

Software Tests and Quality

Practical Group Assessment

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Prof. Sergio Freire

Our Team



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Introduction

OUR PROJECT

CHARGEHUB is a web application developed to improve the EV ecosystem addressing challenges like finding chargers, charger/station management.



OUR PHILOSOPHY

Unlike most projects until now **CHARGEHUB** was developed with **Software Quality and Testing Methodologies** in mind. We deployed many testing strategies and integrated various pipelines to ensure quality and continuous development.

Main Features Implemented (EPICS)



STATION DISCOVERY

- Search Nearby Charging Stations ✓
- Get Route to Selected Station ✓
- Find Charging Stops Along a Trip Route
- **Filter Stations by Type, Availability & Cost** ✓
- View Charging Stations on a Map ✓



SLOT BOOKING & SCHEDULING

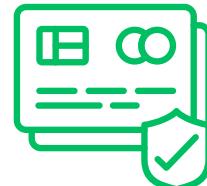
- **Book Charging Slot in Advance** ✓
- Set Custom Station Schedules (Operator)
- Receive Booking Time Notifications
- Get Alert for Disabled Booked Charger



BACKOFFICE OPERATIONS

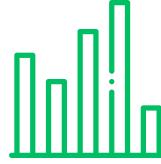
- Update Station Info & Pricing (Operator) ✓
- **Assign Stations to Operators (Admin)** ✓
- Manage User Accounts (Admin)
- View Platform-Wide Reports (Admin)
- Report Misconduct by Users (Operator)
- Submit Charger Feedback (Driver)
- **Create Operator Accounts (Admin)** ✓

Main Features Implemented (EPICS)



PAYMENT

- Access Financial Reports (Operator)
- **View & Complete Charging Payment in App** ✓



AUTH & ACCOUNT MANAGEMENT

- Update Account Information
- Delete Account Permanently
- **Create Account** ✓
- **Login Redirection** ✓



