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Abstract

As part of this project, we developed a web portal dedicated to managing digital simulation activities at Stellantis. This portal centralizes all operations carried out by both internal teams and subcontractors, thus optimizing activity management and improving communication among stakeholders.

The primary goal was to replace the existing tools, which were deemed inadequate, with a more efficient, modern, and accessible solution. Using the Agile methodology, particularly the Scrum framework, the project was completed in multiple sprints, each introducing new and improved features. Key functionalities of the portal include user management, role and permission assignments, and performance indicators such as On-Time Delivery (OTD) and First Time Right (FTR) metrics.

In addition to the technical aspects of the portal's development, particular attention was given to security and scalability to ensure the system's longevity and its ability to meet the company's growing needs. The project significantly reduced the number of email exchanges and optimized activity management through an intuitive user interface and a robust notification system.

Keywords: Web portal, activity management, digital simulation, Scrum methodology, KPIs, Stellantis.

Résumé

Dans le cadre de ce projet, nous avons développé un portail web destiné à la gestion des activités de simulation numérique chez Stellantis. Ce portail centralise l'ensemble des opérations effectuées par les équipes internes ainsi que les sous-traitants, permettant ainsi une gestion optimisée des activités et une meilleure communication entre les parties prenantes.

L'objectif principal était de remplacer les outils actuels, jugés peu adaptés, par une solution plus efficace, moderne et accessible. Grâce à la méthodologie Agile, et plus spécifiquement à la méthode Scrum, le projet a été mené en plusieurs sprints, chacun apportant des fonctionnalités nouvelles et améliorées. Parmi les fonctionnalités clés du portail, on retrouve la gestion des utilisateurs, des rôles et permissions, ainsi que des indicateurs de performance clés (KPIs) tels que le respect des délais de livraison (OTD) et la qualité des livrables (FTR).

En plus des aspects techniques liés au développement du portail, une attention particulière a été portée à la sécurité et à la scalabilité du système, afin de garantir sa pérennité et sa capacité à répondre aux futurs besoins croissants de l'entreprise. Le projet a permis de réduire considérablement le nombre d'échanges par email et d'optimiser la gestion des activités grâce à une interface utilisateur intuitive et un système de notifications performant.

Mots-clés : Portail web, gestion des activités, simulation numérique, méthode Scrum, KPIs, Stellantis.

List of Abbreviations

ATC Africa Technical Center

BEV Battery Electric Vehicle

CETIEV Centre Technique des Industries des Équipements pour Véhicules

FMI Fournisseur Majeur d'Ingénierie

FTR First Time Right

ICE Internal Combustion Engine

KPI Key Performance Indicator

MHEV Mild Hybrid Electric Vehicle

OTD On-Time Delivery

SCRUM Framework Agile de gestion de projet par itérations

SES Support Expertise and Steering

SI Système d'Information

UEC Unité de Compte Économique

UML Unified Modeling Language

UO Unité d'oeuvre

VENG Virtual Engineering

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General Introduction

The automotive industry is undergoing an unprecedented period of transformation, marked by the rapid evolution of technologies, strict environmental regulations, and changing consumer expectations. In this context, companies must adapt by innovating not only in the products they develop but also in their internal processes.

The Stellantis group, born from the merger of PSA and Fiat Chrysler Automobiles (FCA), is part of this transformation dynamic by relying on efficient digital processes. Among these processes, numerical simulation plays a key role in the design, validation, and optimization of vehicles, thus reducing production costs and time while improving product quality.

However, the tools currently used to manage numerical simulation activities, based on email exchanges and Excel files, are showing their limitations in the face of the increasing volume and complexity of projects. It has therefore become crucial to have a more centralized, modern, and efficient solution to optimally manage these activities.

In this context, this project aims to develop a web portal dedicated to managing numerical simulation activities within the Stellantis group. This portal will allow for better coordination between internal teams and subcontractors, optimized activity tracking, as well as a significant improvement in communication and traceability of actions taken.

The objective of this document is to present the context in which this project takes place, the challenges it addresses, as well as the different stages of its execution. We will begin with an analysis of the theoretical and methodological framework followed during the project, before detailing the technical specifications and tools used to design and develop the portal. Finally, we will discuss the results obtained, the prospects for improvement, and the lessons learned from this experience.

Chapter 1

General Context

1.1 Introduction

This chapter opens with an introduction to STELLANTIS, tracing its evolution, global presence, as well as its brands and services. We will then review the main departments and professions within the company, also introducing the work team. Finally, we will present the project as a whole, describing the challenges to be met, the objectives to be achieved, and detailing the timeline for its completion.

1.2 Presentation of the Host Organization

Figure 1.1: Logo of the STELLANTIS group.

1.2.1 STELLANTIS Group: Merger of PSA and FCA

STELLANTIS was born from the merger of PSA and Fiat Chrysler Automobiles (FCA), becoming a major player in the automotive industry despite the challenges of the global health crisis.

• FCA designs, manufactures, and markets vehicles under brands such as Abarth, Alfa Romeo, Chrysler, and Dodge. With nearly 200,000 employees worldwide, FCA has a strong international presence and a diversified portfolio.

• PSA stands out for its innovative automotive experiences and mobility solutions, bringing together five brands and connected services under Free2Move. Its "Push to Pass" strategy focuses on the development of autonomous and connected vehicles.

1.2.2 STELLANTIS Brands

STELLANTIS, with its varied brand portfolio, covers a wide range of automotive needs, from luxury to utility. Present in 30 countries and over 130 markets, the group offers a wide choice to consumers. The figure below shows the main brands of the group.

Figure 1.2: STELLANTIS automotive brands.

1.2.3 STELLANTIS Technical Specifications

Date de création	Fondé le 16 janvier 2021
Chiffre d'affaires	189,5 milliards € (2023)
Siège social	Hoofddorp, Pays-Bas
Président	John Elkan (Président FCA)
Directeur général	Carlos Tavares (PSA)
Effectif	240 000 employés (au monde)
Secteur d'activité	Constructeur Automobile

Figure 1.3: STELLANTIS technical specifications.

1.2.4 Global Presence of STELLANTIS

STELLANTIS is present on five continents with industrial and commercial sites adapted to local markets.

Figure 1.4: STELLANTIS global distribution.

Expanded Europe (EE)

- 48 sites, Fiat, Peugeot, Citroën, Opel, etc.

- 172,500 employees

North America (NA)
- 27 sites, Jeep, Dodge, RAM, Chrysler
- 83,000 employees

South America (SA)
- 13 sites, Jeep, Fiat, Peugeot
- 30,000 employees

China (CHN)
- 9 sites, Peugeot, Citroën, Jeep
- 1,800 employees

Middle East and Africa (MEA)
- 6 sites, Fiat, Peugeot
- 5,800 employees

India-Asia-Pacific (IAP)
- 6 sites, Peugeot, Jeep
- 2,700 employees

STELLANTIS combines local and global to meet needs.

1.2.5 STELLANTIS Presence in Morocco

The STELLANTIS Group is the only manufacturer covering the entire value chain in Morocco and Africa. Its research and development center in Casablanca (ATC), its production and trade plant in Kenitra, and its testing center are the pillars of its presence in Morocco.

For its first significant establishment on the African continent, construction of the STELLANTIS plant in Kenitra began at the beginning of 2017. The plant aims to support the increase in sales in the Middle East and Africa by producing engines and B- and C-segment vehicles for Peugeot, Citroën, DS Automobiles, and Opel.

Figure 1.5: History of STELLANTIS's establishment in Morocco.

1.2.6 Africa Technical Center (ATC)

This section presents the *Africa Technical Center* (ATC) of STELLANTIS, the entity where my internship takes place.

History of the ATC

Figure 1.6: STELLANTIS Africa Technical Center.

In 2018, STELLANTIS opened an automotive design center at Casablanca Nearshore, including an Open Lab and a research and development center called the "Africa Technical Center" (ATC). The center is dedicated to creating the interior and exterior designs of future vehicles that will be manufactured in Morocco. Located in the Shore 22 building in Casablanca, it occupies four floors with a total area of 6,000 m^2.

ATC Organizational Chart

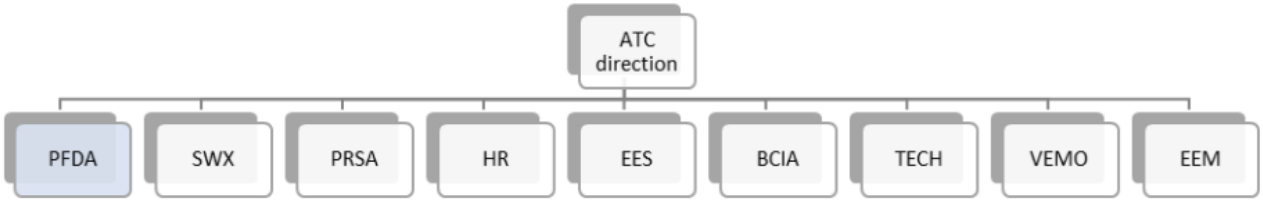

Figure 1.7: ATC organizational chart.

