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Software Engineering 2 Project

Design Document

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Contents

1 Introduction **4**
1.1 Purpose . . . 4
1.2 Scope . . . 4
1.3 Abbreviations, Definitions and Acronyms . . . 4
1.3.1 Abbreviations: . . . 4
1.3.2 Acronyms . . . 4
1.3.3 Definitions . . . 5

2 Architectural Design **6**
2.1 Overview . . . 6
2.2 Component View . . . 6
2.3 Deployment View . . . 6
2.4 Runtime View . . . 6
2.5 Component Interfaces . . . 6
2.6 Selected Architectural Styles And Patterns . . . 6
2.7 Other Design Decisions . . . 6

3 Algorithm Design **7**

4 User Interface Design **8**
4.1 User Interfaces . . . 8
4.1.1 Web Interfaces . . . 8
4.1.1.1 Home Page (Web) . . . 8
4.1.1.2 Registration Page (Web) . . . 9
4.1.1.3 Further Information (Web) . . . 10
4.1.1.4 Map (Web) . . . 11
4.1.1.5 Map - Selected Car (Web) . . . 12
4.1.1.6 Selected Car Confirmation (Web) . . . 12
4.1.1.7 Reservation Confirmed (Web) . . . 14
4.1.2 Mobile Interfaces . . . 14
4.1.2.1 Home (Mobile) . . . 14
4.1.2.2 Map (Mobile) . . . 16
4.1.2.3 Selected Car (Mobile) . . . 18
4.1.2.4 Car Confirmation (Mobile) . . . 21
4.1.2.5 Reservation Confirmed (Mobile) . . . 23
4.1.2.6 Car In Use (Mobile) . . . 23
4.1.2.7 Car Parked (Mobile) . . . 25
4.1.2.8 Rental Ended (Mobile) . . . 27
4.2 Operator Interfaces . . . 27
4.2.1 Web Interfaces . . . 27
4.2.1.1 Operator Main Page (Web) . . . 29
4.2.1.2 Operator chose TODO (Web) . . . 31
4.2.1.3 Operator Searched Car (Web) . . . 32
4.2.1.4 Car Details (Web) . . . 33
4.2.1.5 Changing a Car parameter - Sample (Web) . . . 34
4.2.2 Mobile Interfaces . . . 34
4.2.2.1 Main Page (Mobile) . . . 36
4.2.2.2 Operator chose TODO (Mobile) . . . 38

4.2.2.3 Operator Searched Car (Mobile) 40
4.2.2.4 Operator Car Details (Mobile) 42
4.2.2.5 Changing a Car parameter - Sample (Mobile) 44

5 Requirements traceability **44**

6 Effort spent **45**

1 Introduction

1.1 Purpose

The purpose of this document is to give the detailed structure of PowerEnJoy software system.
So we try to give developers a clear representation of:

- The high level architecture of the system.
- The design patterns applied in order to achieve our specific necessities.
- The main components and the interfaces they provide.
- The Runtime behaviour.

1.2 Scope

PowerEnJoy project aims to give users, operators and callcenter operators access to the system services they need and they are supposed to access.
The system allows:

- Users to manage their personal data through both a web and a mobile app and Active Users to manage reservations only through the mobile app.
- callcenter operators to manage assistance tickets, that will be managed by PowerEnJoy itself.
- PowerEnjoy operators to manage the opened assistance tickets, take them in charge and update car's and user's data accordingly.

The system architecture shall guarantee future proof scalability and allow subsequent improvements and general reliability.

1.3 Abbreviations, Definitions and Acronyms

1.3.1 Abbreviations:

- Gn: the n-th Goal
- An: the n-th Assumption
- Rn: the n-th Requirement

1.3.2 Acronyms

- CC: Credit Card
- DL: Driving Licence
- AU: Active User

1.3.3 Definitions

- Visitor: person that may not be registered to the system or not logged in.
- User: a registered and logged in Visitor, that may be still waiting for his information to be verified.
- Active User: a User whose data (CC, DL) have been verified. (Shares all User's characteristics)
- Safe Zone: predefined zones where parking is allowed, parking is forbidden in any other zone.
- Park: park the car in the safe zone and terminate the rental.

2 Architectural Design

2.1 Overview

The system adopt a three tier architecture with a thin client composed by a web and a mobile app, both managed by a specific server side client handler

2.2 Component View

2.3 Deployment View

2.4 Runtime View

2.5 Component Interfaces

2.6 Selected Architectural Styles And Patterns

2.7 Other Design Decisions

3 Algorithm Design

All algorithms needed in the project are trivial but the one dealing with uniform repartition of cars in the city. This problem has been studied a lot and there are in literature various algorithms that solve it. They are mainly based on mixed integer linear programming techniques and in particular [1] presented a complete model. In [2] is presented a greedy algorithm that achieves almost the same result. In [3] a more sofisticated approach is used taking into account a three dimensional objective function and exploiting genetic algorithms and local search methods. [4] offers a sort of classification of the stragies proposed in the past years.
For our purpose the approach described in [2] is the best since it minimizes the number of the operators needed to relocate cars and so the costs.

Riferimenti

[1] A. G. Kek, R. L. Cheu, Q. Meng, and C. H. Fung, "A decision support system for vehicle relocation operations in carsharing systems", Transportation Research Part E: Logistics and Transportation Review, vol. 45, no. 1, pp. 149–158, 2009.
[2] R. Zakaria, L. Moalic, A. Caminada, M. Dib, "A Greedy Algorithm for relocation problem in one-way carsharing", 10th International Conference on Modeling, Optimization and Simulation - MOSIM'14 – November 5-7-2014- Nancy – France "Toward circular Economy".
[3] Moalic, L., Lamrous, S., & Caminada, A. (2013). A Multiobjective Memetic Algorithm for Solving the Carsharing Problem. Proceedings Of The 2013 International Conference On Artificial IntelligenceIcai 2013, Vol. 1, pp. 877-883.
[4] S. Weikl, K. Bogenberger, "Relocation Strategies and Algorithms for free-floating Car Sharing Systems", 15th International IEEE Conference on Intelligent Transportation Systems Anchorage, Alaska, USA, September 16-19, 2012.

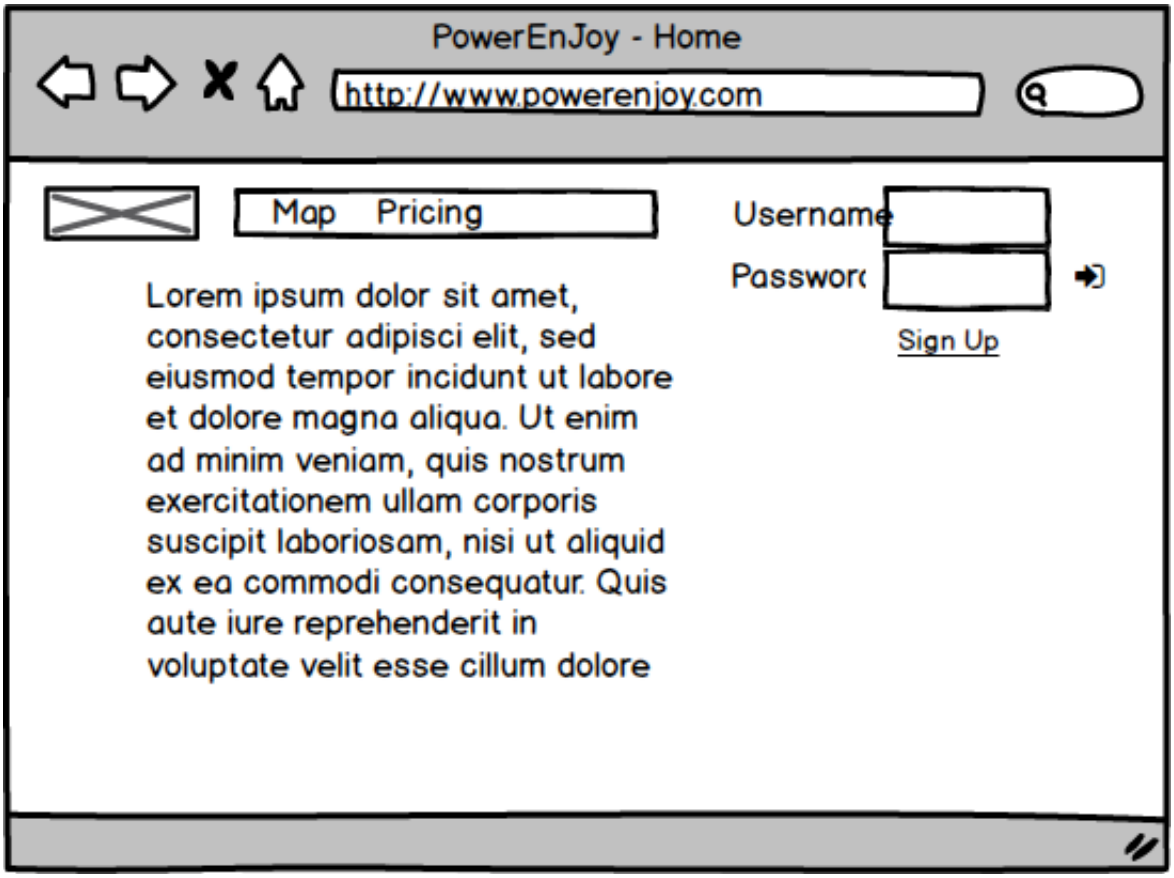

Figure 1: Web Interface - User's Home Page

4 User Interface Design

Below are some mockups to show how users will interact with the service. Since PowerEnJoy can be used both from a computer (except unlocking the car), both Mobile and Web mockups are provided. Moreover, since both users and Operators have access to the service via browser/app, interfaces for both types of users have been created.

4.1 User Interfaces

As anticipated, in this section all User mockups are analyzed. These mockups show how all actions will be performed by our users. This section is further split between Web interfaces, imagined for standard browsers, and Mobile interfaces, designed having a smartphone App in mind

4.1.1 Web Interfaces

4.1.1.1 Home Page (Web) From the home page any user can try to login inserting username and password or they can choose to sign up and go to the registration page. This page will likely show a description of the service as well as providing links to other important part of the website (Map, Pricing, About Us).