CHARGING MANAGEMENT

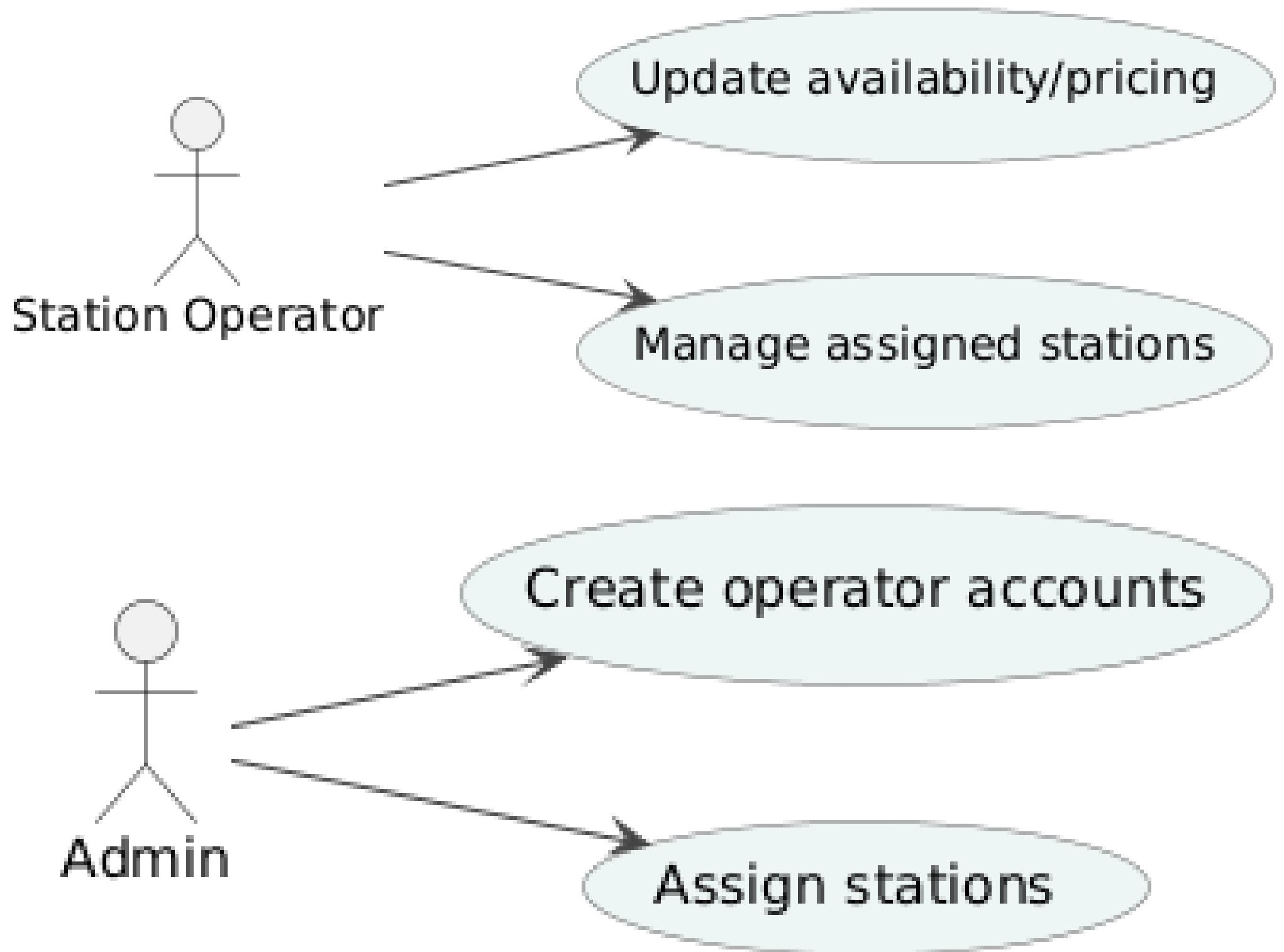
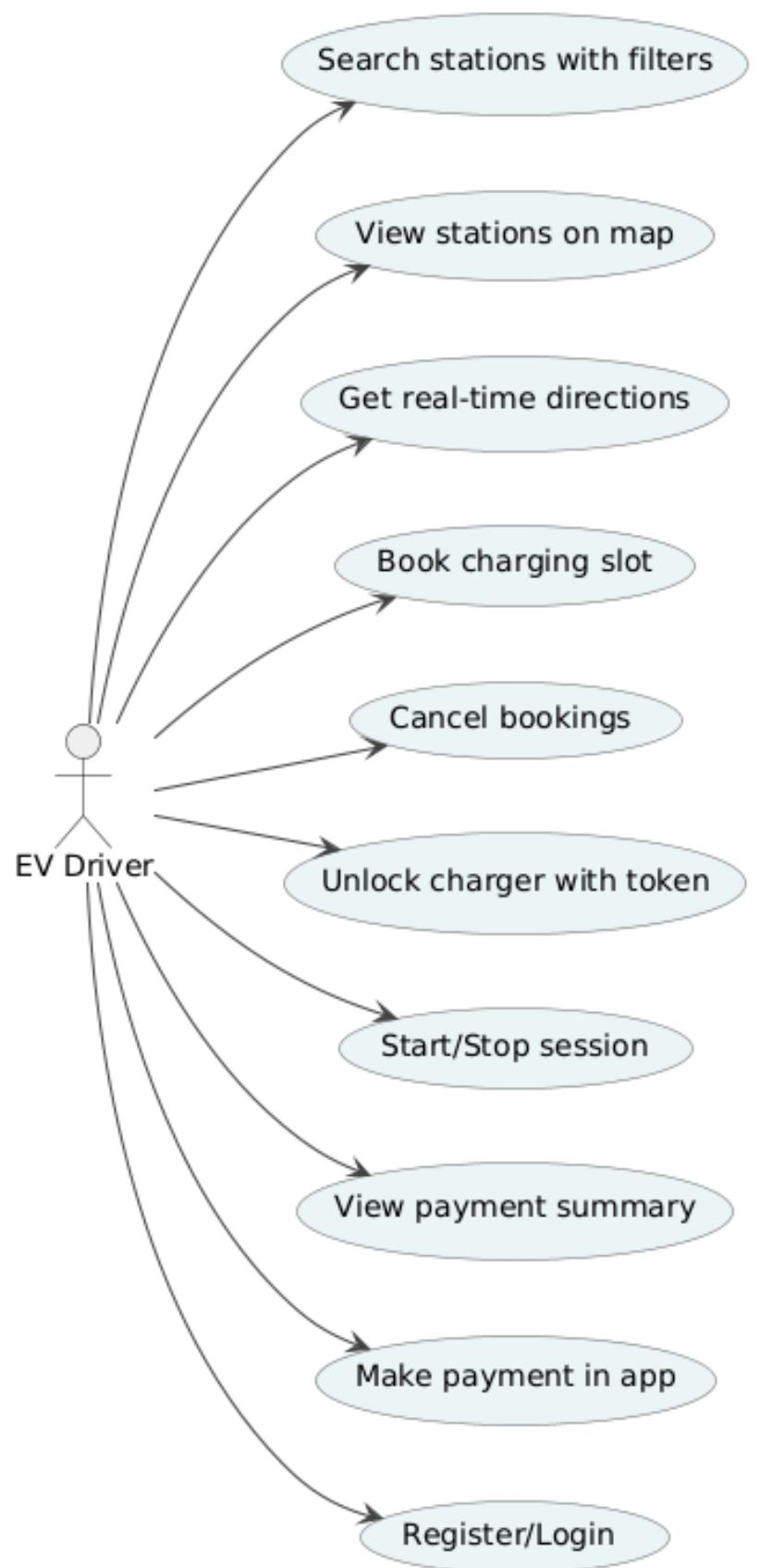
- **Unlock Charger with Reservation Token** ✓
- **Monitor Real-Time Charging Status** ✓
- Track Active & Past Sessions (Operator)
- Restart a Recently Ended Charging Session
- **Stop Charging Session Anytime** ✓