The center is structured into several specialized entities covering different areas of STELLANTIS product development for the DMOA (Middle East and Africa Development) region. The activities are organized around four main areas:

- Vehicle functional architecture.
- Electricity and Electronics.
- Powertrain and Chassis.

- Body, Carriage, and Interior.

VENG Team

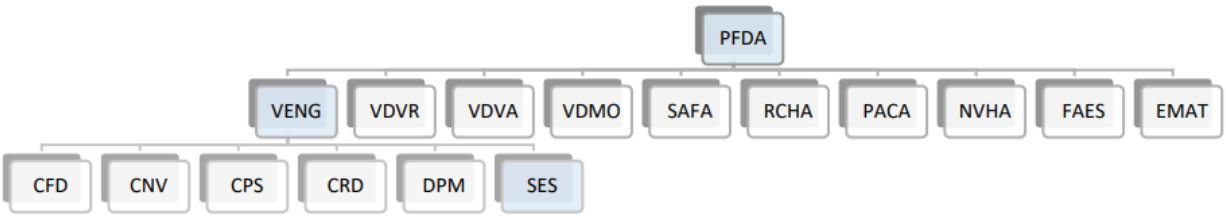

Figure 1.8: VENG organizational chart.

The VENG team provides essential models and numerical simulations for the design of PFDA vehicle projects. Its missions include:

- Leading the creation of models and simulations within deadlines and budgets.
- Reducing simulation time.
- Improving robustness and simplifying trade-offs.
- Creating an effective communication tool.
- Reducing physical testing through digital channels.
- Offering methodological support.

VENG Team Specialties

The specialties are divided into five units:

- **CFD** : Aerodynamics, cabin, and engine thermal.
- **CVN** : Vibrations and noise.
- **CRD** : Endurance and vibration fatigue.
- **CPS** : Crash simulations.
- **DPM** : Digital modeling.

The **SES** team supports these units in terms of digital tools and management.

1.2.7 Overview of the SES Team

This section presents the SES team, in which I completed my internship.

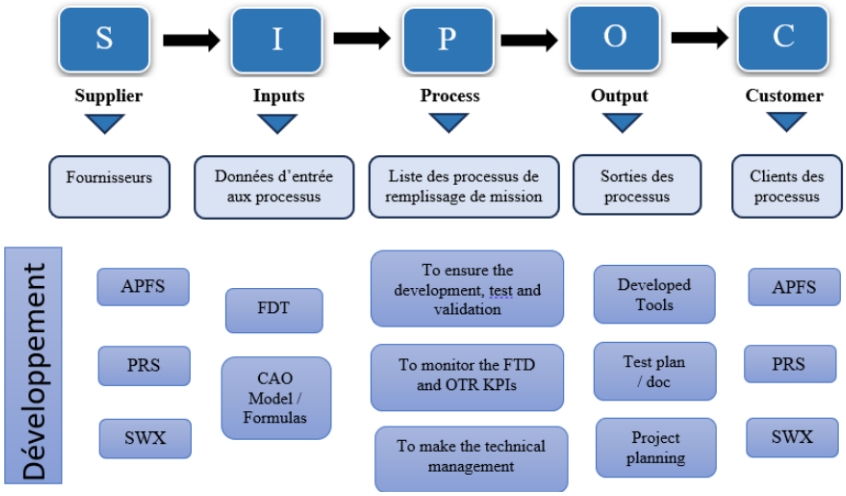

Figure 1.9: SIPOC tool used by the SES team.

SIPOC Tool

The SIPOC tool, which stands for *Supplier, Input, Process, Output, Customer*, is a methodology used to model and document a business process in detail, from suppliers to customers. This approach is used to better define the scope of work and facilitate information sharing with collaborators.

The VENG teams, including the SES Data team, regularly use this technique, illustrated in the following diagram:

SES Team Missions

The SES team manages and provides expertise on the SI ESSAIS projects, including:

SI ROULAGE : A system for storing and analyzing data from instrumented vehicle tests. A BIG DATA web portal provides access to data and test results.

Data Science : Development of KPIs and monitoring of data collected in Big Data databases on vehicle fleets, in line with STELLANTIS's business requirements.

APOGEE : Software support, request analysis, incident tracking, and resolution of software-related issues.

1.3 Conclusion

This chapter has introduced STELLANTIS, its global presence, industrial and commercial activities, and the importance of the ATC in Casablanca for innovation. The VENG team has been highlighted for its role in numerical modeling and simulations, and the SES team for its missions and use of SIPOC.

The next chapter will detail my project within the SES team and its stages of implementation.

Chapter 2

Project Framework

2.1 Introduction

In this chapter, we will present the overall framework of the project, outlining both the context in which it is set and the various challenges it addresses. The project consists of implementing an IT solution adapted to the needs of an increasingly complex environment, with the objective of improving the efficiency of activity management processes and communication between stakeholders. We will also detail the management methods adopted to ensure the success of this project.

2.2 Project Context

The project takes place in an environment where the current processes for managing numerical simulation activities have become obsolete. Indeed, Stellantis, and more specifically VENG, rely on work methods based on email exchanges and the extensive use of Excel files. These tools, although somewhat effective for small-scale operations, are no longer suited to the increasing complexity of the numerical simulation operations carried out within VENG, particularly due to the growing number of users and the diversity of subcontractors involved.

The decentralized nature of the tools used creates multiple sources of errors, with a lack of coordination in activity tracking and inefficient communication between teams. This results in delays in project completion and inconsistencies in summary reports. To address these shortcomings, the implementation of a centralized web portal is necessary, capable of managing and monitoring activities in a more structured and collaborative manner. The new system must not only simplify activity management but also enable better traceability and optimization of collaboration between VENG, Stellantis, and the various subcontractors such as Capgemini, MG2, Segula, and Alten.

2.3 Problem Statement

The problem this project addresses is related to the management of numerical simulation activities and the improvement of communication flows between stakeholders. Currently, the lack of centralization and the inefficiency of tools like Excel and emails make activity

tracking extremely complex. The information exchanged lacks clarity and uniformity, and the absence of a unified information system undermines the overall performance of project management.

To better understand this problem, we adopted an approach based on the QQOQCP tool, which helps structure the essential questions around project management. This tool is particularly useful for asking fundamental questions about the dimensions of the project (What, Who, Where, When, How, Why) to obtain an overview and address the specific challenges of the project. The following table summarizes the application of this tool to our specific case:

Questions	**Sub-questions**	**Answers**
Who?	Who is involved?	VENG teams, Stellantis, subcontractors (Capgemini, MG2, Segula, Alten).
What?	What is it about?	Development of an information system (IS) for managing numerical simulation projects and summary reports with Power BI.
Where?	Where will it be used?	Within Stellantis, primarily VENG, as well as among partner subcontractors.
When?	When does the problem arise?	During the management of numerical simulation activities, which have become too complex due to the growing volume of activities and the ineffective use of current tools, particularly Excel and email exchanges.
How?	How is the project being managed?	The project follows an Agile methodology with sprint organization. Each sprint is dedicated to a specific feature of the portal, and tools such as Gantt charts and sequence diagrams are used to plan and monitor activity progress.
Why?	Why is this project necessary?	To simplify activity management, improve collaboration between stakeholders, and reduce inefficiencies in communication and project tracking.

Table 2.1: Summary of project questions and answers according to the QQOQCP tool

2.4 Project Management and Planning

The management of this project is based on a rigorous and well-structured working methodology, ensuring optimal organization at each stage of the implementation. The adoption of the Agile method, more specifically the SCRUM framework, allows for flexible planning and better adaptation to the constantly evolving needs of the project. Risk management is also considered through tracking tools such as dashboards and Gantt charts, which enable real-time monitoring of various activities and adjustments to planning in response to unforeseen events.

2.4.1 Working Methodology

The SCRUM framework is used to manage the project. SCRUM, which is part of Agile methodologies, promotes an iterative and incremental approach to development, enabling it to meet the changing needs of stakeholders throughout the sprints. This approach allows for continuous improvements, priority adjustments, and the integration of new features while maintaining a high level of user satisfaction.

The SCRUM master, as the facilitator, plays a central role in ensuring the smooth running of the teams, ensuring the proper execution of sprints and resolving any obstacles that may arise. Among the main responsibilities of the SCRUM master are:

→ Planning and organizing the sprints;

→ Leading the daily SCRUM meetings to track work progress;

→ Managing team communication, promoting effective collaboration among members;

→ Anticipating and managing risks to optimize collective performance.