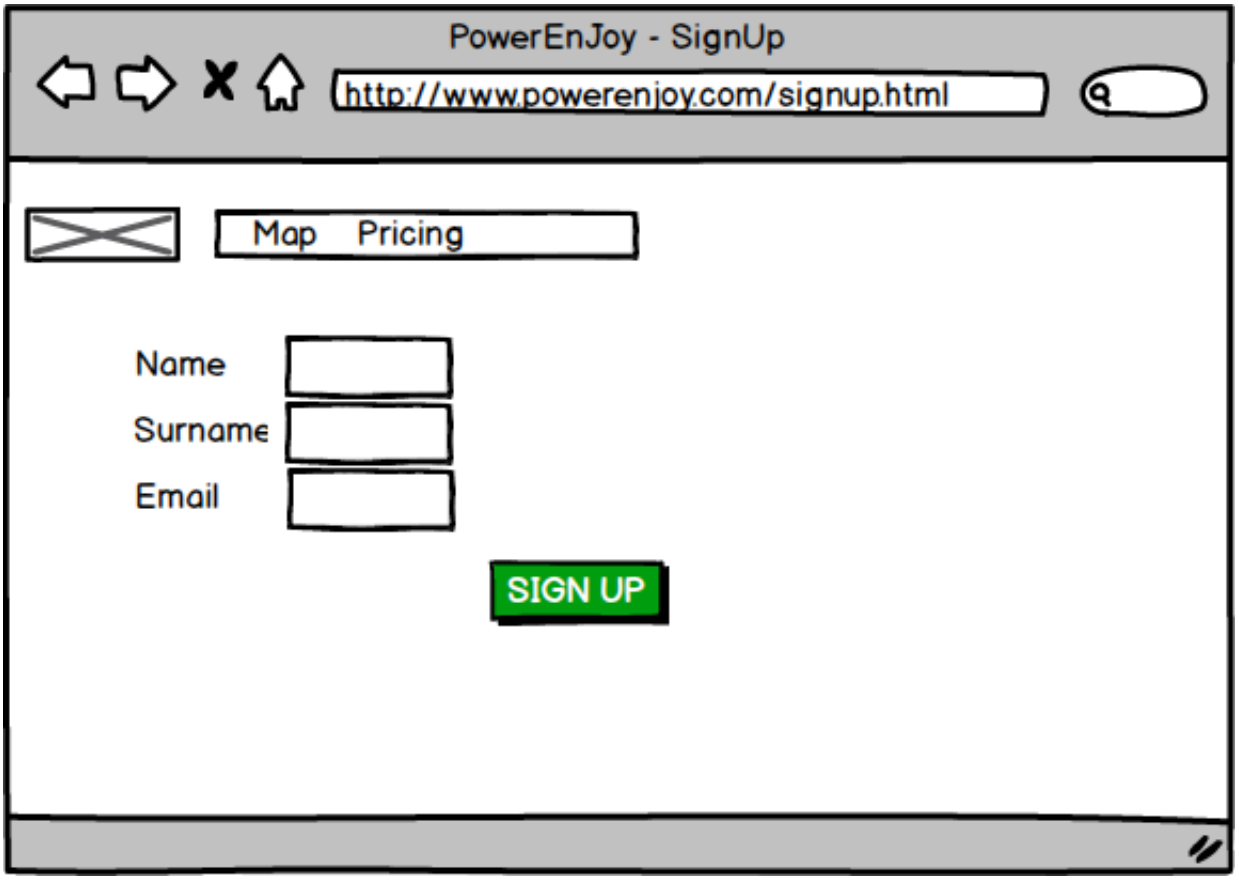

Figure 2: Web Interface - User Registration

4.1.1.2 Registration Page (Web) In this page users must input the core informations to register online: name, surname and email address.

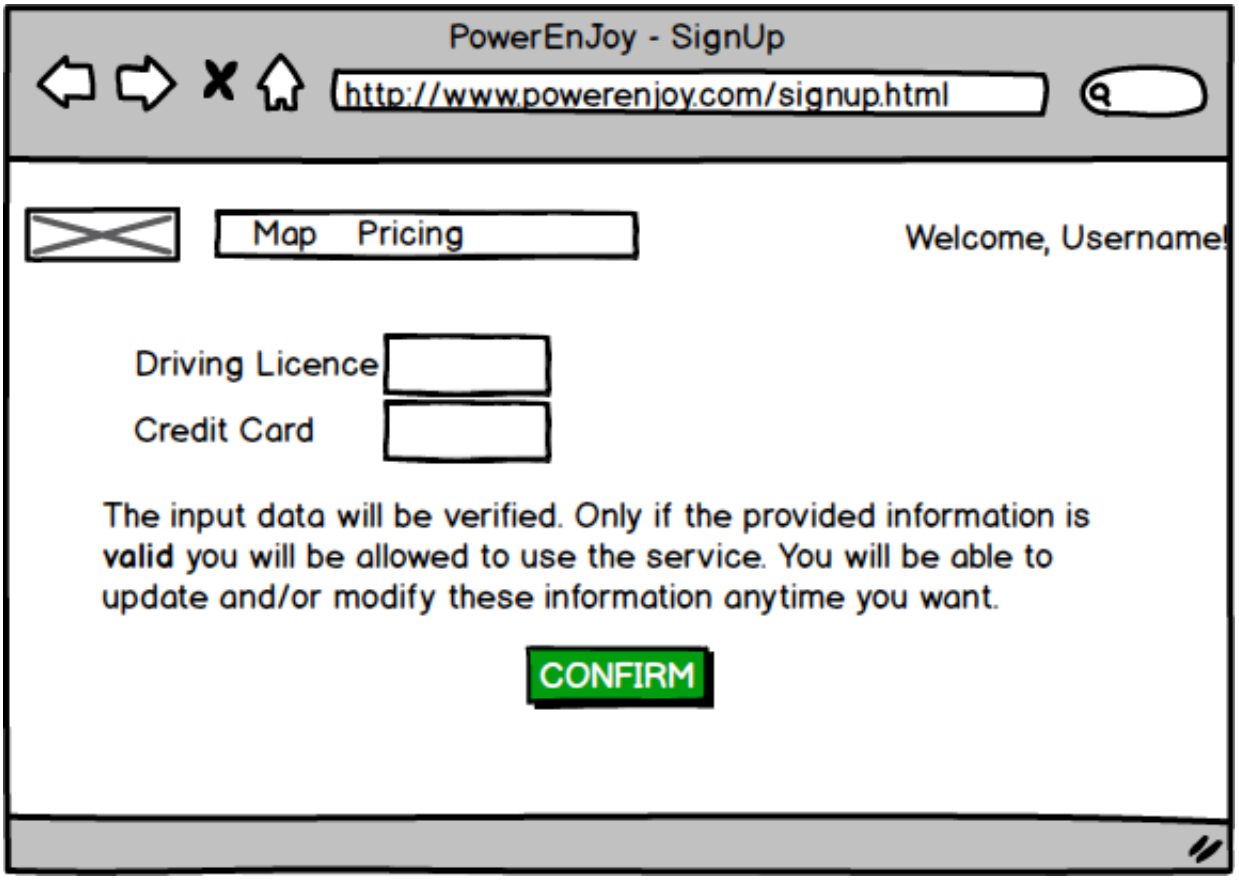

Figure 3: Web Interface - User Further Information

4.1.1.3 Further Information (Web) After having registered and logged in, users must input their Licence and Credit Card in order to use the service.

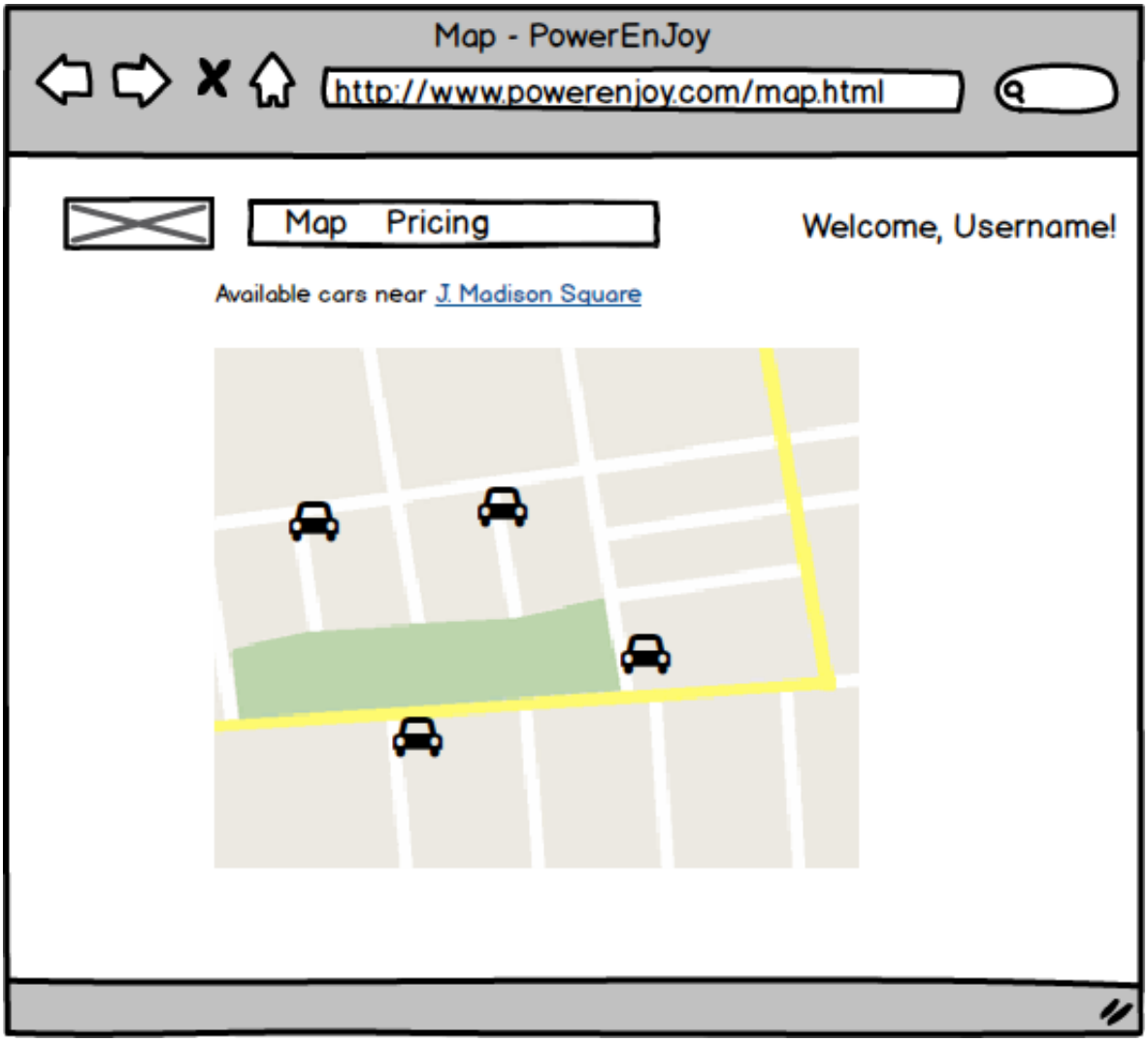

Figure 4: Map

4.1.1.4 Map (Web) All users can view available maps near their position and choose one if they want more info (see next mockup)