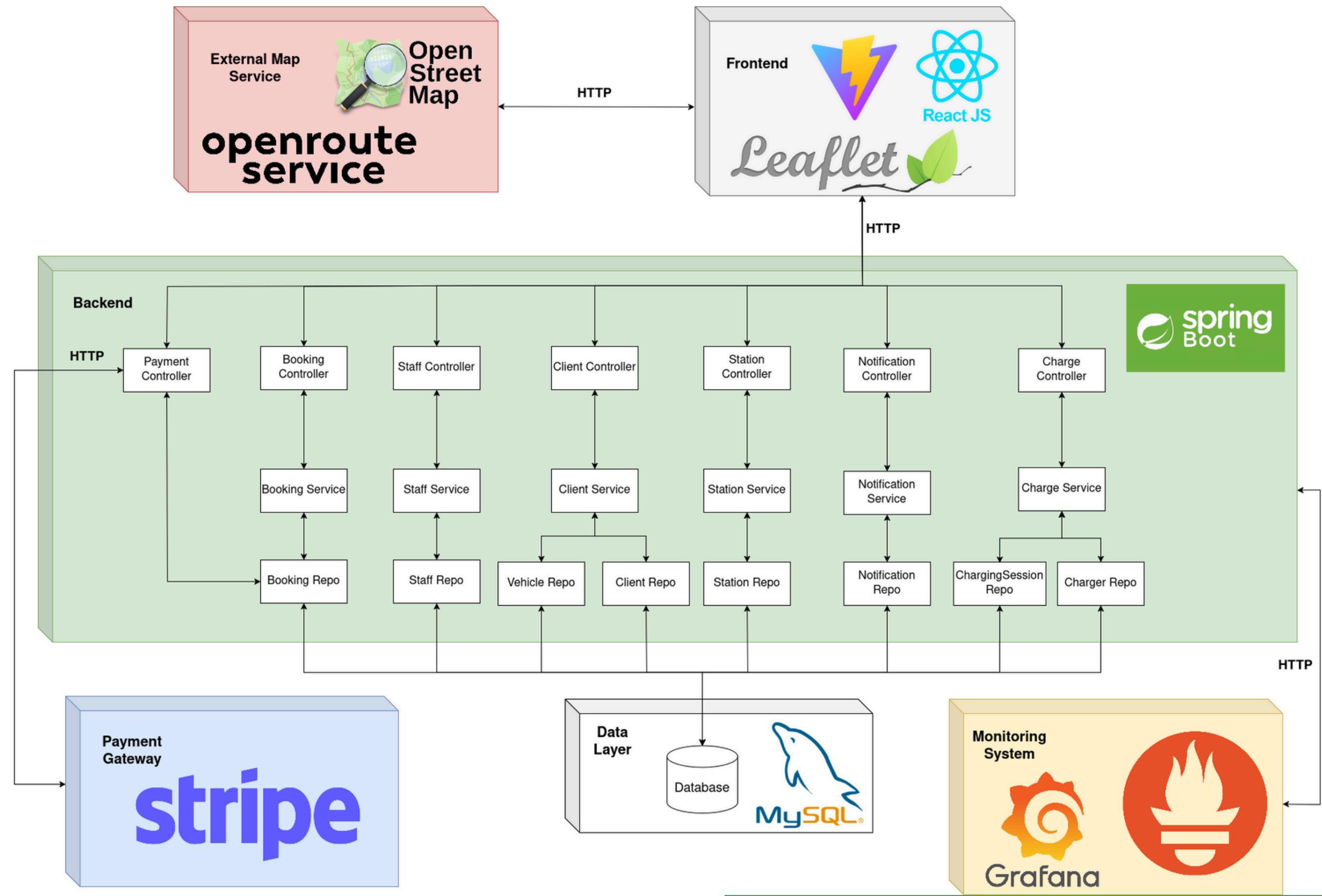
USER PROFILES & CHARGING HISTORY

- View Charging History & Usage Stats
- Track CO2 Savings from EV Usage
- Analyze User Trends & Platform Data (Admin)