2.4.2 Why SCRUM?

SCRUM is particularly suited to this project due to its ability to structure work into short, flexible cycles. This method allows for efficient project management by ensuring that each feature is developed, tested, and validated before moving on to the next one. SCRUM also offers several advantages, such as:

→ Flexible priority management, tailored to the changing needs of the project;

→ Improved project visibility through tracking tools such as Kanban boards and sprint reports;

→ Enhanced communication within teams, fostering collective intelligence;

→ Greater responsiveness to unforeseen events, with the ability to quickly readjust planning;

→ Time savings through close collaboration among teams and frequent iterations.

The following figure illustrates the SCRUM development model used in this project:

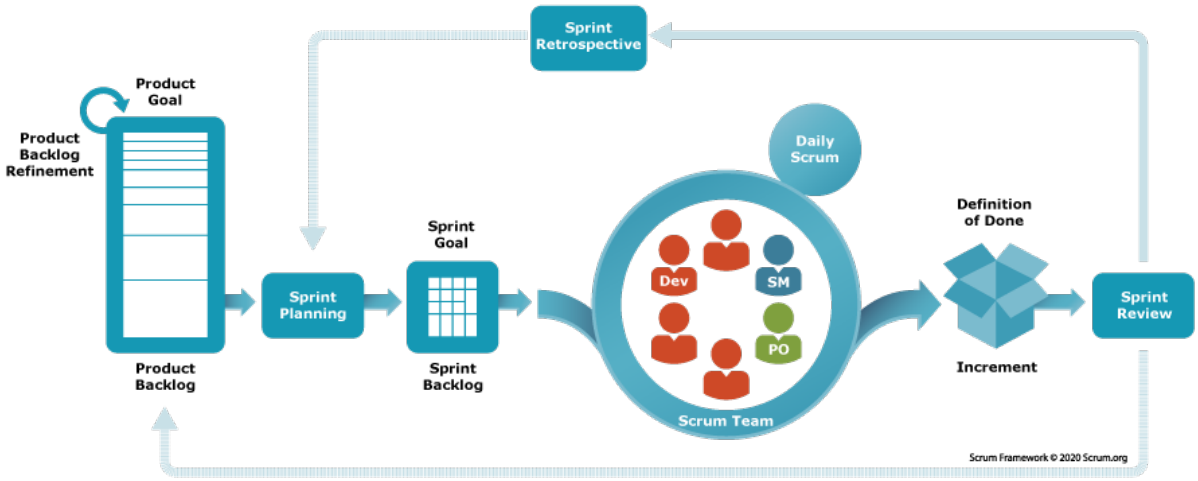

Figure 2.1: SCRUM Development Model

2.5 Conclusion

In conclusion, the project aims to address the numerous challenges related to the decentralized management of numerical simulation activities at VENG and Stellantis. The implementation of a centralized web portal not only simplifies activity management but also improves collaboration between the various project stakeholders. Thanks to the adoption of the Agile methodology, particularly SCRUM, the project benefits from great flexibility and a better capacity to adapt to the changing needs of users.

This methodological framework ensures a clear organization and well-defined step-by-step progression, ensuring that the project's objectives are achieved efficiently and within the given time frame. Regular activity monitoring, coupled with the use of efficient project management tools, ensures smooth task execution and optimal collaboration between teams.

Chapter 3

Project Specifications

3.1 Introduction

This chapter is dedicated to the detailed analysis of the requirements specifications for the VENG web portal. The main objective of this section is to define the expectations in terms of functionalities and technical requirements, so that the final solution is perfectly aligned with the objectives of managing digital simulation activities for Stellantis and VENG. The centralization of data, the streamlining of communication between internal teams and subcontractors, as well as the optimization of cost and deadline convergence processes are the key elements to consider. An in-depth analysis of functional and non-functional requirements is crucial to ensure that the final product is both robust, performant, and capable of meeting the long-term expectations of users.

3.2 Specifications of Requirements

3.2.1 Objectives

The main goal of the project is to implement a centralized platform that will allow for more efficient management of digital simulation activities carried out by VENG. Currently, these activities are scattered across multiple tools, including emails and Excel sheets, leading to coordination and tracking issues. The web portal should therefore provide a single interface where all stakeholders can interact, submit, and monitor their activities in real time, while facilitating the convergence of deadlines and costs.

The sub-objectives associated with this project include the following elements:

- **Improve visibility**: The tool should offer a clear and consolidated view of workload forecasts and deadlines for each project.
- **Automation of communications**: The system should reduce the need for email exchanges by automating notifications and communications with subcontractors through optimized workflows.
- **Real-time activity tracking**: Each user, whether a subcontractor or internal team, should be able to track in real time the progress of tasks and assigned activities.

- **Optimization of KPIs (OTD, FTR)**: The tool should allow for precise tracking of key performance indicators, such as On-Time Delivery (OTD) and First Time Right (FTR), to improve the quality of deliveries and adherence to deadlines.

3.2.2 Functional Requirements Specifications

Functional requirements are the core of the project in terms of what the portal must enable users to accomplish. Below is a description of the main expected features:

1. **Authentication and rights management**: The portal must integrate a secure login system based on Stellantis accounts, with role management that differentiates administrators, managers, and subcontractors. Each user must have specific access rights according to their role, ensuring data security and a clear distribution of responsibilities.

2. **Recording and tracking activities**: Users must be able to record and track their digital simulation activities directly through the portal. This includes entering key information such as forecasted costs, material or human resource needs, as well as the start and end dates of the simulations. A real-time tracking dashboard must be available to provide an overview of activities.

3. **Activity convergence**: A specific feature must be implemented to facilitate the convergence between the agreed costs and deadlines between Stellantis and subcontractors. This process includes the validation or negotiation of initial forecasts.

4. **Deliverable management**: The portal must allow subcontractors to deliver final or intermediate reports of their simulations directly via the interface. Stellantis teams must be able to validate or reject these deliverables, with comments to ensure precise feedback.

5. **KPI tracking**: The system must automatically calculate key KPIs related to simulation performance, such as on-time delivery (OTD) and delivery quality (FTR). These indicators should be displayed in a visual dashboard for quick consultation.

6. **Cost management and invoicing**: The portal must include a cost management module, allowing tracking of expenses associated with simulation activities. A monthly summary of costs per project or subcontractor should be automatically generated, with validation and adjustment options by managers.

3.2.3 Non-Functional Requirements Specifications

Non-functional requirements are equally crucial to ensure that the web portal is performant, secure, and sustainable. They concern the technical aspects that will ensure a smooth and reliable user experience.

1. **Performance**: The portal must be able to handle a large volume of data and users without loss of responsiveness. Page and dashboard load times should be optimized to ensure smooth use, even during peak activity periods.

2. **Security**: Special attention must be given to the security of sensitive data exchanged on the portal. This includes multifactor authentication, encryption of data in transit and at rest, as well as regular audits to detect potential vulnerabilities.

3. **Scalability**: The portal must be designed to easily scale based on the growing number of users, activities, and subcontractors. The database, servers, and system architecture must be dimensioned to support this growth.

4. **Accessibility**: The portal must be compatible with major web browsers and comply with accessibility standards (WCAG) to ensure use by all users, including those with visual or motor disabilities.

5. **Availability**: A high availability rate is required to ensure that users can access the portal at any time, with minimal tolerance for downtime. Redundancy and backup mechanisms must be in place to ensure this availability.

3.3 The Product Backlog

The product backlog represents the list of tasks and features to be developed during the sprints. Each sprint is a development iteration where we focus on a specific set of features. The backlog allows us to plan the work to be done and to track the progress of the project.

Here is a summary of the main sprints with their respective features:

Sprint	**Feature**	**Description**
Sprint 0	Setting up the environment	Configuration of design and development tools, setting up the necessary hardware and software environment.
Sprint 1	Authentication and profile management	Implementation of the authentication system and user account management.
Sprint 2	User and permission management	Implementation of roles and permissions for different types of users (administrators, managers, subcontractors).
Sprint 3	Management of UECs, domains and clients	Management of UECs (Client Team Units), skill domains, scope specifications and clients.
Sprint 4	Program and project management	Monitoring of programs, projects, technical configurations, development phases, energy types and other associated elements.
Sprint 5	Activity and notification management	Monitoring of digital simulation activities, implementation of the notification system to inform stakeholders.
Sprint 6	Capacity and billing management	Implementation of simulation capacity management and billing processes.

