

A.U. : 2016-2017

---

UNIVERSITY OF SOUSSE  
NATIONAL SCHOOL OF ENGINEERING OF SOUSSE

Graduation project report

**Applied Computer Engineering**

Option: Distributed Systems

---

# **Developing a ratings and reviews web app for sustainable tourism**

---

By: Moetaz Bellah Ben Charrada

President : Mr. Imed Bennour, ENISO

Member : Mr. Naoufel Khayati, ENISO

Company supervisor : Mr. Richard Lindberg, One Planet Rating

University supervisor : Mr. Taha Ben Salah, ENISO

To my family and all my beloved.

## Acknowledgements

I would like to express my gratitude towards my university's supervisor, Mr. Taha Ben Salah, and my company's supervisor Mr. Richard Lindberg for supporting me during my internship and for all the knowledge and experience they shared with me. I would also like to thank all my professors for teaching me and helping me achieve my goals.

# Contents

<b>1</b>	<b>Context</b>	<b>2</b>
1.1	Introduction . . . . .	2
1.2	State of the art . . . . .	3
1.3	Formalism . . . . .	7
<b>2</b>	<b>Specifications</b>	<b>8</b>
2.1	Actors . . . . .	8
2.1.1	Internal actors . . . . .	8
2.1.2	External actors . . . . .	9
2.2	Functionalities' overview . . . . .	9
2.2.1	Register . . . . .	11
2.2.2	Login . . . . .	13
2.2.3	Search . . . . .	15
2.2.4	View details . . . . .	17
2.2.5	Review a place . . . . .	19
<b>3</b>	<b>Design &amp; architecture</b>	<b>23</b>
3.1	Physical architecture . . . . .	23
3.2	Logical architecture . . . . .	25
3.3	Modular architecture . . . . .	27
3.4	Modules . . . . .	27

---

3.4.1	SearchAdModule . . . . .	27
3.4.2	OPR app module . . . . .	29
3.4.3	REST API module . . . . .	33
<b>4</b>	<b>Implementation</b>	<b>44</b>
4.1	Technology choices . . . . .	44
4.2	Screenshots . . . . .	48
4.2.1	Web interface . . . . .	48
4.2.2	API . . . . .	51
4.3	Deployment . . . . .	54
4.4	Testing . . . . .	55
4.5	Work environment . . . . .	58
<b>5</b>	<b>Conclusion</b>	<b>61</b>
5.1	NGINX configuration . . . . .	65

## List of Figures

1.1	screenshot of Tripadvisor . . . . .	4
1.2	screenshot of search results for Trivago . . . . .	4
1.3	screenshot of Momondo . . . . .	5
1.4	screenshot of Kayak . . . . .	5
1.5	example of an expert blog . . . . .	6
2.1	general usecase diagram . . . . .	10
2.2	registration sequence diagram . . . . .	11
2.3	login sequence diagram . . . . .	13
2.4	search sequence diagram . . . . .	15
2.5	view details sequence diagram . . . . .	17
2.6	review a place sequence diagram . . . . .	19
2.7	manager usecase diagram . . . . .	21
2.8	admin usecase diagram . . . . .	22
3.1	The app's physical architecture . . . . .	24
3.2	The app's logical architecture . . . . .	26
3.3	The app's modular architecture . . . . .	27
3.4	searchAd class diagram . . . . .	28
3.5	OPR app class diagram . . . . .	29
3.6	search sequence diagram . . . . .	30

3.7	view-details sequence diagram . . . . .	31
3.8	review a place sequence diagram . . . . .	32
3.9	interaction overview diagram . . . . .	33
4.1	Chart showing how nginx's user base is growing while apache's is regressing . . . . .	46
4.2	the landing screen of the app . . . . .	48
4.3	search screen . . . . .	48
4.4	showing the location of a place on the map . . . . .	49
4.5	place details . . . . .	49
4.6	Creating a review . . . . .	50
4.7	Thanks screen . . . . .	50
4.8	Showing a review . . . . .	51
4.9	API Login . . . . .	51
4.10	API Login failure . . . . .	52
4.11	API search request . . . . .	52
4.12	API place details . . . . .	53
4.13	Logout API call . . . . .	53
4.14	AWS EC2 allowed inbound traffic . . . . .	54
4.15	AWS EC2 allowed outbound traffic . . . . .	54
4.16	AWS RDS setup . . . . .	55
4.17	unit tests . . . . .	56
4.18	landing page speed test . . . . .	57
4.19	details page speed test . . . . .	57
4.20	facebook page speed test . . . . .	57
4.21	concurrent users test . . . . .	58

## List of Tables

1.1	comparison of tourism platforms . . . . .	6
2.1	Registration description . . . . .	12
2.2	login description . . . . .	14
2.3	search description . . . . .	16
2.4	view-details description . . . . .	18
2.5	review a place description . . . . .	20
4.1	MySQL vs PostgreSQL . . . . .	45



# Abstract

My graduation project consists in creating a web application that contains listings of hotels, restaurants and any place available in the Google places API and allows registered users to create reviews about these places as well as rate them following some specific criteria like the use of renewable energy and the use of recyclable materials... The web app also provides a REST API that is being used by a mobile app developed separately. Part of the project also consists in deploying the app to the cloud.

## Keywords

Python - Django - Sustainable Tourism - REST API - Amazon Web Services - Ratings

## 1.1 Introduction

The internet is full of tourism platforms that list hotels, restaurants and similar tourism related services. To name a few of them we can cite as notable examples: Tripadvisor, Trivago and Kayak. There is literally tens of these platforms, from different countries and in different shapes and colours. However all of the existing platforms only let users write "general" reviews about the listed places, and the visitors can only distinguish between those places based on either the prices or the "general" reviews. It turns out that there's also a market for people who are interested in "sustainable tourism" and don't mind paying more for an eco-friendly vacation. Sustainable tourism is defined as "tourism that respects local people, the traveller, cultural heritage and the environment" by UNESCO[8], you think of it as "fairtrade" and "organic" but for the travel sector.

One Planet Rating (OPR) was created to fill this void and serve this portion of tourists by listing the same places while focusing on sustainability instead of price. One Planet Rating is a newly founded social startup based in Stockholm, with a portion of its team members working remotely (partially including myself). The startup is in its very early stages, its main product/service is the web application described in this report. The company thrives to have an impact and aims, with its services, to help achieve some of the United Nations' Sustainable Development Goals (UN SDGs)[9] like:

- UN SDG 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all".

- UN SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss"
- UN SDG 13: "Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments in renewable energy.

OPR is a tourism platform that is sustainability-focused, it allows people from around the world to rate and review touristic services based on how much they respect the earth. The long term goal of OPR is to promote the movement of sustainable tourism and incite people to be more responsible during their trips, and eventually help protect the environment and the community. OPR also emphasizes on transparency as it doesn't participate in writing the reviews and ratings, it only provides a playground for all people to express themselves freely.

In this report we briefly cover the state of the art and market analysis of the project. In the first chapter we go through the requirements and specifications. The second chapter covers the design aspects of the project. The third chapter covers the development and deployment aspects of the project.

## 1.2 State of the art

Many online tourism platforms exist today, we can consider these platforms as "indirect competitors" because they offer an alternative functionality to OPR, but what makes the most difference is the target market. Some of these major platforms are Tripadvisor (fig.1.1), Trivago (fig.1.2), Momondo(fig.1.3) and Kayak (fig.1.4). As shown in the following screenshots, all of those platforms focus on the general ratings and the price. They offer very similar functionalities but in different layouts.

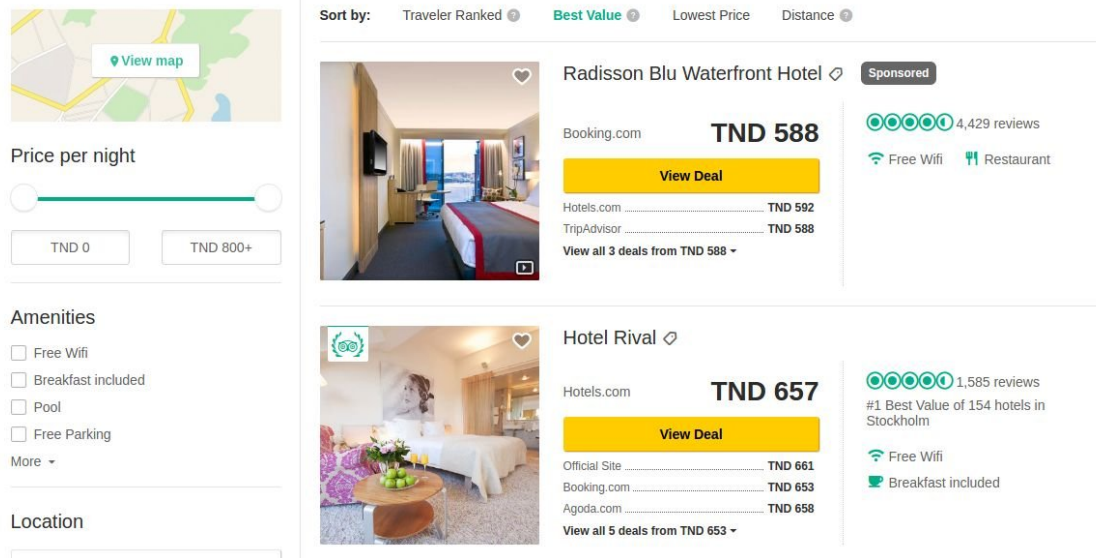


Figure 1.1: Screenshot of Tripadvisor

Tripadvisor, which is the world leader in the tourism sector, provides hotel booking and listing of tourism establishments. The company is based in the United States and it also offers other related services like tourism focused forums. The platform also allows users to search for and book flight tickets.

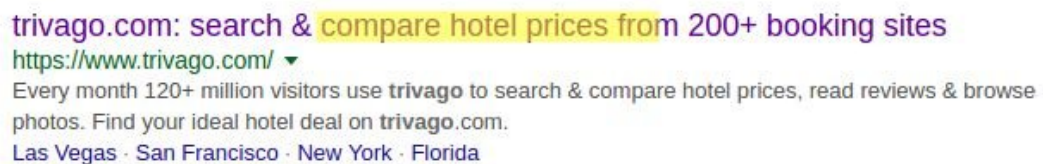


Figure 1.2: Screenshot of search results for Trivago

In contrast, the Germany based company, Trivago, only focuses on hotels. Trivago is the leader hotel search engine in Germany[1]. Though Trivago only lists hotels, it is owned by Expedia, which owns and operates more than 200 websites that offer diverse services in the tourism and travel sectors.

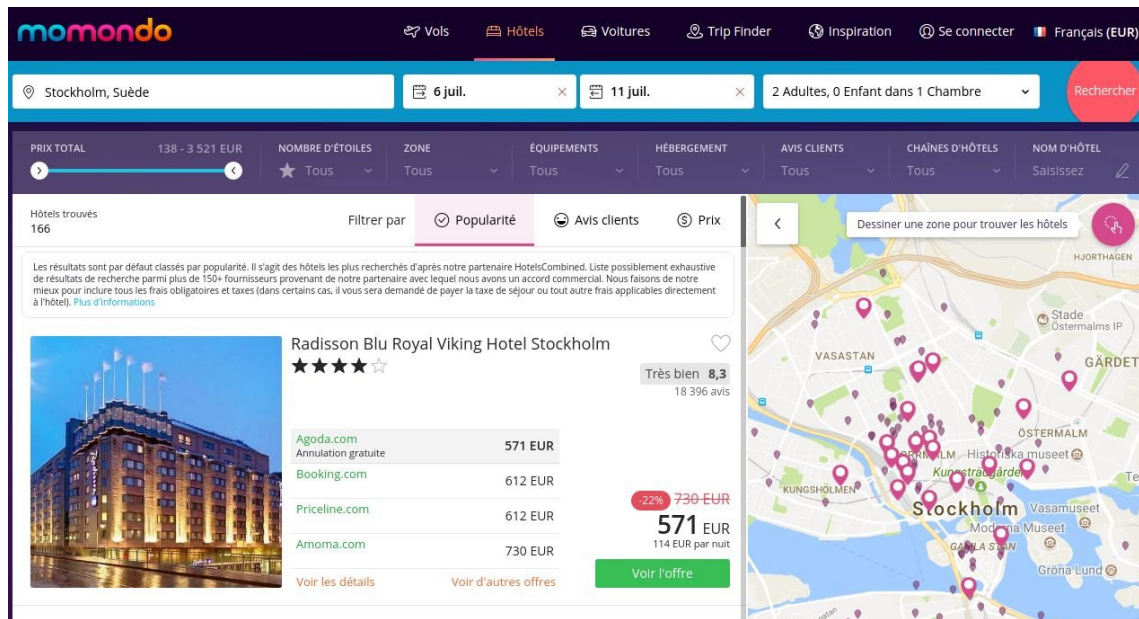


Figure 1.3: Screenshot of Momondo

Momondo is also a similar service which, in addition to listing hotels, also provides flight booking and car rental services. Another interesting thing about Momondo is that it is based in Scandinavia, and this makes of it a local competitor.

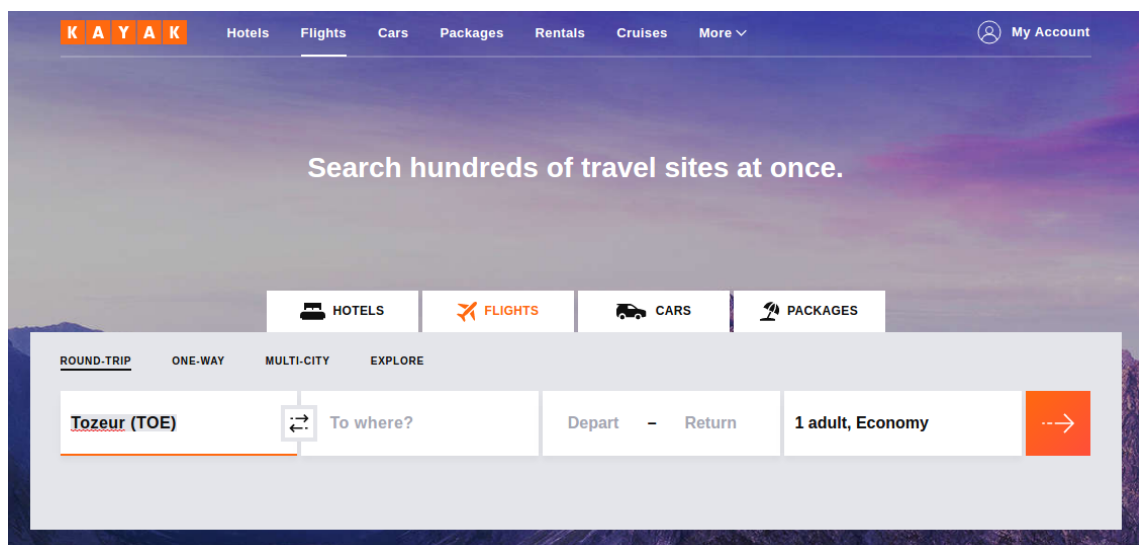


Figure 1.4: Screenshot of Kayak

Kayak is also one of the most popular travel search engines. It is owned by The Priceline Group which runs multiple tourism related services. Kayak offers multiple services like booking flights, hotels and cars.

The following table shows more in detail the difference between OPR and the above-mentioned competitors:

Funtionality	Tripadvisor	Trivago	Momondo	Kayak	OPR
Search hotels	YES	YES	YES	YES	YES
Search restaurants	YES	NO	NO	NO	YES
Search activities and other places	YES	NO	NO	YES	YES
Search for flights	YES	NO	YES	YES	NO
Booking service	YES	YES	YES	YES	NO
General ratings	YES	YES	YES	YES	YES
Sustainability ratings	NO	NO	NO	NO	YES

Table 1.1: Comparison of tourism platforms

It is worth noting that most of these "indirect competitors" are booking websites while OPR is not. OPR's goal is to promote the sustainable places and discourage the unsustainable ones.

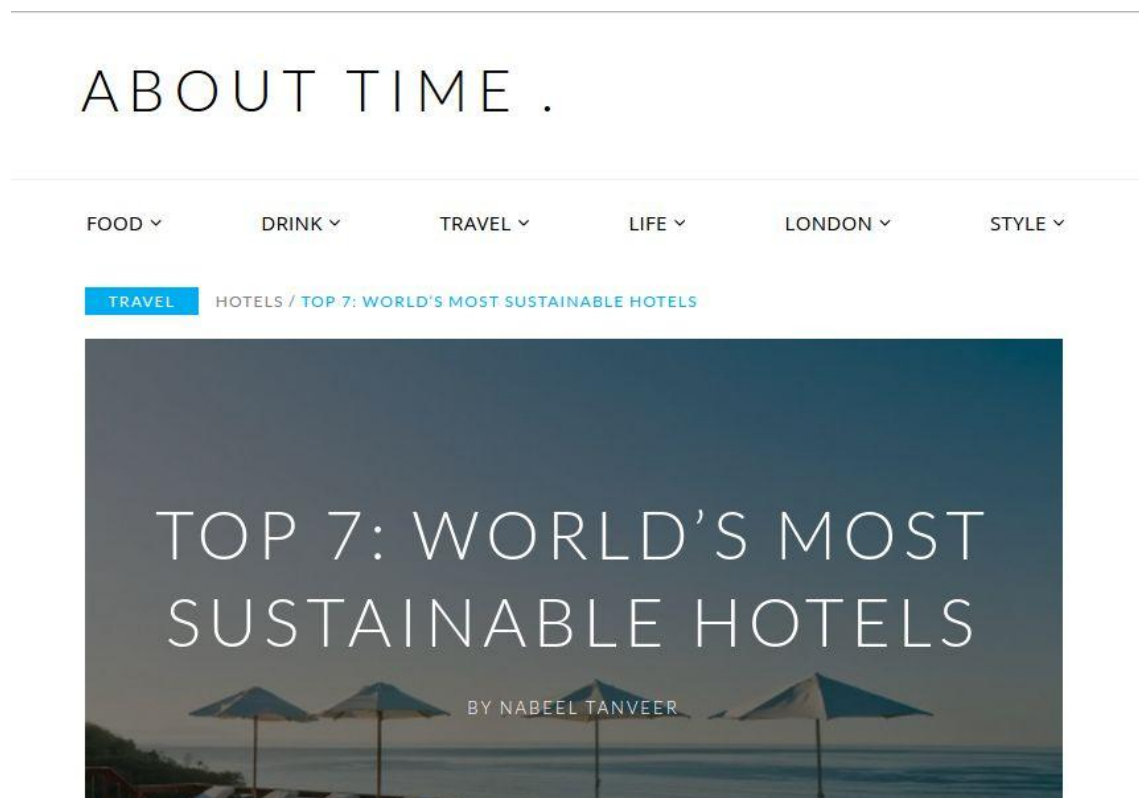


Figure 1.5: Example of an expert blog

Another category of competitors includes magazines, blogs and expert websites (fig.1.5) that promote some specific sustainable places. Those are also indirect competitors because they rely on experts' advice on their reviews which tend to be not very trustworthy. OPR's content will be completely user generated, because most people believe more in reviews created by peers and want to be part of the content creation. OPR will only be the intermediary between content creators and content consumers, and will not participate in content creation.

In short, OPR's main goal is to generate sustainability-focused reviews created by travelers and normal internet users.