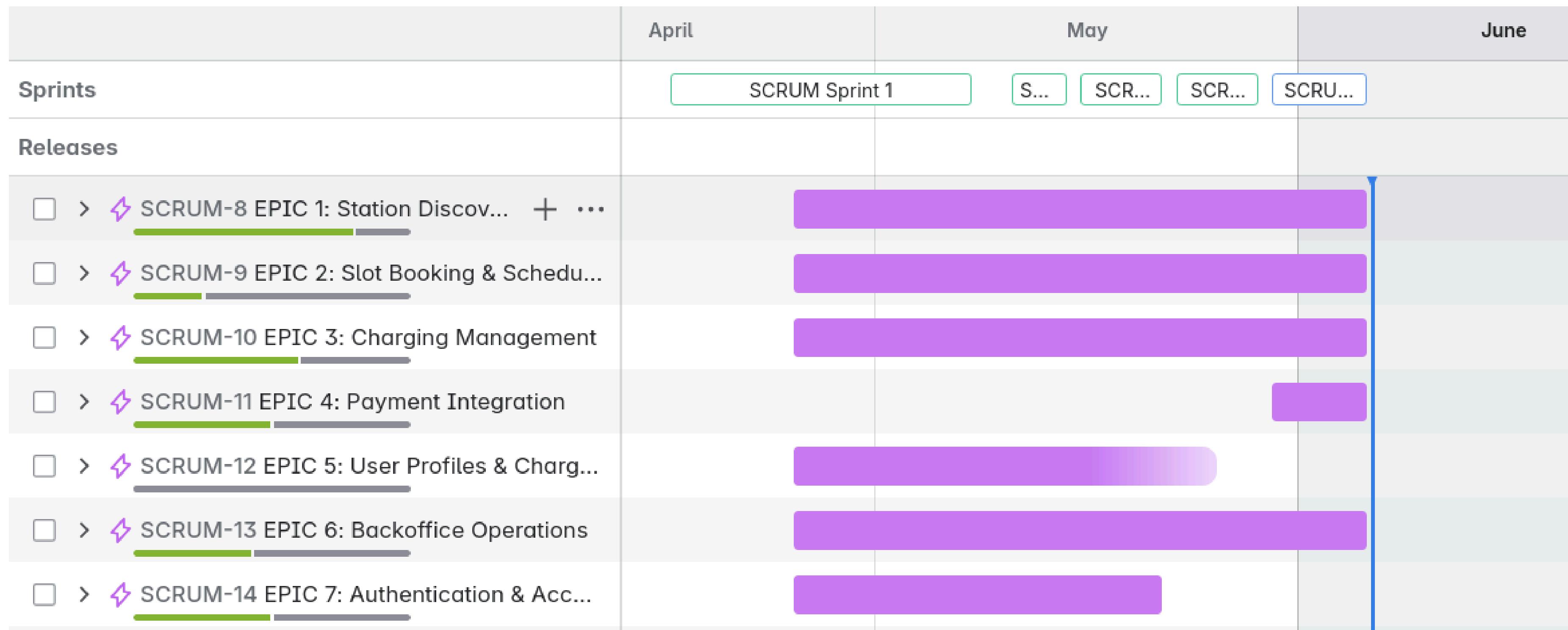
Use Cases



Software Architecture



Development Roadmap



Backlog Grooming

Projects

TQS-Project ...

Summary Timeline Backlog Board Calendar List Forms Goals All work Development Code Security Releases More +

Search list Filter Group

Type	Key	Summary	Status	Comments	Sprint	Assignee	Due date
<input checked="" type="checkbox"/>	SCRUM-44	Define Personas and Scenarios	DONE	Add comment	SCRUM Sprint 5	JN João Neto	May 4, 2025
<input type="checkbox"/>	SCRUM-8	EPIC 1: Station Discovery	TO DO	Add comment	SCRUM Sprint 5		
<input type="checkbox"/>	SCRUM-9	EPIC 2: Slot Booking & Scheduling	TO DO	Add comment			
<input type="checkbox"/>	SCRUM-10	EPIC 3: Charging Management	TO DO	Add comment			
<input type="checkbox"/>	SCRUM-11	EPIC 4: Payment Integration	TO DO	Add comment			
<input type="checkbox"/>	SCRUM-12	EPIC 5: User Profiles & Charging History	TO DO	Add comment			
<input type="checkbox"/>	SCRUM-13	EPIC 6: Backoffice Operations	TO DO	Add comment			
<input type="checkbox"/>	SCRUM-14	EPIC 7: Authentication & Account Management	TO DO	Add comment			

User Story Creation

SCRUM-8 / SCRUM-15

User story - Search Nearby Charging Stations

+ Add

Apps

Description

- User story
 - As an EV Driver, when I search for charging stations near my location, I want to access stations within a short distance from me so that I can charge my vehicle conveniently.

Context

This issue involves the need for an EV charging station app feature that allows users to find nearby charging stations based on their current location.

Acceptance criteria

- be able to allow location access
- be able to see a list of charging stations
- be able to view stations ordered by proximity

Other information

- Priority/Estimate: High, 2

Subtasks

... 0- +

100% Done

T...	Key	Summary	P...	A...	Status
↳	SCRUM-60	Write and Test your code (Unit Tests, Integration Tests, Behavioural Tests)	=	HR	DONE ▾
↳	SCRUM-59	Write the code for the frontend of this User Story (Components, Consumers, Pages, Links etc...)	=	HR	DONE ▾
↳	SCRUM-58	Write the code for the backend of this User Story (Models, Repos, Services, Controllers etc)	=	HR	DONE ▾

Details

⚙️ ^

HR Hugo Santos Ribeiro

Assign to me

UserStories

↳ SCRUM-8 EPIC 1: Station Disco

Parent

Jun 06, 2025

Team

None

Start date

Apr 25, 2025

Story point estimate

3

Sprint

SCRUM Sprint 5

Code Review



FunnyJoaoneto commented 2 weeks ago • edited

Member

...