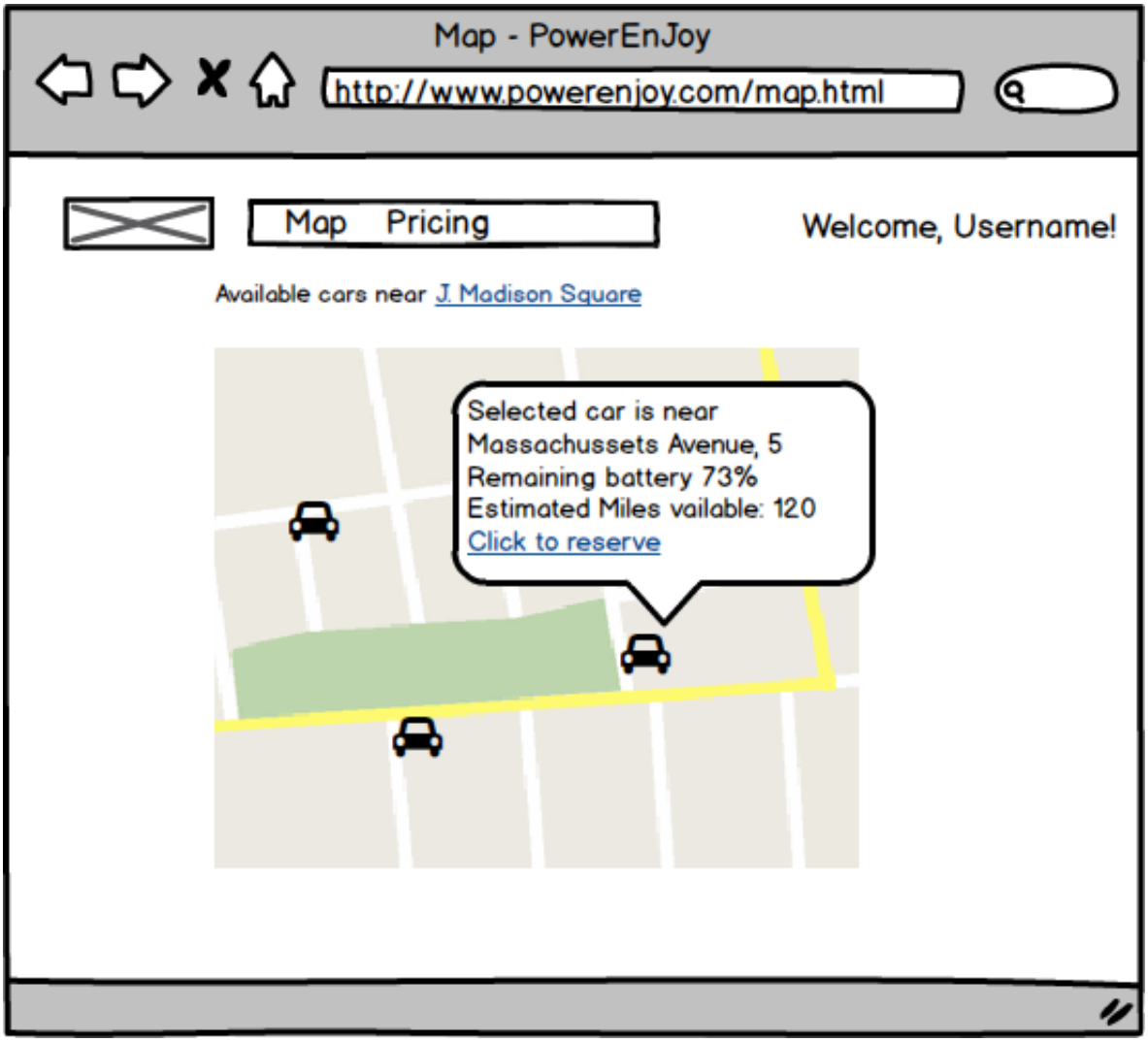

Figure 5: Selected car

4.1.1.5 Map - Selected Car (Web)

4.1.1.6 Selected Car Confirmation (Web) After having selected a car and having pressed "Click to reserve", users are asked to confirm their choice one last time, to avoid mistakenly pressed links or misread information.

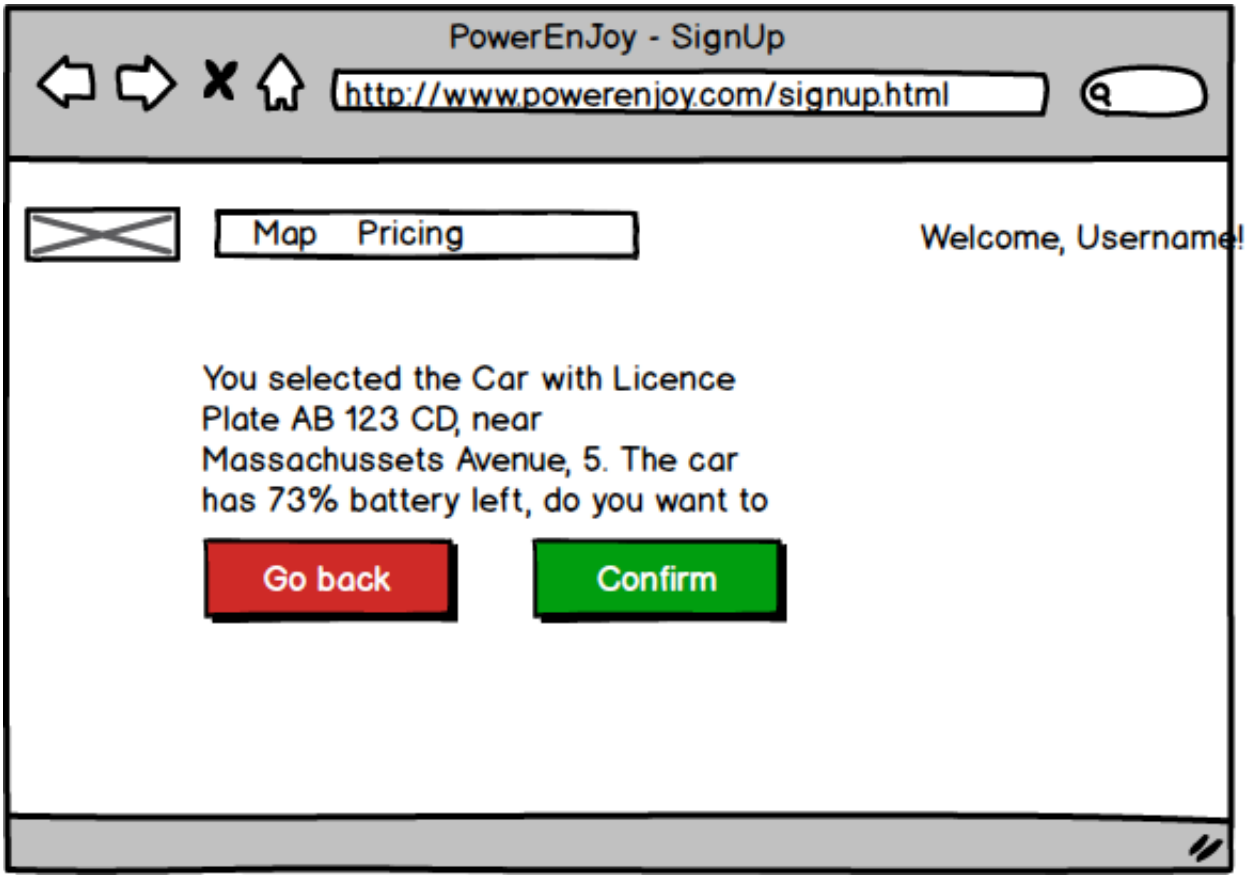

Figure 6: Car Confirmation Screen

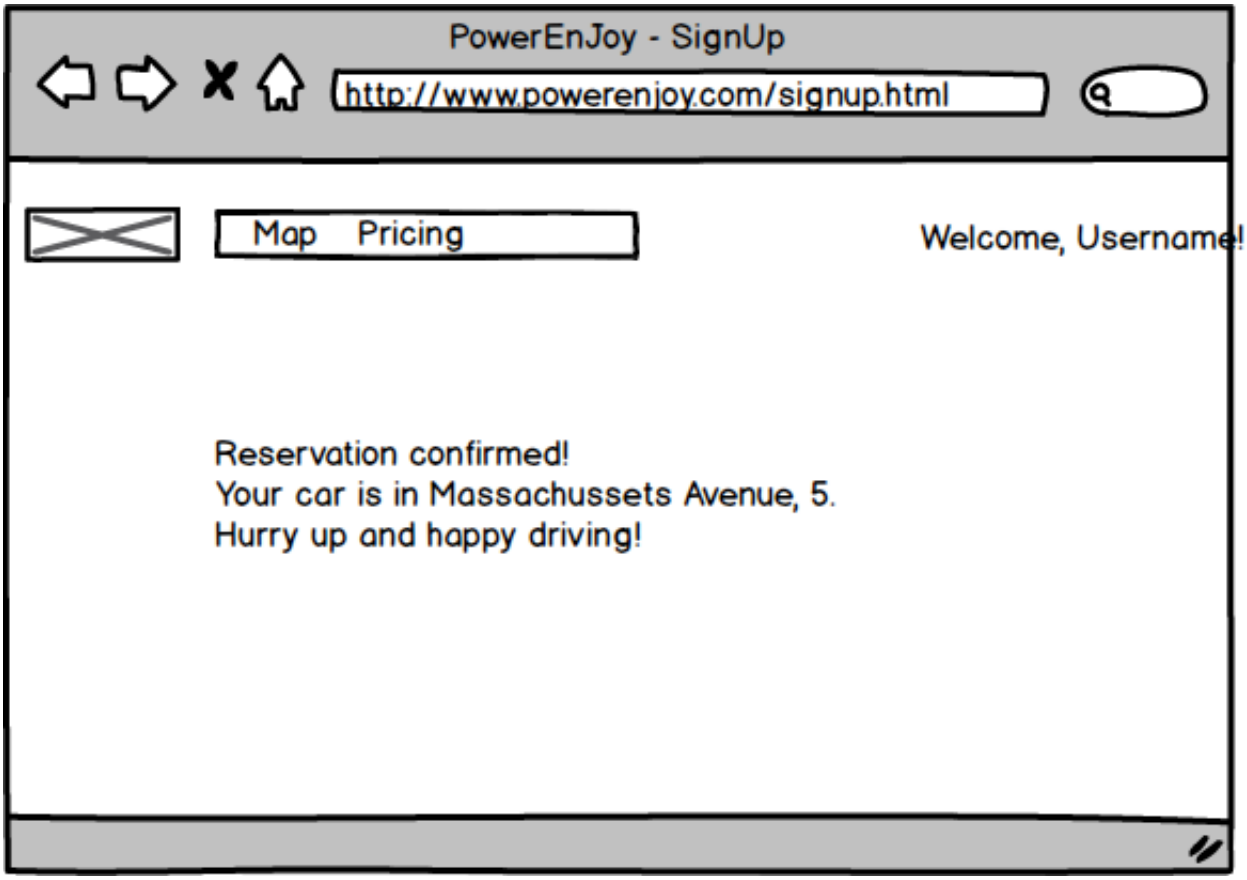

Figure 7: Reservation Confirmed

4.1.1.7 Reservation Confirmed (Web)

4.1.2 Mobile Interfaces

4.1.2.1 Home (Mobile) From the App's home page users can either login or create an account. Login is handled inside the app, while to create an account the user is redirected to the website.