Table 3.1: Product backlog with associated sprints and features

3.4 Conclusion

The functional and non-functional requirements specifications defined in this chapter are essential to ensure that the VENG web portal meets the expectations of end users. The features cover critical aspects such as authentication, activity management, and key performance indicator monitoring. In parallel, the technical requirements ensure that the system will be efficient, secure, scalable and accessible.

These specifications will serve as a basis for the next design and development phases, ensuring that the final solution aligns perfectly with the operational objectives of the project and that it can evolve according to future needs.

Chapter 4

Conceptualization and Development

4.1 Introduction

This chapter presents the technical architecture and the tools used for the development of the VENG web portal. The Agile Scrum methodology is at the heart of the process, allowing flexible and reactive project management thanks to rapid iterations. This chapter is divided into several sections, each describing the steps of setting up the work and development environment, as well as the techniques employed.

4.2 Global Class Diagram

This class diagram represents the basic structure of the project, defining the different entities and their interaction within the system. Each activity, user, and subcontractor is modeled as a class with specific attributes and associated methods.

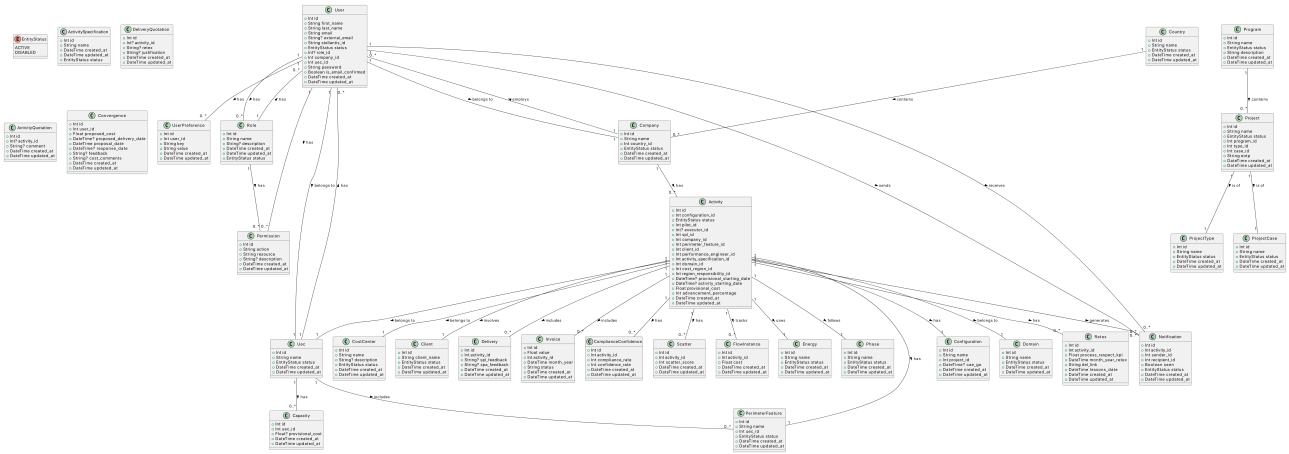

Figure 4.1: Sequence Diagram for Domain Management

4.3 Sprint 0: Setting up the Technical Environment

4.3.1 Design Tools

To ensure effective project management and an effective architecture, several tools were chosen.

Jira for Agile Scrum

Jira is the central tool for managing the project using the agile Scrum method. Each sprint, task, and user story is tracked via Jira, allowing clear visibility on project progress, obstacles, and priorities. Jira also facilitates backlog management, task assignment, and bug tracking, while ensuring fluid communication between team members.

UML Language

The use of the UML (Unified Modeling Language) allows formalizing the different parts of the project through class, activity, and sequence diagrams. UML helps to model the system architecture by making relationships and processes clearer before the actual coding.

Instagantt for Timeline

Instagantt is used to visualize project timelines, organize tasks according to sprints, and ensure deadlines are met. It allows planning each iteration and monitoring progress in real time. This tool helps anticipate delays and adjust priorities if necessary.

Communication using Microsoft Teams

For continuous and effective communication, the team uses Microsoft Teams. Whether for quick discussions, daily Scrum meetings, or file sharing, Teams centralizes all exchanges.

4.3.2 Development Tools

To guarantee the performance and modularity of the portal, a modern and efficient technology stack was chosen.

TypeScript

Project development is carried out in TypeScript, a superset of JavaScript that adds static typing. TypeScript offers significant advantages in terms of error management and code readability, while facilitating the development of complex and scalable applications.

Node.js

Node.js is used to manage the portal's backend server. Thanks to its ability to handle a large number of simultaneous connections and its speed, Node.js allows building a high-performance and scalable API, essential for a project of this scale.

Next.js

Next.js is the chosen framework for the application. In addition to offering server-side rendering (SSR) to optimize SEO and performance, Next.js facilitates route management and API integration. This allows creating a smooth user experience while optimizing page load time.

React.js

React.js is the JavaScript framework used to create the user interface components. It allows for rapid and modular development, with efficient management of the application state and dynamic updating of views based on user interactions.

TailwindCSS

TailwindCSS is the CSS style library used for the portal design. It allows creating modern and responsive interfaces while facilitating the maintenance and evolution of the design. Its utility-first approach reduces the number of custom CSS classes, making the code cleaner and easier to maintain.

PostgreSQL

PostgreSQL is the chosen database to store all portal data, including activities, users, and KPIs. PostgreSQL is recognized for its reliability, robustness, and adaptability to the growing needs of a large-scale project.

Prisma

Prisma is used as an ORM (Object-Relational Mapping) to facilitate the management of the PostgreSQL database. It simplifies SQL queries while ensuring efficient management of relationships between tables, making the backend code cleaner and more maintainable.

ShadCN/UI (UI component library)

ShadCN/UI is a UI component library that simplifies the development of complex interfaces. It allows quickly creating consistent user interfaces while ensuring a high-quality user experience thanks to reusable components.

Nginx (Reverse proxy + caching)

Nginx is used as a reverse proxy server and for caching. Since the application runs only on the company's internal network, Nginx ensures the security of connections, optimizes performance, which improves the portal's processing capacity.

TanStack Table

TanStack Table is used to display activities in complex tables containing more than 30 columns and thousands of rows. This tool is chosen for its optimal performance and its ability to handle large amounts of data while offering an excellent user experience.

4.3.3 Techniques Used

The project is developed following an **agile methodology** based on development **sprints**. Each sprint lasts approximately two weeks and includes several phases, including planning, development, validation, and review.

The Scrum method is adopted with well-defined ceremonies:

- **Sprint planning**: At the beginning of each sprint, the team defines the objectives to be achieved based on the backlog priorities.
- **Daily Stand-up**: Every day, the team meets briefly to discuss progress, roadblocks, and next steps.
- **Sprint review**: At the end of the sprint, the team presents the completed work, allowing for feedback and ensuring that the deliverables meet expectations.
- **Sprint retrospective**: The team reviews internal processes to identify areas for improvement.

This iterative approach allows adapting to the changing needs of the project, integrating user feedback continuously, and ensuring rapid delivery of critical functionalities.

4.4 Sprint 1: Authentication, Registration and Profile Management

4.4.1 Objective

The main objective of this sprint is to set up an authentication and user profile management system, guaranteeing the security and integrity of user data. As the portal is exclusively accessible via the Stellantis internal network, the authentication system relies on Stellantis credentials (**ID** and **password**). Users must be able to register, log in, and manage their personal profile.

The key features to be developed during this sprint are:

- Secure authentication.
- Session management with **cookies** for secure login persistence, preventing malicious scripts from accessing them with XSS attacks. The token stored in the cookie is used to authenticate subsequent requests, thus ensuring session persistence.
- Secure password management with a robust hashing algorithm which is **Bcrypt**. This mechanism ensures that even in the event of a data leak, passwords remain protected.

4.4.2 Sequence Diagram

Authentication

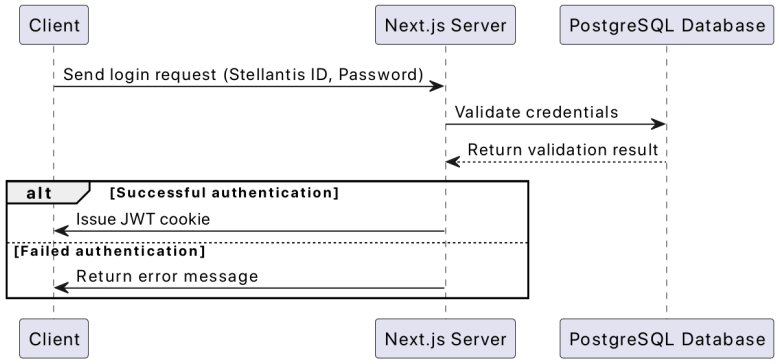

Figure 4.2: Sequence Diagram for Authentication

Registration

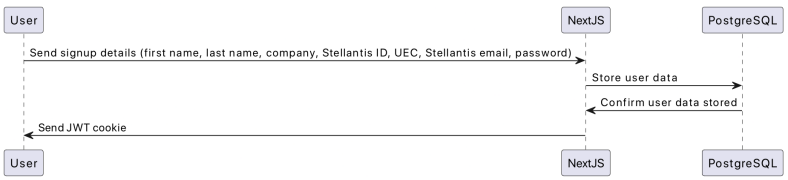

Figure 4.3: Sequence Diagram for Registration

4.4.3 Implementation

For the implementation of authentication, we opted for a custom authentication system based on the fact that users log in using their **Stellantis ID** and password. During login, the server verifies the authenticity of the information.