Description

"Main page for driver", where an ev driver can see all the stations and filter through them as he likes. The frontend accepts later review but for now it will go like these. All testing done

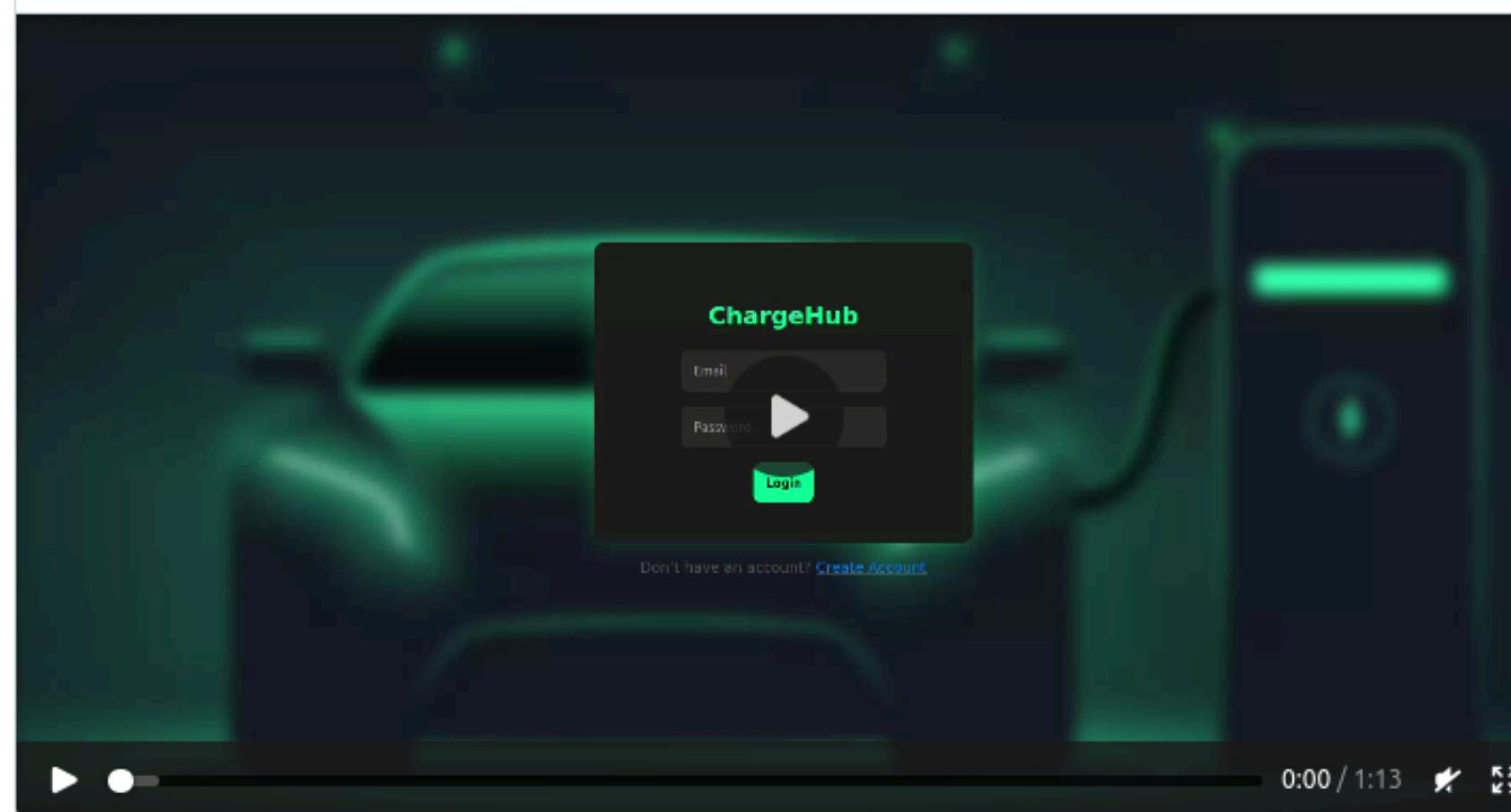
Don't take navbar seriously, the current navbar is just for convenience. There still things we have to do like create a logout user story for example.

Related Issue(s)

SCRUM-16

How Has This Been Tested?

Screencast from 24-05-2025.01.01.11.webm



sonarqubecloud bot commented 2 weeks ago

✓ Quality Gate passed

Issues

- ✓ 16 New issues
- ⌚ 0 Accepted issues

Measures

- ✓ 0 Security Hotspots
- ✓ 82.0% Coverage on New Code
- ✓ 0.0% Duplication on New Code

[See analysis details on SonarQube Cloud](#)



✓ rodrigoabreu22 approved these changes 2 weeks ago

[View reviewed changes](#)

rodrigoabreu22 left a comment

Bom trabalho, está de acordo com as expectativas.