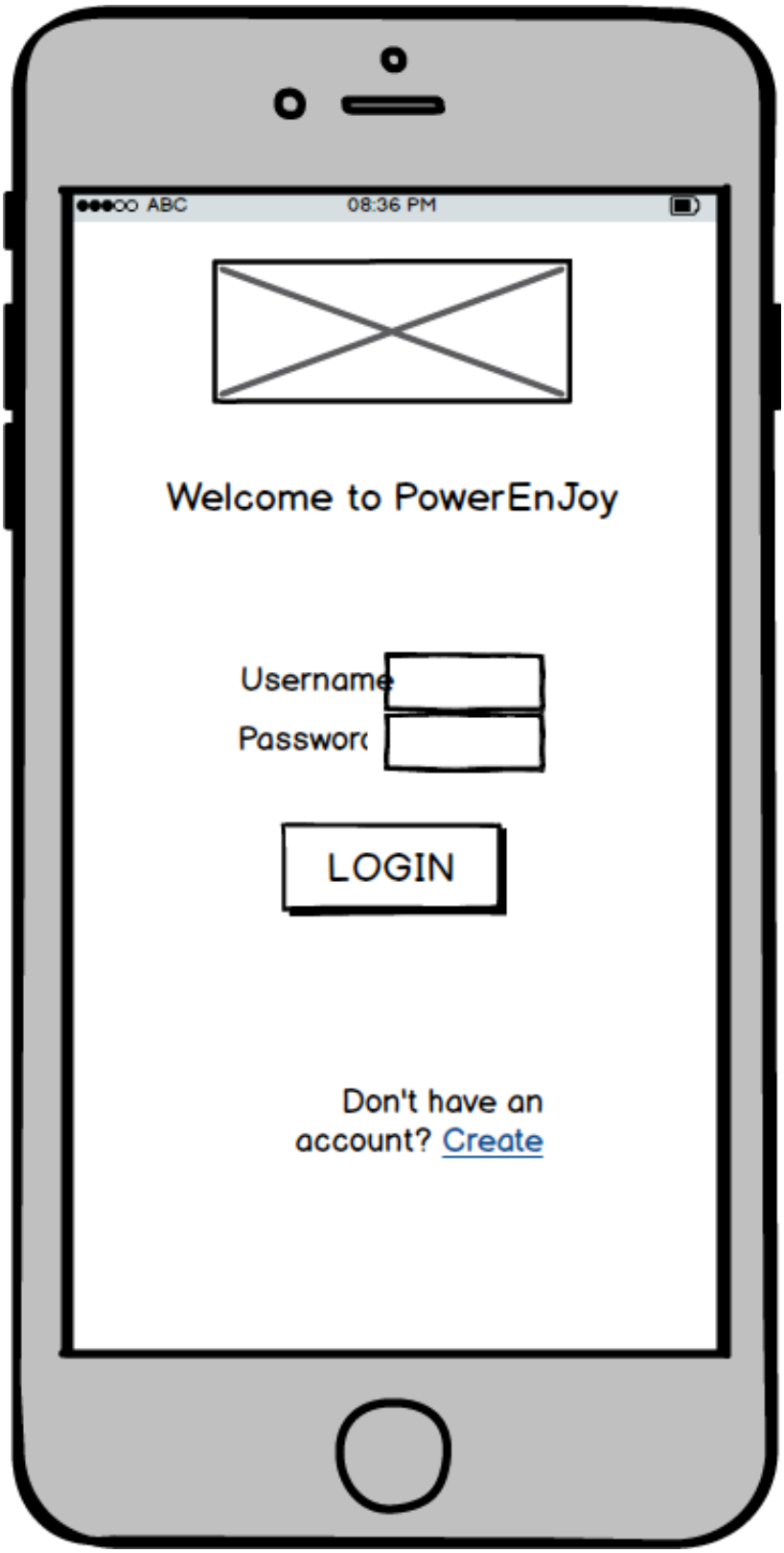

Figure 8: Mobile Home Page

4.1.2.2 Map (Mobile) The user is shown a map displaying all cars that are nearby. His position can be calculated using the built in GPS receiver or can be manually input.