## **1.3 Formalism**

During the work on this project we used the following formal methods:

### **UML**

We used UML (Unified Modeling Language) for describing and modeling the specifications of the project. UML is very flexible and versatile. UML is also one of the best choices for modeling because it is very popular and widely used across the globe, which makes it easier to grasp by other people. Most software engineers are probably familiar with it.

### **Agile scrum**

We used the agile scrum method because it is the most convenient method to the project. Every week we have a sprint where we define the goals of that week from the backlog. This methodology turned to be very efficient, especially that the project consists in developing a prototype, which requires continuous thinking and customization. Agile scrum allowed us to customize the project while working on it.

## CHAPTER 2

# Specifications

## 2.1 Actors

### 2.1.1 Internal actors

#### **User**

Anybody who accesses OPR Ratings via App or Web is a User. As opposed to "Member" (see below) this does not require any log-on, or creation of a OPR Profile. A User can search for specific places and read reviews of those places.

#### **Member**

OPR Members are Users who sign up to use OPR's services with a Profile. A User needs to be logged in, to be acting as a Member. A member can do everything a User can do, in addition to the ability of posting their own reviews and ratings.

#### **Manager**

In addition to the permissions that a Member has, an Admin has the permission to Create, Read, Update and Delete (CRUD) Ads, reviews and rating categories.

#### **Admin**

The admin is responsible of managing the users, he has the permission to CRUD users.



### 2.1.2 External actors

#### Google places service

Google places API is a passive actor that is called for every search to look for relevant places based on provided location.

The API provides us with :

Basic information (Name, address..), Photo, Google's place\_id (unique identifier)

#### Google maps service

Google Maps API is another passive actor that provides us with a map pointing at the specific location based on the location's place\_id we retrieve from Google Places API

#### Gmail service

Google's Gmail is used to send the emails to users. This actor is also passive.

## 2.2 Functionalities' overview

The main functionality of the platform is to allow members to read and post reviews and ratings about some specific places. Obviously this implies that they need to be able to register and login to the platform. Users should also be able to search for a specific place by a keyword. And since OPR is all about sustainability-related reviews, the platform offers the possibility to rate establishments based on multiple criteria. The platform also has a mobile app, and this implies that the web based app should provide an API to supply the mobile app with the data.

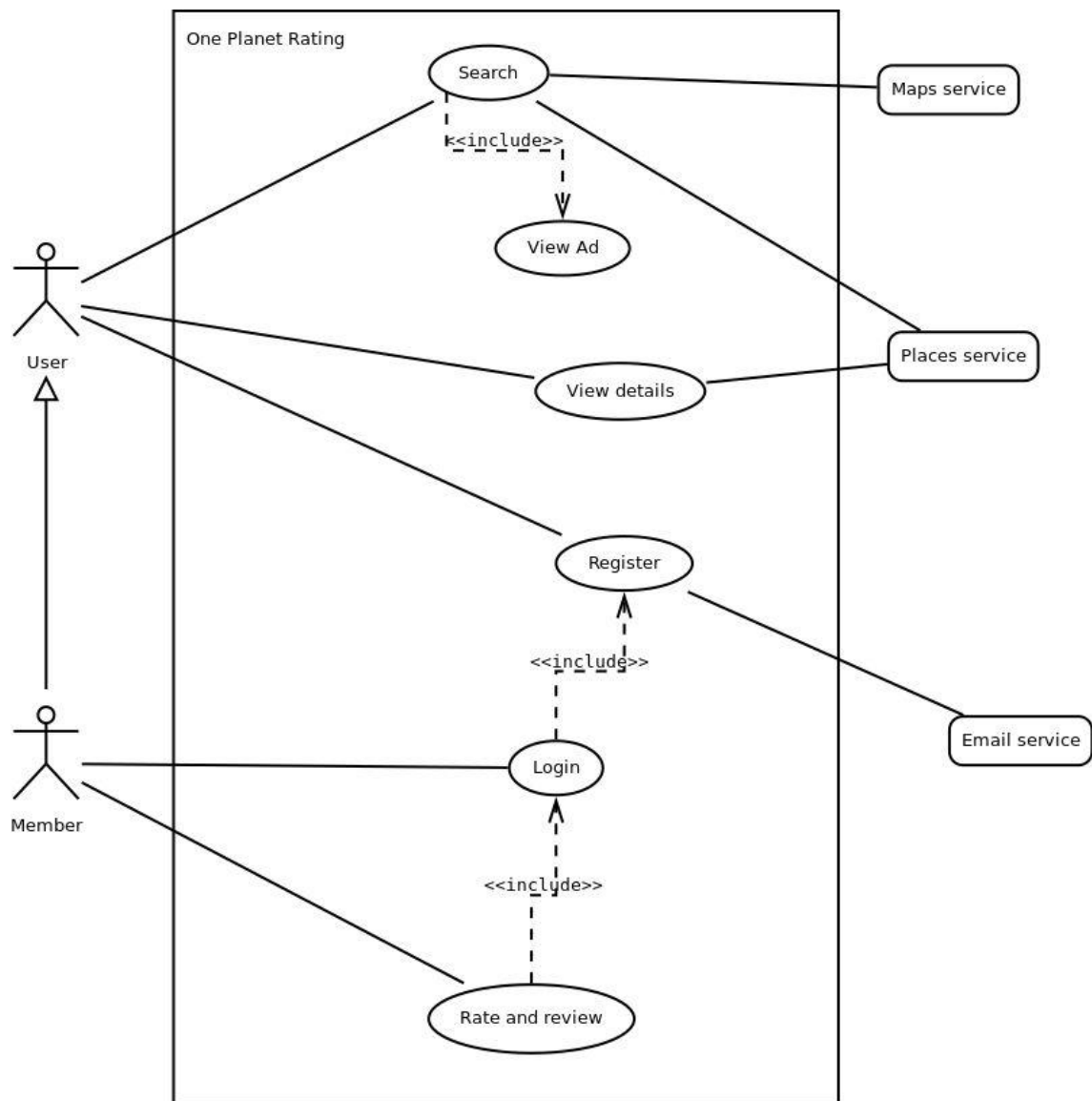


Figure 2.1: General usecase diagram

As shown in the use case diagram (fig.2.1), any user can use the app to search and view the details of a place. The search functionality pulls data from Google places service, and shows a map using Google maps service. When a user registers, he becomes a member. During the registration process Gmail service is used to send a confirmation email. The member can then login to his profile and becomes able to rate and review places.

### 2.2.1 Register

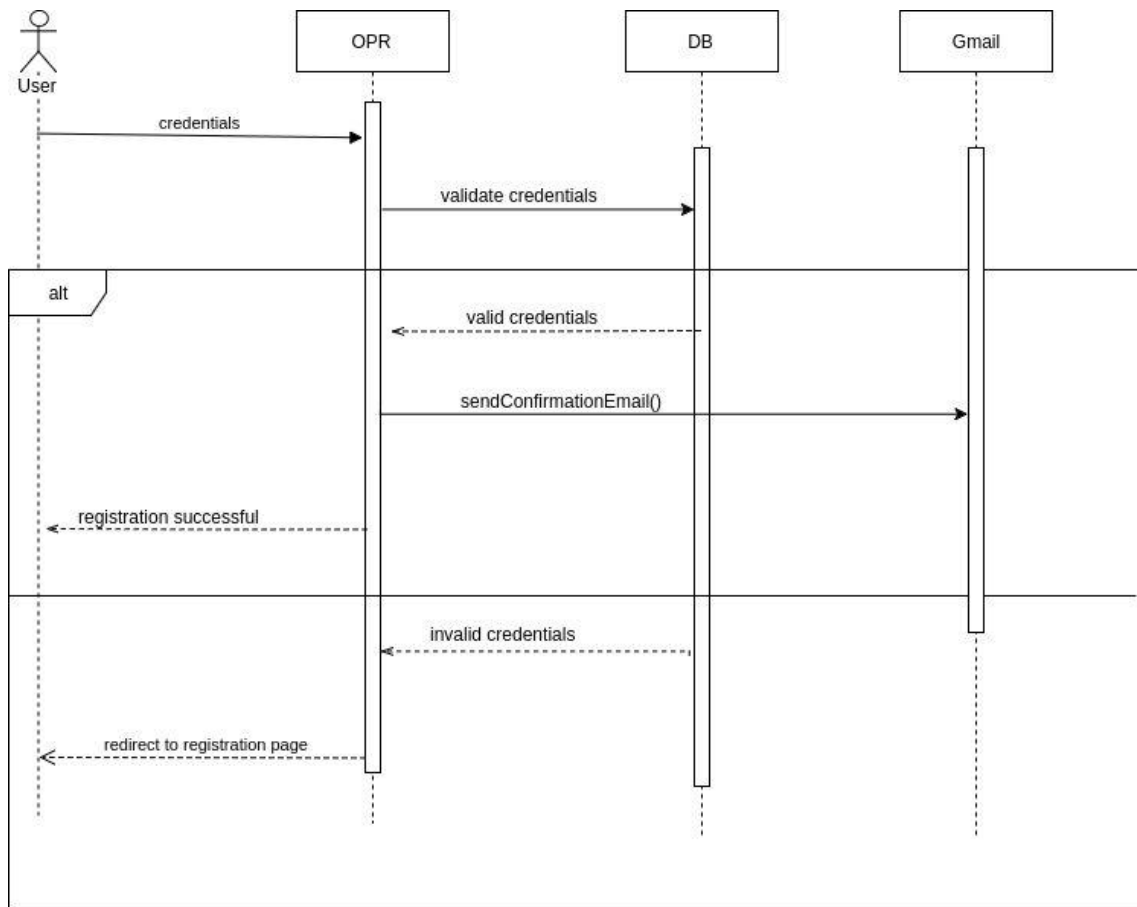


Figure 2.2: Registration sequence diagram

Title	Registration
Author	Moetaz Ben Charrada
Version	1.0
Objectives	Allows users to register and create an account
Actors	User - OPR - Gmail
Pre-conditions	The user should be on the registration page The user must not be already registered.
Post-conditions	The user becomes registered (member)
Story	1. The user enters his username 2. The user enters his email 3. The user enters his password 4. The user re-enters his password 5. The user submits the form
Alternative story	The functionality is accessed through the mobile app instead of a browser.
Exceptional story	If the user enters an email that's already in the DB, the user will be prompted to enter a different email. If the user enters a password that's not compliant to the security constraints, he will be prompted to enter a different password

Table 2.1: Registration description

Every user can register (fig.2.2) to OPR and becomes a member. A member has the option to post reviews in addition to all the privileges a normal use has. The registration process starts by the user entering his username, email and password. After submitting these information, OPR's registration system checks the unicity of the email and username, as well as the strength of the password. If either the username or email are not unique, or the password is not secure enough (i.e. at least 8 characters, composed of letters, numbers and special characters), the user will be prompted to re-enter the data with changes to the fields in question.

When the data is valid, OPR sends an email-confirmation request to the new member. OPR sends the email via Gmail, through an SMTP connection. A registration is only considered complete after the email verification occurs.

### 2.2.2 Login

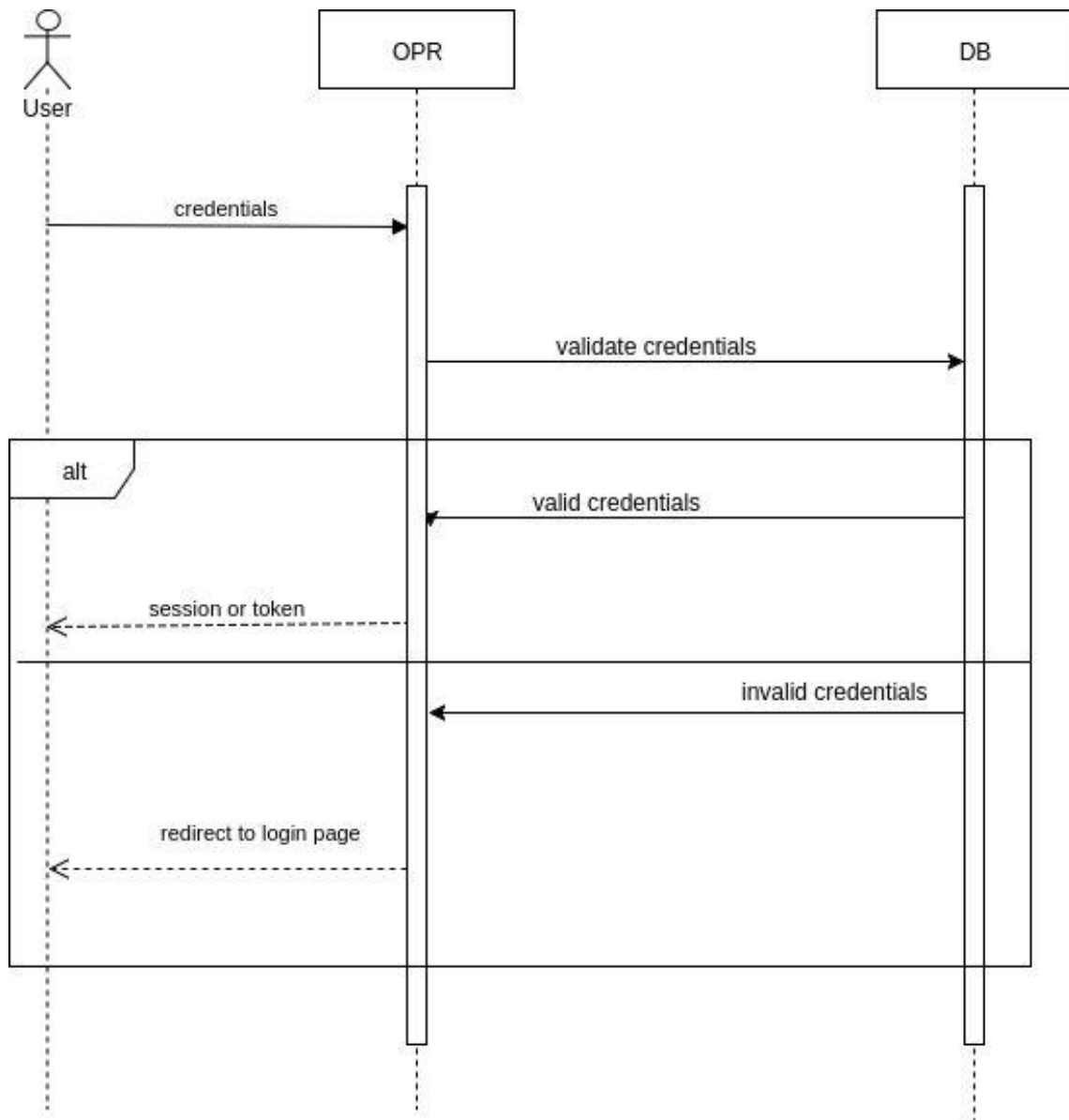


Figure 2.3: Login sequence diagram

Title	Login
Author	Moetaz Ben Charrada
Version	1.0
Objectives	Allows users to login and access his account
Actors	User - OPR
Pre-conditions	The user should be a registered member. The user must not be already logged in.
Post-conditions	The user becomes authenticated. The user can then post reviews.
Story	1. The user enters his username 2. The user enters his password 3. The user submits the form
Alternative story	The functionality is accessed through the mobile app instead of a browser. (Through the REST API)
Exceptional story	If the user enters incorrect credentials, he will be prompted to try to login again.

Table 2.2: Login description

Another basic functionality of the app is letting users log in (fig.2.3). In fact users need to log in to be able to post reviews. And to be able to login, the user must be already registered. To login, the user provides his username and password. If they are valid the user is either given a cookie (if he is using a web browser) or an authentication token (if he is using the mobile app). If the credentials he provided are invalid he is prompted to try to log in again.

### 2.2.3 Search

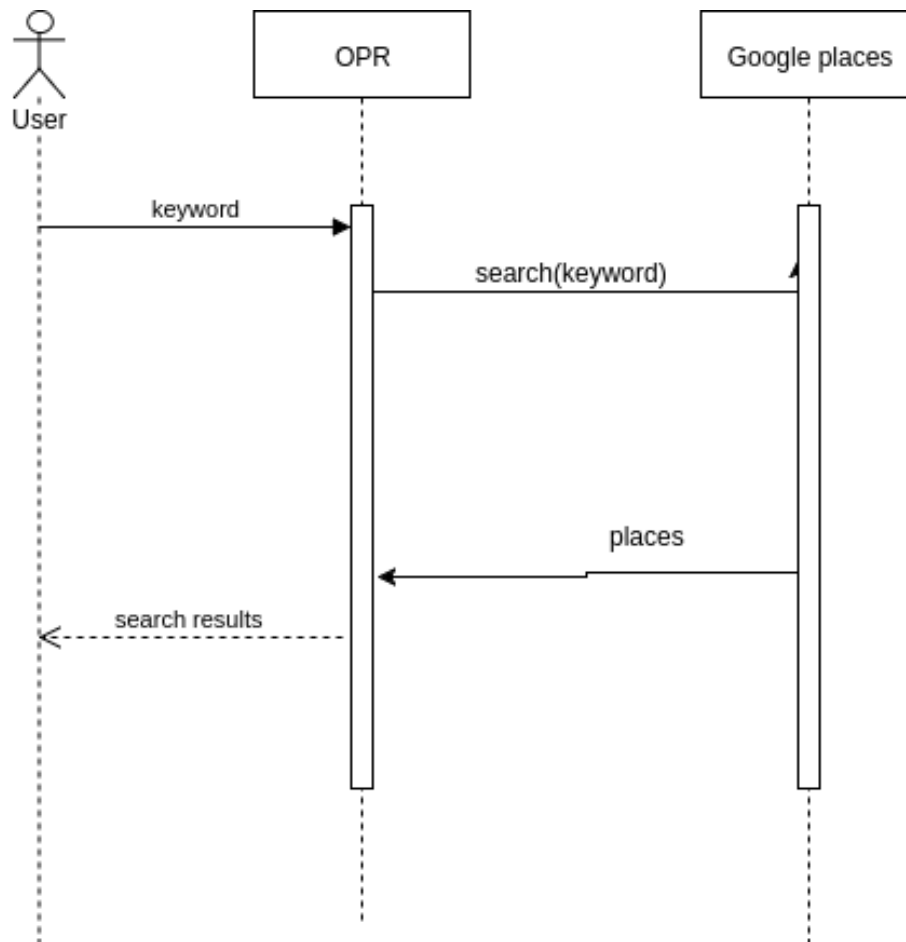


Figure 2.4: Search sequence diagram

Title	Search
Author	Moetaz Ben Charrada
Version	1.0
Objectives	Allows users to search for a specific place.
Actors	User - OPR - Places service
Pre-conditions	The user should be on a page where there's a search bar.
Post-conditions	The user finds places related to his keywords, and may click to check the details of that place.
Story	1. The user enters keywords related to the place he's looking for 2. The user selects the type of place 3. The user submits the form
Alternative story	The functionality is accessed through the mobile app instead of a browser. (Through the REST API)

Table 2.3: Search description

The search functionality (fig.2.4) is a basic but essential functionality of the app. It allows the user to look for a location based on its type (Hotel, restaurant, activity) and location. The search bar offers autocomplete functionality to assist the user with the location names. After a user submits a search query, OPR will make HTTP calls to google's places services to find the locations. The response from the call is formatted, and OPR's data is added (average rating + number of reviews) and then delivered to the client.