✓ odraude23 approved these changes 2 weeks ago

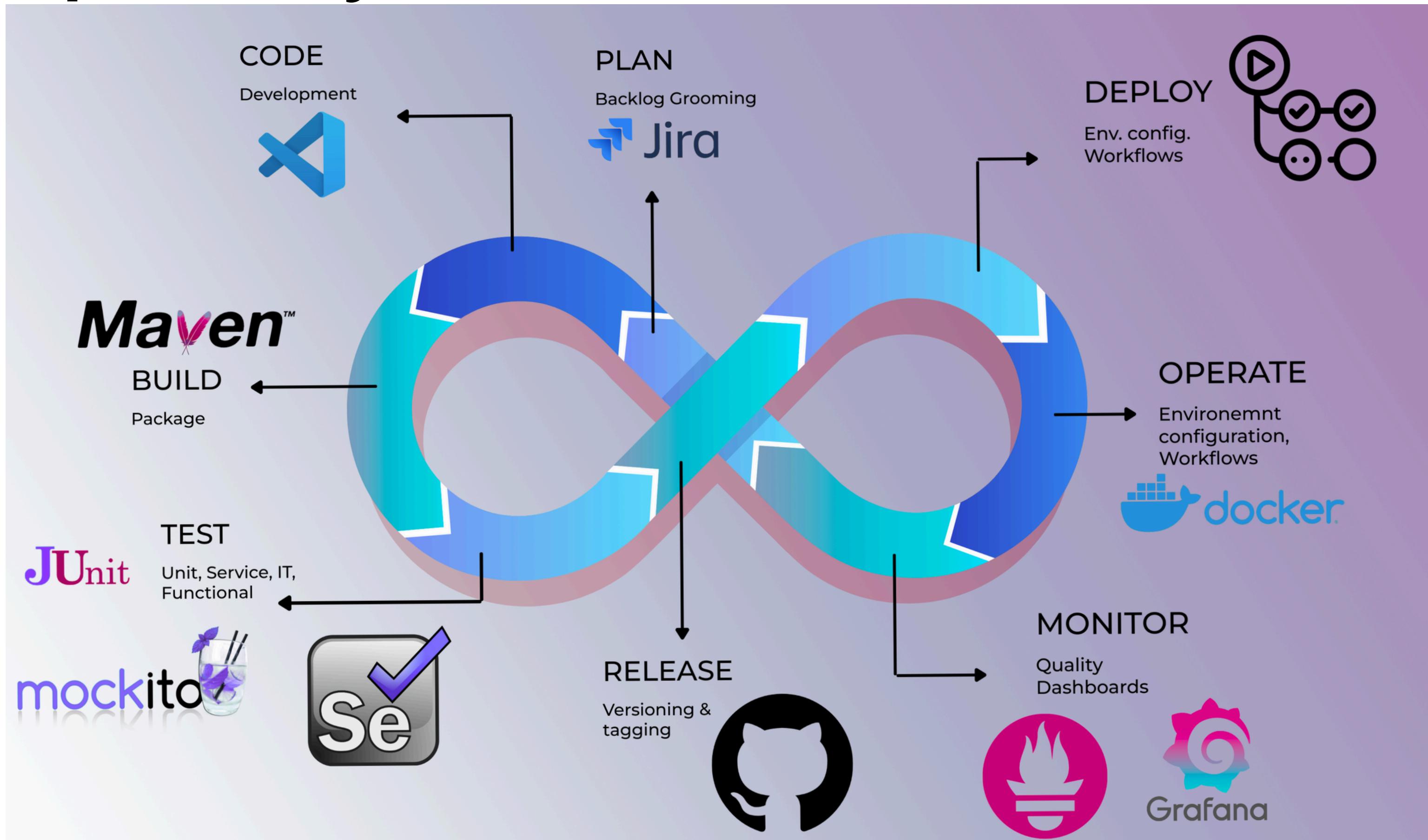
[View reviewed changes](#)

odraude23 left a comment

Keep up the good work



DevOps Lifecycle



Continuous Integration (CI)

✓ Scrum-24 unlock charger with token

Enforce Coding Styling For Backend #103: Pull request [#49](#) synchronize by FunnyJoaoneto

SCRUM-24-unlock-charger-w...

📅 4 hours ago

⌚ 18s

✓ Scrum-24 unlock charger with token

Enforce Coding Styling For Frontend #103: Pull request [#49](#) synchronize by FunnyJoaoneto

SCRUM-24-unlock-charger-w...

📅 4 hours ago

⌚ 19s

✓ Scrum-24 unlock charger with token

CI with Maven and SonarCloud #107: Pull request [#49](#) synchronize by FunnyJoaoneto

SCRUM-24-unlock-charger-w...

📅 4 hours ago

⌚ 2m 24s

✓ Scrum-24 unlock charger with token

Run Selenium Tests with Chrome #88: Pull request [#49](#) synchronize by FunnyJoaoneto

SCRUM-24-unlock-charger-w...