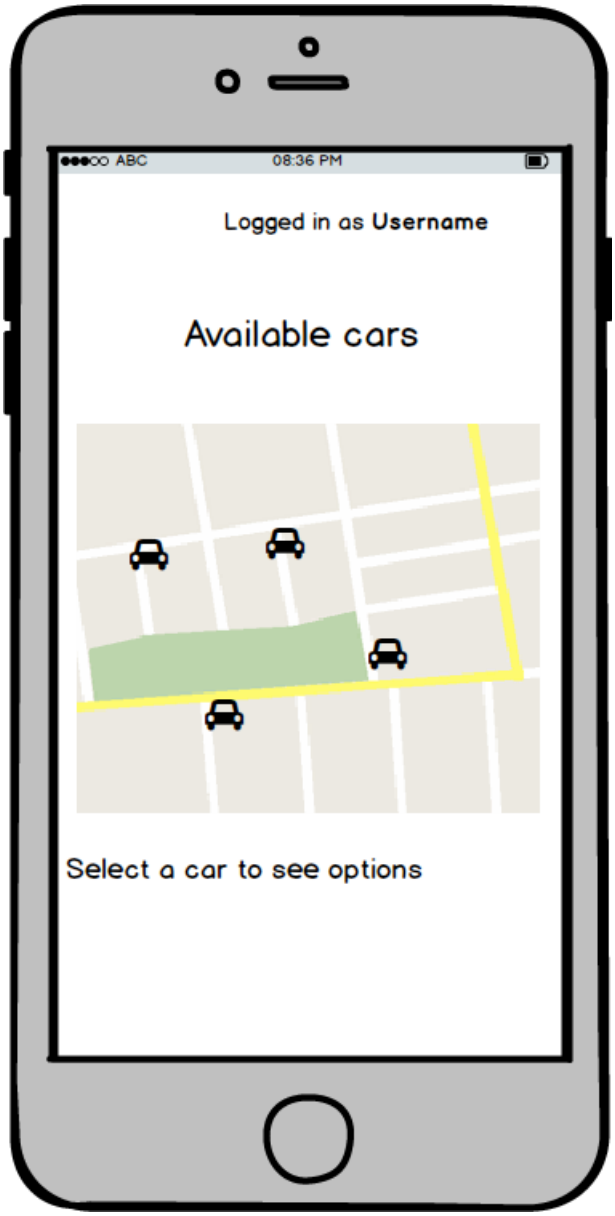

Figure 9: Map Mobile

4.1.2.3 Selected Car (Mobile)

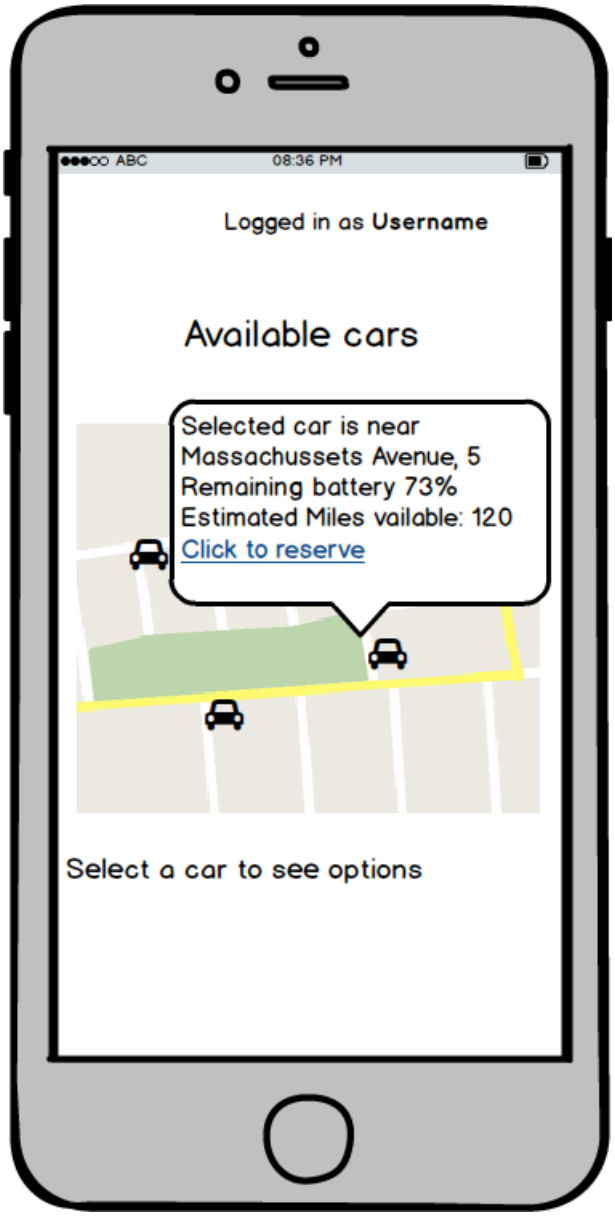

Figure 10: Selected Car Mobile

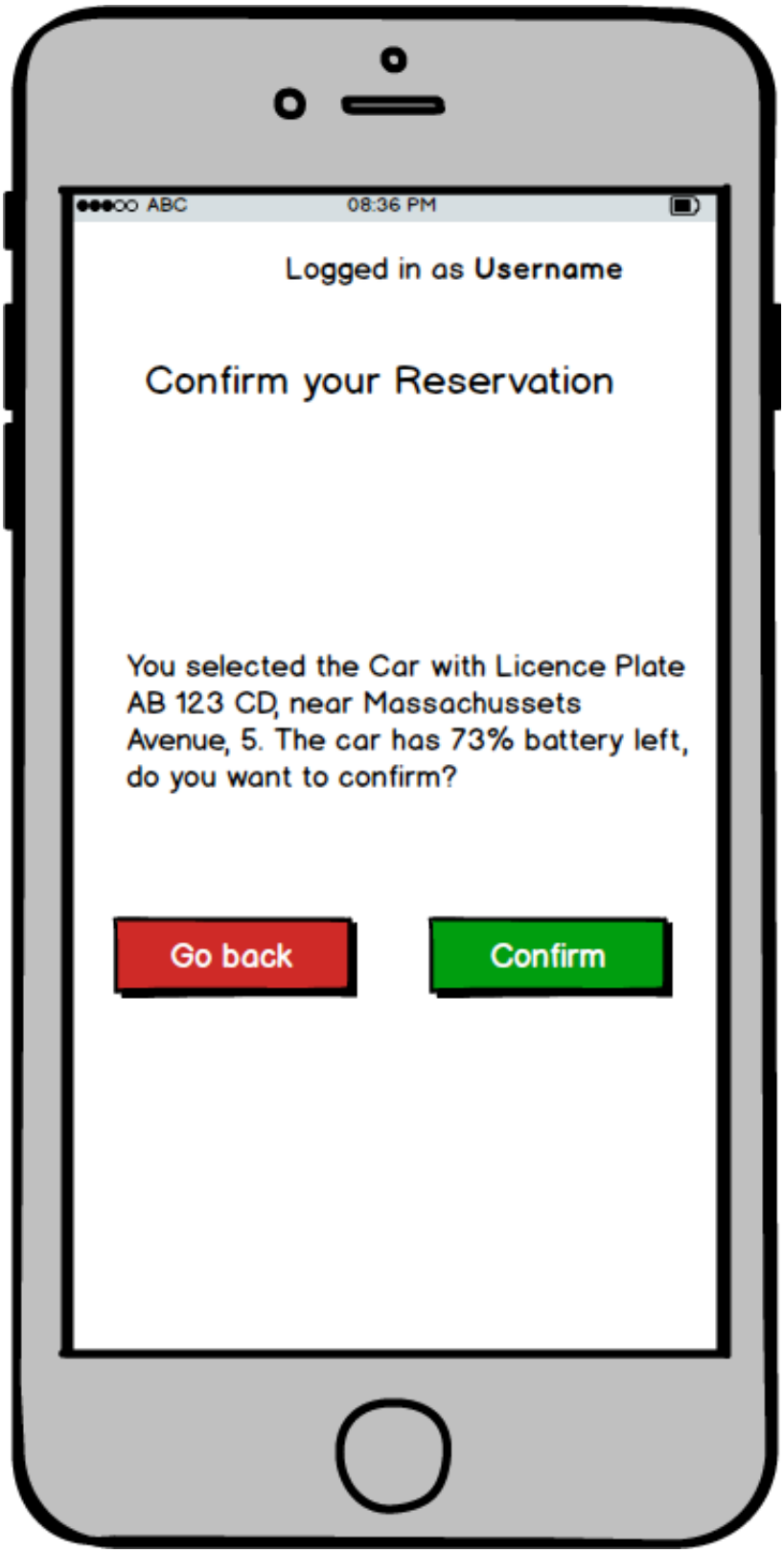

Figure 11: Car Confirmation Mobile

4.1.2.4 Car Confirmation (Mobile)

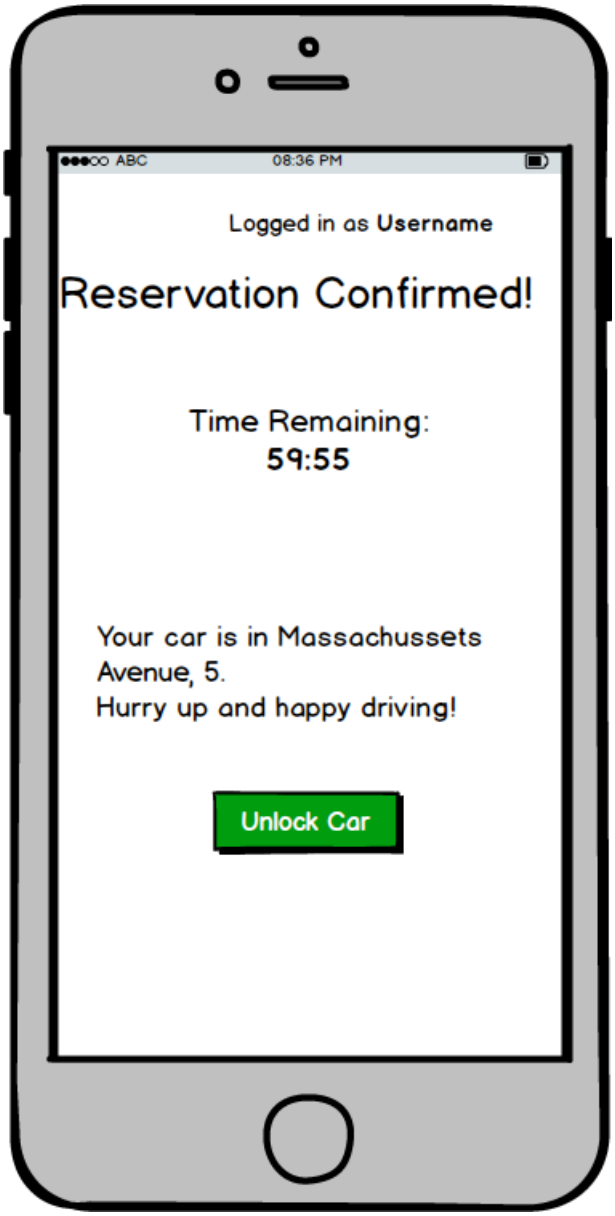

Figure 12: Reservation Confirmed Mobile

4.1.2.5 Reservation Confirmed (Mobile)

4.1.2.6 Car In Use (Mobile) While using the car, Users can decide to park it — which signals the system that the car will be picked up by the same user and that the rental is not to be terminated — or to end the rental.

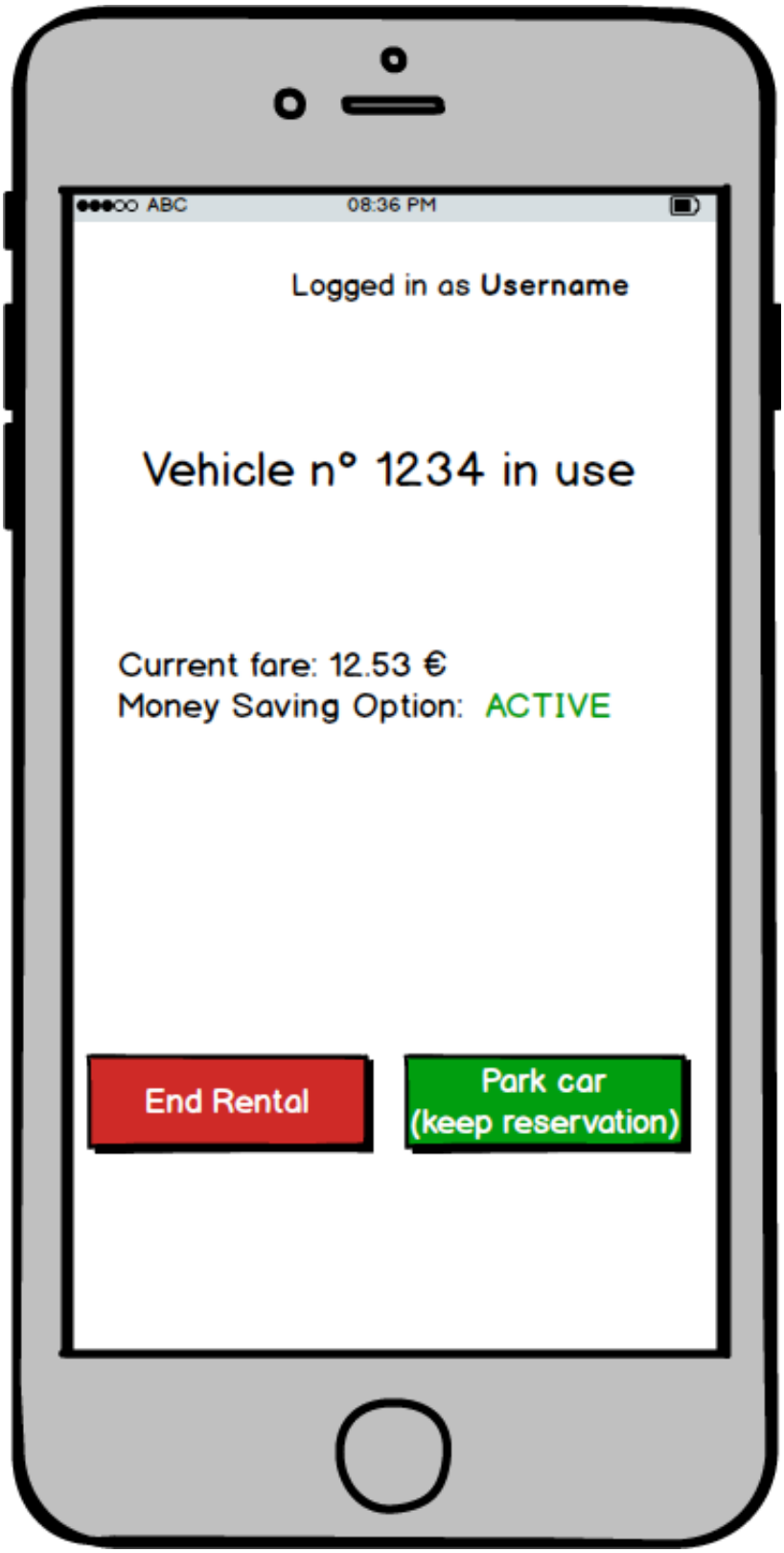

Figure 13: Car in Use

4.1.2.7 Car Parked (Mobile) If the car is already parked users can decide to end the rental using the app. In case they want to continue their journey, they only have to jump back on the car.