Here are some of the main aspects of the implementation:

- **CRUD for profile management**: Users can:
  - **Create** their account via the registration process.
  - **Read** and view their profile information.
  - **Update** certain information such as their first name, last name, and password.

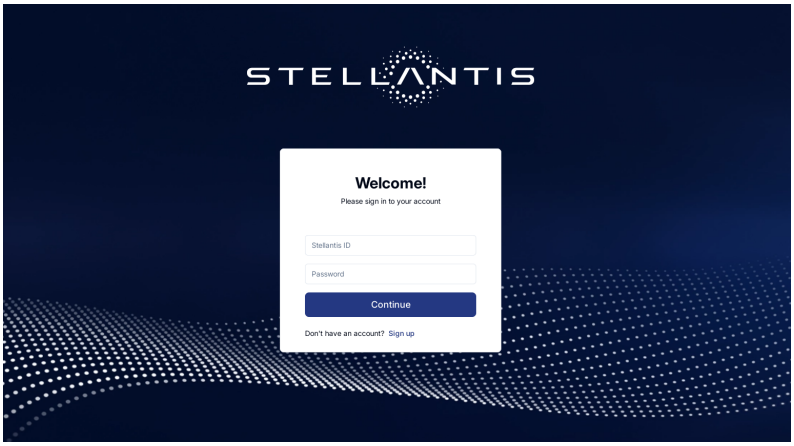

Figure 4.4: Authentication Page

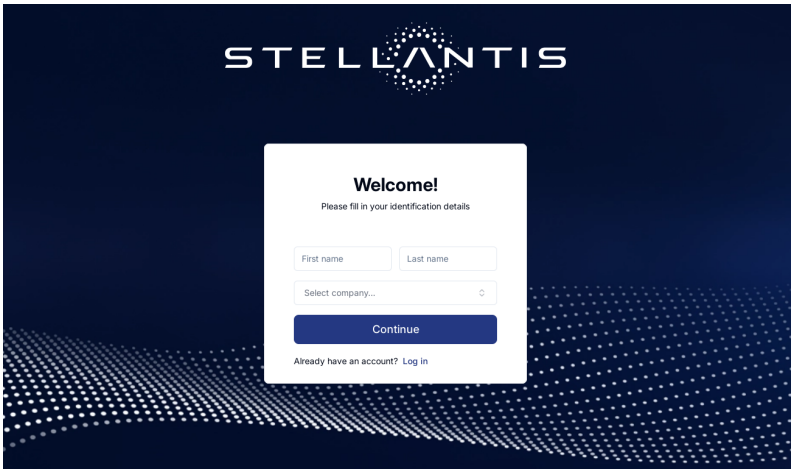

Figure 4.5: Registration Page - Step 1

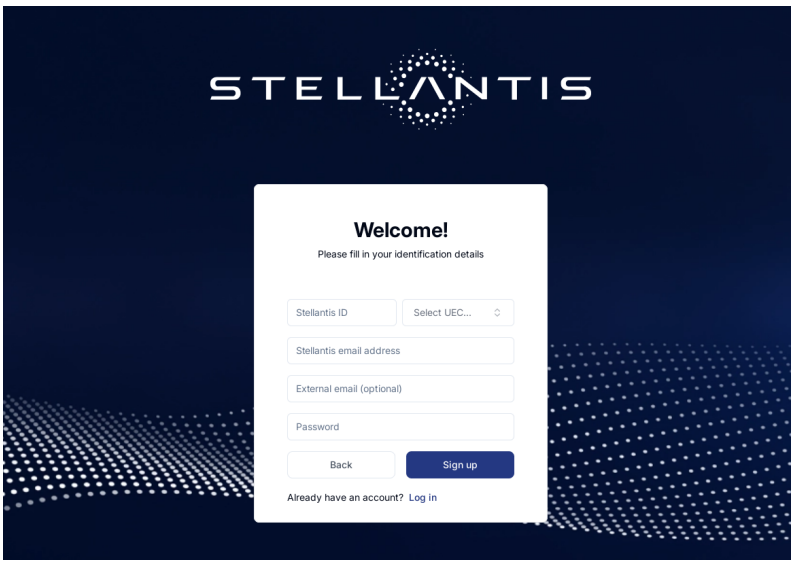

Figure 4.6: Registration Page - Step 2

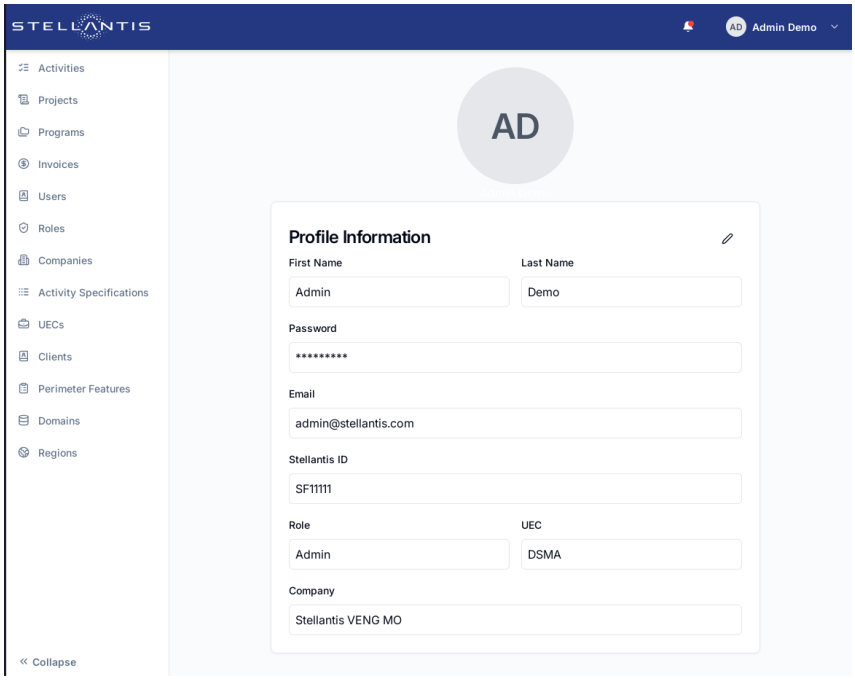

Figure 4.7: Profile Page

4.5 Sprint 2: User Management, Role Management and Permissions

4.5.1 Objective

The objective of this sprint is to develop an interface dedicated to administrators to facilitate the management of users and roles within the platform, as well as the precise allocation of permissions associated with each role. These features offer detailed and personalized control over the access and actions that each user can perform, whether in terms of viewing, creating, modifying, or deleting data. This allows administrators to define specific rights for each user, based on their role and responsibilities within the system.

4.5.2 Sequence Diagram

Sequence Diagram - Role Management

The role diagram illustrates the process of adding and updating roles as well as assigning permissions. The administrator first views the list of existing roles, then can add a new role via a form, defining the desired permissions. They can also modify an existing role to adjust permissions. All modifications are then saved in the database.

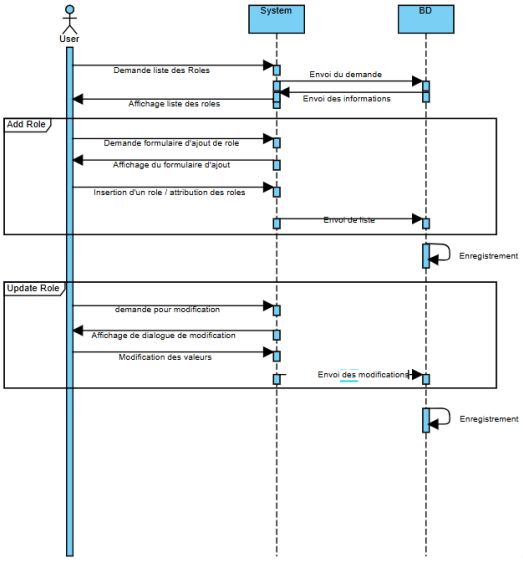

Figure 4.8: Sequence Diagram for Role and Permission Management

Sequence Diagram - User Management

The user diagram shows the user management process, including displaying the list of users, modifying their information, and assigning roles and permissions. The administrator modifies the user's details via a form, then the changes are saved in the database, ensuring that access and information are updated.

