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departamento de eletrónica,
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TQS: Product specification report

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1   Introduction

1.1   Overview of the project

Our product is a lightweight bike rental platform called **Jolteon**.
Jolteon allows users to **rent electric bikes from designated locations**, plan trips between a start and destination point, and choose **cultural stops** (like museums or landmarks). The platform emphasizes **simplicity and accessibility**, providing just the essential features needed for a smooth point-to-point rental experience.
Jolteon is ideal for **casual tourists and city explorers** looking for a hassle-free way to navigate urban areas and discover cultural spots: without needing a guided tour or complex mobile features.

This project idea stems from the recommended electrical scooter idea shared by the professor, with the added twist of tour stop recommendations for a tourist-focused market. We also took some inspiration from the local e-bike fleet and idealized the implementation of our platform working with the **BUGAS** fleet in Aveiro, where the density of tourists is high and many would benefit from **Jolteon**.

1.2   Known limitations

Planned features: Authentication was not implemented. As a result, seeing a rental history is also not available to the user, and the payment system was also not implemented due to this. The Cultural Landmark page to check details and reviews was also not implemented.

Out of scope: We can't see the current bike location (like with GPS).

1.3   References and resources

https://github.com/mikepenz/xray-action
https://devopscube.com/github-actions-self-hosted-runner/
https://dev.to/pixiebrix/disable-a-direct-push-to-github-main-branch-8c2

Some tutorials:
https://www.youtube.com/watch?v=1mtYVDA2_iQ
https://www.youtube.com/watch?v=h_GGd7HfKQ8&t=146s
https://www.youtube.com/watch?v=6BkcHAEWeTU&t=4s
https://www.youtube.com/watch?v=FR5wFTvXiEs&t=148s

2   Product concept and requirements

2.1   Vision statement

Functional (Black-Box) Description

High-Level Business Problem:
Cities need a way to offer visitors an e-bike reservation system that balances user experience with operational efficiency. Visitors want a simple way to rent e-bikes and easily find charging stations along their route.

Key Features Addressing the Problem:

- Bike Renting system

- Renting duration and details display

- Interactive map that shows bike charging spots and notable landmarks

- Operator dashboard to add new bikes and charging spots

- City-Admin dashboard to add and update cultural landmarks

- Course selection with suggested notable landmarks

- Check real-time bike availability

- Event notifications for users

- Cultural Landmark rating and reviewing

Requirements Gathering & Selection

Concept Development: Brainstormed as a group, with inspiration on the BUGAS, the UA Bikes project, and the high density of tourists in Aveiro and in Portugal that would benefit from our app.

2.2 Personas and scenarios

Personas

1st Persona: Maria Sanchéz

Maria Sanchéz is a fifty-four-year-old retired English teacher from Santa Marta, Colombia, currently on a solo city-break. She is fluent in both her mother tongue, Spanish, as well as English. She is very keen on art, history, and architecture, so she loves traveling the world and getting to know new cultures. She is very athletic and loves to ride her bike, but she can't bring it when she travels to other countries. Her comfort level with technology is moderate, as she uses WhatsApp and basic map apps but is hesitant to explore new apps.

She struggles with existing travel apps. She tried using some and found it overwhelming to choose from too many route options and complicated UIs.

Motivation: To travel more effectively, she would like an app that allows her to rent e-bikes, so she can visit multiple museums quicker than on foot.

2nd Persona: Raphael Müller
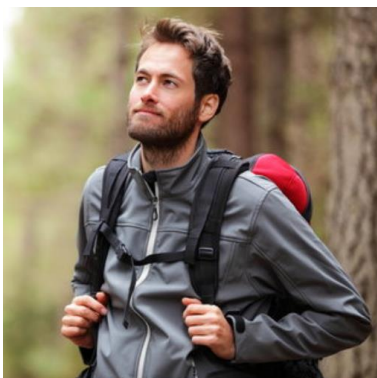
Raphael Müller is a twenty-nine-year-old tourist from Munich, Germany, currently on a two-week hiking trip across Europe. Professionally, he works as a software engineer in an urban setting, but during his travels, he seeks to reconnect with nature. Raphael is fluent in German and English and has a basic understanding of French. He is highly comfortable with technology and relies on various travel apps, booking platforms, and GPS tools on his smartphone to enhance his journey.

As a nature enthusiast, he craves long and uninterrupted bike rides through parks, river trails, and rural outskirts, preferring routes with minimal stops.

Overly frequent pop-ups for points of interest or step-by-step navigation can distract him from the ride, diminishing the experience he seeks.

Motivation: Raphael would like an app that shows accurate bike autonomy information to confidently complete a 25-kilometer nature loop. He would also like that app to have an intuitive map view and a user interface free of unnecessary clutter.