📅 4 hours ago

⌚ 3m 22s

Automated Testing

```
@Test  
@Requirement("SCRUM-20")  
  
public void whenValidInput_thenReturnsOk() throws Exception {  
    CreateBookingDTO dto = new CreateBookingDTO();  
    dto.setMail("user@example.com");  
    dto.setChargerId(1L);  
    dto.setStartTime(LocalDateTime.now().plusDays(1));  
    dto.setDuration(20);  
  
    mockMvc  
        .perform(  
            post("/api/booking")  
                .contentType(MediaType.APPLICATION_JSON)  
                .content(objectMapper.writeValueAsString(dto)))  
        .andExpect(status().isOk());  
}
```

```
@Test  
@Requirement("SCRUM-35")  
void createOperator_duplicateEmail_returns400() {  
    // reuse admin's email to trigger conflict  
    CreateStaffDTO dto = new CreateStaffDTO();  
    dto.setName("Duplicate");  
    dto.setMail("admin@mail.com");  
    dto.setPassword("securepass123");  
    dto.setAge(40);  
    dto.setNumber("912999999");  
    dto.setAddress("Santarém");  
  
    HttpHeaders headers = new HttpHeaders();  
    headers.setContentType(MediaType.APPLICATION_JSON);  
    headers.setBearerAuth(token);  
  
    HttpEntity<CreateStaffDTO> request = new HttpEntity<>(dto, headers);  
  
    ResponseEntity<String> response =  
        restTemplate.postForEntity("/api/staff/operator", request, String.class);  
  
    assertThat(response.getStatusCode()).isEqualTo(HttpStatus.BAD_REQUEST);  
    assertThat(response.getBody()).contains("Email already in use");  
}  
  
@Then("I should see a list of chargers")  
public void viewListOfChargers() {  
    List<WebElement> chargers =  
        wait.until(  
            ExpectedConditions.visibilityOfAllElementsLocatedBy(  
                By.cssSelector(".charger-list .charger-card")));  
    Assertions.assertFalse(chargers.isEmpty(), "No chargers are visible");  
}
```

Continuous Deployment (CD)

✓ .github/workflows/deploy.yml

.github/workflows/deploy.yml #22: completed by odraude23

📅 yesterday

⌚ 2m 45s

```
on:  
  workflow_run:  
    workflows: ["Run Selenium Tests with Chrome", "CI with Maven and SonarCloud"]  
    branches: [main]  
    types:  
      - completed
```

✓ fix do docker de prod

CI with Maven and SonarCloud #92: Commit [a8ed3af](#) pushed by odraude23

main

📅 yesterday

⌚ 2m 32s

✓ fix do docker de prod

Run Selenium Tests with Chrome #73: Commit [a8ed3af](#) pushed by odraude23

main

📅 yesterday

⌚ 3m 10s

Testing and Quality Philosophy

TDD

TDD was suggested to our developers but not enforced. We suggest a top-down approach, starting from the controller, then the service, then the repository, and ending with full context integration tests. Whether the developer chooses to perform tdd or not, the service and the controller should always be tested which is enforced by sonarcubecloud.

Feature: View Stations on a Map

Scenario: User views Stations on a Map

Given I am on the login page

When I enter "driver@mail.com" and "driverpass"

And I click the login button

Then I should be redirected to the "/driver" page

And I should see a list of EV charging stations

When I enter "Lisboa" in the district filter

And I click the "Map View" button

Then I should see a map with only stations located in "Lisboa"

Coverage	Duplications	Security Hotspots
85.9%	0.0%	0
Required \geq 80.0% on 131 New Lines to cover	Required \leq 3.0% on 3.3k New Lines	No conditions set

BDD

Uses Cucumber to define structured, human-readable feature files and to validate system behavior through realistic user scenarios. Selenium web driver is then deployed to run this with Cucumber on a Chrome Browser.

QA stack

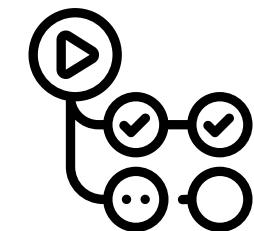
TESTING STRATEGY

- **Unit Tests:** JUnit, Mockito (backend logic)
- **Integration Tests:** Spring Boot Test, MockMvc
- **UI Tests:** Selenium + Cucumber (BDD approach following user story acceptance criteria)
- **Performance Test:** K6 Grafana