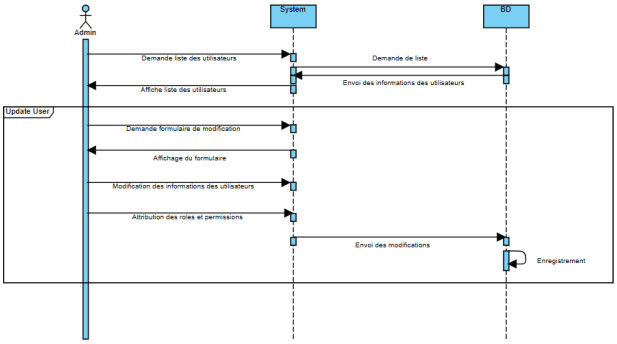

Figure 4.9: Sequence Diagram for User Management

4.5.3 Implementation

User Management

User management allows administrators to control access and actions on the platform. The interface displays details such as the ID, name, email, role, UEC, and approval status of each user. By clicking on *Edit*, the administrator can modify the information and assign roles, which displays the associated permissions. It is also possible to add specific permissions. The administrator can approve logins with *User Approved* or disable an account with *Disable*.

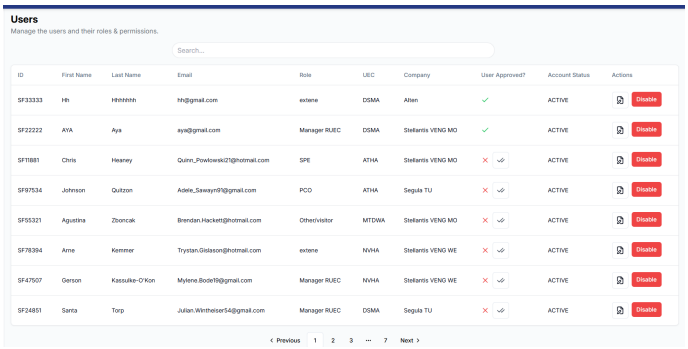

Figure 4.10: Interface displaying the list of users.

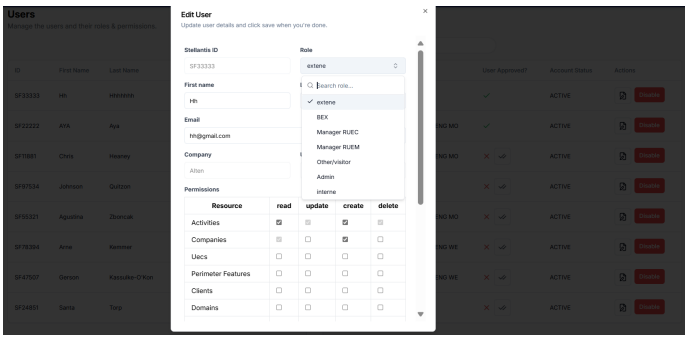

Figure 4.11: Interface displaying the form for modifying user information.

Role and Permission Management

Role management displays existing roles and their associated permissions, which can be modified or deleted by the administrator. When adding a role, the administrator defines the permissions, allowing actions such as viewing, creating, updating or deleting data. Specific permissions can also be assigned or removed from users.

Permission Functionality

Permissions control user access to sections of the application (activities, companies, clients, etc.), according to authorized actions. This ensures that each user only accesses functionalities corresponding to their permissions, ensuring secure data management.

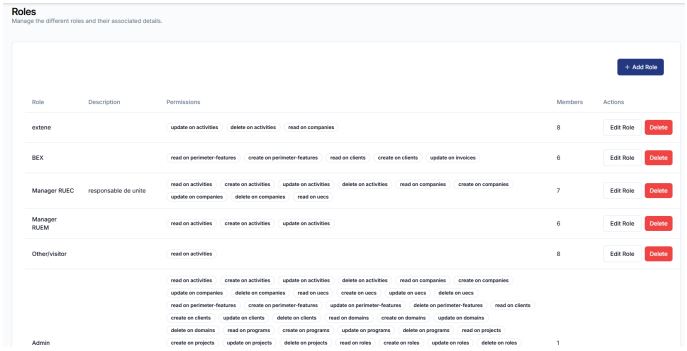

Figure 4.12: Interface that displays the roles and their permissions.

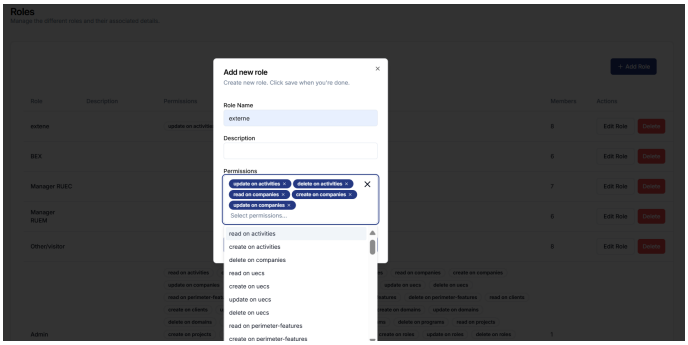

Figure 4.13: Interface for adding a role and assigning permissions.

4.5.4 Conclusion

This user, role, and permission management functionality allows structuring access and actions within the application in a flexible and secure manner. Administrators can effectively manage user accounts while precisely controlling access rights via roles and permissions. This ensures that each user only has the necessary access for their functions, while guaranteeing data protection.

4.6 Sprint 3: Management of UECs, Domains, Perimeter Specifications, Subcontracting Companies, Regions, and Clients

4.6.1 Objective

The objective of this sprint is to develop an intuitive interface for the centralized management of UECs, domains, perimeter specifications, subcontractors, regions and clients of Stellantis. Each feature aims to offer a fluid experience and rigorous organization of entities. This solution allows consulting, adding, modifying or deleting these entities while guaranteeing data consistency throughout the system.

4.6.2 Sequence Diagram

The sequence diagram below shows the interactions between the user, the system, and the database during domain management. Available operations include requesting the list of domains, adding, deleting and updating domain information.

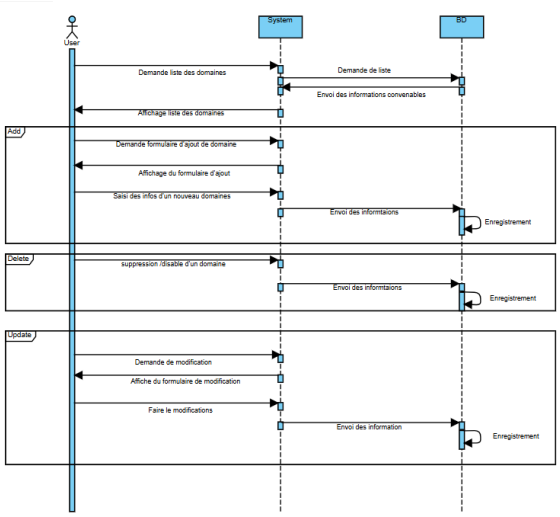

Figure 4.14: Sequence diagram for domain management

4.6.3 Implementation

In this section, we present the implemented interfaces and functionalities to manage the different entities, such as UECs, domains, perimeters, companies, regions and clients.

UEC Management

The UEC management interface allows the user to **view**, **add**, **modify** and **delete** UECs. Each UEC is associated with specific domains in which it operates. This interface ensures organized UEC management by providing clear information on their activities and their role within Stellantis.

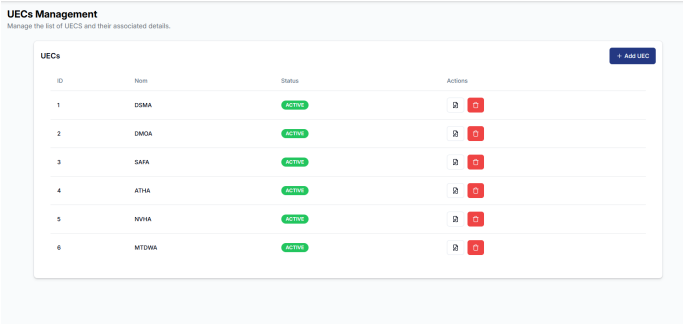

Figure 4.15: Interface displaying the list of Uecs and their status and possible actions (add, modify and delete)

Domain Management

Domains represent the main fields of activity of UECs. The domain management interface allows the user to easily manipulate them. They can **add** new domains to reflect the evolution of Stellantis' activities, **update** information to keep it relevant, and **deactivate** certain domains while retaining historical data, without definitive deletion.

