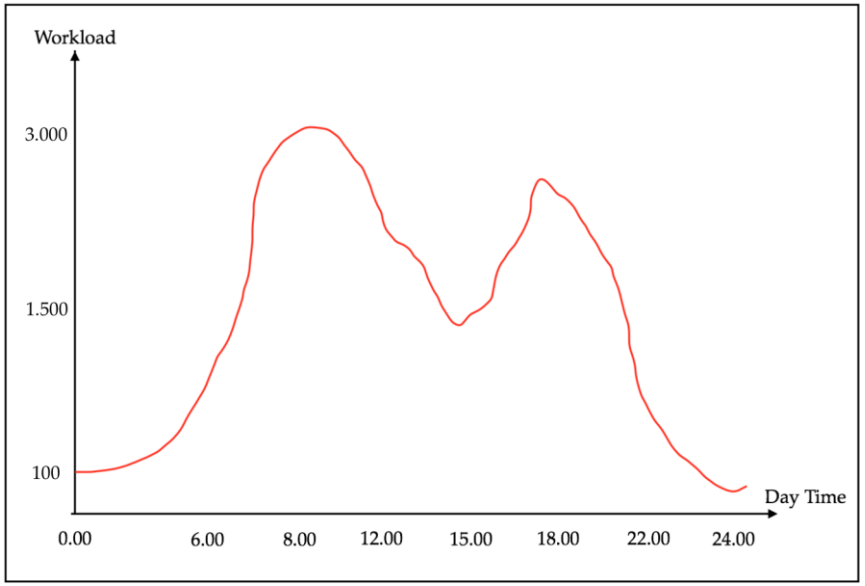
Cars aren't abandoned in bad spots We suppose users are reliable and never let the cars run out of battery before parking in a safe area.

Performance Requirements

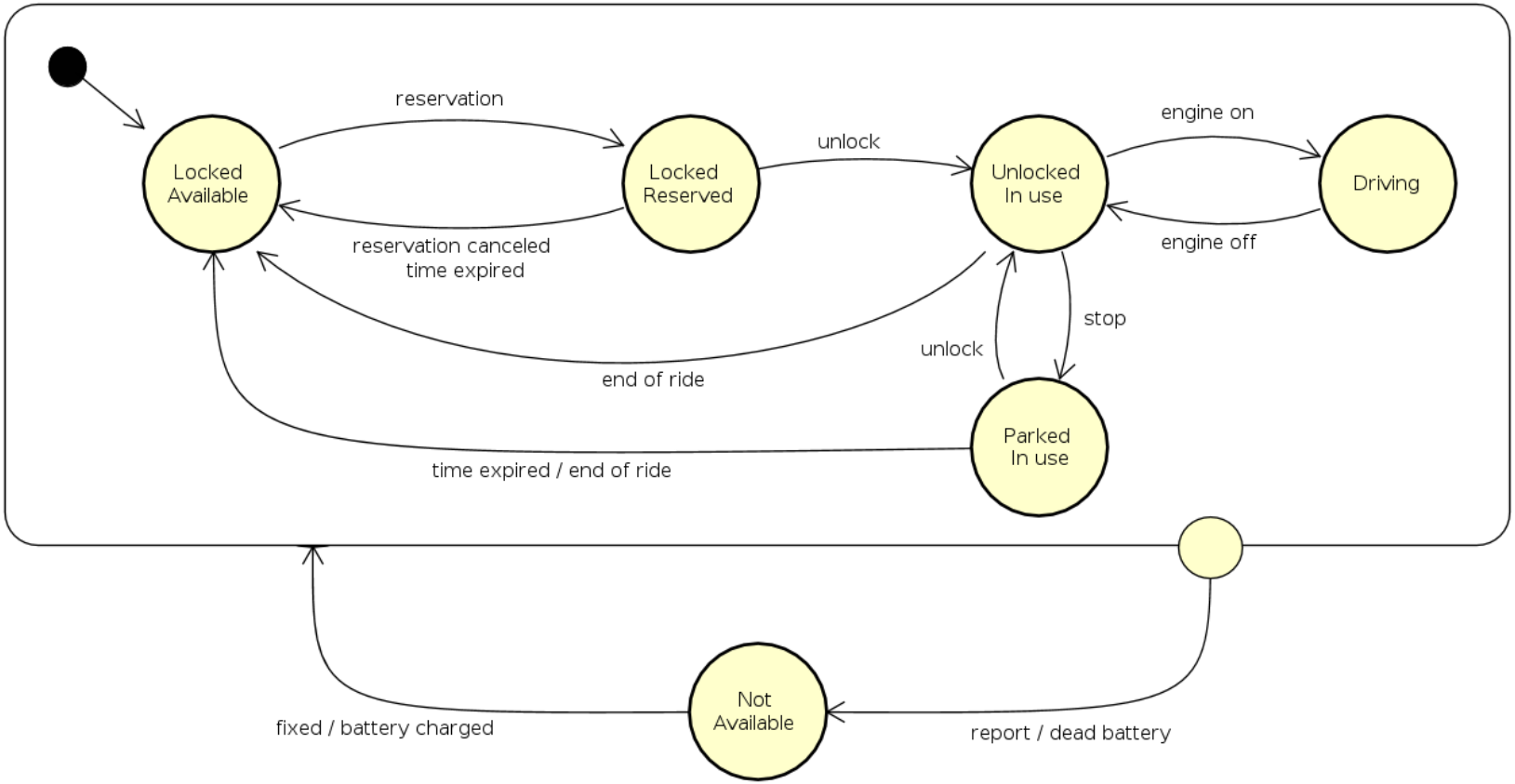
Response Time: we want that our software will satisfy the 100% of requests in maximum 0.5 seconds.

