Concession and Development of a Dispatch Board for Public Transport Operators Based on Web Technologies

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May 31, 2024

Bachelor of Informatics and Computer Engineering

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1 Introduction

This report aims to provide an overview of our project that involved the implementation of a system for a dispatch board for public transport operators.

1.1 Background

The project was carried out within the OPT facilities (Otimização e Planeamento de Transportes S.A). We were accompanied by our tutor from OPT, Thiago Sobral, who guided us through the entire work and helped us with everything we needed.

1.2 Objectives and Expected Results

The main motivation behind this project was the need to upgrade the already existing software used to display the dispatch board to a programming language that could be more easily managed, maintaining the existing features, and database integration.

The existing software was considered outdated and hard to deploy since it ran natively on the devices, every update and bugfix required a manual software update of all the machines that needed it.

The development of this dispatch board was based on an existing program, our job was to upgrade it by:

- adapting it to a web-based language, so that it is easier to expand and debug, taking advantage of the best and most recent tools of web-dev;
- adding customizations and "quality of life" features to improve the overall usability of the product.

1.3 Report Structure

This report will have the following structure:

- **Introduction:** Brief description of the initial background, motivation and context behind the project and the expected results.
- **Methodology and Development Process:** Description of the methodologies and main activities that were carried out in this project, including the methodology that was used, the intervenients and their roles/responsibilities, and the main activities that were developed during the project.
- **Solution Development:** The requirements and restrictions of the final product and the architecture and technologies used.
- **Conclusion:** Conclusion of the report with a summary of what we as a group achieved with this project and what we learned.

2 Methodology and Development Process

2.1 Methodology

To ensure consistent progress and receive regular feedback, our group established a weekly meeting schedule with our OPT tutor. These meetings allowed us to review our work, discuss any challenges, and make necessary adjustments based on the feedback received.

For version control and collaboration, we utilized GitHub. We created a repository where we committed our code, which greatly enhanced our communication and organization. This platform allowed us to track changes, manage different versions of our project, and work simultaneously without conflicts.

Our online meetings were conducted through a Discord group we created specifically for this project. We utilized both text and voice chat features to communicate in real-time while working on the project. Additionally, we included our OPT tutor in the Discord group so he could monitor our progress and provide feedback directly within this collaborative environment.

For coding, we chose Visual Studio Code as our primary editor. This tool offered an array of extensions and features that facilitated our development process, making it easier to write, debug, and collaborate on our code efficiently.

2.2 Stakeholders and roles

Several people were involved in the project, each with specific roles and responsibilities. The stakeholders and their roles are as follows:

- Project Team(4 members):
  - António Ferreira: Frontend Developer
  - Cristiano Rocha: Frontend Developer
  - José Ferreira: Frontend Developer
  - Pedro Magalhães: Backend Developer
- Project Coordinators:
  - Professor and advisor Thiago Sobral from OPT: Responsible for advising and mentoring us, providing expertise and guidance.
  - Professor and supervisor Maria Teresa Galvão Dias from FEUP: Oversees the project and provides guidance and feedback.
  - Professor and Director of Capstone Project (Projeto Integrador) Nuno Flores: Conductor of Projeto Integrador.
- Project Users:
  - Transport Operators: The primary users of the dispatch board system.