## 2.2.4 View details

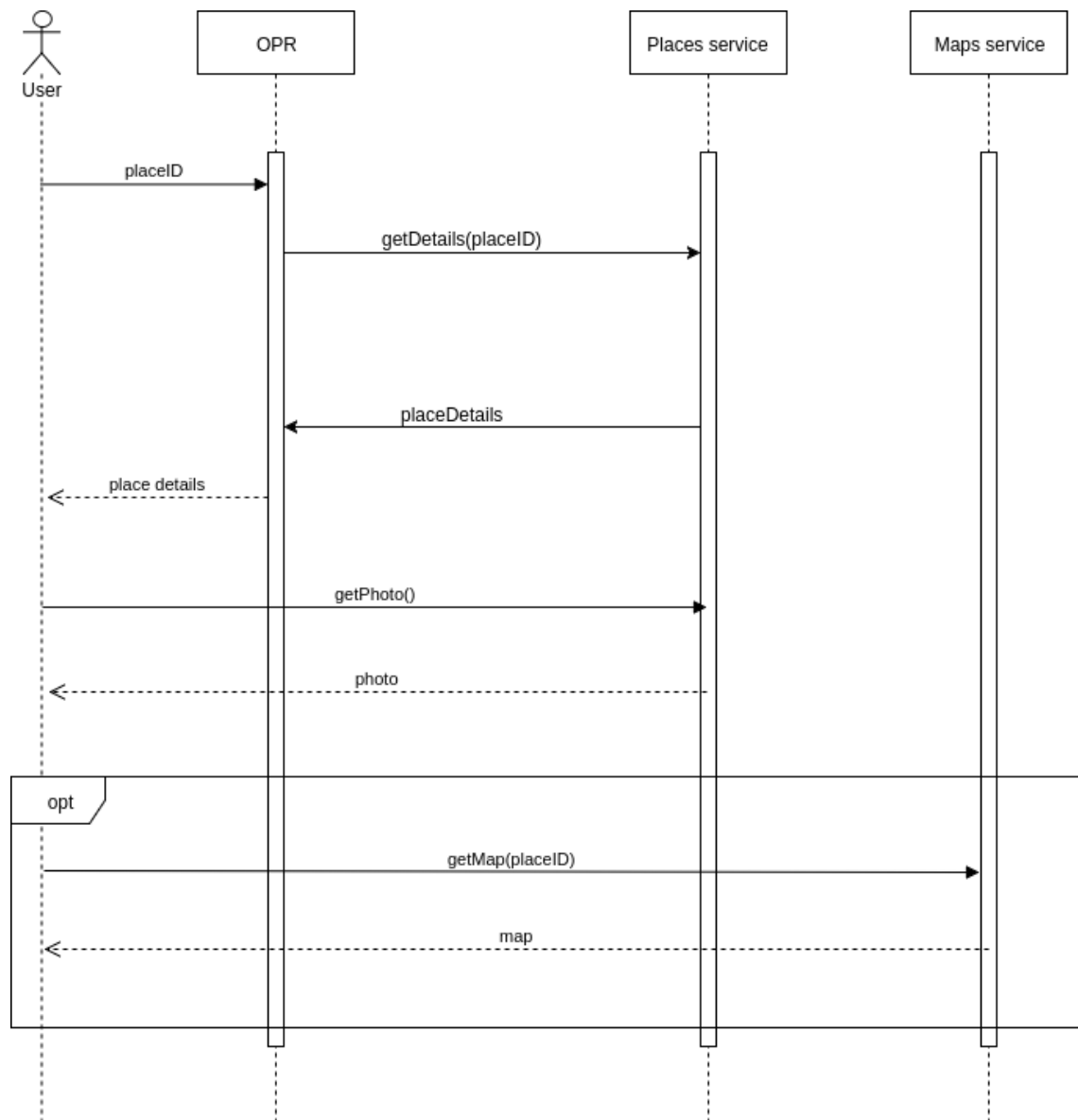


Figure 2.5: View details sequence diagram

Title	View details
Author	Moetaz Ben Charrada
Version	1.0
Objectives	Allows users to view the details and reviews of a specific place
Actors	User - OPR - Places service - Maps service
Pre-conditions	The user should have searched for the place before.
Post-conditions	The user sees the details and reviews of the place and can possibly post a review about it.
Story	<ol style="list-style-type: none"> <li>1. The user clicks on one of the places he found in the search view.</li> <li>2. OPR app will then get the details of that place from Google places service, get the map from Google maps service.</li> <li>3. The data is combined with the local reviews' data and is sent back to the user.</li> </ol>
Alternative story	The functionality is accessed through the mobile app instead of a browser. (Through the REST API)

Table 2.4: view-details description

After searching for a place, the user will select one of the places shown in the search results, the user is then redirected to the view-details (fig.2.5) page. When the user does so, OPR calls Google's places service again, but this time to request the details of a specific place. The places are identified by their `place_id`.

### 2.2.5 Review a place

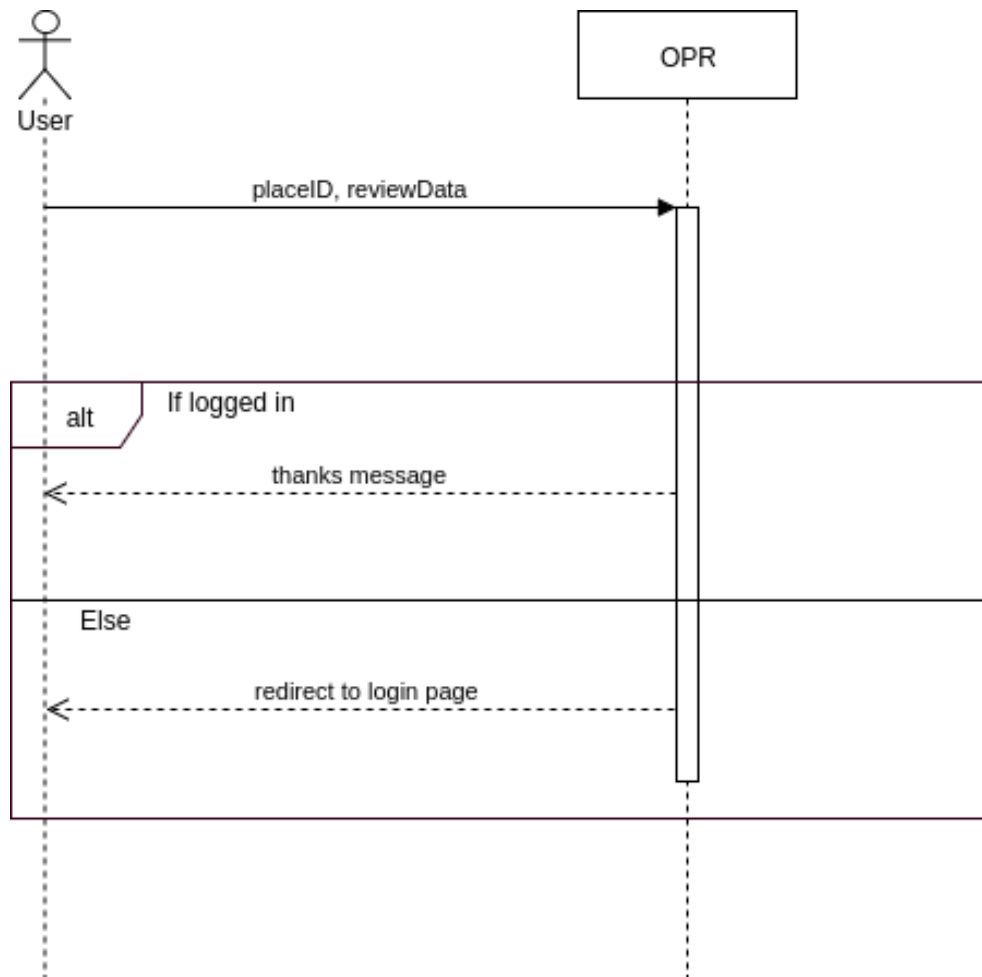


Figure 2.6: Review a place sequence diagram

Title	Review a place
Author	Moetaz Ben Charrada
Version	1.0
Objectives	Allows users to post a review about a specific place
Actors	User - OPR
Pre-conditions	The user should be authenticated to be able to post a review.
Post-conditions	The user creates a review. The review becomes visible to the public.
Story	1.The user enters his review data 2.The user submits the form. 3.The review data is saved to the database. 4.A thanks message is shown to the user.
Alternative story	The functionality is accessed through the mobile app instead of a browser. (Through the REST API)
Exceptional story	If the user tries to post a review while he's not authenticated. He is redirected to the login page.

Table 2.5: Review a place description

After a user finds the place he is looking for, he can review (fig.2.6) that place. If he is not logged in, he is redirected to the login page. In case he is already logged in, the user is provided with a review form where he can enter his comments about the place as well as stars-based ratings following some specific criteria. After the user fills and submits the review form, the review is persisted in OPR's DB and the user is shown a thanks screen.

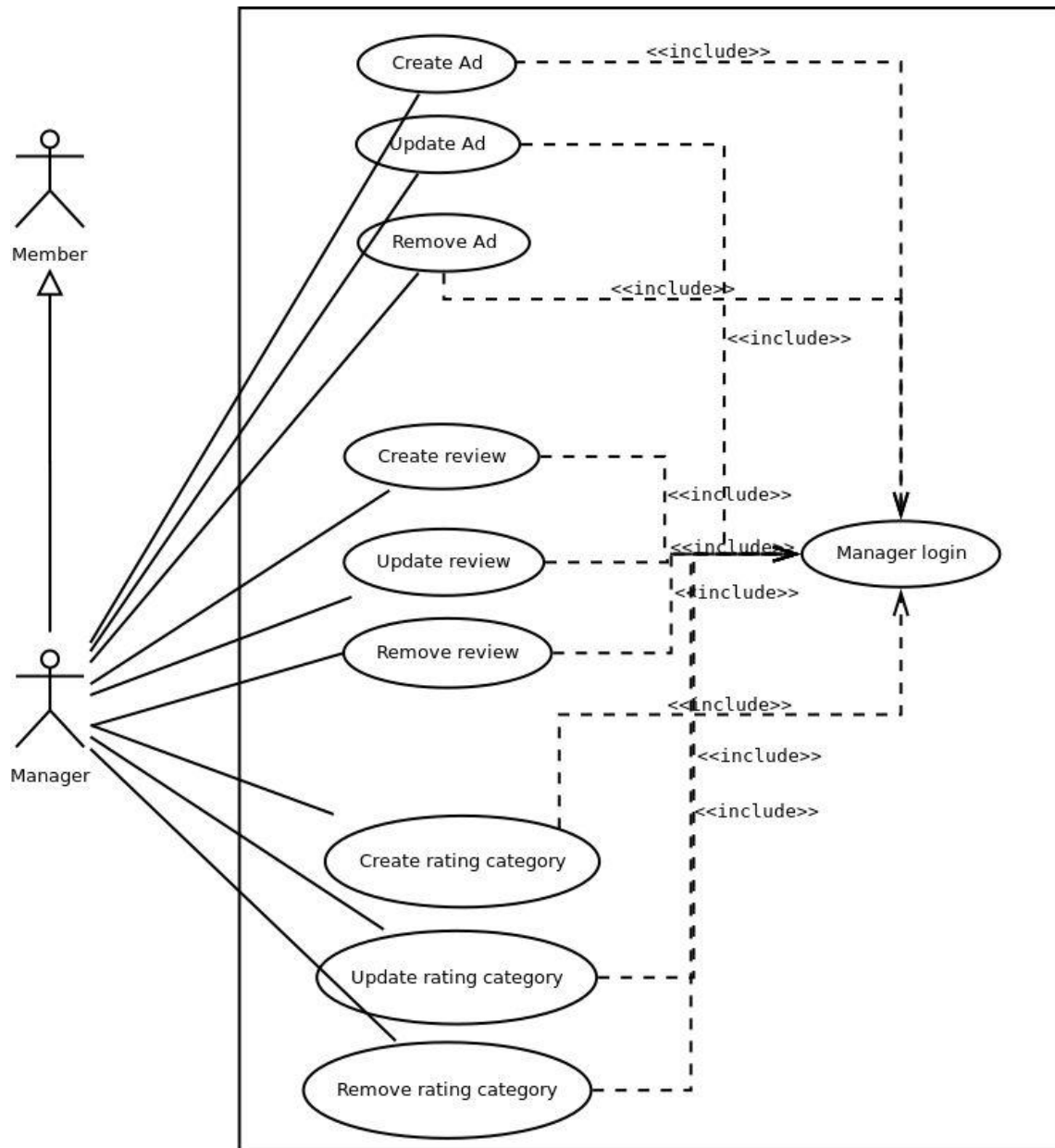


Figure 2.7: Manager usecase diagram

A manager (fig.2.7), is a member with additional privileges. A manager can create, update and delete: ads, reviews and rating-categories.

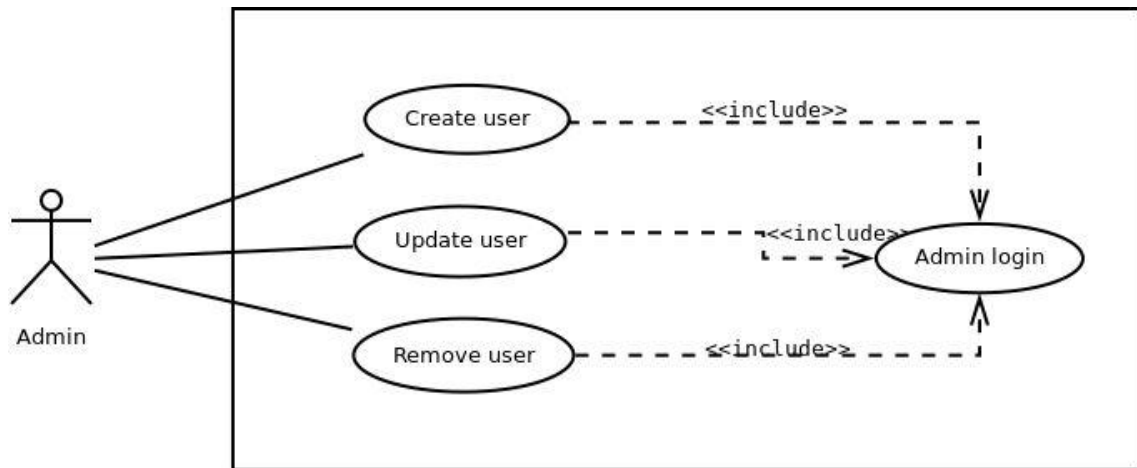


Figure 2.8: Admin usecase diagram

The admin (fig.2.8) however is only responsible for managing users. The admin can give and remove users' privileges, and thus can turn normal members into managers and vice-versa.

## CHAPTER 3

# Design & architecture

In this chapter we go through the design of the app from the ground up. Since we are building the app from scratch we had to take into consideration both the physical and logical aspects of the app.

As for the physical architecture, the app is designed in a way that prioritizes security and makes it easily scalable.

In the logical side, the app is broken into smaller modules to facilitate maintainability and extensibility. During the design I aimed to make the modules independent to reduce coupling as much as possible, thus offering the possibility to easily change a module in the future, without touching the other modules.

### 3.1 Physical architecture

The main parts of our physical architecture (fig.3.1) are: The server hosting the web server and static files, the server hosting the app and the business logic and The DB server.

For both the web server and the app server, we used an amazon EC2 instance running Ubuntu 16.04LTS. AWS offers great support and scalability features.

The first server hosts the static files of the app (Images, CSS, JS) as well as the web server, in our case NGINX. The web server is configured to listen for the incoming requests, whether from a web browser or the mobile app. If the call is requesting a static file, NGINX will get the file using filesystem access and will send it back to

the client. If the call is requesting a function to be run in the app, NGINX acts as a proxy[4] and redirects the call to the app server via HTTP, then gets the response and redirects it to the client.

The second server is hosting the app, and the app server. Our app server is Gunicorn, it's a python WSGI server. That is where all the business logic is hosted and run. When a call only requires computing capabilities, this server will respond without needing any third parties. When the call requires external data, this server is responsible for acquiring that data.

Our sources of data are either Google's APIs or our own DB. If the data needed is from Google, the app just triggers an HTTP request to Google's API.

If, on the other hand, the data requested is on our DB, the app has to access the DB through a TCP connection and get that data. The DB server is an AWS RDS instance hosting a PostgreSQL DB.

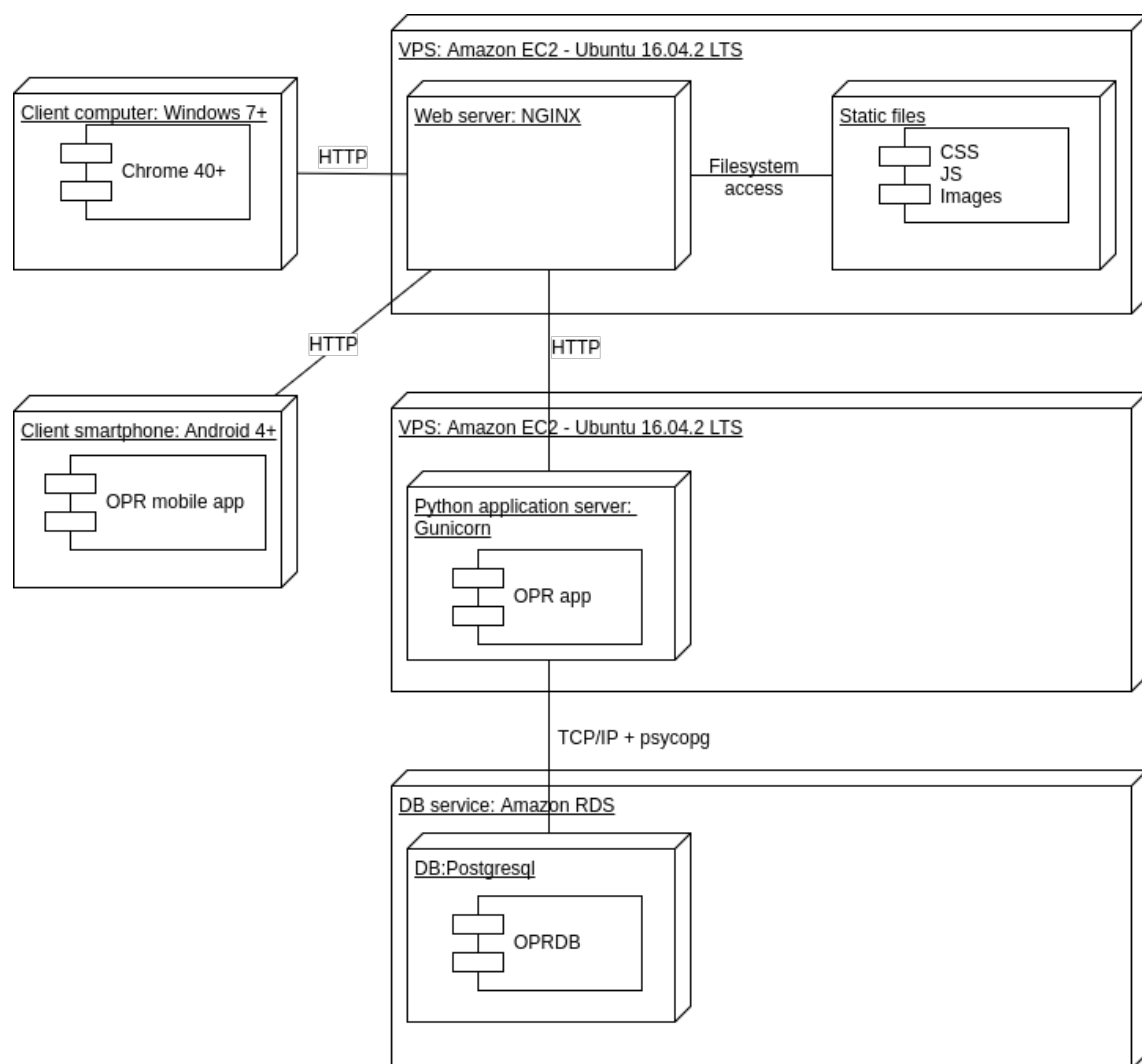


Figure 3.1: The app's physical architecture



## 3.2 Logical architecture

The architecture (fig.3.2) used is a mix of MVC + 3 Tiers.

