Politecnico di Milano  
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Software Engineering II Assignment

PowerEnJoy - car sharing

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PowerEnJoy



Car Sharing App

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# INTRODUCTION

## 1.1 Purpose

This document has the purpose to give more information about the PowerEnJoy System than the Requirement Analysis and Specification Document (RASD).

This document addresses developers and has the objective to identify:

* The architectural design;
* The design choices that we have made;
* How the system components interface with each other;
* The behavior of the system at runtime.

## 1.2 Scope

The system has the purpose of allowing users and more in general citizens to rent cars easily via mobile app in order to increase people’s mobility and decrease city pollution.

To use the application and the service that comes with it, people has to register and join a community of car sharers; after registration, they can rent cars and drive wherever they want to go with the condition to bring back the car in a safe area.

Users can choose a car from the nearest parking suggested by the app based on their GPS position or on the given address, and they can pick it up with a limited time.

Anytime during the driving, users can set the car in pit stop mode to park the car in a sort of “reserved” state where the car is still linked to the user but it is stopped and parked outside of the safe areas.

At the end of the ride, users must return the car in a safe area and the system calculates the final amount with respect to certain situations that give user discounts or surcharges: to help users with low budget, there’s also a money saving option that calculates the nearest special parking area to the final destination of the user to get the maximum amount possible of discounts.

Therefore, the final objective of the system is to allow the company to manage the car requests faster and automatically to substitute the previous system, described in section 1.2 of the RASD.

## 1.3 Definitions, Acronyms, Abbreviations (UNDER CONSTRUCTION)

All the words defined in the RASD at section 1.5 are still valid and they will appear in this document too.

DD: Design Document.

RASD: Requirements analysis and Specification Document.

## 1.4 Reference Documents

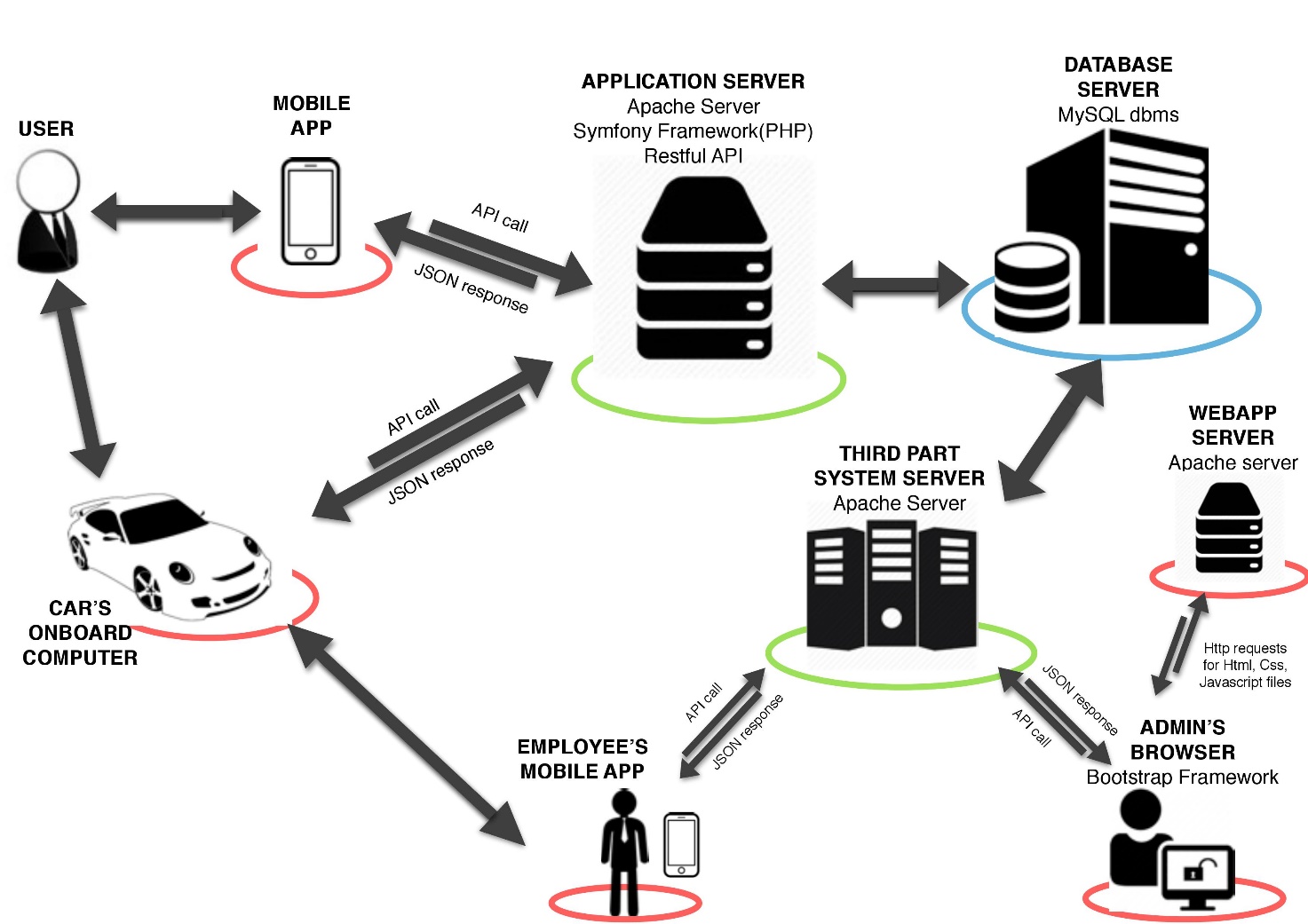
* RASD;
* Assignment AA 2016-2017.pdf;
* Sample Design Deliverable on Nov 2.pdf.