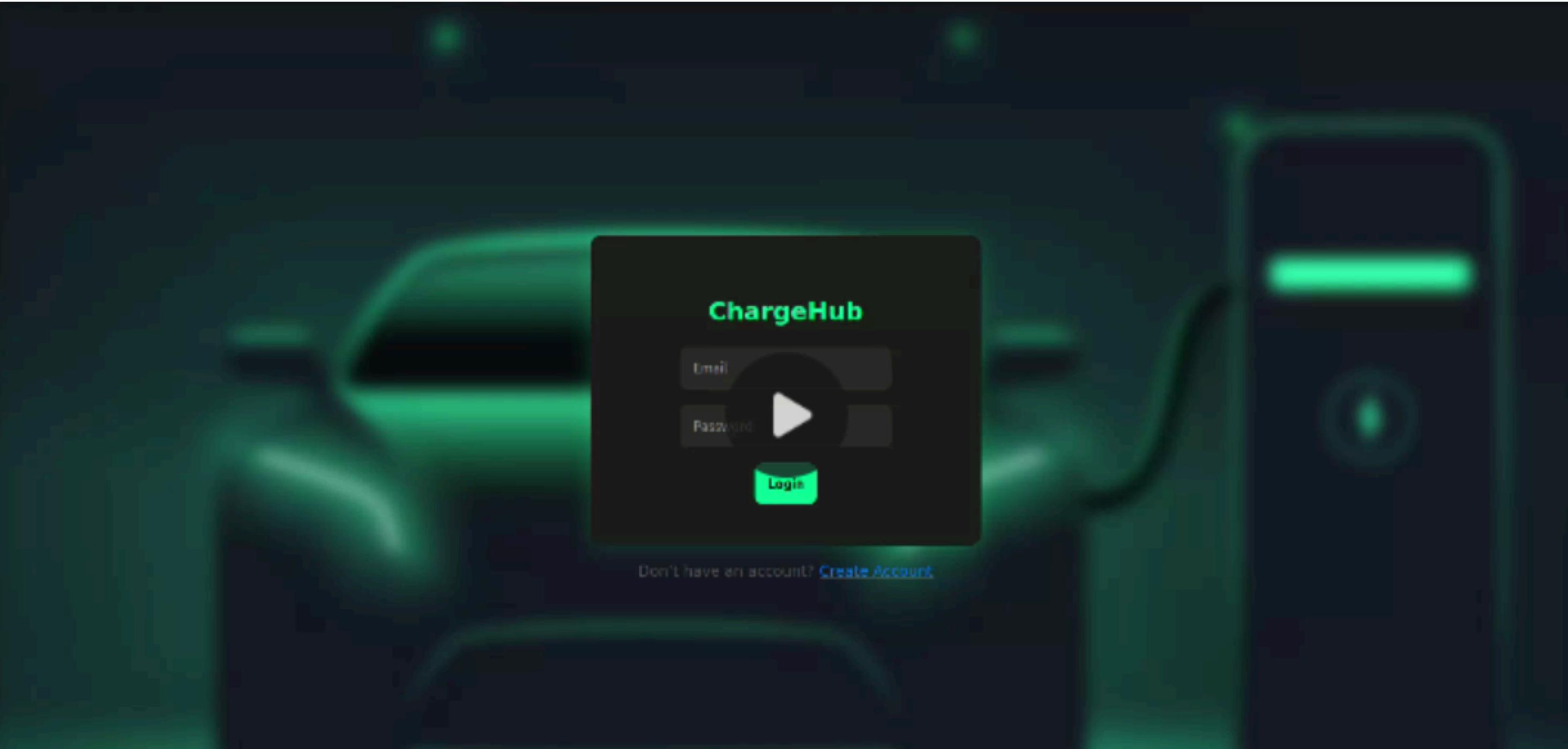


TEST AUTOMATION TOOLS

- **CI/CD:** GitHub Actions for test automation on PRs
- **Test Reporting:** JaCoCo Maven plugin
- **Code Quality:** SonarQube
- **Observability:** Actuator + Grafana + Prometheus



DEMO



Self Review

Plus

- Tests regarding the booking/payment cover many cases.
- We fully integrated X-ray with JIRA..
- Actual login and role based access implemented.
- Non-functional tests performed.
- Exploratory testing performed for all new code.
- Backlog was established early and consistently kept up to date.
- MVP Achieved.
- Complete CI pipeline.

Minus

- Very simplistic frontend.
- Low and medium User Stories not implemented for the most part.
- BDD tests are very simplistic except for booking.
- Staging phase not implemented
- Simple CD.

Interesting

- Different approach for fullstack projects.
- Applicable to other courses now like PI and future ones.
- Many new tools learned and experimented with.

Future Work - Future Iterations

Implement more User Stories

Type	Key	Summary	Status
User Story	SCRUM-9 ↳ SCRUM-21	User Story - Set Custom Station Schedules (Operator)	TO DO
User Story	SCRUM-9 ↳ SCRUM-22	User Story - Receive Booking Time Notifications	TO DO
User Story	SCRUM-9 ↳ SCRUM-23	User Story - Get Alert for Disabled Booked Charger	TO DO
User Story	SCRUM-10 ↳ SCRUM-26	User Story - Track Active & Past Sessions (Operator)	TO DO
User Story	SCRUM-10 ↳ SCRUM-28	User Story - Restart a Recently Ended Charging Session	TO DO
User Story	SCRUM-11 ↳ SCRUM-...	User Story - Access Financial Reports (Operator)	TO DO
User Story	SCRUM-12 ↳ SCRUM-31	User Story - View Charging History & Usage Stats	TO DO
User Story	SCRUM-12 ↳ SCRUM-32	User Story - Track CO ₂ Savings from EV Usage	TO DO
User Story	SCRUM-12 ↳ SCRUM-33	User Story - Analyze User Trends & Platform Data (Admin)	TO DO
User Story	SCRUM-8 ↳ SCRUM-19	User Story - Find Charging Stops Along a Trip Route	TO DO
User Story	SCRUM-13 ↳ SCRUM-37	User Story - Manage User Accounts (Admin)	TO DO
User Story	SCRUM-13 ↳ SCRUM-38	User Story - View Platform-Wide Reports (Admin)	TO DO
User Story	SCRUM-13 ↳ SCRUM-39	User Story - Report Misconduct by Users (Operator)	TO DO
User Story	SCRUM-13 ↳ SCRUM-...	User Story - Submit Charger Feedback (Driver)	TO DO
User Story	SCRUM-14 ↳ SCRUM-...	User Story - Update Account Information	TO DO

Assess SonarCube code smells

Severity

 Blocker 1

 High 3

 Medium 28

 Low 44

 Info 26

All maintainability related
0 security hotspots



**THANK
YOU**

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