### 3 Tiers

3 Tiers was used to separate the data, logic and the presentation from each other. Each of those three tiers is a separate, standalone entity. This provides more security, because if one of the tiers gets attacked the other tiers remain intact. This also provides some sort of interoperability because we can change one of the tiers without touching the other ones.

### MVC

MVC architecture was used at the server level. MVC architecture facilitates code visibility and maintainability because the architecture is well known and one can easily predict and understand the functionality of each of its components. MVC also has the advantage of loose coupling, which also offers interoperability as explained in the example of 3 Tiers above.

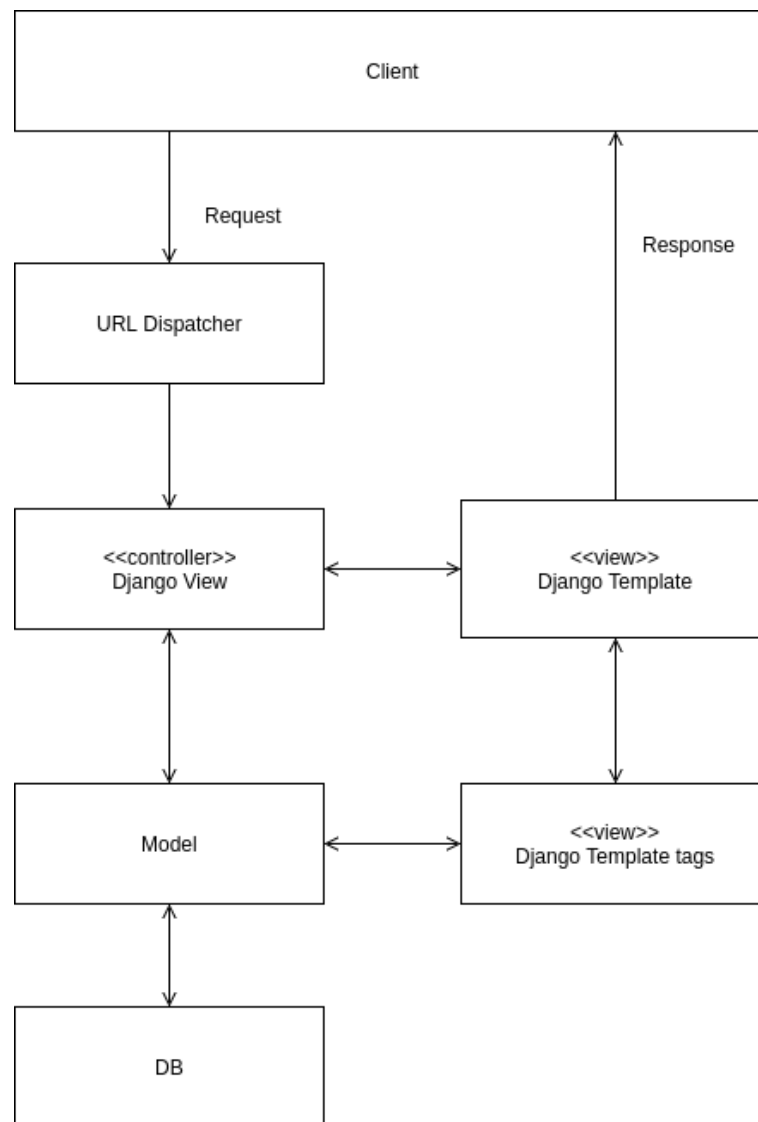


Figure 3.2: The app's logical architecture

Django uses the MVT (Model View Template) which is very similar to the MVC model, but with differences in the terminology. So the View block acts as the controller, it is where all the logic lives. The Template and Template tags blocks act as the views, that is where the formatting and styling are.

## 3.3 Modular architecture

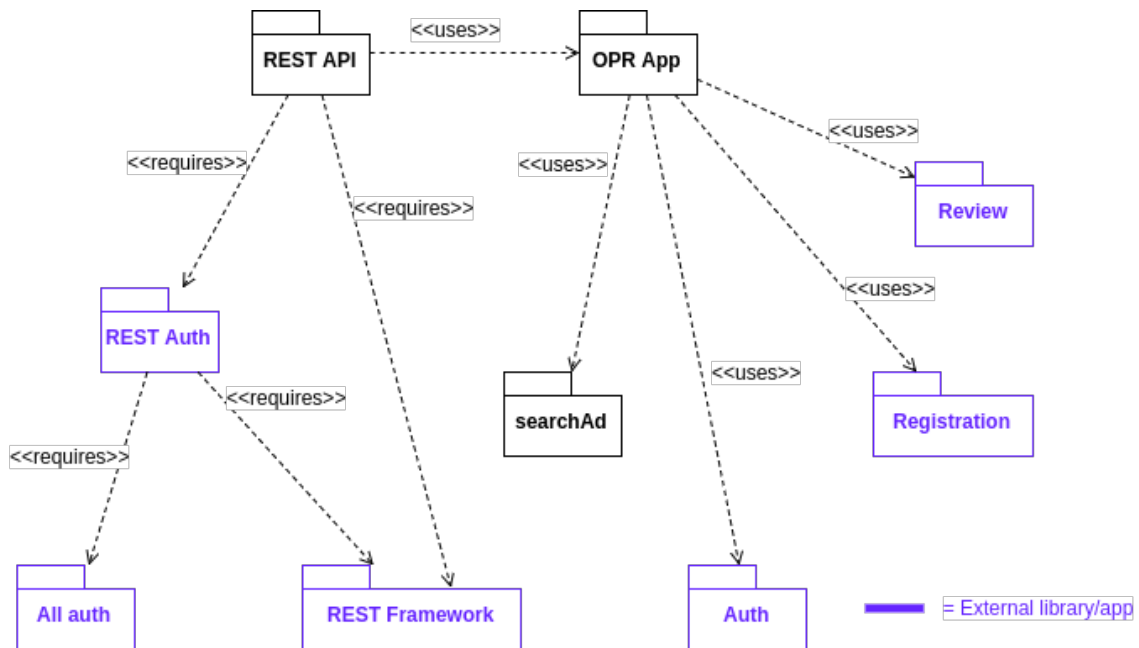


Figure 3.3: The app's modular architecture

During my work on the project I tried my best to reuse existing code, thus some of the modules shown in the diagram (fig.3.3) are external libraries. My work consists of creating the following modules: OPR App, REST API and searchAd.

## 3.4 Modules

### 3.4.1 SearchAdModule

This is a standalone library that offers the possibility to create and show ads either from a local source (the user's DB) or from an external source (like Google Adsense).

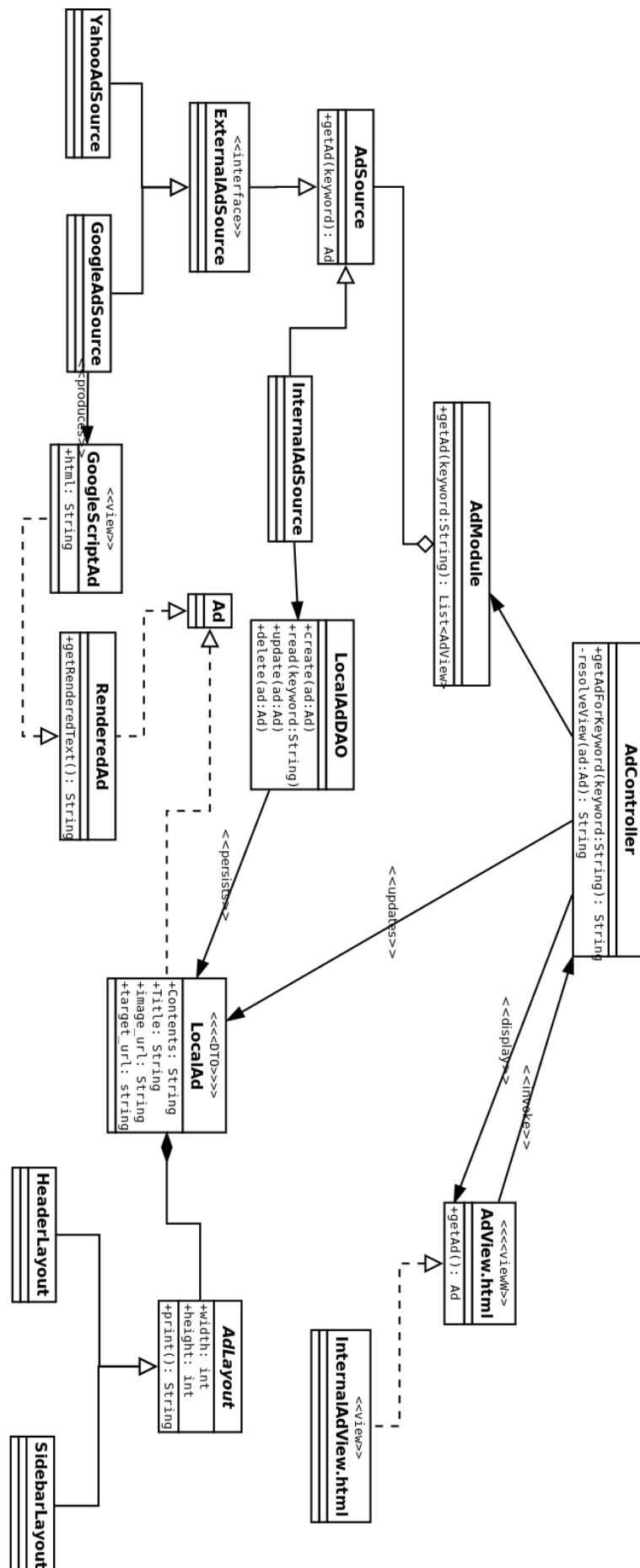


Figure 3.4: SearchAd class diagram

The SearchAd module (fig.3.4) is designed following the MVC architecture. The AdController is the entryptpoint for the module, it allows the user to get an ad based on a keyword. It also contains a private method resolveView() that shows the ad in html format to be directly injected in the view.

The ExternalAdSource allows to get ads from external sources like Google AdWords. It is made in a way to make it easily extensible with other external sources. In fact all we have to do is create a new class inheriting the ExternalAdSource class and containing the url to the ads service.

In case the ads are not pulled from an external source, they are stored in the local database as LocalAd. The LocalAd model contains a title, content, target\_url and image\_url.

### 3.4.2 OPR app module

This is the main app, it contains the business logic for searching and rating places. It is also where most of the other libraries are integrated and linked together (fig.3.5).

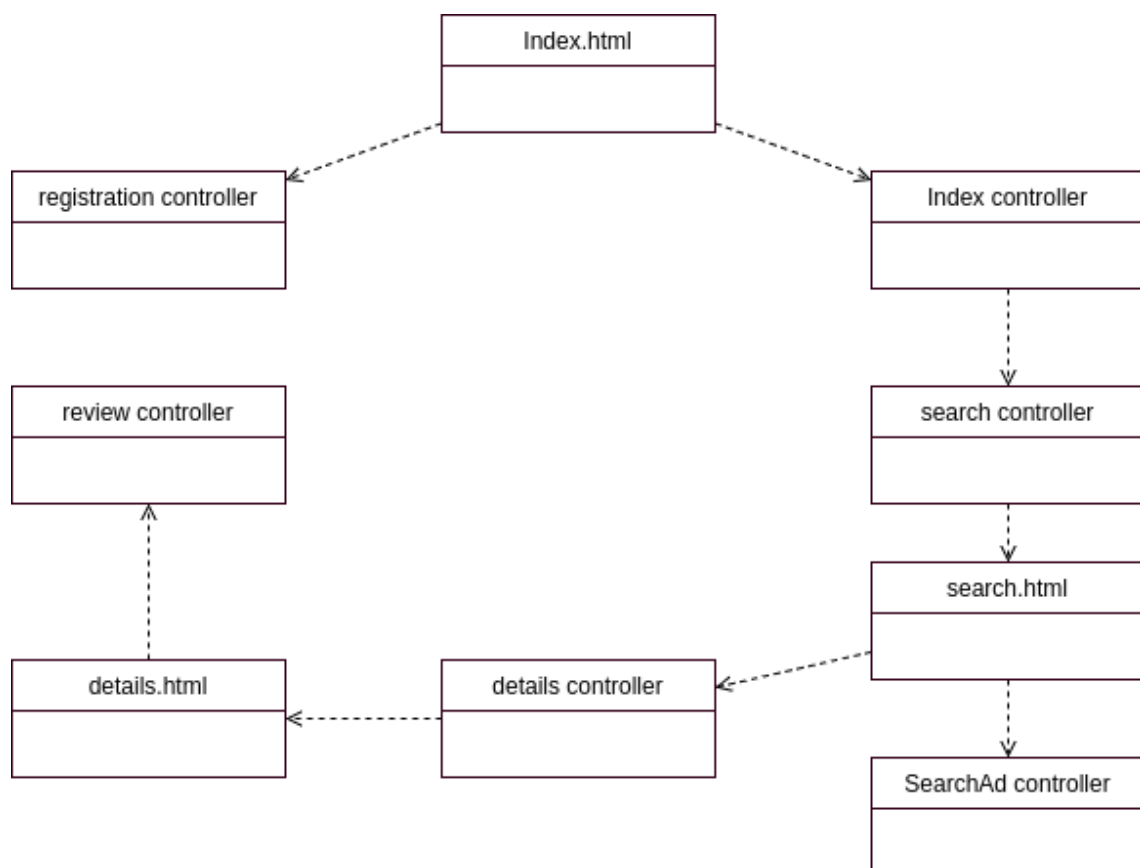


Figure 3.5: OPR app class diagram

## Search

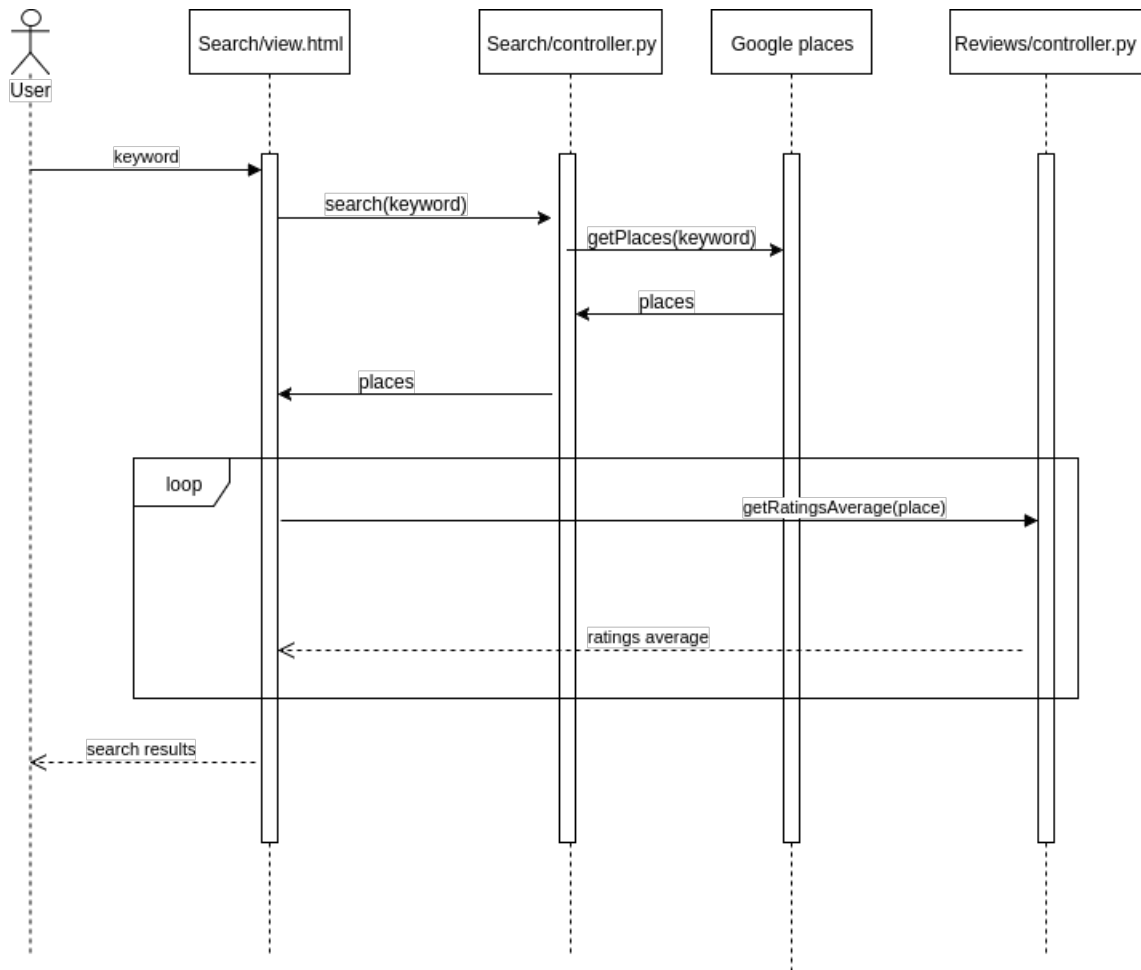


Figure 3.6: Search sequence diagram

When the user submits a keyword to search for, the search view (fig.3.6) which is the intermediary between the user and the business logic gets the keyword and triggers the controller to process it. The search controller pulls the search results from Google places API and returns them to the view. The view also triggers the reviews controller to get the average ratings of the relevant places. The page returned to the user contains the places with their average ratings.