3rd Persona: Mariana Vivágua

Mariana Vivágua is a twenty-four-year-old city planner from Aveiro, Portugal. She recently graduated on Tourism Planning and Management in Aveiro's University and now gets to work in the Aveiro's municipal tourism department, where she is responsible for curating public experiences and ensuring that safety regulations are properly enforced. She is highly comfortable with technology, particularly web portals and spreadsheet tools for organizing and analysing data. However, she faces some frustrations in her work as she lacks access to meaningful user feedback, which makes it difficult to make data-driven decisions or adjust experiences based on real tourist behaviour and preferences.

Motivation: She would like a system where she could easily manage bike rental and analyse the user's feedback to allocate budget for new signage, bike lanes or bike charging/holding sites.

4th Persona: Vitor José

Vitor is a thirty-seven-year-old fleet operator from Porto, Portugal. He is a regional operations manager for the e-bike service, who oversees maintenance crews and daily bike distribution. Vitor is very comfortable with technology, as he uses dashboards, analytics tools, and dispatch systems daily. His main frustrations are the overload of alerts (there is a need for prioritized notifications) and incomplete or delayed status updates (requires near-real-time data). Vitor's key need is an operator dashboard.

Motivation: Quickly manage bikes and charging stations from the comfort of his house.

Scenarios

1st Persona: Maria Sanchéz – "Cultural City Explorer"

Scenario:

Maria Sánchez arrives in Lisbon for a 3-day solo trip. On her first morning, she opens Jolteon hoping to find a well-structured route that covers great views. It suggests stops at the National Museum of Ancient Art, the Belém Tower and Museum of Art.

She appreciates how the app recommends stops on a simplified map, with brief descriptions. She chooses the 3-hour route and selects an end parking spot. When she finishes the tour, she parks her bike in the spot she selected in the end of her route selection.

2nd Persona: Raphael Müller – "The Minimalist Nature Cyclist"

Scenario:

On the fourth day of his hiking trip, Raphael finds himself in Slovenia and wants to explore a 25-kilometre forest loop near Lake Bled.

He opens Jolteon to rent a bike in a charging spot near Lake Bled.

Near the halfway point, he wonders what the bike's remaining power is, so he opens Jolteon and notices that the bike's autonomy shows 16km. Relieved, he continues along the trail without worrying. He finishes the loop on time, satisfied and energized.

3rd Persona: Mariana Vivágua – "The Smart Experience Curator"

Scenario:

Two months after launching a new tourism initiative, Mariana logs into her management dashboard. The system displays an aggregated map highlighting visitor activity and feedback patterns across different attractions.

She notices a trend: visitors tend to leave early near one particular mural. Reviewing feedback linked to the location, she finds consistent complaints that there are not enough bike stations around. With this information, she can think about using resources to build new stations.

Meanwhile, Mariana checks an unexpected hotspot: Venebread. Visitors frequently mention it in positive comments despite it not being part of the original plan. Seeing an opportunity, Mariana adds Venebread to the official itinerary.

4th Persona: Vitor José – "The Operational Problem Solver"

Scenario:

It's 7:00 AM in Porto, and Vitor José begins his shift at the regional fleet operations center. He logs into the Jolteon operator page, where he manages the city's e-bike infrastructure. Upon logging in, he sees a filtered map view displaying all bike and station locations across Porto.

While navigating the dashboard, Vitor notices that a newly added charging station in Gaia is performing well. He decides to add another station near the São Bento area, anticipating increased demand. He inputs the new station's details, sets its location on the map, and saves the entry.

By early afternoon, Vitor does a sweep of the system to keep the fleet data accurate. He deletes one old station marked for decommissioning and updates a few bikes' statuses. Before ending his shift, he observes a growing trend of frequent bike drop-offs in the riverside zone. He makes a note to bring this up with the city planners, suggesting a potential new charging spot based on station density and battery drain trends.

2.3 Project epics and priorities

Epic 1: Bike Reservation (High)

Goal: Help users reserve bikes
Scope Includes:

- Finding and booking available bikes on a map

- Rent a bike

- Seeing remaining renting duration (and more details)

Epic2: Route Selection (High)

Goal: Help users discover routes, evaluate, and reserve bikes for curated routes.
Scope Includes:

- Browsing city map

- Choose landmarks to visit in the chosen city

Epic 3: Ride Tracking & Bike Return (High)

Goal: Support users throughout their ride and ensure smooth returns.
Scope Includes:

- Choose station to drop-off bike

Epic 4: User Registration & Profile (we planned this, but couldn't implement it) (Low)

Goal: Enable users to onboard, configure their preferences, and review their past activity.
Scope Includes:

- Account creation

- Viewing history of completed tours

- Profile management (update personal details)

Epic 5: Operator Control Panel (Medium)

Goal: Manage bikes and drop-off stations.
Scope Includes:

- Uploading and configuring bikes and drop-off stations.