Workload: we assume that the workload will be distributed following the profile shown in figure. We assume that our software will be able to manage a large number of connection

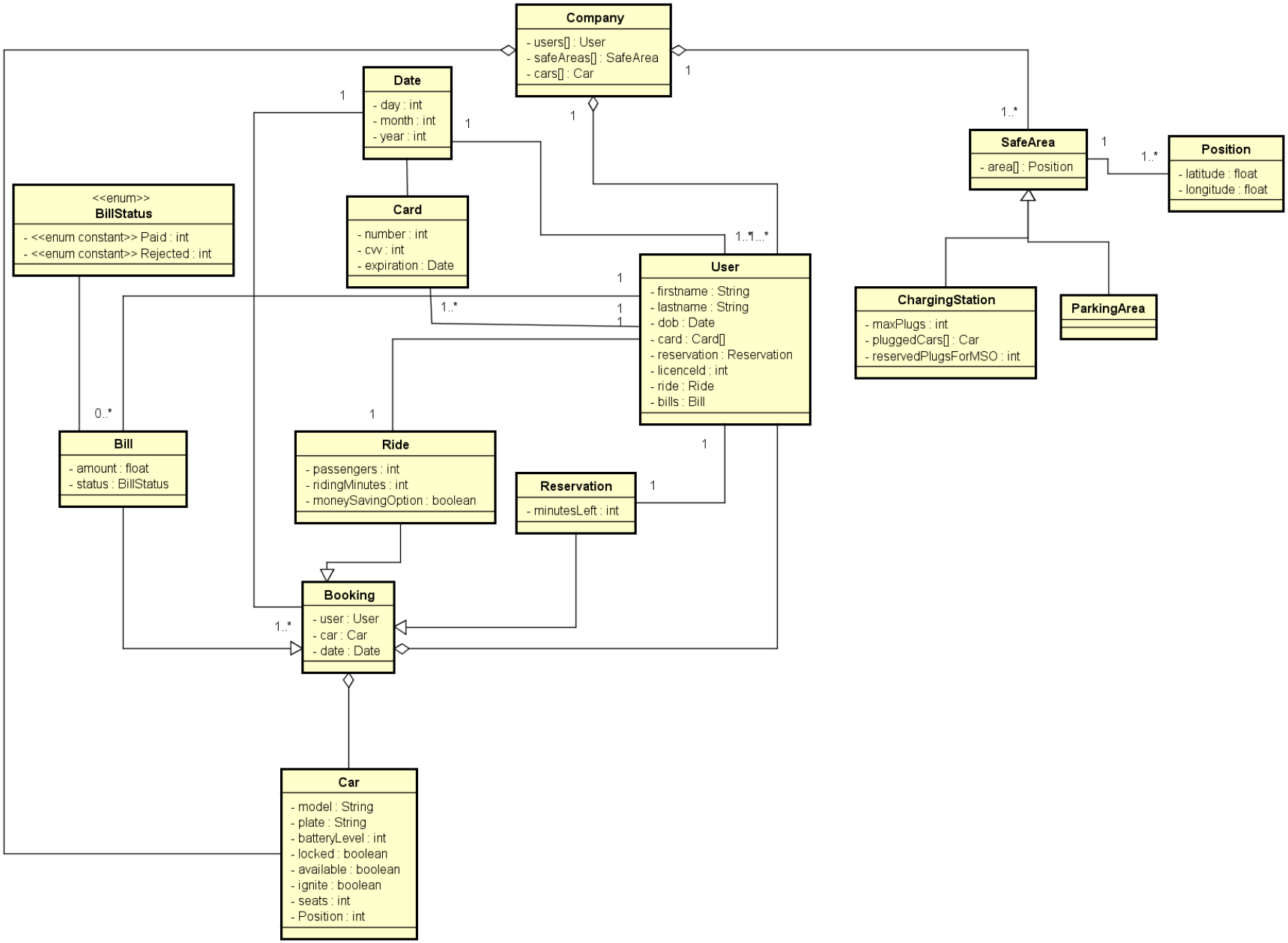
(we estimates the the peak load could be about 3000 connections) between users and the system.