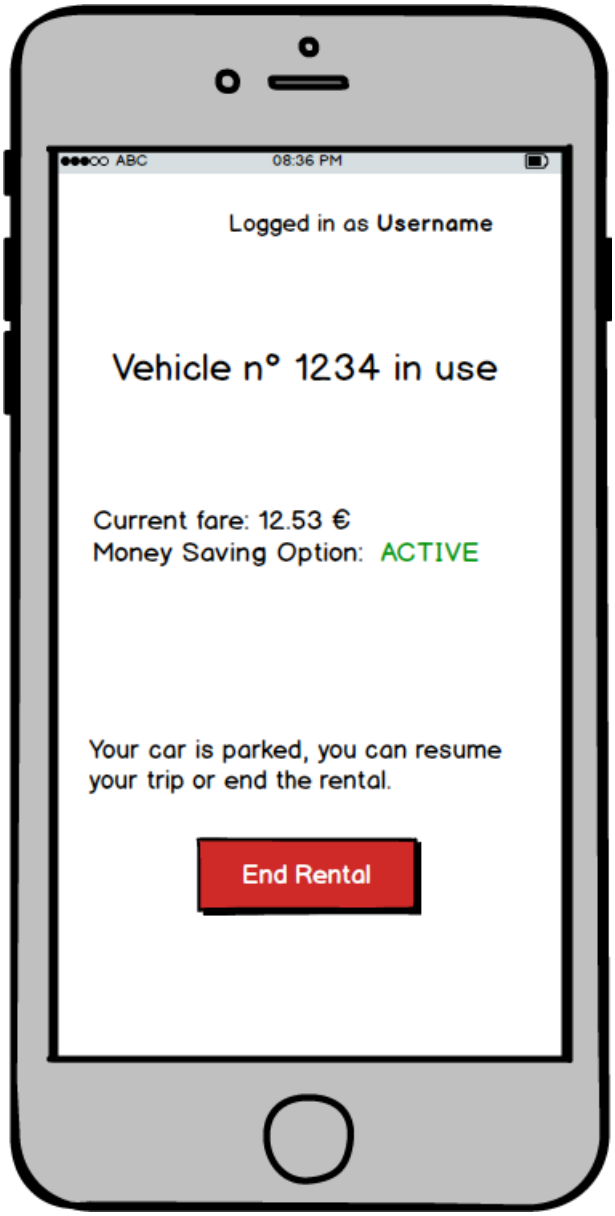

Figure 14: Car Parked

4.1.2.8 Rental Ended (Mobile)

4.2 Operator Interfaces

4.2.1 Web Interfaces

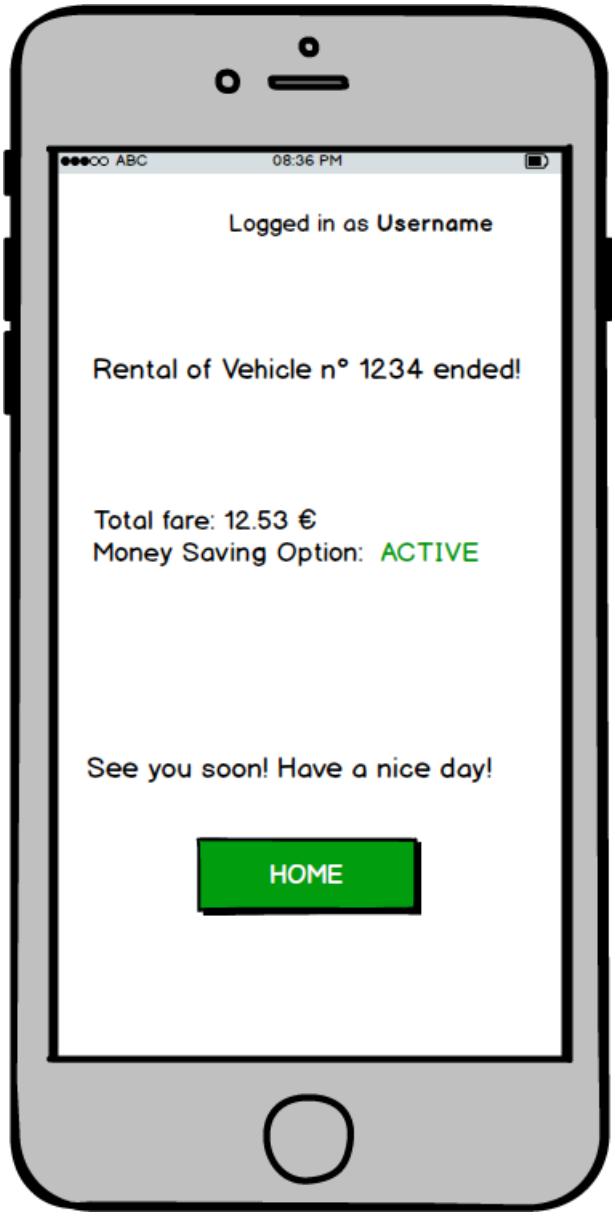

Figure 15: Rental Ended

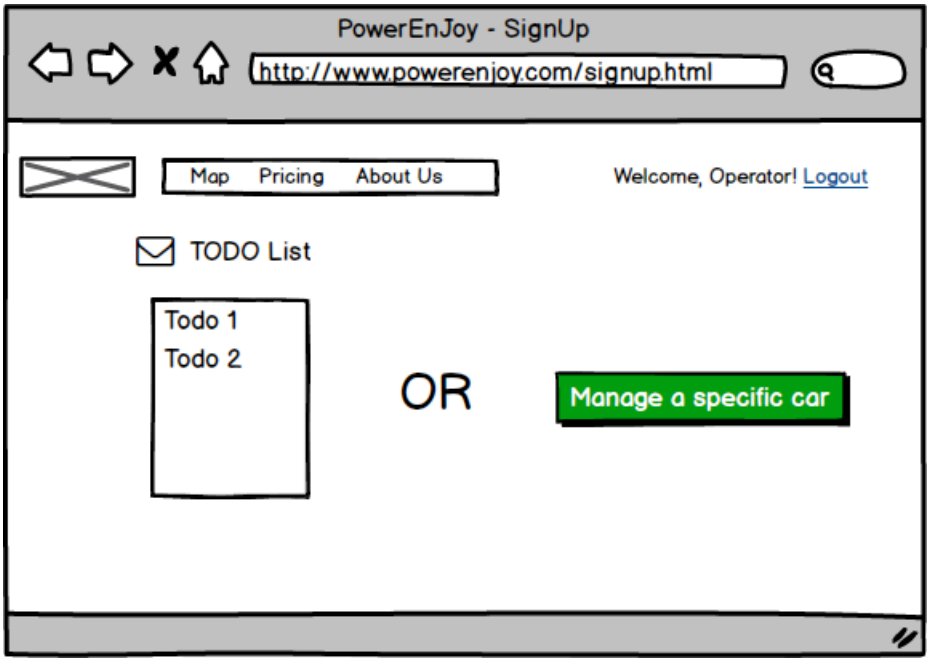

Figure 16: Operator Main Page

4.2.1.1 Operator Main Page (Web)

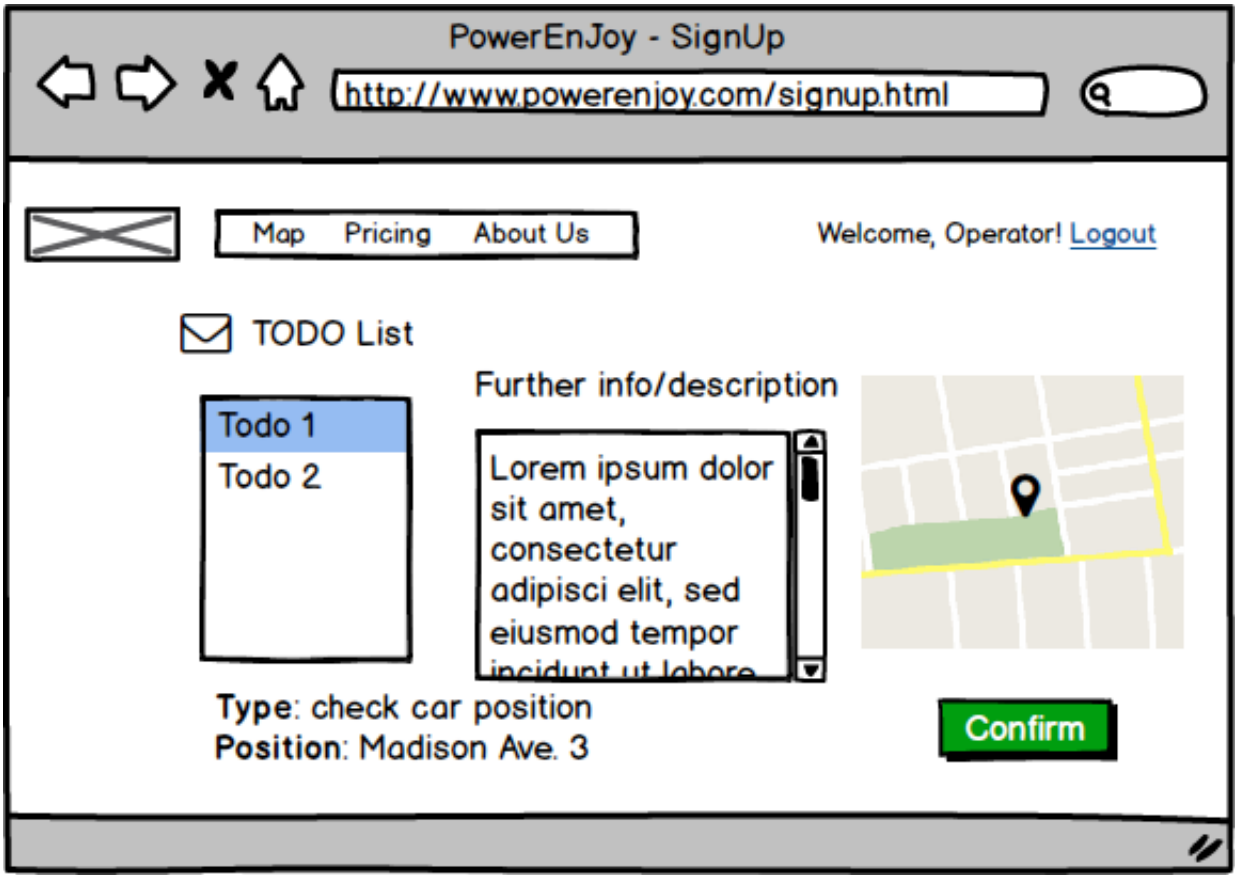

Figure 17: Chosen TODO

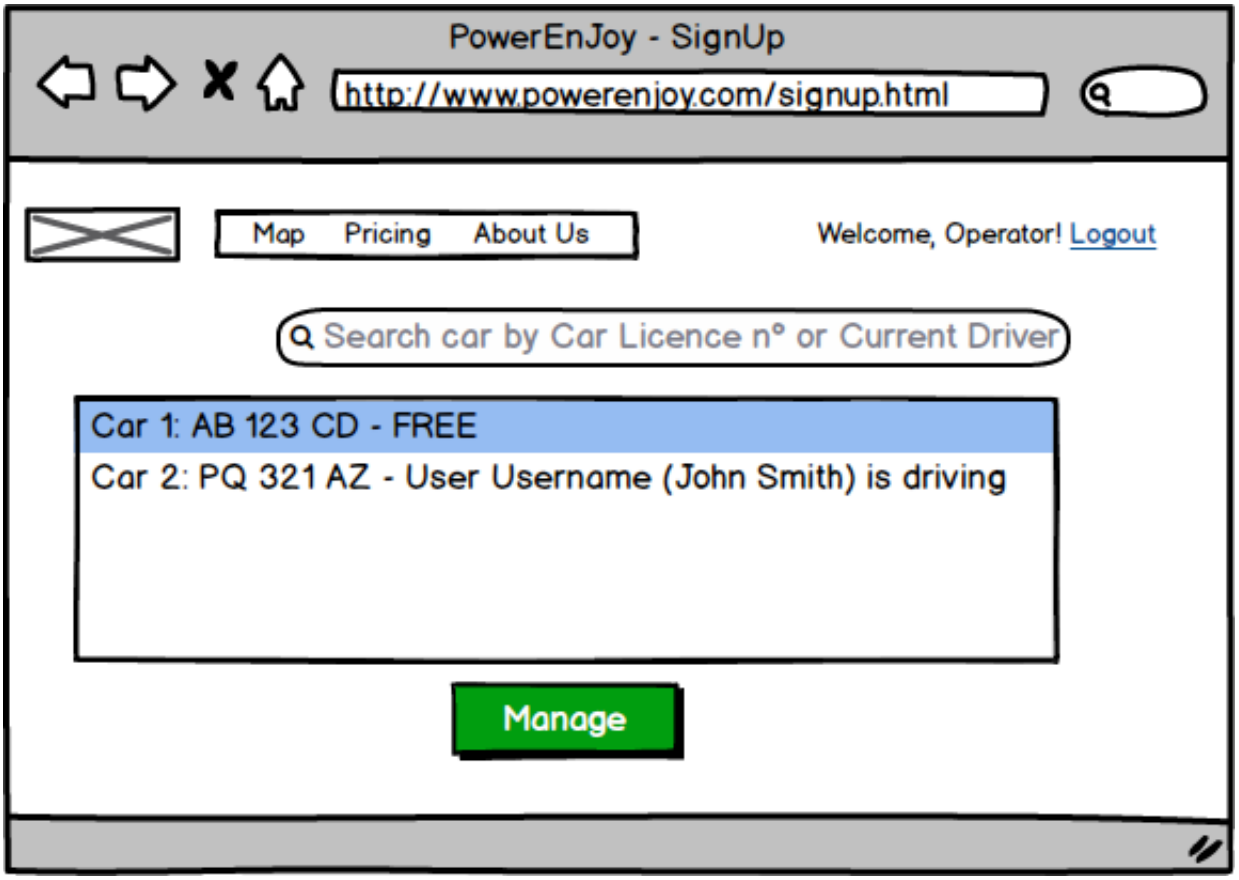

Figure 18: Car Search

4.2.1.2 Operator chose TODO (Web)