45426 Teste e Qualidade de Software

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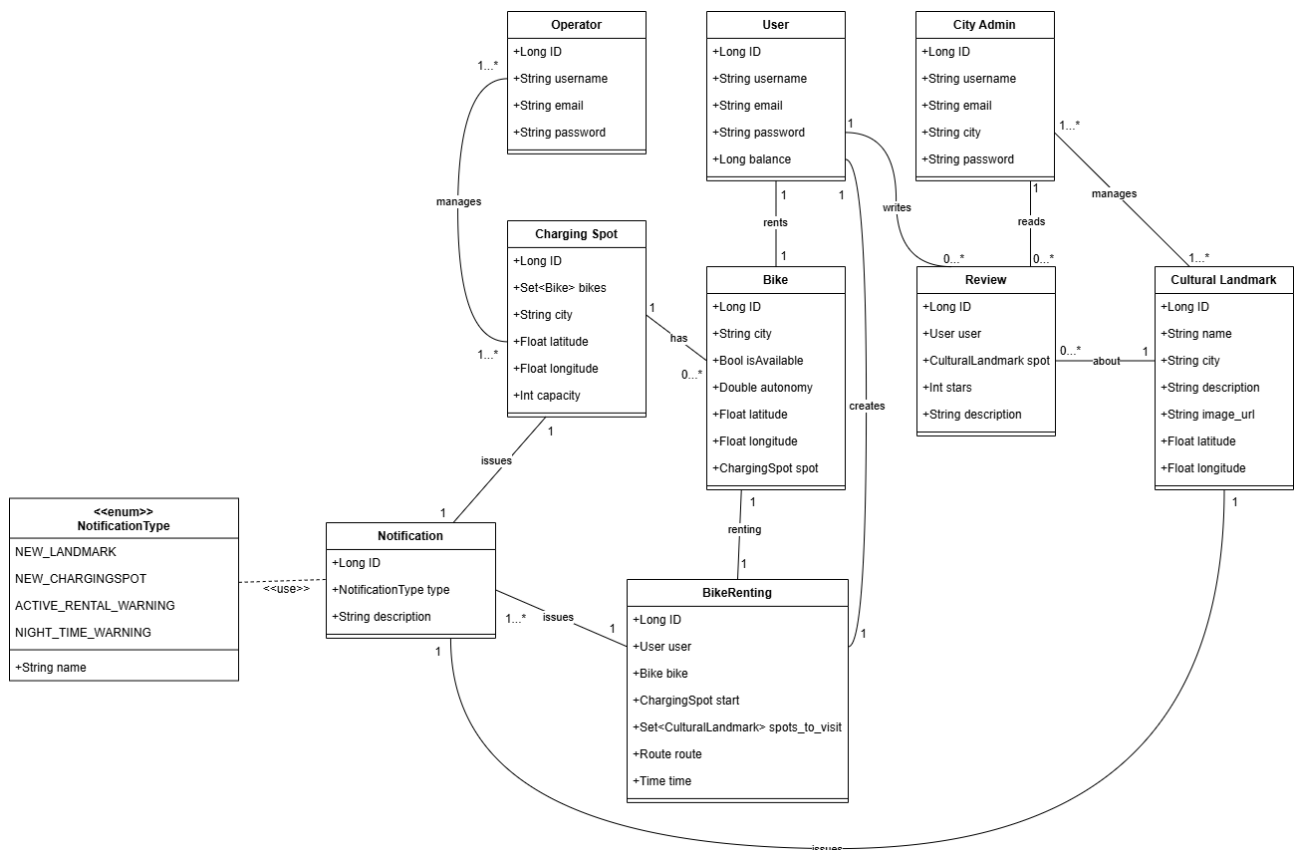- Check all bikes and stations' positions

Epic 6: City Admin Control Panel and Reviews (Medium)

Goal: Empower city administrators to curate landmarks and monitor engagement.
Scope Includes:

- Uploading and configuring cultural landmarks

- Checking reviews for existing cultural landmarks

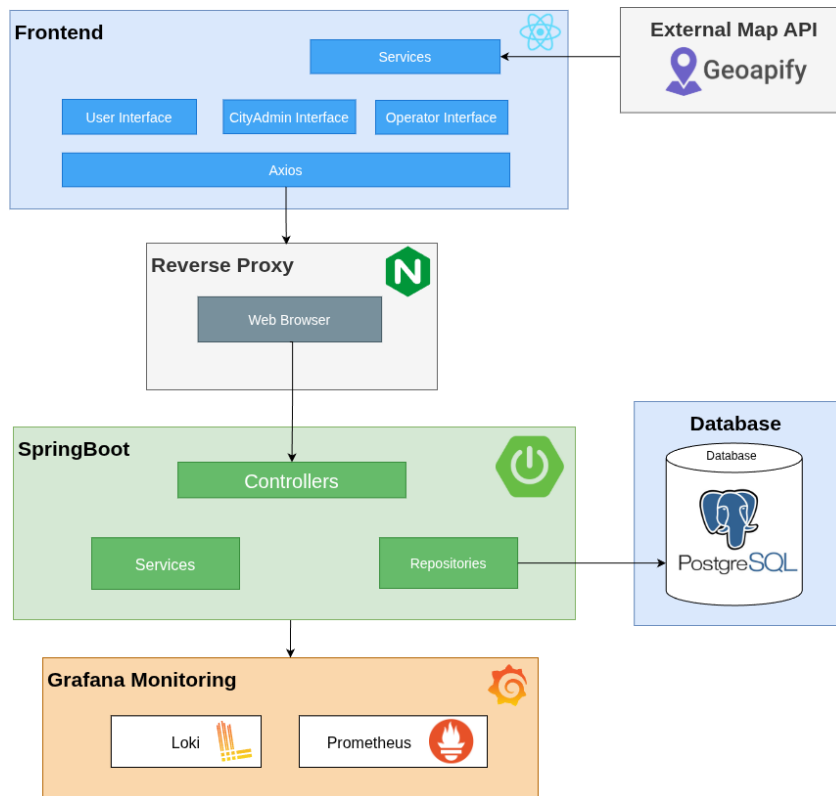- Post reviews to Cultural Landmarks

3 Domain model

4   Architecture notebook

4.1   Key requirements and constrains

The system is meant to be used as a web platform. It must allow multiple users concurrently. It's dependent on the bike hardware working as intended (bike availability and live location, for example).

4.2   Architecture view

4.3   Deployment view

For the API urls, as they change from deploy to production, we use a .env_deploy_example, that has the correct link for the URL once deployed.

For deployment, we use docker for the orchestration of the services.
In terms of ports:

Backend: 8080

Frontend: 80

PostgreSQL: 5433

Prometheus: 9090

Node Exporter: 9100

Grafana: 3001

Loki: 3100

5 API for developers

Swagger API Docs:
http://deti-tqs-06.ua.pt:8080/swagger-ui/index.html

review-controller ^

| GET | /api/reviews | ∨ |

| POST | /api/reviews | ∨ 📋 |

| GET | /api/reviews/user/{userId} | ∨ |

| GET | /api/reviews/cultural-landmark/{culturalLandmarkId} | ∨ |

| DELETE | /api/reviews/{id} | ∨ |

operator-controller ^

| POST | /api/operators/createChargingSpot | ∨ |

| POST | /api/operators/createBike | ∨ |

| GET | /api/operators/bikesInCity | ∨ |

| GET | /api/operators/bikeStatus/{id} | ∨ |

| DELETE | /api/operators/deleteChargingSpot | ∨ |

| DELETE | /api/operators/deleteBike | ∨ |

city-admin-controller ^

| GET | /api/city-admin | ∨ |

| POST | /api/city-admin | ∨ |

| GET | /api/city-admin/{id}/cultural-landmarks | ∨ |

charging-spot-controller ⌃

GET	/api/stations/{id}	⌄
PUT	/api/stations/{id}	⌄
DELETE	/api/stations/{id}	⌄
GET	/api/stations	⌄
POST	/api/stations	⌄
GET	/api/stations/{id}/available	⌄
GET	/api/stations/search	⌄

bike-renting-controller ⌃

PUT	/api/rentings/{rentingId}/end	⌄
GET	/api/rentings	⌄
POST	/api/rentings	⌄
GET	/api/rentings/active/{userId}	⌄

cultural-landmark-controller ⌃

GET	/api/cultural-landmarks/{id}	⌄
PUT	/api/cultural-landmarks/{id}	⌄
DELETE	/api/cultural-landmarks/{id}	⌄
GET	/api/cultural-landmarks	⌄
POST	/api/cultural-landmarks	⌄
GET	/api/cultural-landmarks/search	⌄

bike-controller ⌃

GET	/api/bikes/{id}	⌄
PUT	/api/bikes/{id}	⌄
DELETE	/api/bikes/{id}	⌄
GET	/api/bikes	⌄
POST	/api/bikes	⌄
GET	/api/bikes/search	⌄
GET	/api/bikes/available	⌄