State Chart for cars

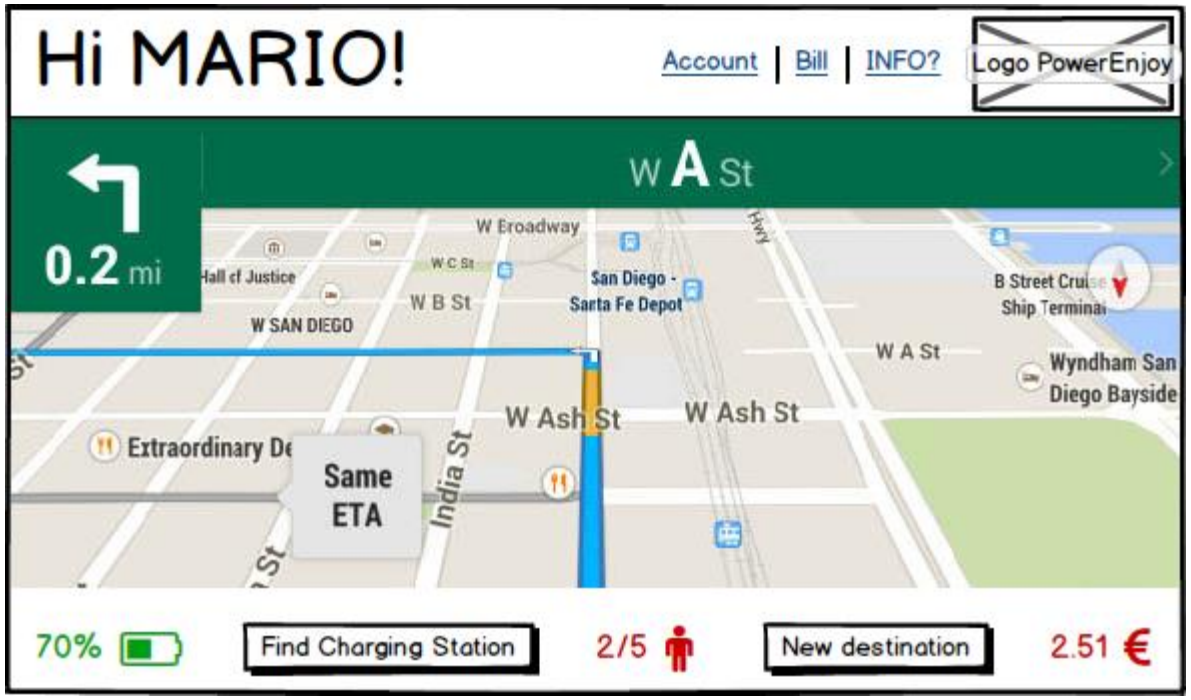


Class Diagram



Mobile Mockups

Car Mockup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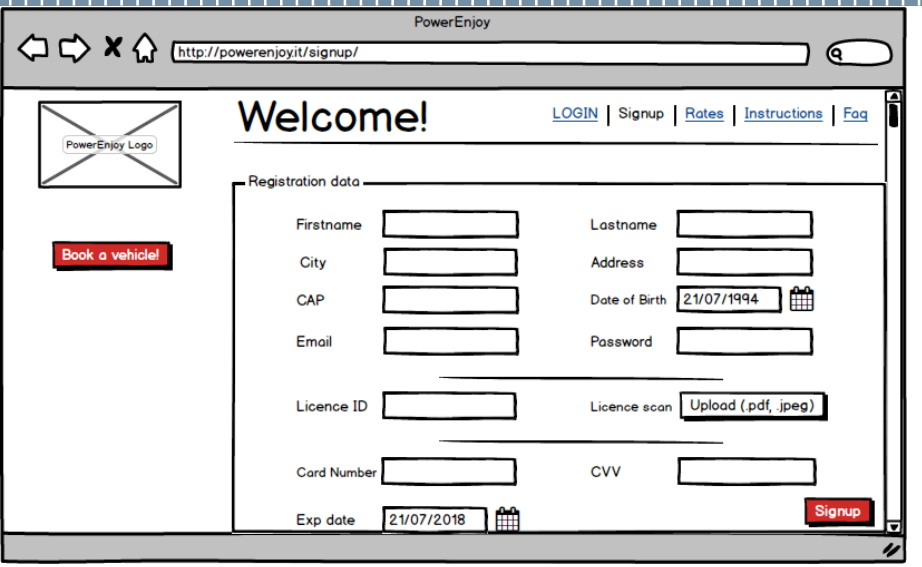
Web Mockups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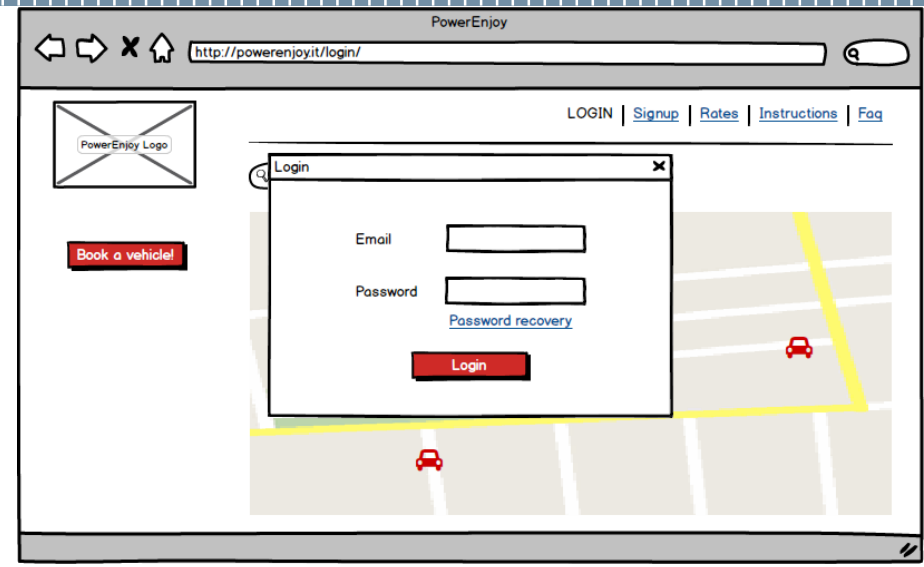