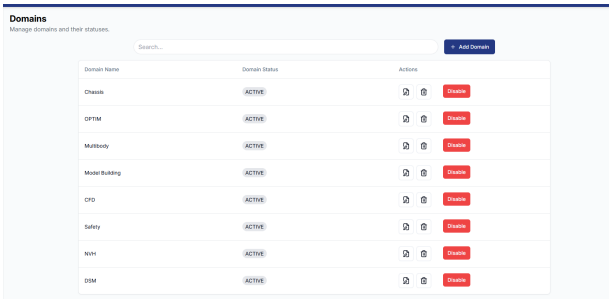

Figure 4.16: Interface displaying the list of Uecs and their status and possible actions (add, modify and delete)

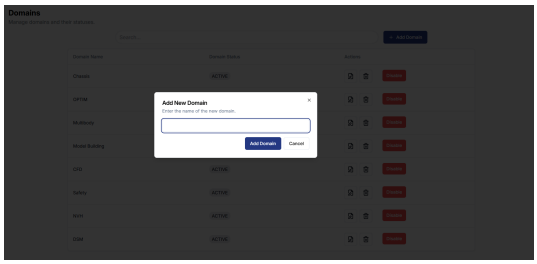

Figure 4.17: Interface displaying a form for adding a domain

Perimeter Specifications Management

Perimeter specifications, or *perimeter features*, are sub-domains defining the specific activities of UECs at Stellantis. The management interface allows adding new specifications, **modifying** existing specifications as needed, or **deactivating** those that have become obsolete. This granular management ensures a clear distribution of tasks within the UECs.

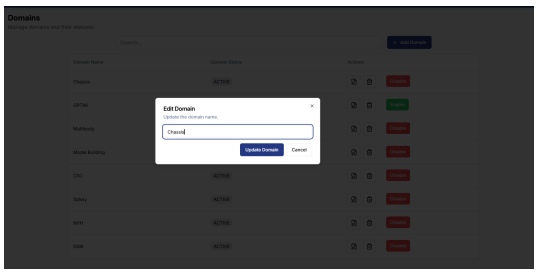

Figure 4.18: Interface displaying a form for modifying a domain

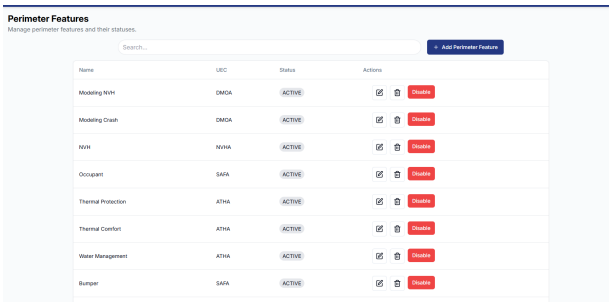

Figure 4.19: Interface displaying the list of perimeter specifications and their actions.

Subcontracting Companies Management

Subcontracting companies are **strategic partners** with whom Stellantis collaborates. Each company is associated with a country. The interface allows **managing these companies**, from their creation to their modification, including deactivation. This management ensures effective collaboration between Stellantis and its subcontractors.

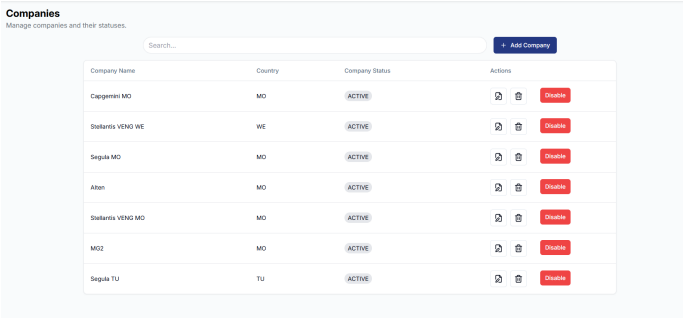

Figure 4.20: Interface displaying the list of companies and their actions.

Region Management

Regions allow structuring UECs and companies geographically. The region management interface offers the possibility to **create**, **modify** and **deactivate** regions according to Stellantis' activities and work areas. This geographical organization facilitates the management of international operations.

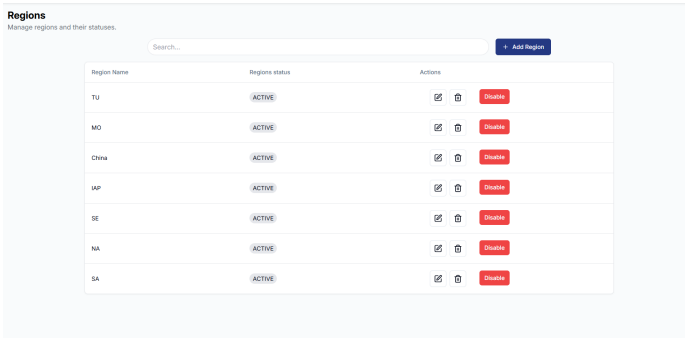

Figure 4.21: Interface displaying the list of regions and their actions.

Client Management

The client management interface allows Stellantis to **view** and **manage** customer relationships. It offers options to **add**, **modify** and **deactivate** clients while preserving the integrity of data related to past collaborations. This management contributes to improving Stellantis' strategic relationships with its clients.

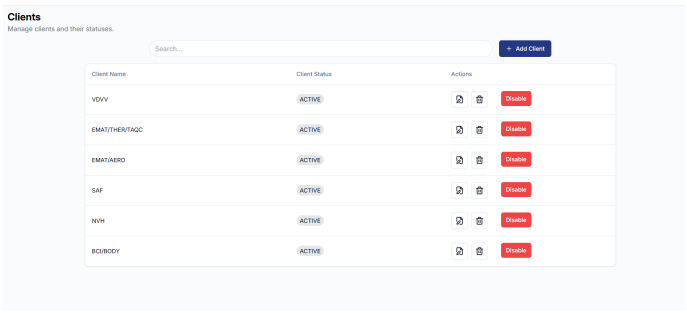

Figure 4.22: Interface displaying the list of clients and their actions.

4.6.4 Conclusion

This sprint allowed implementing a centralized and intuitive management of UECs, domains, perimeters, subcontracting companies, regions, and clients. These functionalities reinforce Stellantis' operational efficiency by facilitating the management of entities with which the company collaborates.

4.7 Sprint 4: Management of Programs, Projects, Configurations, Phases, Energies, Types and Cases

4.7.1 Objective

The objective of this sprint is to develop a complete and intuitive module for the management of programs and projects, as well as related elements such as configurations, phases, energies, types and cases. This module aims to centralize the management of these entities and facilitate the addition, modification and deletion of projects and their associated attributes.

4.7.2 Sequence Diagram

The sequence diagram below illustrates the interactions between the user, the system, and the database during project management. Available operations include consulting the list of projects, adding a new project, and updating the information of an existing project.

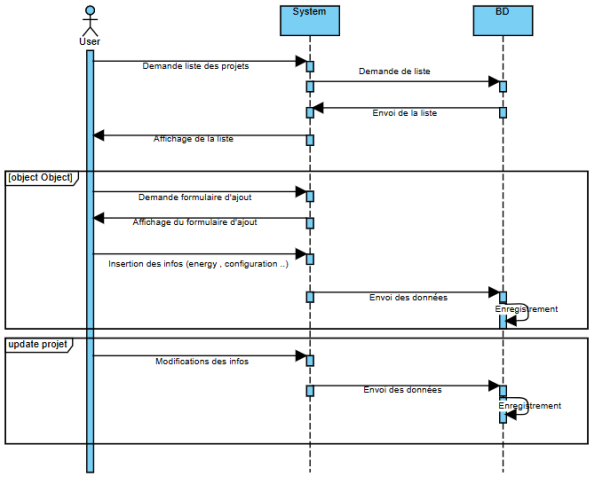

Figure 4.23: Diagramme de séquence pour la gestion des projets

4.7.3 Implementation

This section describes the interfaces for managing programs, projects, configurations, phases, energies, types and cases.

Program Management

The interface allows to **view**, **add**, **modify**, and **delete** programs, each program grouping several projects. The user can consult, add, modify or delete programs via a form. This organized management facilitates the monitoring of projects related to each program.