## View details

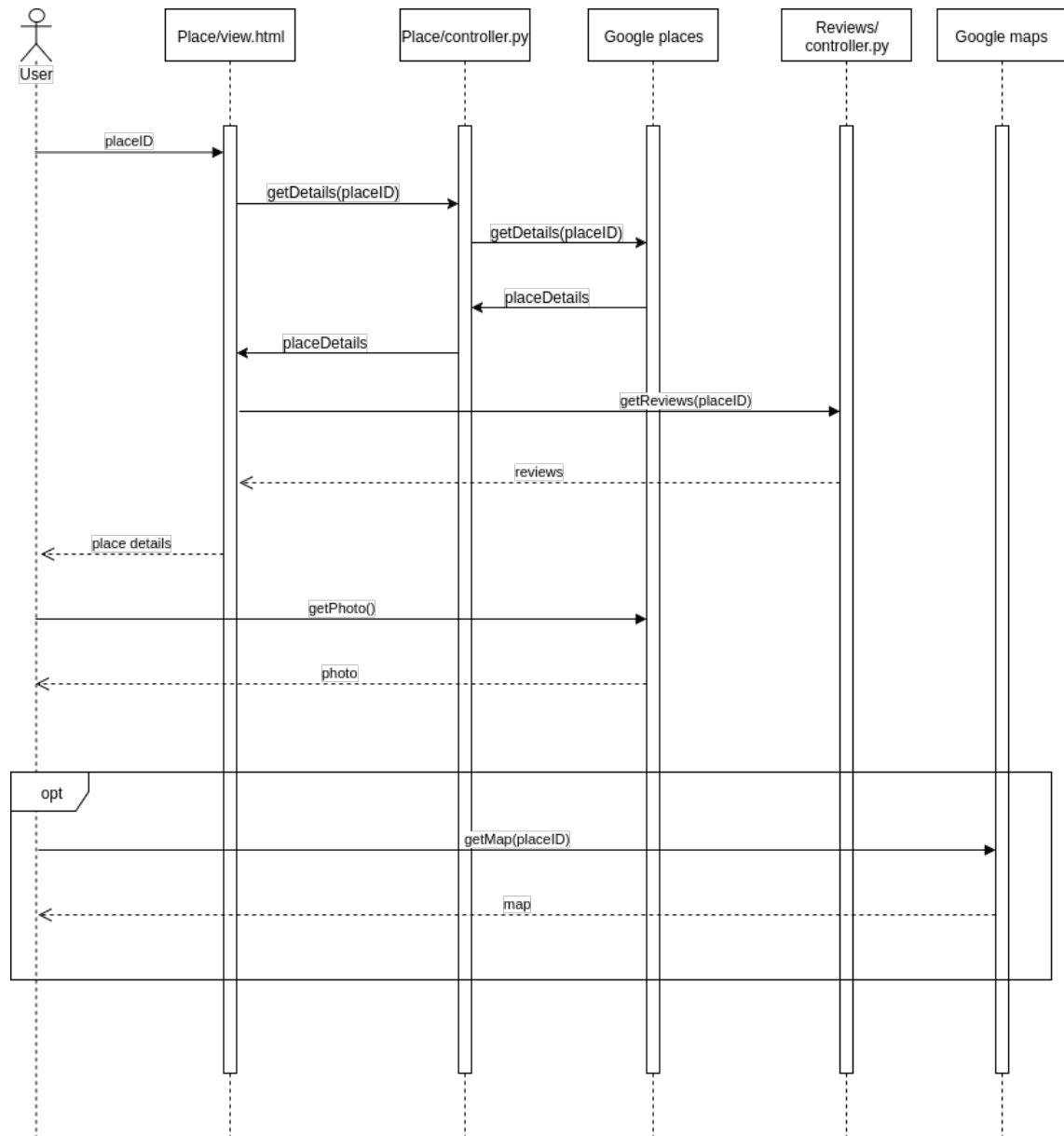


Figure 3.7: view-details sequence diagram

When a user requests the details of a place (fig.3.7), the place view triggers the place controller to get the details. Again the place controller pulls the data from Google places and returns them to the view. The view also gets the reviews from the reviews controller, and embeds the urls to the photo in the view. The view returned to the user contains the details, reviews and photo url of the place. Optionally the user may also want to see the map which is requested directly from Google maps by the browser.

## Review a place

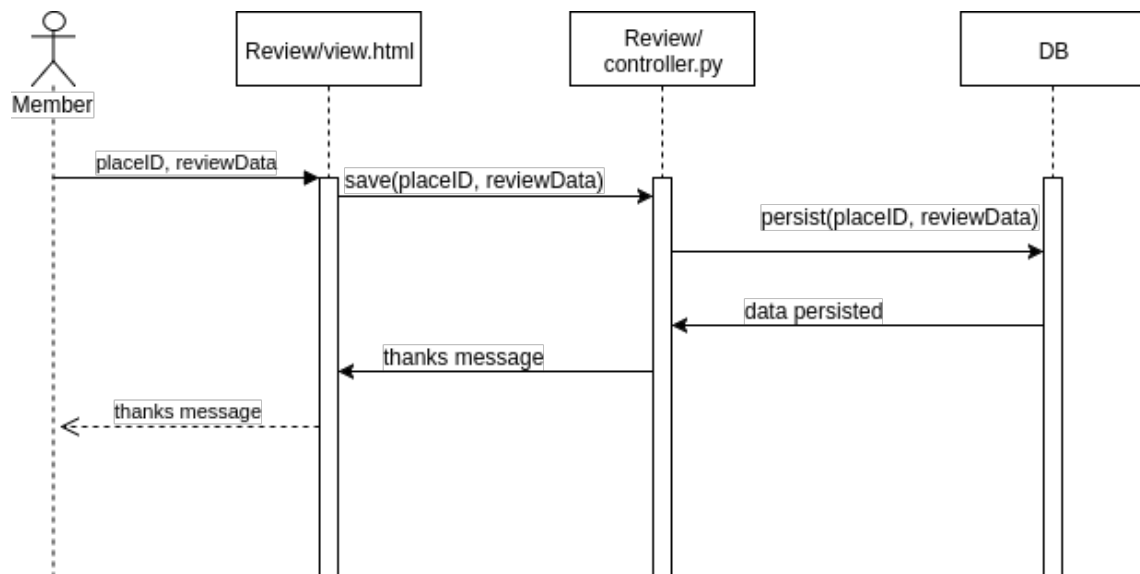


Figure 3.8: Review a place sequence diagram

Note that a user can only post a review (fig.3.8) if he is logged in. The process is explained in the following interaction diagram (fig.3.9)



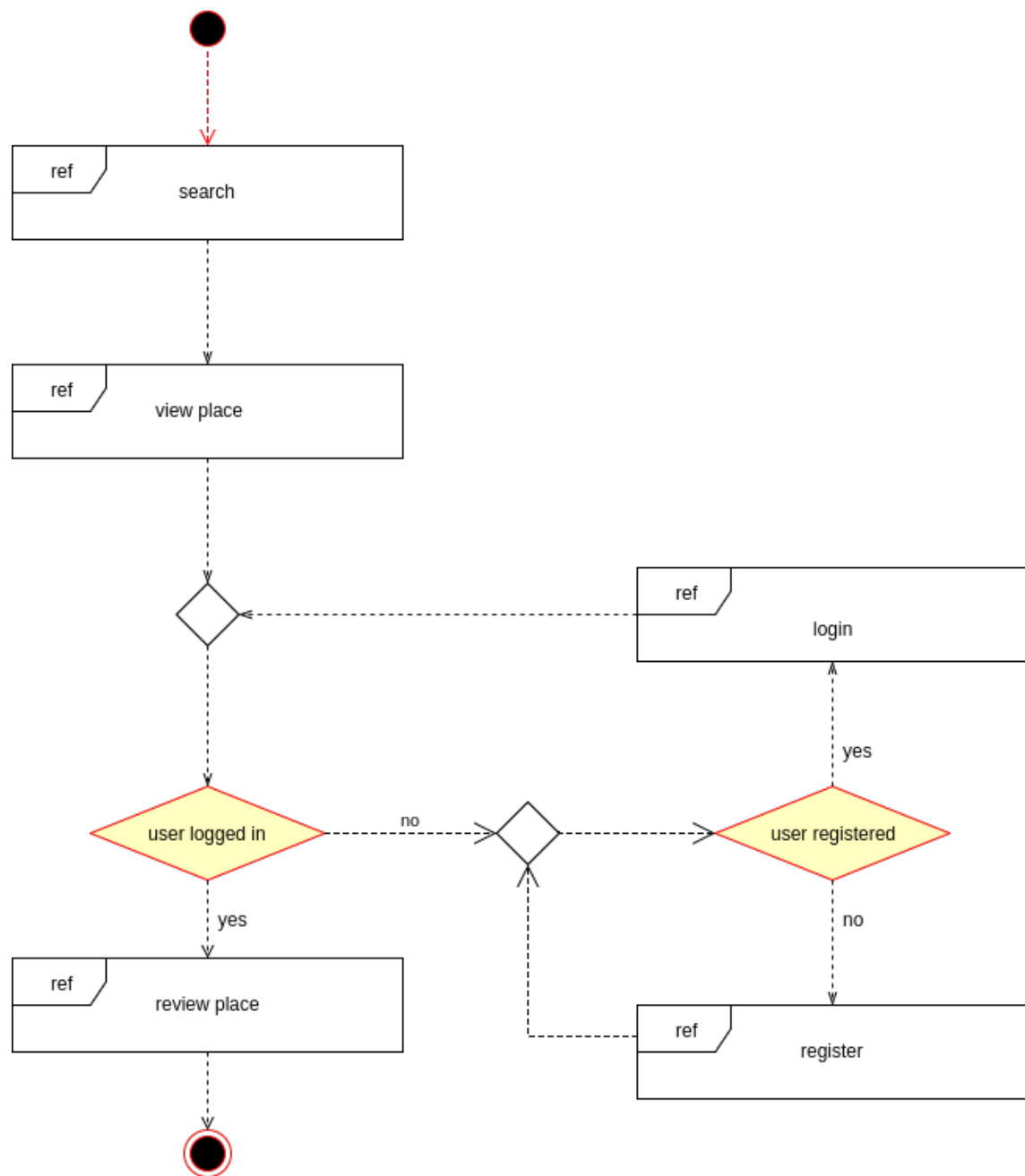


Figure 3.9: Interaction overview diagram

### 3.4.3 REST API module

This is a sort of a wrapper for OPR App that provides a REST API interface, to be used by the mobile app.

For the REST API Module, I worked using the backwards approach[2]; I started by writing the user manual and documentation of the functionalities before implementing.

The services provided by the API are:

- Login
- Register
- Logout
- Search for places
- Get place details
- Get reviews
- Add review

The functions that require the transfer of critical data were designed to use the HTTP POST method because it is more secure and it is the standard for this type of operations, for instance we used POST for the authentication and registration functions. We also chose HTTP POST for posting reviews, because it contains the authentication token, which is critical data, and it contains the review's text, whose size might exceed the GET data size limit.

As for the other functionalities we used HTTP GET methods. One of the benefits of using GET here is that you can share and bookmark links easier when the data is included in the URL.

## Login

Authenticate the user with the system and obtain the auth\_token

### Request

Method	URL
POST	api/accounts/login/

Type	Params	Values
POST	username	string
POST	password	string

### Response

Status	Response
200	<pre>{   "auth_key": &lt;auth_key&gt; }</pre> <p>auth_key (string) - all further API calls must have this key in headerx</p>
401	<pre>{"error": "Incorrect username or password."}</pre>
500	<pre>{"error": "Something went wrong. Please try again later."}</pre>

## Register

Create and add a new user to the app

### Request

Method	URL
POST	api/accounts/register/

Type	Params	Values
POST	username	string
POST	Password	String
POST	email	string

### Response

Status	Response
200	{ "status": "success" }
500	{"error": "Something went wrong. Please try again later."}

## Logout

Log out the current user

### Request

Method	URL
POST	api/accounts/logout/

Type	Params	Values
POST	auth_key	string

### Response

Status	Response
200	{ "status": "success" }
500	{"error": "Something went wrong. Please try again later."}

## Search for places

Search for hotels, restaurants or activities

### Request

Method	URL
GET	api/search/

Type	Params	Values
GET	type	string
GET	keyword	string

Example:

api/search/?type=hotel&type=restaurant&keyword=stockholm

## Response

Status	Response
200	<p><b>Response will be an object containing the list of places with their id, name, average rating, number of ratings, image.</b></p> <pre>{   "places": [     {       "place_id": "qsdf6r45",       "image":         "https://maps.googleapis.com/maps/api/place/photo?maxheight=1000&amp;photoreference=v2d5qsd",       "name": "Radisson Blu Stockholm",       "avg_rating": "3.7",       "ratings_count": "125"     },     {       "place_id": "fsqd1qs887",       "image":         "https://maps.googleapis.com/maps/api/place/photo?maxheight=1000&amp;photoreference=g88s9d",       "name": "Marriott Stockholm",       "avg_rating": "4.1",       "ratings_count": "354"     }   ],   "places_count": 2 }</pre>
500	<pre>{ "error": "Something went wrong. Please try again later." }</pre>

## Get place details

Get the details of a specific place using its place\_id

### Request

Method	URL
GET	api/place/

Type	Params	Values
GET	place_id	string

### Response

Status	Response
200	<pre>{   "place_id": "qsdf6r45",   "image":     "https://maps.googleapis.com/maps/api/place/photo?maxheight=     00&amp;photoreference=v2d5qsd",   "name": "Radisson Blu Stockholm",   "avg_ratings": [     "general": "3.7",     "environmental": "3",     "social": "2",     "cultural": "5",     ...   ],   "ratings_breakdown": [     ["Very poor", 0, 0.0],     ["Poor", 0, 0.0],     ["Acceptable", 1, 25.0],     ["Good", 1, 25.0],</pre>

	<pre>["Outstanding", 2, 50.0]] ,   "ratings_count": "125",   "description": {     "address": "stockholm, sweden",     ...   } }</pre>
500	<pre>{"error": "Something went wrong. Please try again later."}</pre>

In the `ratings_breakdown`, `["Outstanding", 2, 50.0]` means there is 2 votes for outstanding, which count for 50% of the total number of votes



## Get reviews

Get the reviews of a place using its place\_id

### Request

Method	URL
GET	api/reviews

Type	Params	Values
GET	place_id	string
GET	page	number

Reviews will be split into pages containing X reviews each.

Example:

api/reviews?place\_id=qsdf6r45&page=1

### Response

Status	Response
200	<pre>{   "place_id": "qsdf6r45",   "page": "1",   "total_reviews_count": "1025",   "reviews_in_page": "50",   "reviews": [     {       "review_id": "12",       "author": {</pre>

	<pre>"User_id": "lmkjsqdf" "name": "John Doe", "image": "http://opr.com/user/1655/image.jpg" }, "date": "May 3, 2017, 2:15 p.m.", "review": {   "title": "clean, solar powered hotel",   "visit_date": "May 1, 2017",   "text": "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco",   "type": "business",   "ratings": {     "general": "4",     "environmental": "4",     "energy": "5",     "water": "1",     ...   } }, ...</pre>
500	<pre>{"error": "Something went wrong. Please try again later."}</pre>

## Add review

Add a new review to a place

### Request

Method	URL
POST	api/addreview

Type	Params	Values
POST	auth_key	string
POST	user_id	string
POST	place_id	string
POST	visit_date	string
POST	title	string
POST	text	string
POST	type	string
POST	general	number
POST	environmental	number
POST	energy	number
POST	...	

### Response

Status	Response
200	{ "status": "success" }
500	{"error": "Something went wrong. Please try again later."}

## 4.1 Technology choices

### Frontend

For the front-end I used HTML/CSS/JS with JQuery library because it facilitates basic functionalities like DOM manipulation.

I also used twitter's Bootstrap in order to use its prebuilt components like the buttons.

### Backend

The programming language used is Python, with the framework Django.

After careful thought I went with this choice because of several factors, including but not limited to:

- Portability: this stack is cross-platform and can run on linux as well as windows
- Lots of tools out of the box: this choice offers:
  - Runtime + Web framework
  - Package manager (PIP)
  - A database to test with (sqlite)
  - A lightweight development server
  - Unit testing library
- Integrated ORM

- Lots of libraries and ready-to-use components
- Abundant support and documentation
- Stability and reliability
- Scalability
- Great community

This boils down to creating a prototype quickly with this technology stack; we can get a lot done in little time. Timing is a crucial part of this project, especially in this phase (prototyping).

### Database

While comparing multiple databases, I ended up with two of the most popular databases to compare between: MySQL and PostgreSQL.

The following table shows some differences of how things work in MySQL vs. in PostgreSQL.

	MySQL	PostgreSQL
CREATE INDEX	Entire table is locked for writes	Entire table is locked for writes. But PSQL has "CREATE INDEX CONCURRENTLY" that permits the creation of index without locking the entire table (but it is slower)
Adding new column	Entire table data needs to be rewritten	Instantaneous
Connection model	One thread/connection: Easy to create but hard to monitor and manage	One process/connection: Easier to monitor and manage

Table 4.1: MySQL vs PostgreSQL

I decided to use PostgreSQL as a database because of the previous comparison<sup>[3]</sup> and because it is well supported by Django.

This choice is somewhat influenced by the previous choice.

### Server

I used an Ubuntu 16.04 LTS Virtual Private Server for hosting the project. Ubuntu has a great community and support, is reliable, and the Long Term Support (LTS) version remains maintained for 5 years, so we won't have to worry about upgrading

the system for five years.

Ubuntu is based on Debian, which is one of the most stable Linux distributions ever. The provider of the VPS is Amazon Web Service (AWS). I used AWS because it offers a free tier during the first year of use, and because it has extensive capabilities beyond offering a simple VPS. One of the capabilities that interested me the most is the ease of scaling and setting up load balancers for the project.

### Web Server

I had the choice between Apache HTTP Server and NGINX.

Both of them are great web servers and have great communities and support, and both of them are open source as well.

I went with NGINX because it's better performance-wise and is becoming more and more popular, while Apache HTTP server's userbase is shrinking[5] (fig.4.1).

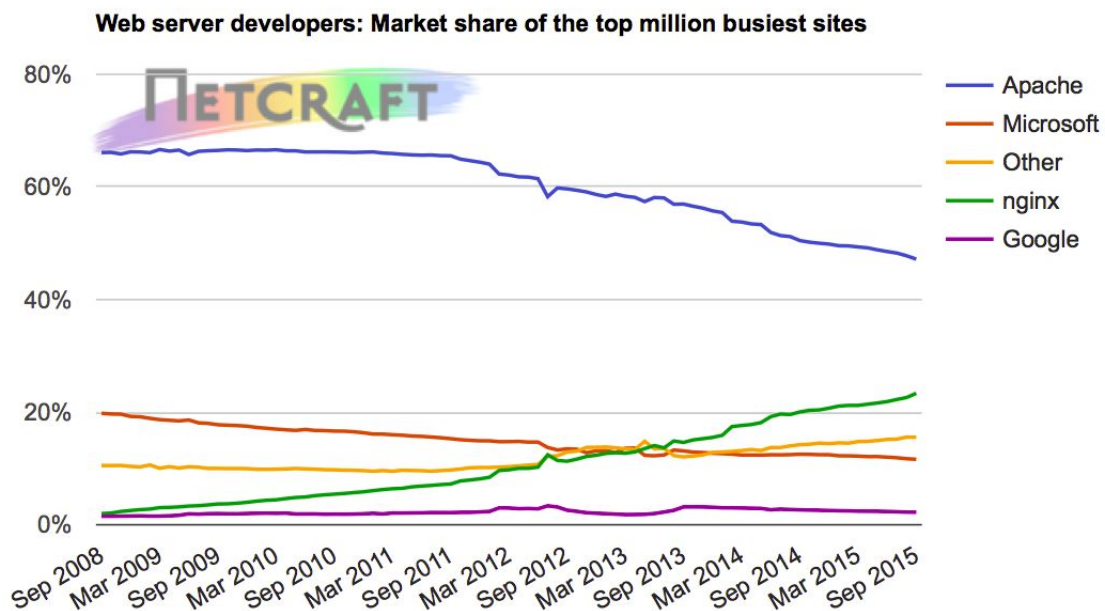


Figure 4.1: Chart showing how nginx's user base is growing while apache's is regressing

### Python Application server

I used Gunicorn as application server because it is the most popular and the best supported server.