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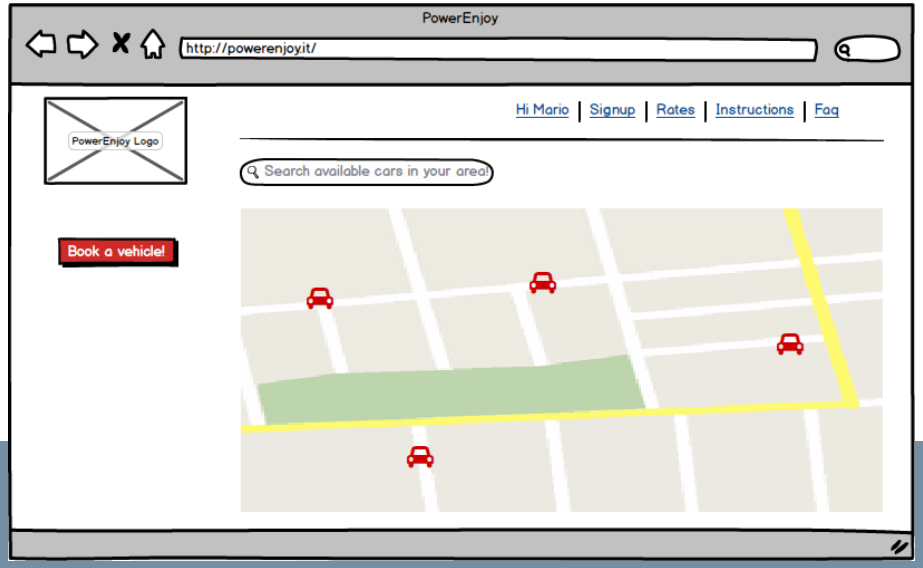
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Hi Mario | Signup | Rates | Instructions | Faq
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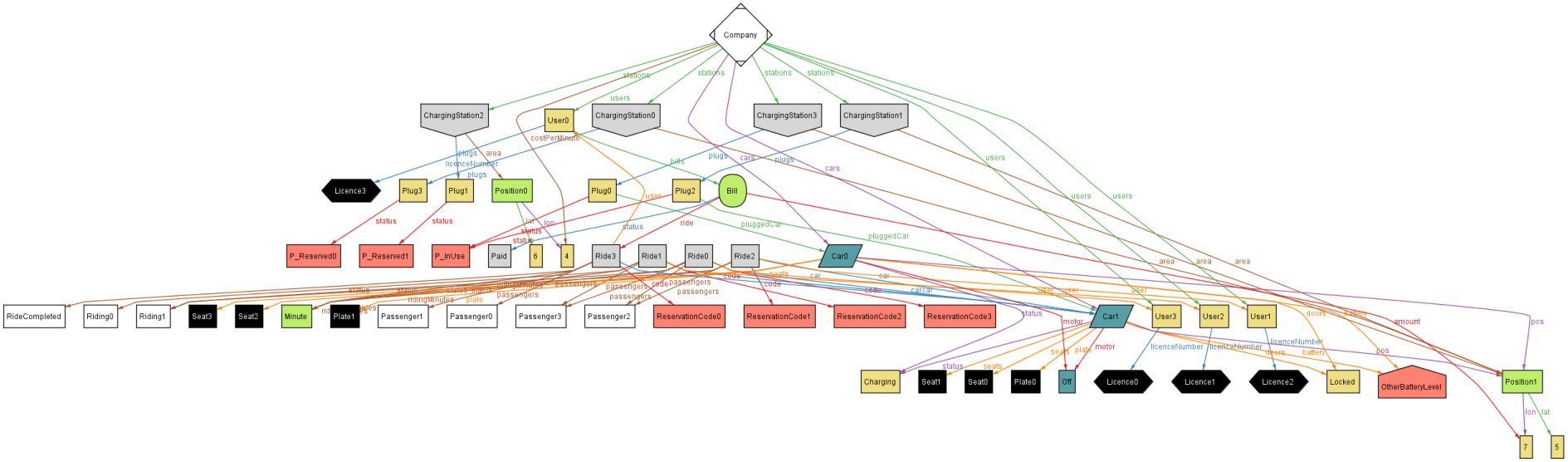
Book a vehicle!

Alloy World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Ride2
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Seat3
Seat2
Minute
Plate1
Passenger1
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Passenger3
Passenger2
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ReservationCode2
ReservationCode3
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User2
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