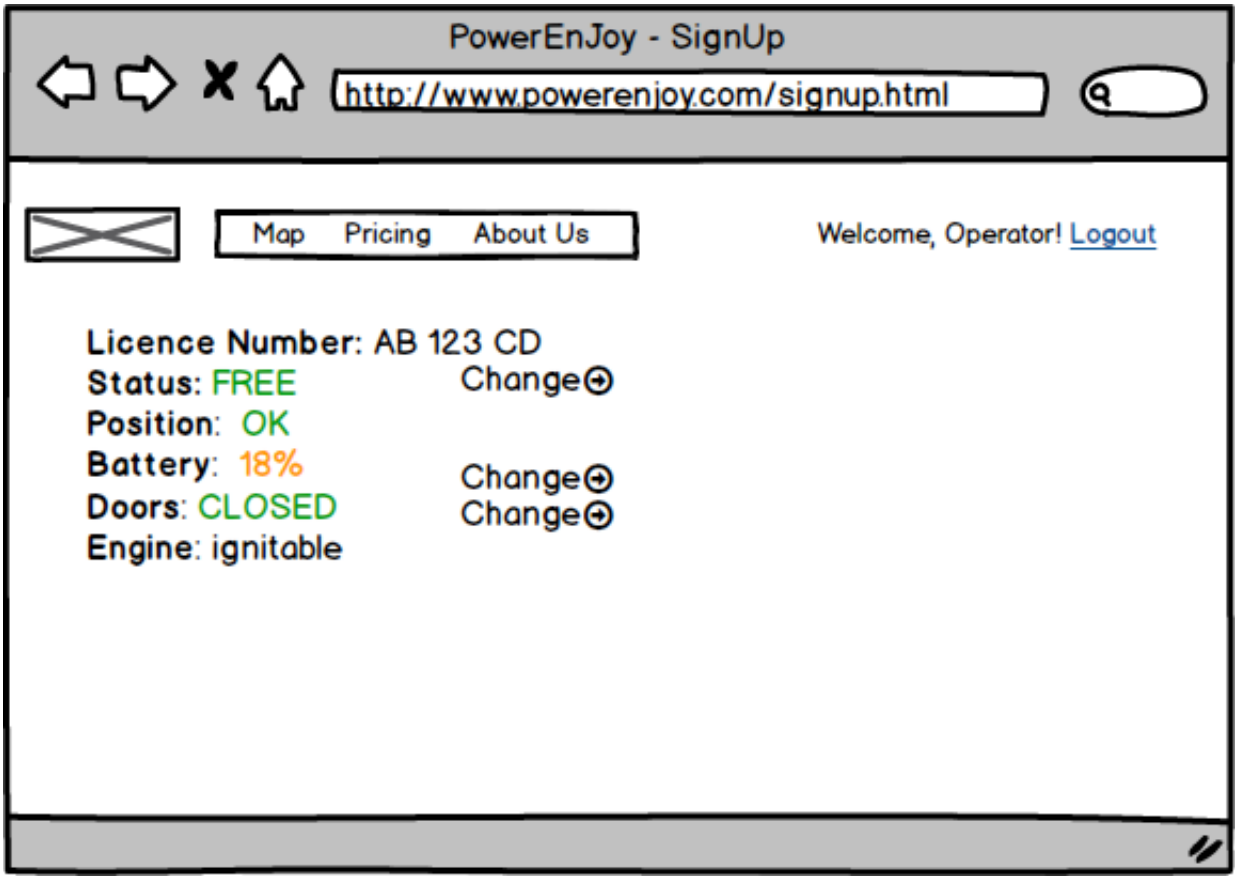

Figure 19: Car Details

4.2.1.3 Operator Searched Car (Web)

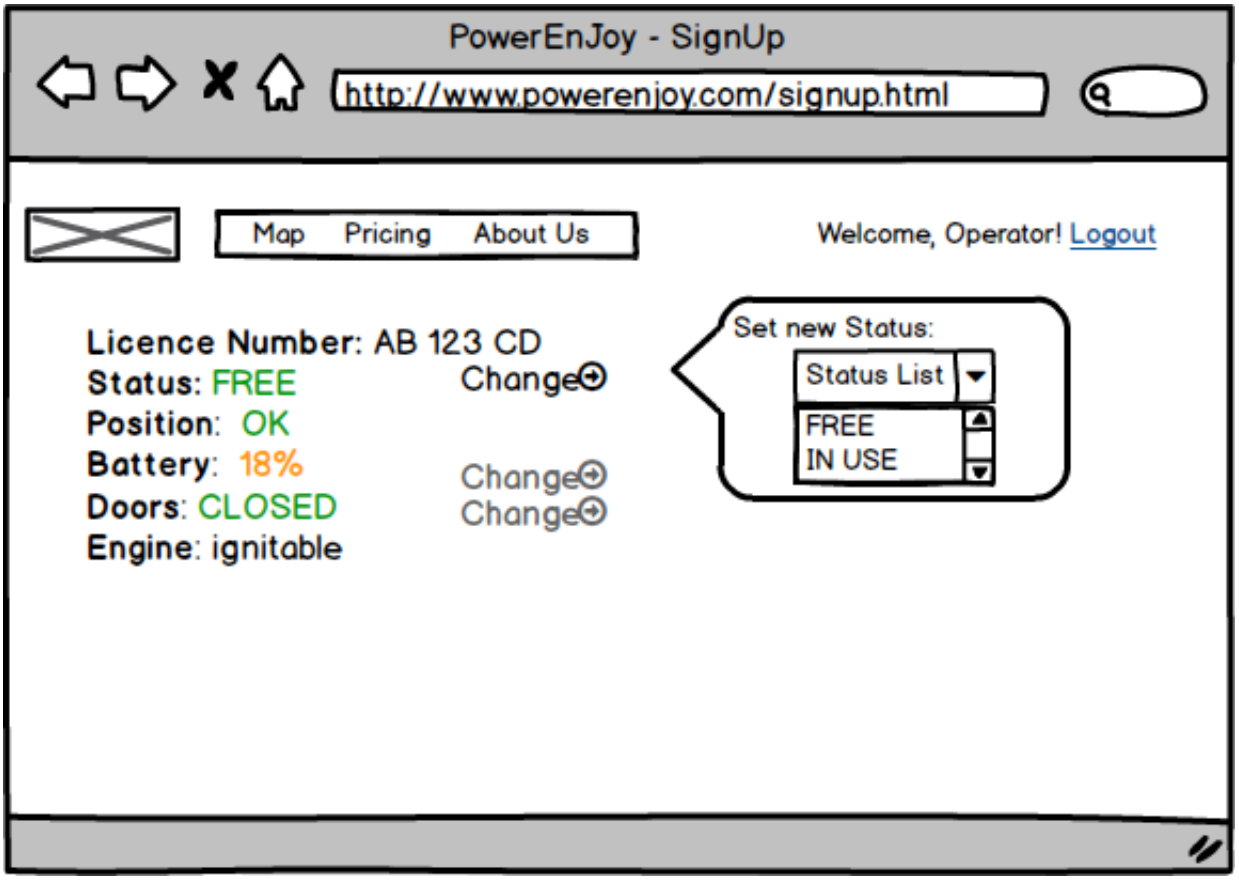

Figure 20: Changing a detail

4.2.1.4 Car Details (Web)

4.2.1.5 Changing a Car parameter - Sample (Web)

4.2.2 Mobile Interfaces

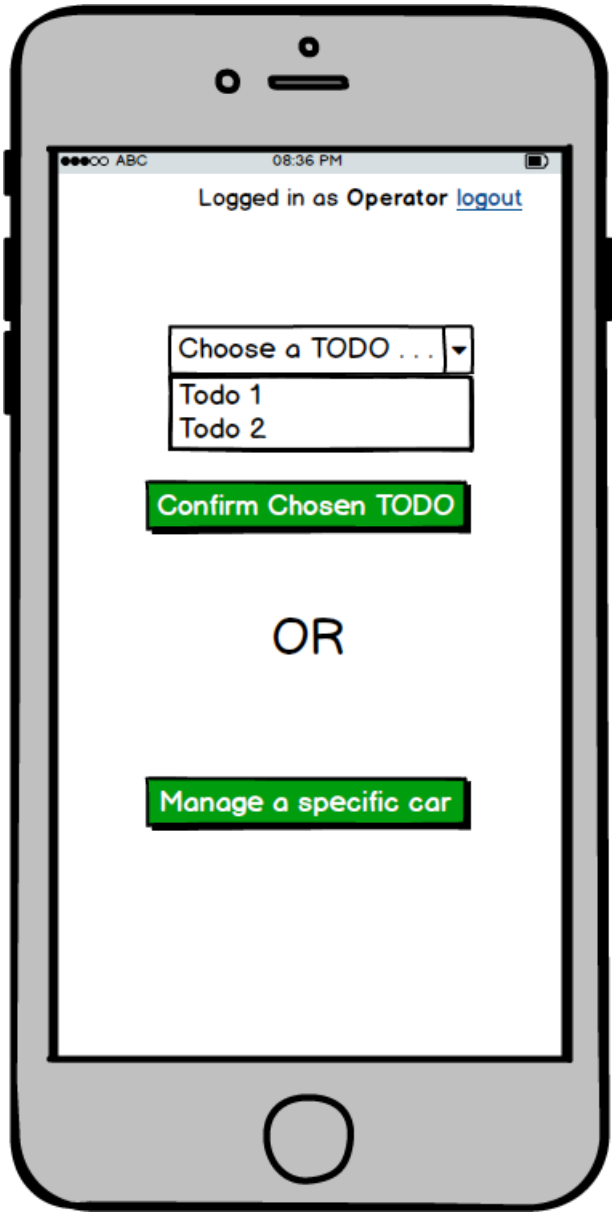

Figure 21: Operator Main Mobile

4.2.2.1 Main Page (Mobile)

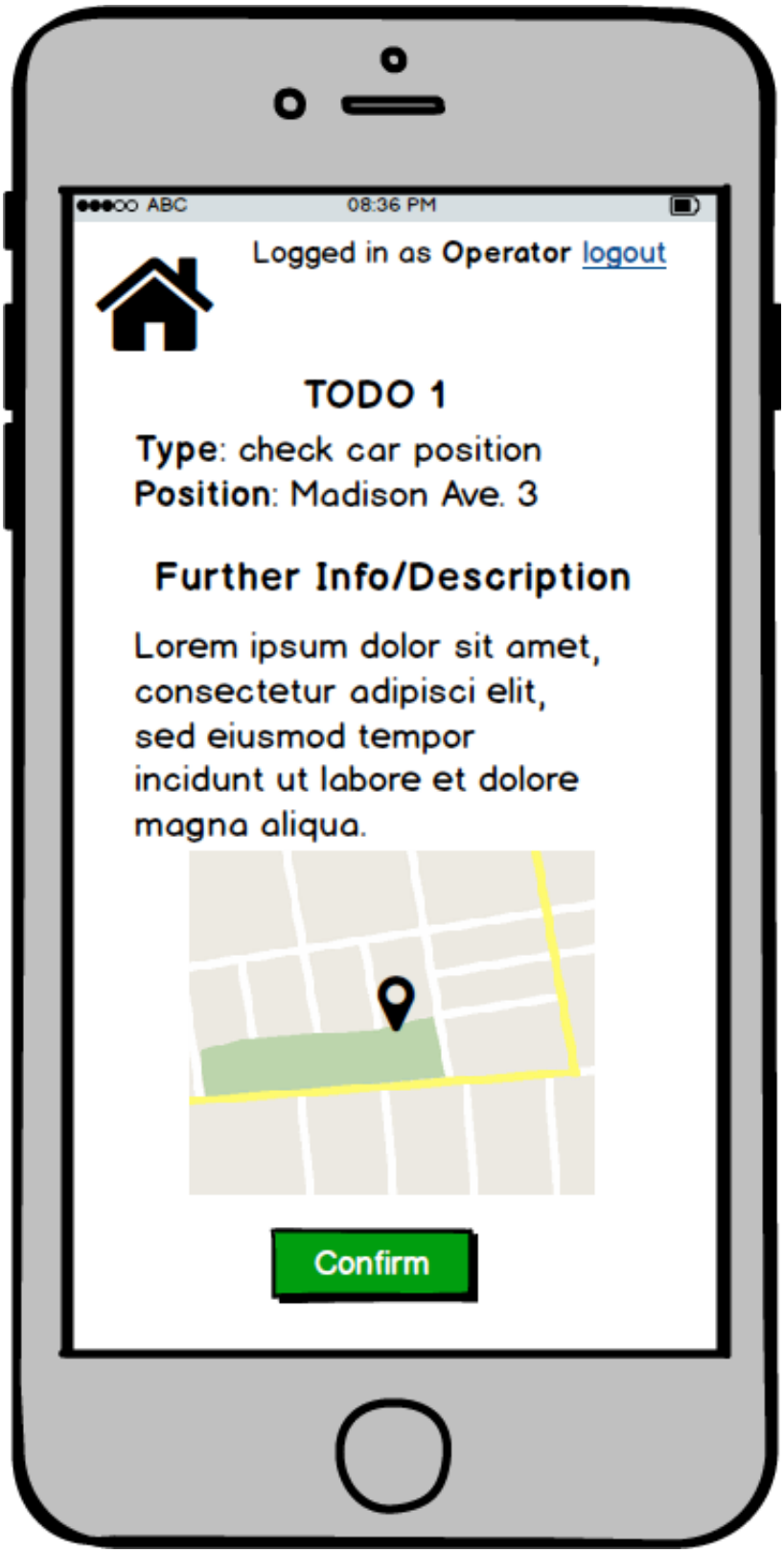

Figure 22: Chosen Todo