## **Additional Frameworks/libraries**

### **Django-rest-framework**

Django-rest-framework (DRF) supports the creation of REST APIs on top of Django. This framework is django's standard tool to create REST APIs. It also includes a web browsable API to facilitate the development. The framework has extensive documentation and is used by multiple huge companies like RedHat and Heroku.

### **Django-allauth**

This is a library addressing authentication, registration, account management and social authentication. The library allows authentication using multiple services including social login with facebook, twitter and lots of other services. The library can be customized to send messages for email verifications.

### **Django-rest-auth**

This library makes the previously mentioned library (allauth) accessible via REST API. The library is backed by the company Tivix. The functionalities offered by this library are: registration and activation, login/logout, password change, password reset and social authentication.

### **Django-review**

This is a library facilitating the creation of reviews and ratings. I found multiple libraries offering reviews-related functionalities. I chose this library because it's kept updated and is backed by the company bitlabstudio.

## 4.2 Screenshots

### 4.2.1 Web interface

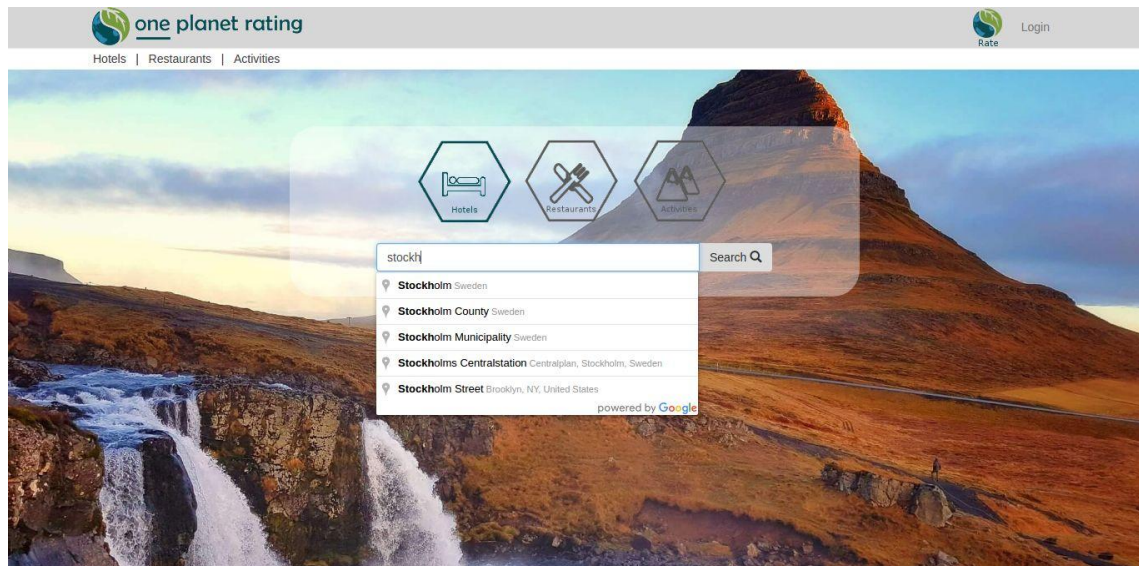


Figure 4.2: The landing screen of the app

When first accessed, the app shows the previous landing page (fig.4.2). From there the user is able to search for a place using the search bar.

The user is also able to access the login screen from there.

Other functionalities include listing the popular and trending hotels using the links in the top left corner, but these functionalities haven't been implemented yet.

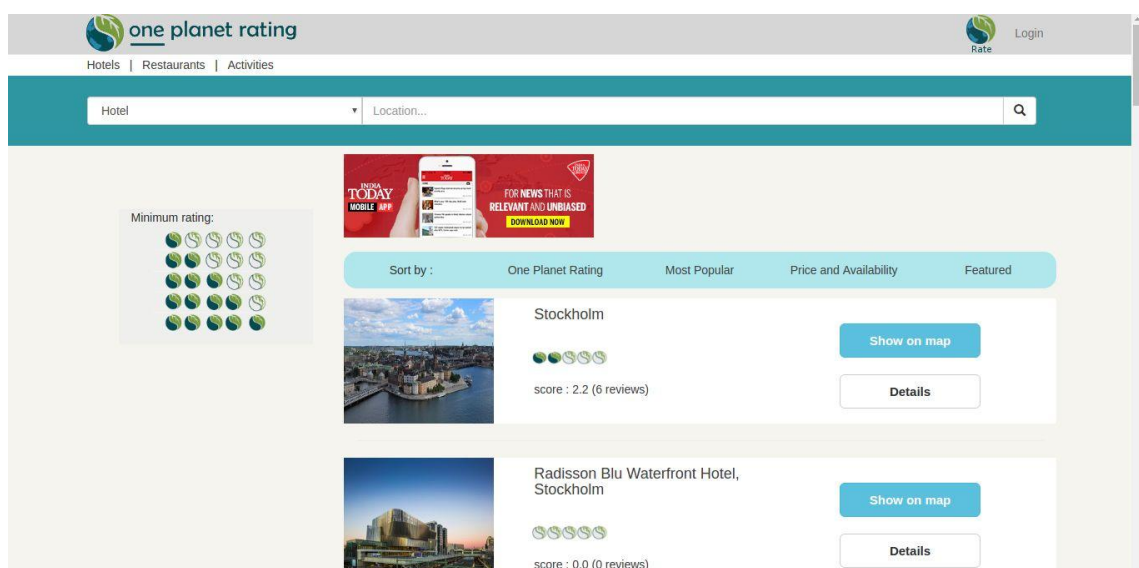


Figure 4.3: Search screen



After the landing page, when a user searches for a place he will get redirected to this search screen (fig.4.3) which includes the results retrieved from Google's places service. The search results include the name and the picture (from google) as well as the number of reviews and the average score from the reviews posted on OPR.

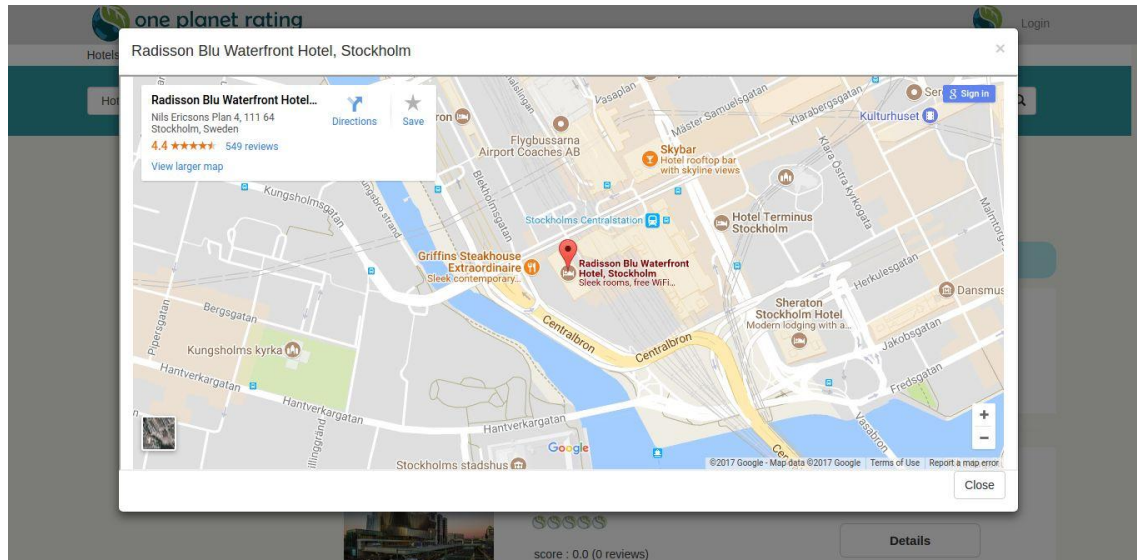


Figure 4.4: Showing the location of a place on the map

From the search screen, the user is able to click the "show on map" button to see the selected place on Google maps. The map is shown in a modal view (fig.4.4) in order for the user not to quit OPR's site.

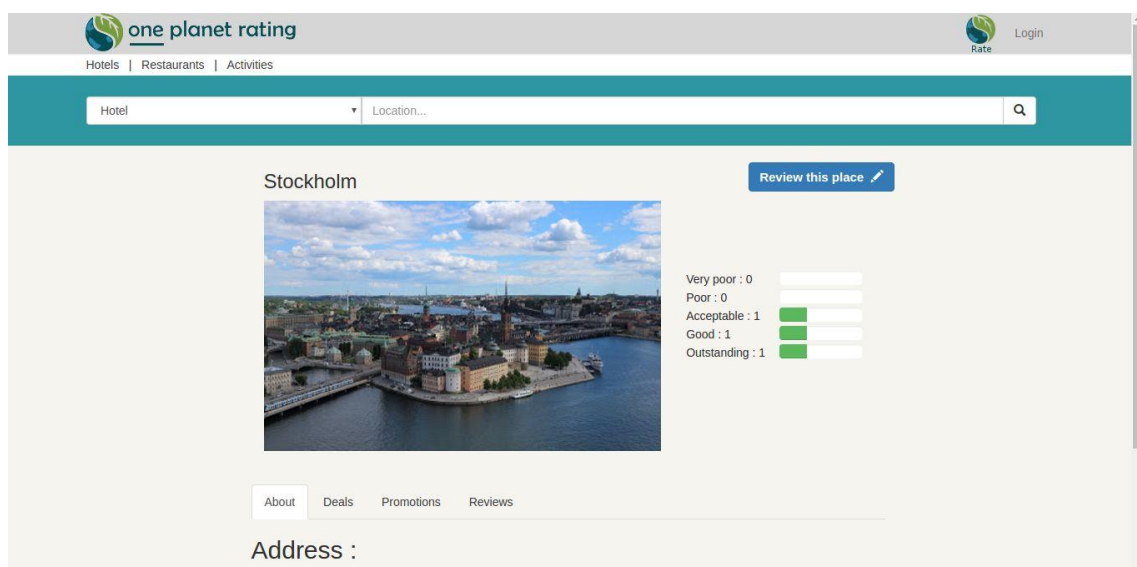
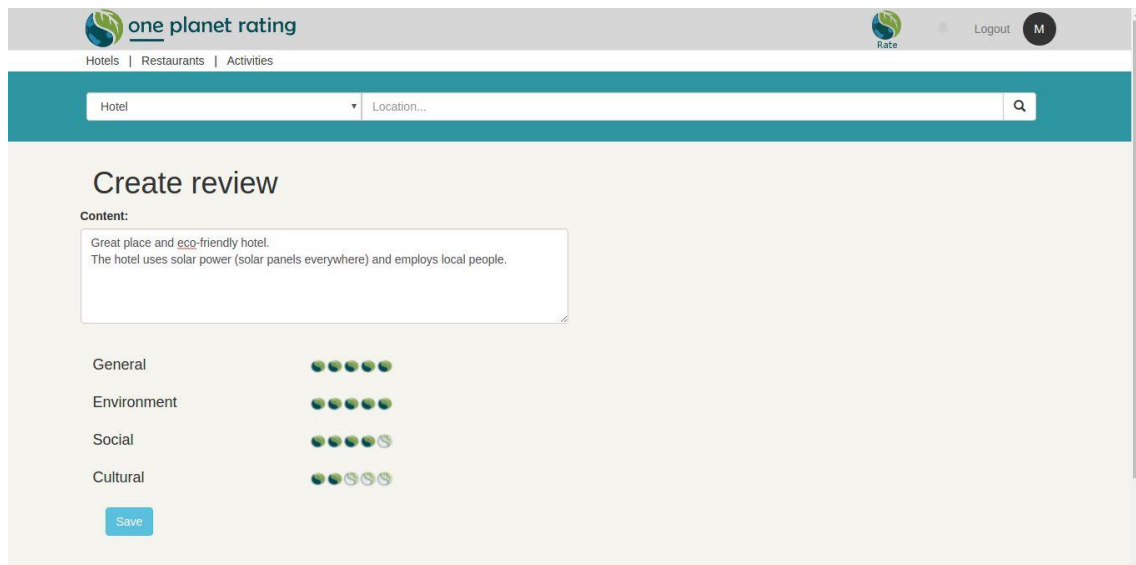


Figure 4.5: Place details

When the user selects a place to see its details, he's shown this screen (fig.4.5); it contains the name, picture and basic details of the place. This same screen also

contains the reviews and a chart showing the numbers and proportions of ratings.

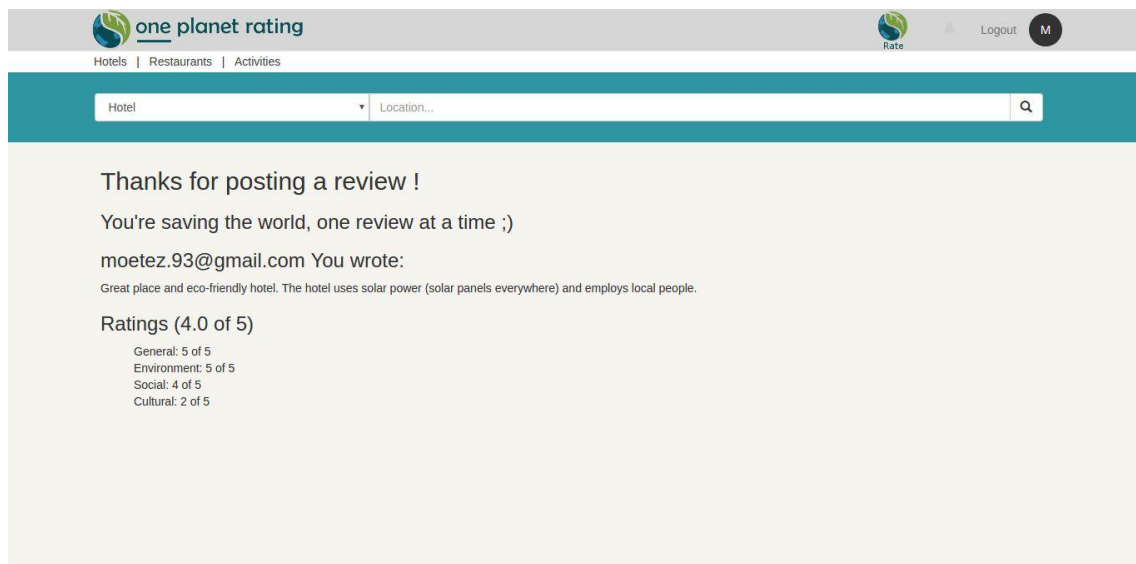


The screenshot shows the 'one planet rating' app interface. At the top, there's a header with the logo and navigation links: 'Hotels | Restaurants | Activities'. Below the header is a search bar with a dropdown menu set to 'Hotel' and a 'Location...' input field. The main content area is titled 'Create review'. It features a text input field for the review content, which contains the text: 'Great place and eco-friendly hotel. The hotel uses solar power (solar panels everywhere) and employs local people.' Below the text field are four rating categories: 'General', 'Environment', 'Social', and 'Cultural'. Each category has a row of five green circular icons representing stars. The 'General' category has all five stars filled. The 'Environment' category has all five stars filled. The 'Social' category has four stars filled and one empty. The 'Cultural' category has two stars filled and three empty. A blue 'Save' button is located at the bottom left of the form.

Figure 4.6: Creating a review

When the user chooses to create a review, the app first checks whether he's logged in.

If not, the user is redirected to the login screen, otherwise this form appears (fig.4.6). The form allows the user to enter a text review as well as ratings following specific criteria.



The screenshot shows the 'one planet rating' app interface after a successful review submission. The header and search bar are the same as in Figure 4.6. The main content area displays a confirmation message: 'Thanks for posting a review !'. Below this, it says 'You're saving the world, one review at a time ;)'. The user's email address 'moetez.93@gmail.com' is shown, followed by 'You wrote:'. The review content is displayed: 'Great place and eco-friendly hotel. The hotel uses solar power (solar panels everywhere) and employs local people.' Below the review content, the ratings are shown: 'Ratings (4.0 of 5)'. The ratings are listed as follows: 'General: 5 of 5', 'Environment: 5 of 5', 'Social: 4 of 5', and 'Cultural: 2 of 5'.

Figure 4.7: Thanks screen

After a member posts a review successfully, he's shown a thanks screen (fig.4.7).

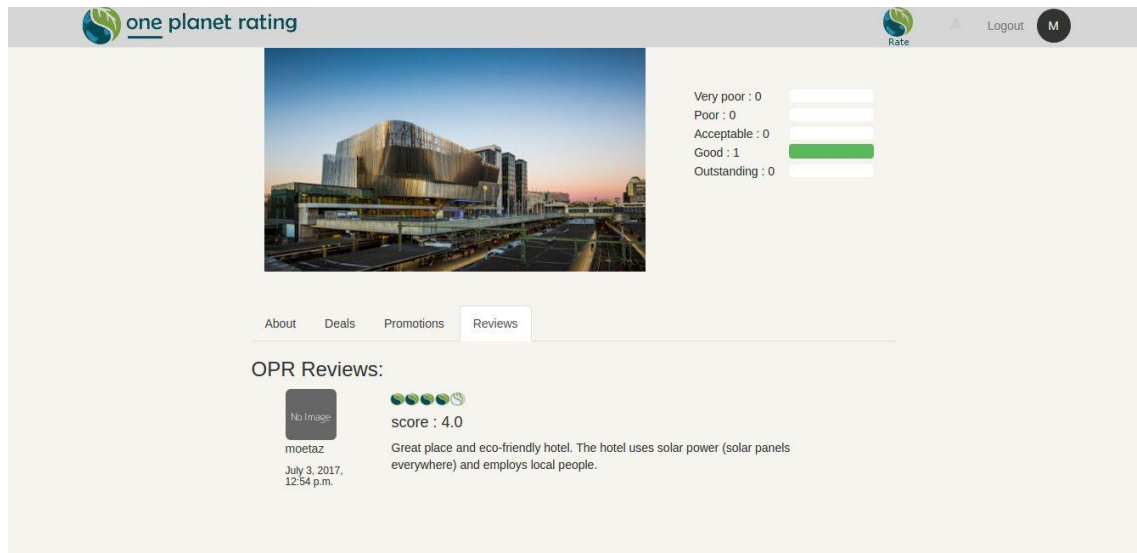


Figure 4.8: Showing a review

After a review is added, it is displayed as in this screenshot (fig.4.8). The score, text, username and date are currently shown. Other features are being added like the user's photo and the categorized ratings.

