Project Proposal: Electric Vehicle Charging Management System

Group 11 – *Watt's Up*

Team Members:
Primož Gabrovec
Stefan Krstevski
Tomi Trošt

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1 Project Title

Electric Vehicle Charging Management System

2 Group Information

- **Group Number:** 11
- **Group Name:** Watt's Up
- **Members:** Primož Gabrovec, Stefan Krstevski, Tomi Trošt

3 Project Description

It can be difficult to find locations of available charging stations for electric vehicles in the city for those who can't charge their cars at work, and buying a charging station for yourself can be very expensive. We are trying to solve both of these problems by developing an application that will allow users to see all EV charging locations in their city. The system will be able to monitor charging sessions and handle billing as well. Application will also allow the owners of EV charging stations to register and promote their locations, set pricing and time availabilities. This way the users will be able to earn some of the money that was spent on buying the charging station back. We will use a cloud native architecture, ensuring high availability, fault tolerance and modular scalability.

4 Frameworks and Development Environment

The project will be developed using the following technologies and tools:

- **Backend Framework:** .NET
- **Frontend Framework:** React.js
- **Database:** SQL Database
- **Cloud Platform:** Microsoft Azure
- **Virtualisation:** Docker, Kubernetes
- **Communication Protocols:** REST, gRPC
- **Development Tools:** Visual Studio Code, Azure DevOps, Postman
- **Version Control:** GitHub Organization Repository

5 System Architecture

Below is the initial architecture schema showing microservice interactions, their interaction with the application and the database.

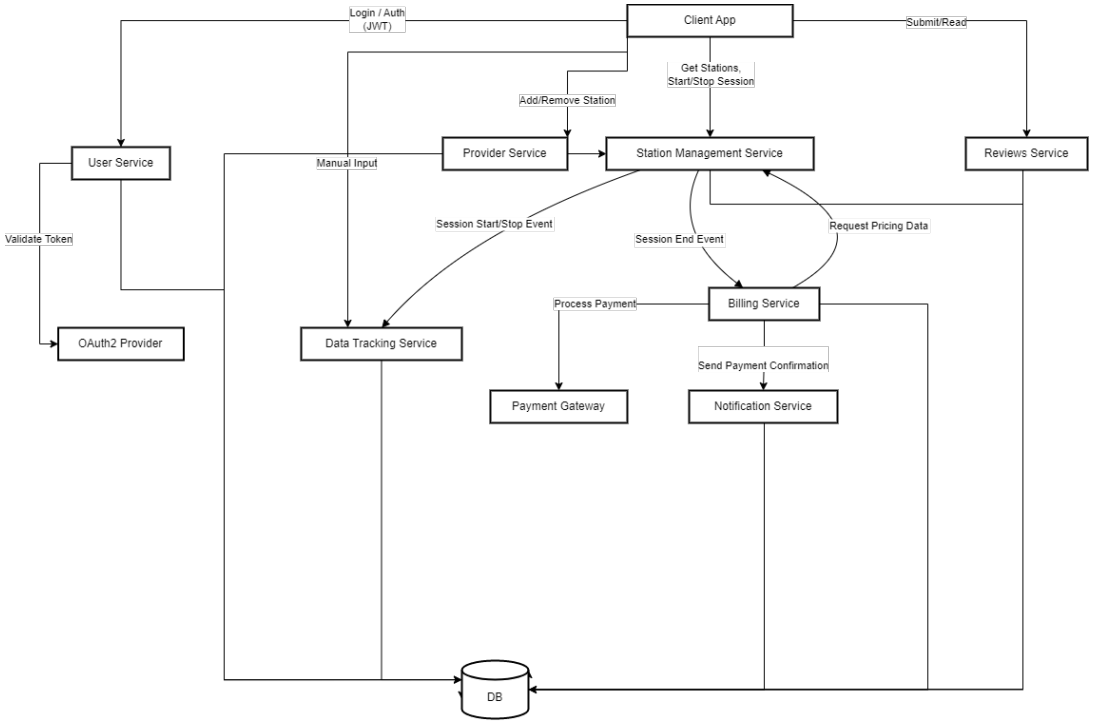

Figure 1: Initial Architecture Schema of the EV Charging Management System

6 Microservice Functionalities

- **User Service:** Manages user registration, authentication (JWT), user profiles and roles.
- **Station Management Service:** Handles operations for charging stations, status monitoring and availability tracking. Manages session lifecycles: start, stop, duration and energy consumption logging.
- **Billing Service:** Calculates charging costs, processes payments, and generates invoices.
- **Provider service:** Set prices and locations of charging stations, ability for the provider to add their charging station.
- **Data tracking service:** Allows for the user to track the energy consumptions of the car and anything else the user might be interested in.
- **Reviews service:** Users can review their experience at the charging station.
- ***Notification Service:** Sends email about session updates, billing confirmations, or maintenance alerts.

7 Use Cases

- **UC1:** User views nearby charging stations on a map and checks their availability.
- **UC2:** User starts a charging session via web interface, then stops the session, pays and writes a review if he wants to.
- **UC3:** Administrator or provider adds, updates, or removes charging stations from the network.

Complex use case with multiple services:

1. The user logs in via the **User Service**, authenticated through JWT.
2. The frontend requests available stations from the **Station Management Service** and retrieves pricing and location data.
3. The user selects a station and starts the session. The **Station Management Service** begins the charging process and sends a start event to the **Data Tracking Service**.
4. Once charging is complete, data about charging is sent to **Data Tracking Service** and the **Billing Service** calculates the total cost based on pricing data from **Station Management Service**.
5. The user can then review the charging experience using the **Reviews Service**.
6. *The **Billing Service** finalizes the payment and calls the **Notification Service** to send a payment confirmation to the user.