## 1.5 Document Structure

* **Introduction:** this section opens the document and shows the main purpose of the system-to-develop, the structure of the entire document and deepens some aspects introduced in the RASD.
* **Architecture Design:**
  + Overview: this section illustrates the physical deployment of our system;
  + High-level components and their interactions: shows how the different components of the system interface with each other and with the third-party system;
  + Component view: deepens the view of the components and gives more details;
  + Runtime view: this section explains with sequence diagrams, how the system should work during different tasks;
  + Component Interfaces: presents the communication of the different components;
  + Selected architectural designs and patterns: this section describes all the design patterns that we used to model the system and how they work.
  + Other design decisions: the title is self-explaining.
* **Algorithms Design:** this section includes some algorithms that manages particular tasks of the system. The algorithms are written in pseudo-code in order to clarify the behind the scenes of system with the maximum readability.
* **User Interface Design:** it should include design mockups to describe the possible result of the mobile application.
* **Requirements Traceability:** shows where the goals defined previously in the RASD take shape in design elements.

# ARCHITECTURAL DESIGN

## 2.1 Overview



Caption:

Red: Tier 1 – Presentation

Green: ier 2 – Business logic

Blue: Tier 3 – Data Manipulation

As we can see our PowerEnJoy system has a 3-tier architecture:



**The presentation tier,** or user services layer, gives a user access to the application. This layer shows data to the user and optionally permits data input. The two main types of user interface for this layer are the traditional application and the Web-based application (used by the admin of third party system).

**The application layer** runs business logic for both client sides (user and admin) to ensure that effective communication with instances of the client over the network is possible.

**The data layer**: This is the actual DBMS access layer. It can be accessed through the application layer. This layer consists of data access components to aid in resource sharing and to allow clients to be configured without installing the DBMS libraries and ODBC drivers on each client.

At this point, we would like to point out some important observations:

* our server is going to be used by many different clients that we do not have control over.
* we want also to be able to update the server regularly without needing to update the client software.

So we need to minimize the coupling between client and server components in this application. In order to cover this requirements we decided to use RESTful API. RESTful web services, as the name suggests, are resources on the web that can be used to get specific information. These services basically portray the working of the REST API. The client requests a resource from the server and the server sends back the response.

In this way on the Client there will be not a static GUI but a dynamic one that is generated on client side.

## 2.2 High level components and their interaction

[immagine del component interactions]

The high-level components architecture is composed of seven different elements. The main element is a singleton, the central called “main System”. The main System receives requests of reservations from another element: the client. Clients can initiate this communication only from mobile application. This communication is made in asynchronous way since the client, that initiates the communication, has to wait the answer of the main System that acknowledges him that his request has been taken into account. In this way, according to the request of the client, System provides him, for example, after search the availability of the car, all the possible parking areas where to pick the car up.