4.2.2.2 Operator chose TODO (Mobile)

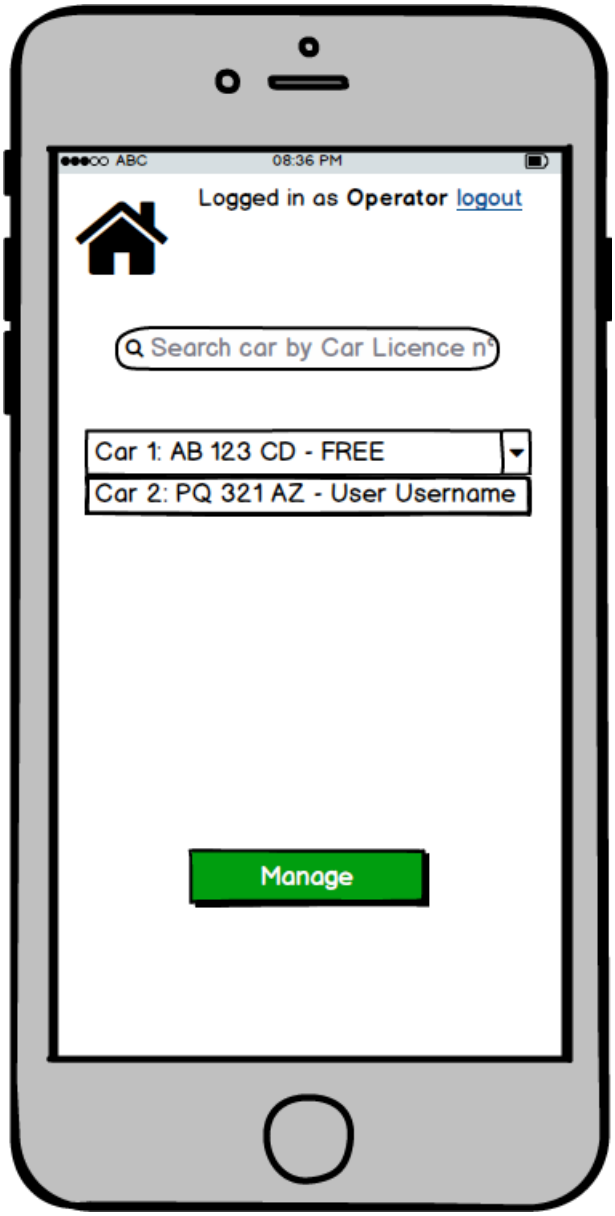

Figure 23: Car Search

4.2.2.3 Operator Searched Car (Mobile)

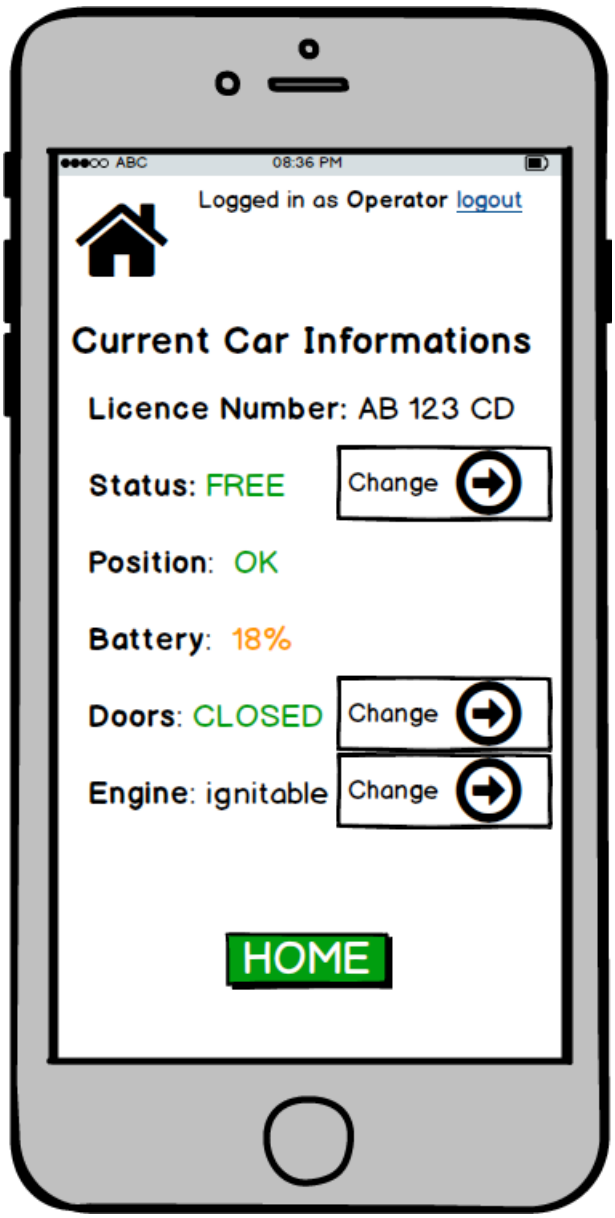

Figure 24: Car Details

4.2.2.4 Operator Car Details (Mobile)

Figure 25: Changing a Car's parameter

4.2.2.5 Changing a Car parameter - Sample (Mobile)

5 Requirements traceability

6 Effort spent

Component	Time spent (in hour)
Philippe Scorsolini	23
Lorenzo Semeria	18
Gabriele Vanoni	24.5