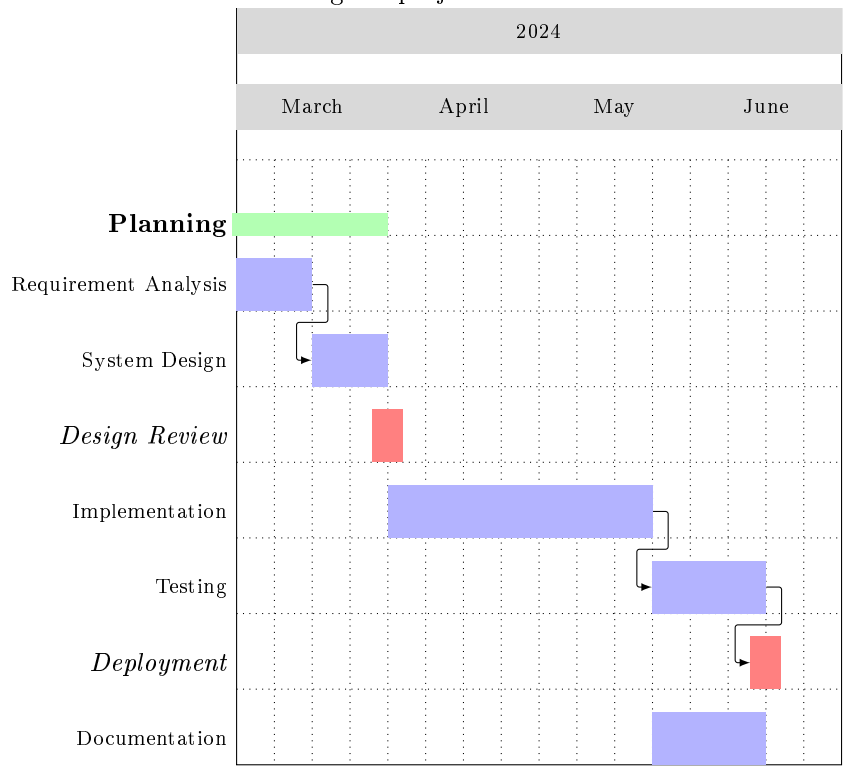
2.3 Activities Developed

During the project's duration, several activities took place, such as planning, coding and team meetings.

- **Planning:**
  - The initial phase involved determining the technologies to be used. In a meeting with our OPT coordinator, we decided on Node.js and Prisma for the backend, and React with TypeScript for the frontend.
  - We also discussed the project's requirements and constraints, such as the need for real-time updates and the importance of maintaining the existing features.
  - After the initial planning, we began the requirement analysis, which involved understanding the existing system and identifying the features that needed to be implemented in the new dispatch board. We consulted with our OPT coordinator to ensure that the new system met the required specifications.

- **Development:**
  - The development phase began with setting up the project structure and creating the initial files. We were provided a database from one of the existing dispatch board systems, which we used to test the backend. We were also provided the queries used to retrieve the data from the database.
  - We then proceeded to implement the backend, focusing on the database connection and API endpoints. We used Prisma to interact with the database and Next.js to create the API routes.
  - Another important aspect was the implementation of a way to customize the dispatch board, allowing users to change the colors and layout and the logo according to their preferences. We decided to use a JSON file to store these customizations, so that the users could export and import their settings to other devices.
  - The frontend development followed, with the creation of the user interface and integration with the backend. We used React with TypeScript to build the frontend, focusing on the real-time updates and customization features. There was a focus on creating a simple and intuitive interface that would be easy to use by the transport operators.
- **Testing:**
  - We conducted several rounds of testing to ensure that the system was functioning correctly and that all features were working as expected. We tested the real-time updates and customization options to verify that they were working properly.
  - We also conducted user testing with the transport operators to gather feedback on the system's usability and identify any issues that needed to be addressed.

Here's a Gantt chart showing the project's timeline:



3 Solution Development

3.1 Requirements

The main requirements for the dispatch board system were as follows:

- **Keep the existing features:** The system should maintain the existing features of the dispatch board, such as displaying the buses'/trains' schedules.
- **Customization:** The system should allow users to customize the dispatch board according to their preferences, such as changing the colors, logo and layout(display the columns that they consider useful and hide the ones that are considered useless for that company, also switch the order of the columns).
- **User-friendly interface:** The system should have a simple and intuitive interface that is easy to use by the transport operators.
- **Database integration:** The system should be able to connect to a database to retrieve the necessary information about the buses and schedules.
- **Modular architecture:** The system should be modular, allowing for easy expansion and maintenance. It should also be possible for many transportation companies to use the same system, with each one having its own customizations and schedules.

3.2 Architecture and Technologies

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