The main System will also send an asynchronous message to the client in the form of email to inform about, for example, the receipt of the booking (with the place and the number of the car) or the receipt of the bill for the payment.

The main System communicates also with the car: after the user tries to unlock the car, the main system provides user’s credentials, in this way the on board computer will recognize him and unlock the car, starting charging his bill. The communication between the main System and the on Board Computer is also asynchronous; in this way, the car sends to the main System all the feedbacks about its state and position, so the main system will know all the information about all cars.

The main system communicates also with a third type of component, the third party System through the database.

The last type of component is the database. The database still manages registration of new users, car states, quantities of cars and plugs, information about car distribution in the city, information about user’s receipt, account information, trips, booking etc. Therefore, the main System and the third party system communicates synchronously with the old database to extract the right information when needed.

## 2.3 Component view

[immagine component view]

* User.Authentication: handles the registration and the login of the user in the system;
* User.Positioning: handles the detection of user’s position;
* User.Reservation: handles all the actions linked to the reservation client side;
* User.Payment: handles the payment method that user inserts;
* System.UserHandler: handles multiple users and their authentication. Also allow them to see their personal information;
* System.ReservationHandler: handles the reservation server side. Checks if the user can rent a car or if a particular car can be rented;
* System.DataManagement: handles the communication between the MySQL server and the main system;
* Database: contains the MySQL database;
* Car.GPS: handles the detection of car position;
* Car.Sensor: handles all detection made by car sensors and sends them, together with the position, to the central system on car shut down.

## 2.4 Deploying view

[immagine del deployment ed eventuale descrizione]

## 2.5 Runtime view

[immagini dei sequence e spiegazione del funzionamento]

## 2.6 Component interfaces

[immagine component interfaces]

## 2.7 Selected architectural styles and patterns

[immagine class diagram]

### 2.7.1 Overall architecture

### 2.7.2 Protocols

### 2.7.3 Design patterns

## Other design decisions

# ALGORITHM DESIGN

# USER INTERFACE DESIGN

The User Interface Mockups are already included in the RASD at section 3.2.

# 5 REQUIREMENTS TRACEABILITY

The system has to fulfill the goals defined previously in the RASD. We put a list below that contains all the goals defined previously but in a shorter shape with every component that fulfills them one by one.

* [G1] Users must have the possibility to register to the system;
  + UserAPP.AuthenticationManager.Registration;
  + System.UserManager.UserRegistration;
  + System.DataManagement;
  + Database
* [G2] The user can select the parking lot from a subset of them where to pick the car;
  + UserAPP.ReservationManager.ReservationCreation;
  + System.ReservationManager.ReservationManager;
  + System.ReservationManager.BookingManager;
  + Car.GPS;
* [G3] The user will be able to reserve a car for up to one hour from the pickup, from the list of the available ones in the selected parking lot;
  + System.ReservationManager.ReservationManager;
  + System.ReservationManager.BookingManager;
  + Car.GPS;
  + System.DataManagement;
  + Database;
* [G4] The system must control that every reserved car will be picked in the time range;
  + UserAPP.UtilityUserManager.UnlockCarManager;
  + UserAPP.UtilityUserManager.NotificationReader;
  + System.ReservationManager.ReservationManager;
  + System.ReservationManager.BookingManager;
  + System.ReservationManager.UnlockCarManager;
  + Car.SensorManager.UnlockCar;
* [G5] The system must charge the user by a certain amount of Euros per minute;
  + Car.GPS;
  + Car.SensorManager.UnlockCar;
  + System.ReservationManager.UnlockCarManager;
  + System.ReservationManager.PaymentManager;
  + UserAPP.UtilityUserManager.Payment;
* [G6] The system must provide the user the possibility to select the money saving mode;
  + UserAPP.ReservationManager.ReservationCreation;
  + System.ReservationManager.ReservationManager;
  + System.ReservationManager.BookingManager;
  + Car.GPS;
* [G7] To close the bill, the user must park the car in one of the predefined parking areas.
  + System.ReservationManager.ReservationManager;
  + System.ReservationManager.BookingManager;
  + Car.GPS;
  + System.ReservationManager.PaymentManager;
  + UserAPP.UtilityUserManager.Payment;
  + System.DataManagement;
  + Database;

# 6 REFERENCES

## 6.1 Used tools

# 7 HOURS OF WORK