## 4.2.2 API

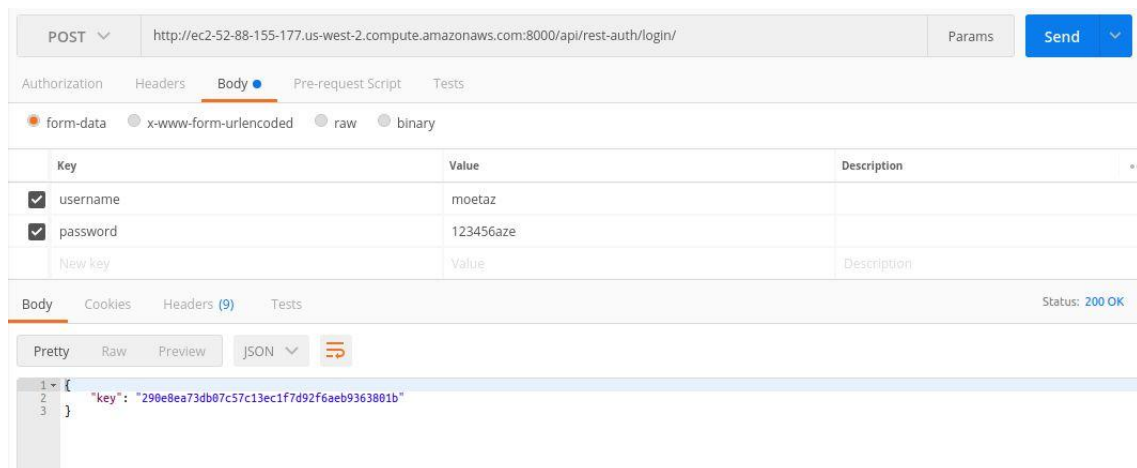


Figure 4.9: API Login

This screenshot (fig.4.9) shows an example of a login request through the REST API.

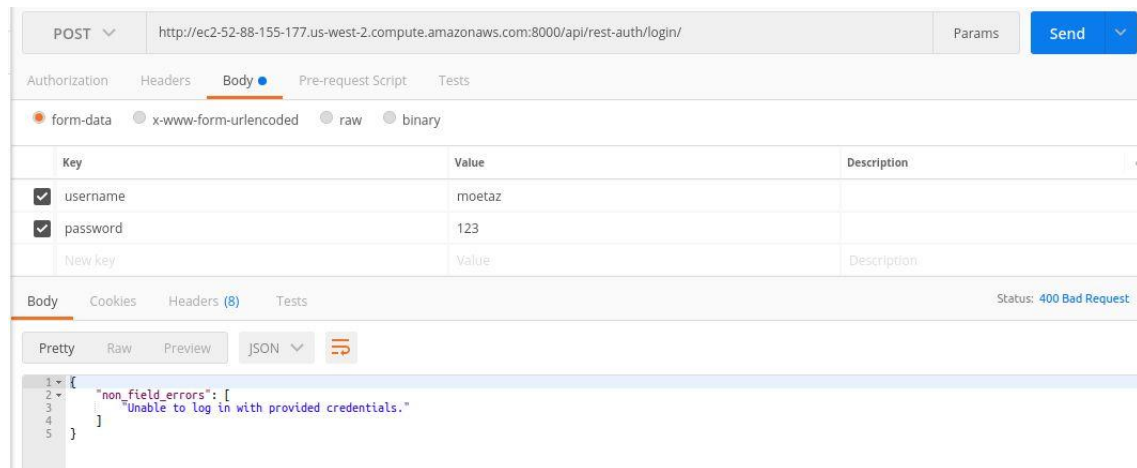


Figure 4.10: API Login failure

In case of failure (wrong credentials), an error message is sent back to the user (fig.4.10).

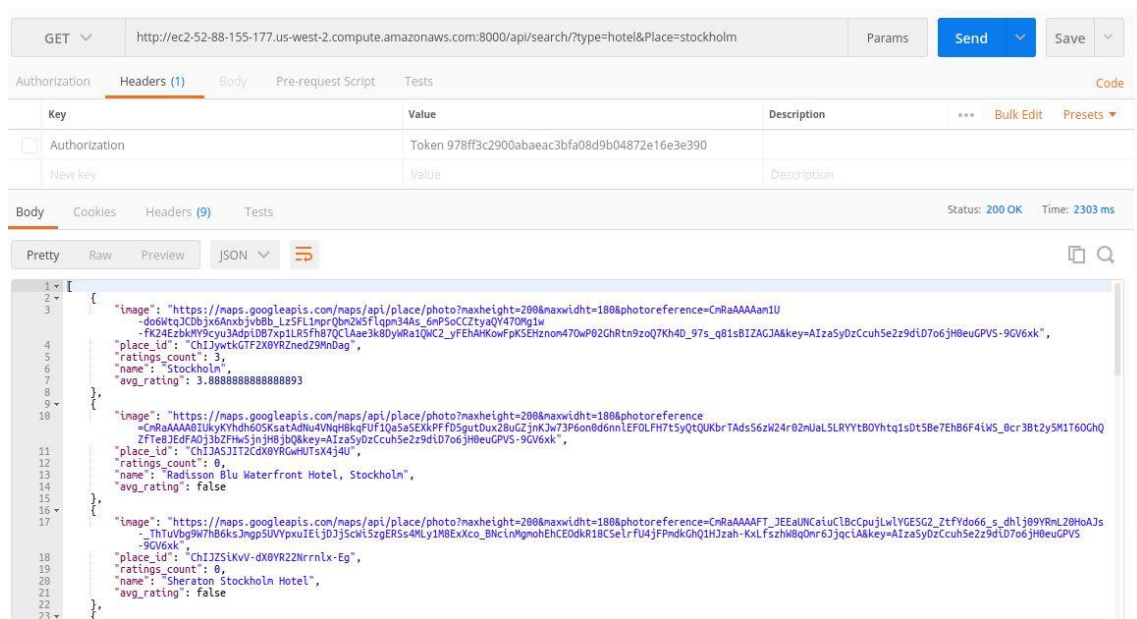


Figure 4.11: API search request

This screenshot (fig.4.11) shows the response to a search query. The query includes as parameters the type of place (hotel, restaurant..) as well as a keyword to specify the location.

The response contains the name, image, place\_id, ratings count, and the average rating.

The name and image are displayed as is. The ratings count and the average rating, however, are used to display the globes/stars next to each place in the results list. The place\_id is used to get the place's map or the place's details.

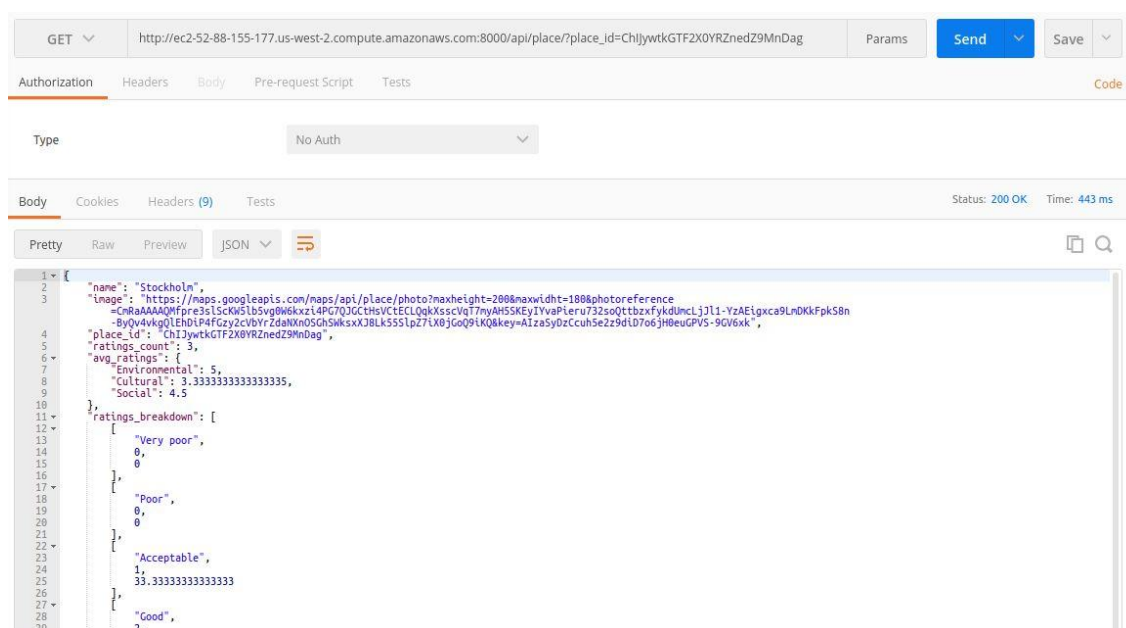


Figure 4.12: API place details

When requesting the details of a place (fig.4.12), the request includes the `place_id` of the place.

Obviously the response includes the name and image of the place, it also includes the number and averages of ratings. It also contains the ratings breakdown, which consists of the proportions of the ratings arranged by the number of stars ( 0 star = very poor, 1 star = poor...)

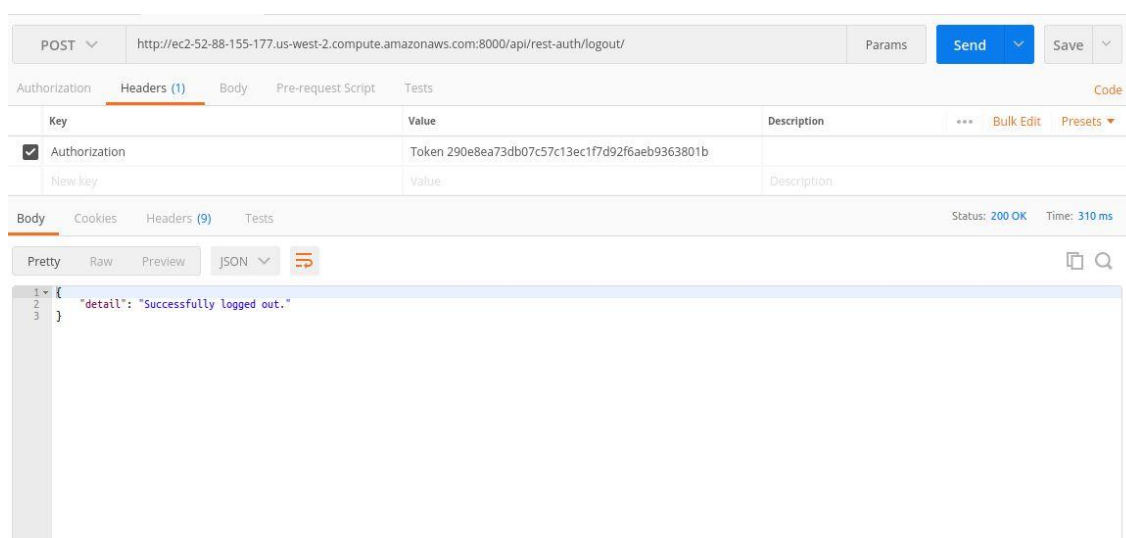
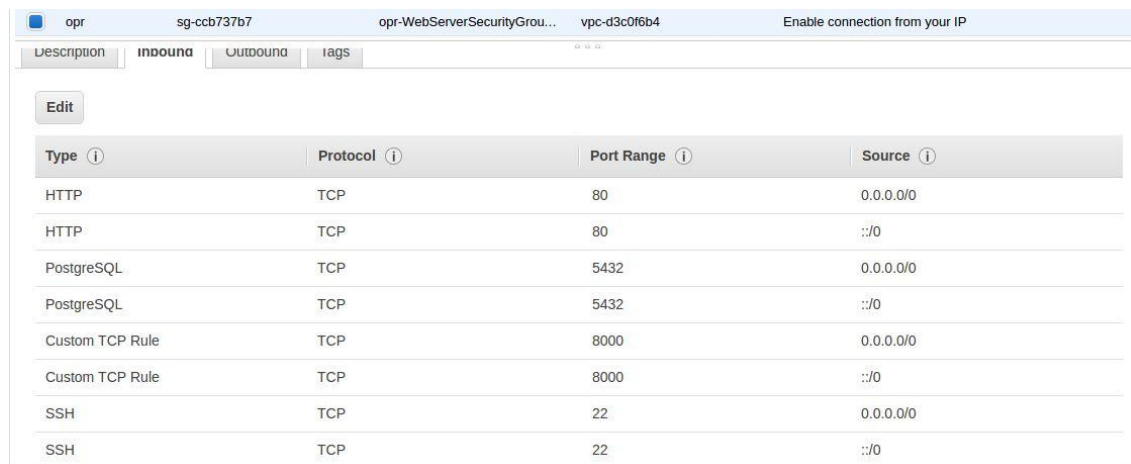


Figure 4.13: Logout API call

This screenshot (fig.4.13) shows a successful logout call. The authentication is based on an authorization token stored in the DB. After logging out, that token is deleted.

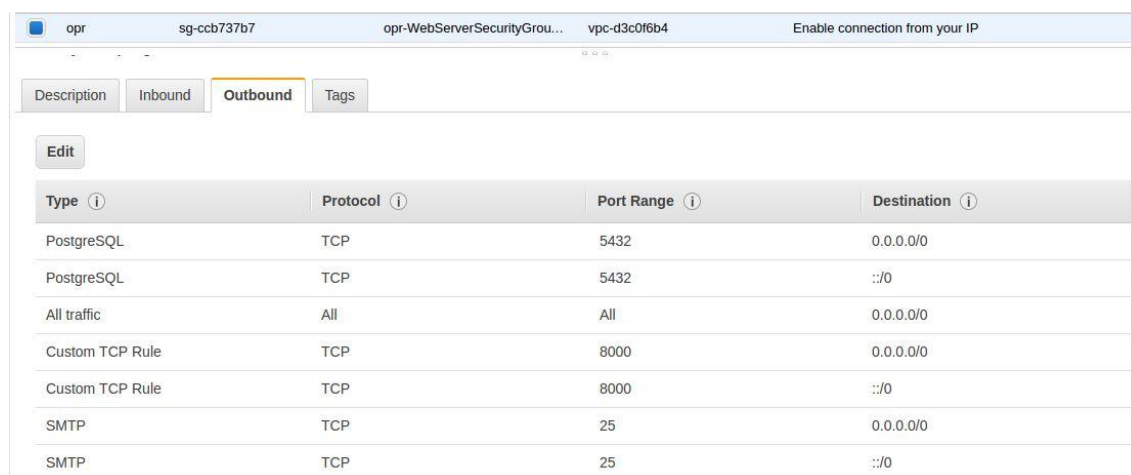
## 4.3 Deployment

### AWS EC2 Security setup



Type	Protocol	Port Range	Source
HTTP	TCP	80	0.0.0.0/0
HTTP	TCP	80	::/0
PostgreSQL	TCP	5432	0.0.0.0/0
PostgreSQL	TCP	5432	::/0
Custom TCP Rule	TCP	8000	0.0.0.0/0
Custom TCP Rule	TCP	8000	::/0
SSH	TCP	22	0.0.0.0/0
SSH	TCP	22	::/0

Figure 4.14: AWS EC2 allowed inbound traffic



Type	Protocol	Port Range	Destination
PostgreSQL	TCP	5432	0.0.0.0/0
PostgreSQL	TCP	5432	::/0
All traffic	All	All	0.0.0.0/0
Custom TCP Rule	TCP	8000	0.0.0.0/0
Custom TCP Rule	TCP	8000	::/0
SMTP	TCP	25	0.0.0.0/0
SMTP	TCP	25	::/0

Figure 4.15: AWS EC2 allowed outbound traffic

A problem I encountered during the deployment is to get the server to reply for requests. In the beginning I was even unable to ssh into the VPS. It turned out, for security reasons AWS blocks all incoming<sup>[7]</sup> (fig.4.14) and outgoing (fig.4.15) traffic.

## AWS RDS setup

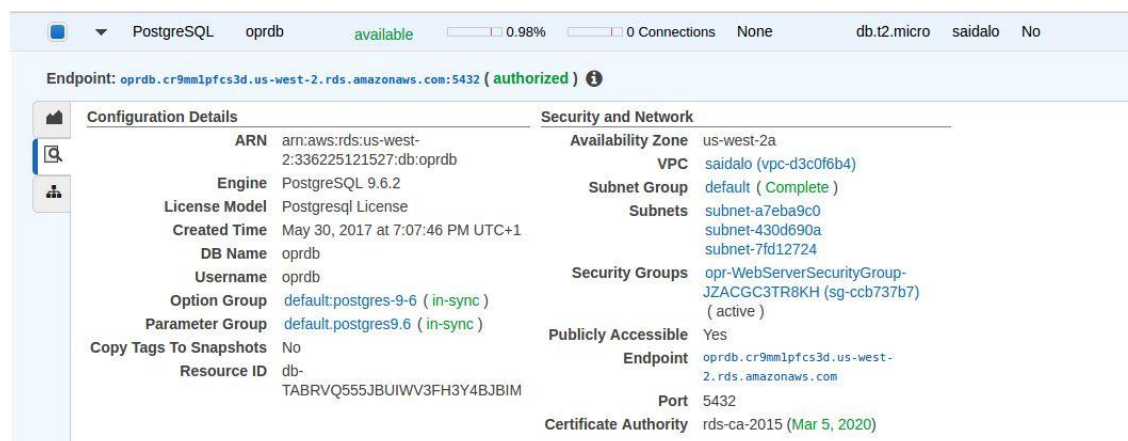


Figure 4.16: AWS RDS setup

I used AWS RDS (fig.4.16) for hosting the database because security wise it's better approach to host the database separately from the app. Another advantage of AWS RDS is that it automatically creates backups of the DB[6].

First I hosted a local db for testing purposes then I moved the same DB to RDS.

## NGINX setup

NGINX is the entypoint to the app. It's also the web server used to serve the app. NGINX was setup to listen on port 8000 and to serve the static files like the images and css ( practically every url pointing to /static). In case of non static files, NGINX redirects the request to gunicorn which is the python server that's serving the app. For the configuration of NGINX please refer to "NGINX configuration" in the appendix

## 4.4 Testing

For the development of searchAd module, which is a sort of standalone library, I also created unit tests (fig.4.17) for it.

The unit tests ensure that the code works correctly, and helps verify that the code didn't break after some changes. This provides better quality and saves more time.



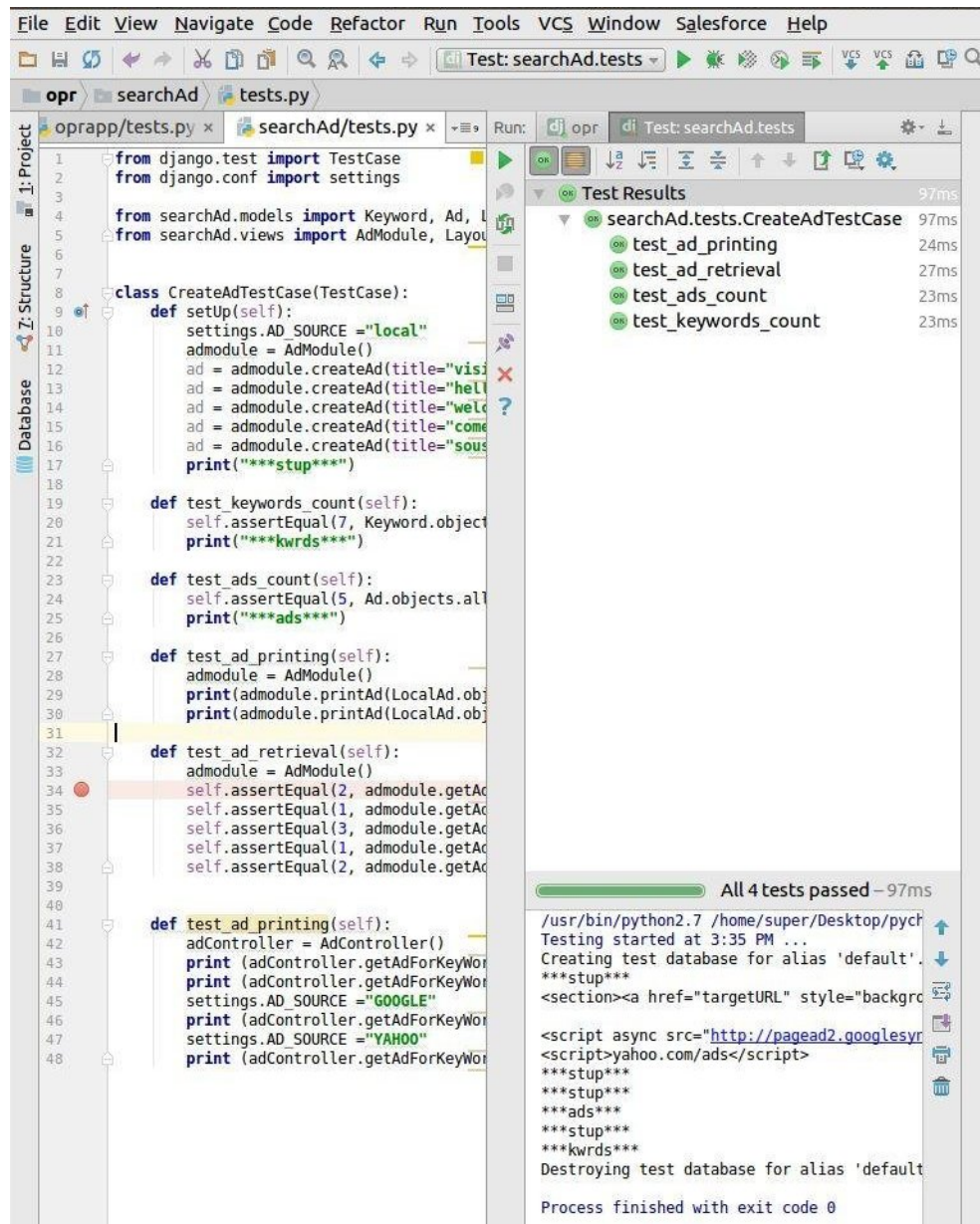


Figure 4.17: Unit tests

I also tested the performance of the app (load speed) using google's Pagespeed Insights, and I got some amazing results (fig. 4.18 and fig.4.19)



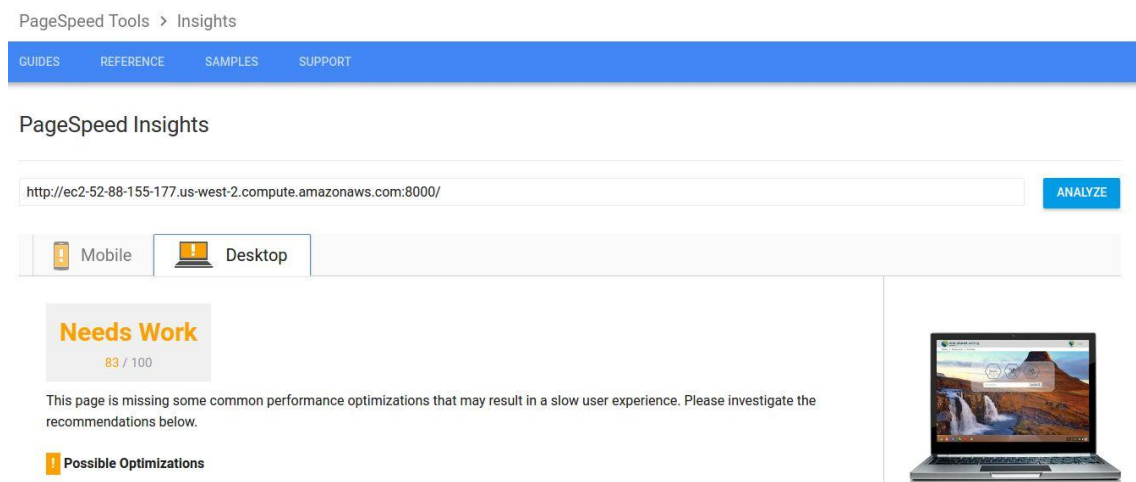


Figure 4.18: Landing page speed test

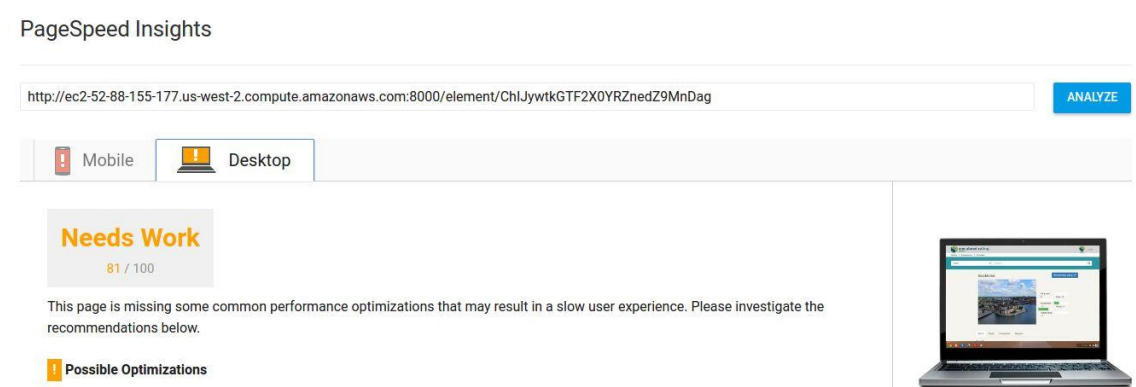


Figure 4.19: Details page speed test

Below (fig.4.20) is included the result for the same test applied to facebook.com for comparison purposes:

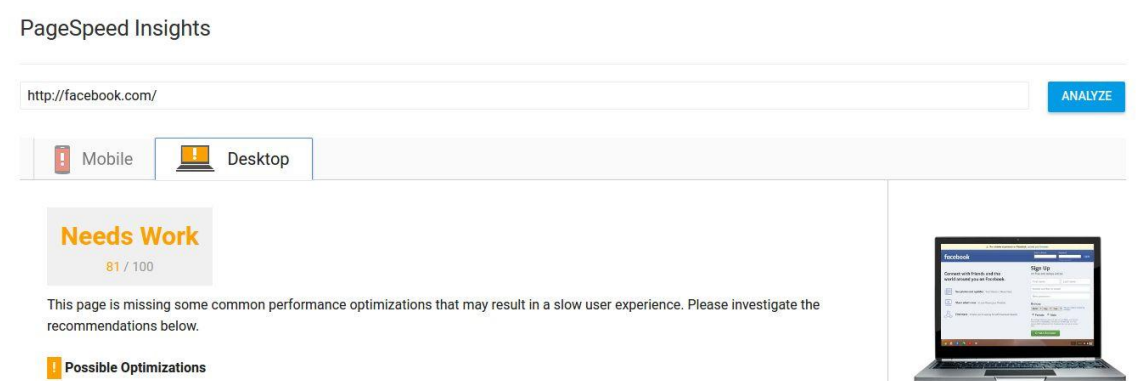


Figure 4.20: Facebook page speed test

I also tested the performance of the app using blazemeter (fig.4.21). I tested the service with 50 simultaneous virtual users and the results were good enough.

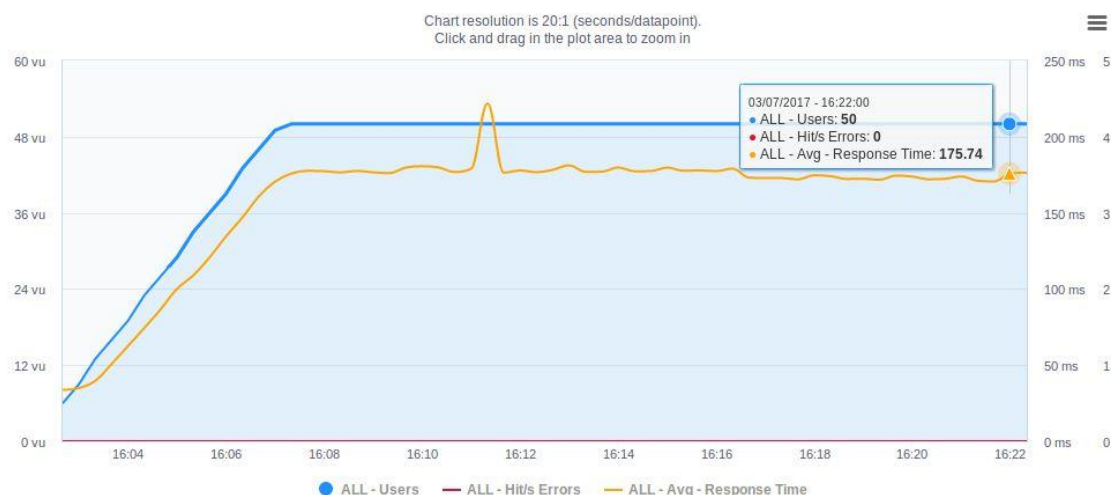


Figure 4.21: Concurrent users test

With 50 simultaneous users the response time was 170ms which is okay. Note that the performance is influenced by the performance amazon's server, which is very limited but easily scalable. For the development, I went with a low-performance server instance because of budgetary reasons, but we can scale up easily later when we need to. The used instance is an AWS EC2 t2.micro with the following specs:

- RAM: 1 GB
- vCPUs: 1

## 4.5 Work environment

All of the development was made on my personal laptop which has the following specs:

- RAM: 8GB
- CPU: Intel core i7
- OS: Ubuntu 16.04 LTS

### PyCharm

During the development I used the IDE PyCharm. It's developed by JetBrains, the world leader in IDEs development. PyCharm's user interface is very user-friendly and familiar because it's similar to the company's other products.

PyCharm is also extremely powerful. To name a few of its features we can cite: code completion, debugging and integrated version control tools.

**BitBucket**

For version control we used Git, hosted on BitBucket. Git is the most popular distributed version control system. It's widely used and very powerful. It allows developers to keep all the history of the project, and allows them to collaborate efficiently. BitBucket offers unlimited free private git repositories for teams of up to 5 people.

**Slack**

Communication was all held on Slack. Slack is becoming the standard in the corporate communication tools and is used by some of the biggest organizations in the world like NASA. Slack allows people to create chat channels, share files, and hold audio and video calls from the web browser. Another major powerful feature of Slack is that it has multiple plugins and external integrations.

**draw.io & Dia**

The diagrams were made using Dia and draw.io

Both of these tools are open source and very popular. The main difference is that Dia runs locally while draw.io runs on the browser. Both of these tools are powerful, versatile and have ready-to-use UML components.

**GIMP**

In the beginning of the project I also did some graphic design using GIMP, which is an open source and free alternative to photoshop.

GIMP allows the creation of layers, transparency, filters and many advanced features that were very useful during the design phase.

**InvisionApp**

I used InvisionApp to create an interactive prototype using the mockups I designed. InvisionApp allows the creation of prototypes from images only. Images become clickable and the behaviour is customizable. The prototype can then be tested in the browser or using a mobile device, and gives a very real experience.

**Chrome developer tools**

Chrome developer tools were used extensively for debugging and tweaking the frontend.

The tools offer several features from simple ones like changing the styling of the DOM and seeing the changes in realtime to more advanced operations like debugging JavaScript code in the browser and monitoring the requests and their responses.

**Postman** Postman was used to test the REST requests for the API.

Postman is a Chrome extension that allows to send custom HTTP requests and preview their responses. In the beginning I used curl, but it turned out Postman is a lot more efficient.

**Unittest** Unittest is a python library for unit testing. It's included with python by default. I used it for testing the searchAd module.

The work done during my internship constitutes the first working prototype of OPR. In the beginning a substantial effort and time was dedicated to analyze the project and identify the available alternatives. We also defined the specification and requirements in details so we can have a clear vision about the needs that the project should satisfy.

Then we went through the design aspects and set the physical architecture (we chose AWS' EC2 and RDS with NGINX as a web server, Gunicorn as python server, PostgreSQL as DB and Ubuntu LTS as OS). We also went through the logical architecture and we decided to use MVC + 3 Tiers. The last step in the design process was to set the modular architecture of the project.

Finally we covered the implementation details, by explaining the tool choices and tech stack as well as exposing how the system works. We also covered the deployment process, configuration and the tests that the project went through.

The prototype is being tested internally and soon to be released to the public. But before becoming production ready, the app needs security and penetration testing. Also, now that the project is getting bigger, the project should also take advantage of more sophisticated yet facilitating tools, like continuous integration, continuous deployment and containerization.

The REST API might also turn out useful if the frontend of the web app gets re-designed using a single-page app framework such as React or Angular. Other performance improvements can be easily implemented, like using a Content Delivery Network to deliver the static files, but the project is still not big enough and not mature enough to require such optimizations.

The project is easily scalable, especially with the help of AWS which allows the expansion of the infrastructure in a couple of clicks[7][6]. During the deployment I set up a couple instances and a loadbalancer to test the high-availability of the service and it worked perfectly, but I later removed it for budgetary reasons.

# Bibliography

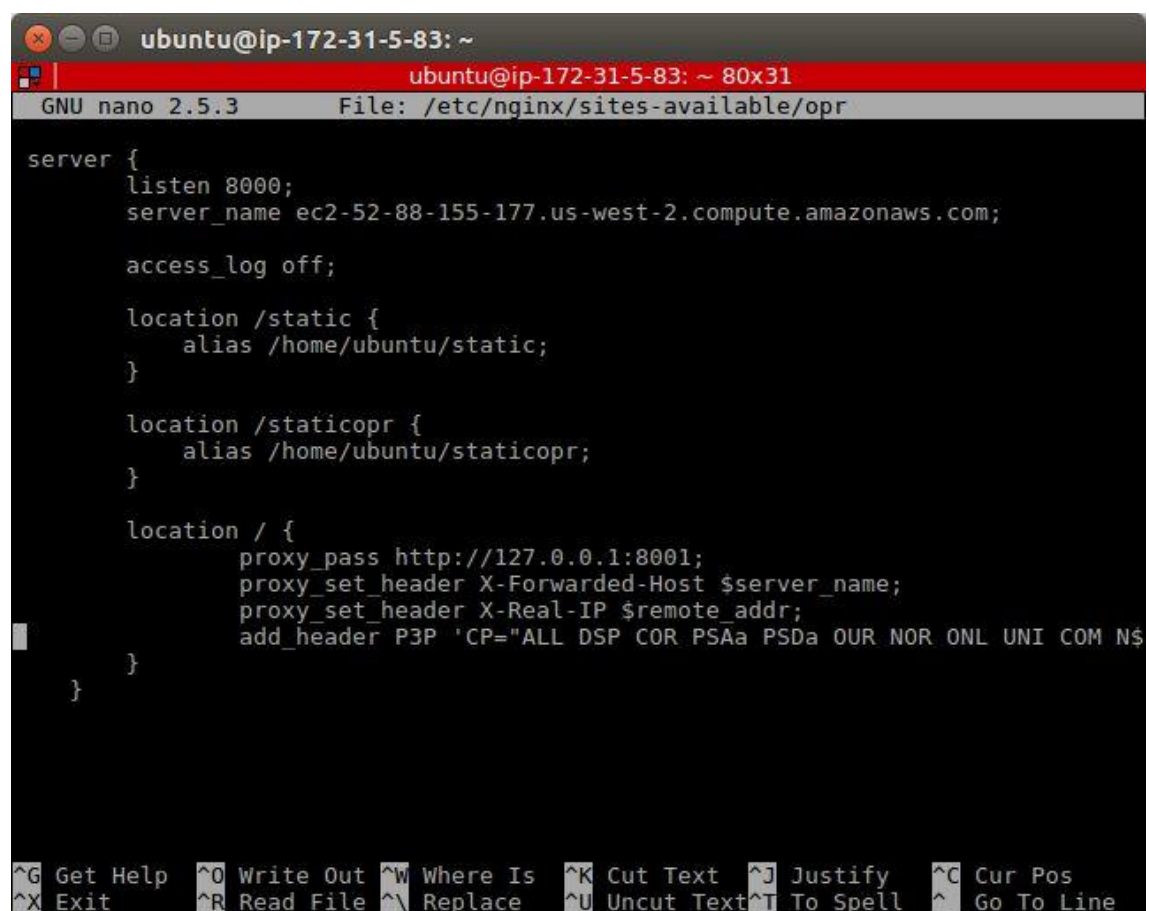
- [1] Paolo Anania.  
*Arbeiten bei Trivago: Keine Hierarchien und 15 Biersorten gratis.* (German)  
*Working with Trivago: No hierarchy and 15 offices.* (English)  
[http://www.lead-digital.de/aktuell/work/arbeiten\\_bei\\_trivago\\_keine\\_hierarchien\\_und\\_15\\_biersorten\\_gratis](http://www.lead-digital.de/aktuell/work/arbeiten_bei_trivago_keine_hierarchien_und_15_biersorten_gratis).
- [2] Werner Vogels, CTO@Amazon  
*Working Backwards*  
[http://www.allthingsdistributed.com/2006/11/working\\_backwards.html](http://www.allthingsdistributed.com/2006/11/working_backwards.html).
- [3] Anand Chitipothu.  
*Ten Reasons Why You Should Prefer PostgreSQL to MySQL .*  
<https://www.slideshare.net/anandology/ten-reasons-to-prefer-postgresql-to-mysql>.
- [4] Justin Ellingwood.  
*How To Set Up Django with Postgres, Nginx, and Gunicorn on Ubuntu 16.04 .*  
<https://www.digitalocean.com/community/tutorials/how-to-set-up-django-with-postgres-nginx-and-gunicorn-on-ubuntu-16-04>.
- [5] Alexandra Leslie.  
*NGINX vs. Apache (Pro/Con Review, Uses, & Hosting for Each) .*  
<http://www.hostingadvice.com/how-to/nginx-vs-apache/>.
- [6] Amazon web services.  
*AWS RDS Documentation .*  
<http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Welcome.html>.

- [7] Amazon web services.  
*AWS EC2 Documentation* .  
<http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/concepts.html>.
- [8] John Fien, Margaret Calder and Clayton White.  
*Sustainable tourism* .  
[http://www.unesco.org/education/tlsf/mods/theme\\_c/mod16.html](http://www.unesco.org/education/tlsf/mods/theme_c/mod16.html).
- [9] United Nations.  
*Sustainable Development Goals* .  
<https://sustainabledevelopment.un.org/sdgs>.



# Appendix

## 5.1 NGINX configuration



The screenshot shows a terminal window with the title bar 'ubuntu@ip-172-31-5-83: ~'. The terminal is running the GNU nano 2.5.3 text editor, editing the file '/etc/nginx/sites-available/opr'. The configuration file content is as follows:

```
server {
    listen 8000;
    server_name ec2-52-88-155-177.us-west-2.compute.amazonaws.com;

    access_log off;

    location /static {
        alias /home/ubuntu/static;
    }

    location /staticopr {
        alias /home/ubuntu/staticopr;
    }

    location / {
        proxy_pass http://127.0.0.1:8001;
        proxy_set_header X-Forwarded-Host $server_name;
        proxy_set_header X-Real-IP $remote_addr;
        add_header P3P 'CP="ALL DSP COR PSAa PSDa OUR NOR ONL UNI COM NS';
    }
}
```

The bottom of the terminal window displays a row of nano editor shortcuts: ^G Get Help, ^O Write Out, ^W Where Is, ^K Cut Text, ^J Justify, ^C Cur Pos, ^X Exit, ^R Read File, ^\ Replace, ^U Uncut Text, ^T To Spell, and ^\_ Go To Line.