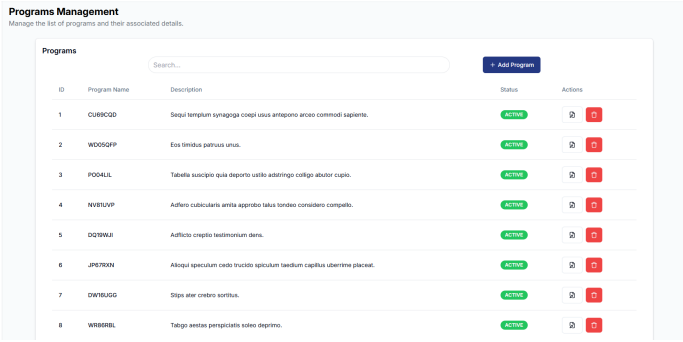

Figure 4.24: Interface displaying the list of programs and their actions.

Project Management

delete programs as needed. This feature ensures organized program management, facilitating the monitoring of different projects attached to each program.

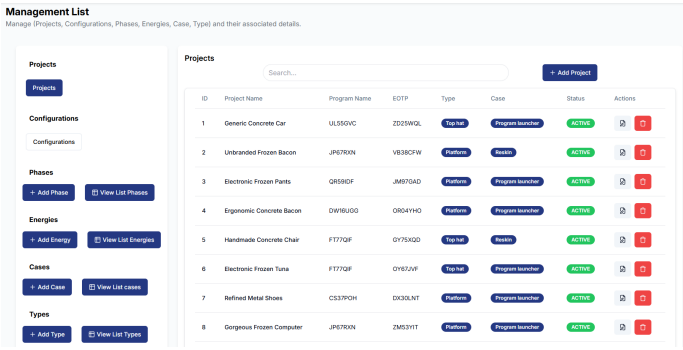

Figure 4.25: Interface displaying the list of projects and their actions.

The project management interface allows to **view**, **add**, **modify**, and **delete** projects. When adding, the user selects a program, as well as attributes such as EOTP, type, and case to classify the project.

A form allows entering the required information: project name, associated program, EOTP, type, and case, guaranteeing consistent input. This organized management of programs facilitates the monitoring of related projects.

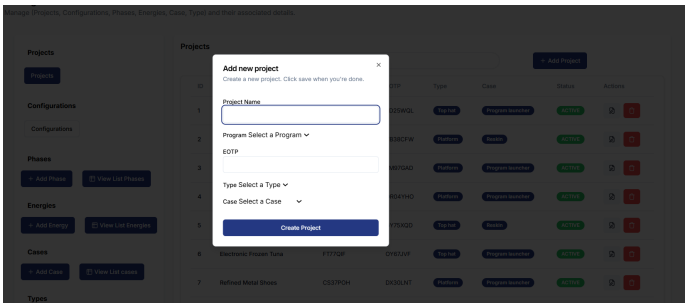

Figure 4.26: Interface displaying the project addition form.

Configuration Management

Configurations represent sets of parameters related to projects. The interface allows to **view**, **add**, **modify** and **delete** configurations associated with projects. Each configuration is identified by a unique name and is linked to a specific project.

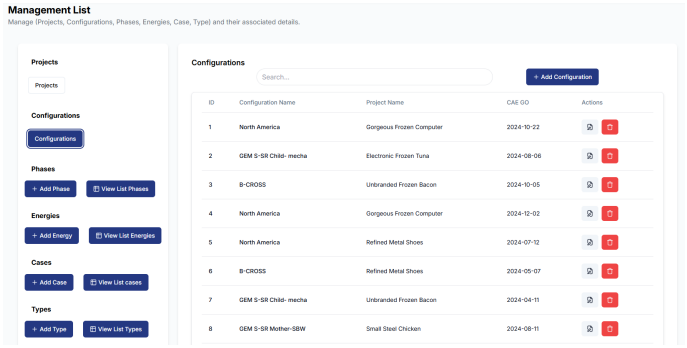

Figure 4.27: Interface displaying the list of configurations and their actions.

Phase Management

Phases represent the stages of a project. This interface allows to **manage phases** by offering options to **add**, **modify**, and **delete** phases. These phases are essential to track the progress of a project over time.

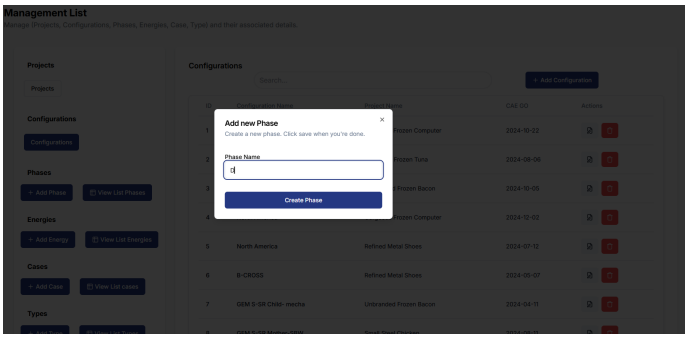

Figure 4.28: Interface displaying the list of phases and their actions.

Case Management

Cases are specific scenarios or use cases of a project. This interface allows to **manage these cases**, offering options to **add**, **modify**, and **delete** cases according to the needs of the projects.

Energy Management

Energies represent the types of energy associated with a project (e.g., BEV, ICE, MHEV, etc.). The energy management interface allows the user to **add**, **modify** and **delete** energy types.

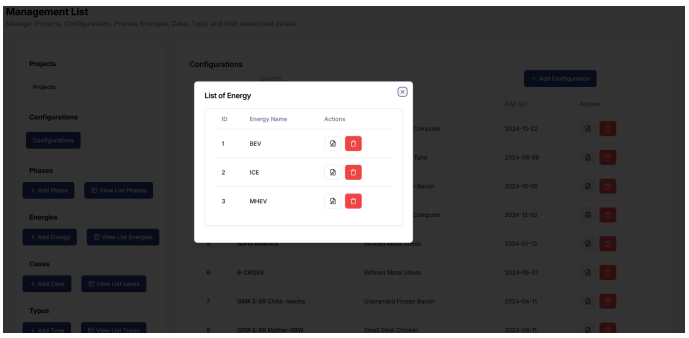

Figure 4.29: Interface displaying the list of energies and their actions.

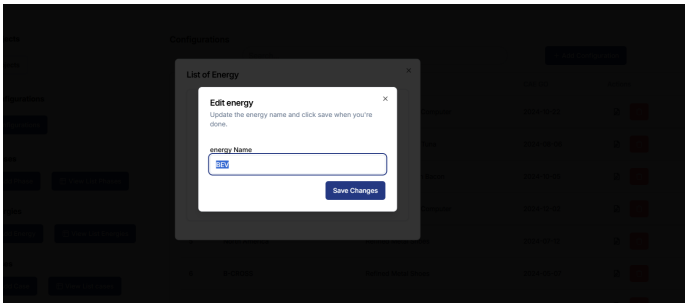

Figure 4.30: Interface displaying the energy modification form.

Type Management

Types are specific categories assigned to projects. The user can **add**, **modify** and **delete** types through a dedicated interface.

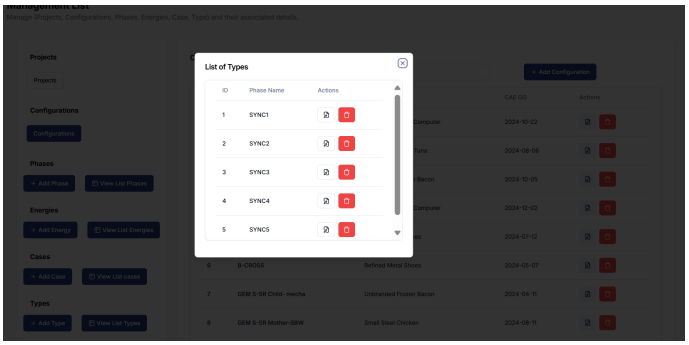

Figure 4.31: Interface displaying the list of types and their actions.

4.7.4 Conclusion

This sprint allowed the implementation of a centralized management of programs, projects and their associated attributes (configurations, phases, energies, types, and boxes). This management is essential to ensure organized and detailed monitoring of projects, by facilitating the addition, modification, and deletion of each element. Thanks to this complete interface, users can efficiently manage their projects and programs, while ensuring data consistency across all associated entities.

4.8 Sprint 5: Management of Activities, Their Flows, and Notifications

4.8.1 Objective

The objective of this sprint is to implement efficient management of activities, from their creation to their delivery, with notifications, KPIs such as FTR (First Time Right) and OTD (On-Time Delivery), as well as flow management. This system improves coordination between teams, ensures traceability of actions, and offers a clear visualization of progress via dashboards.

4.8.2 Sequence Diagram

This sprint is illustrated by several sequence diagrams showing the information flow between the actors (internal and external), the system and the database. These diagrams detail the processes of adding activities, managing convergence statuses, delivery and quotation.

Adding an Activity and Convergence Process

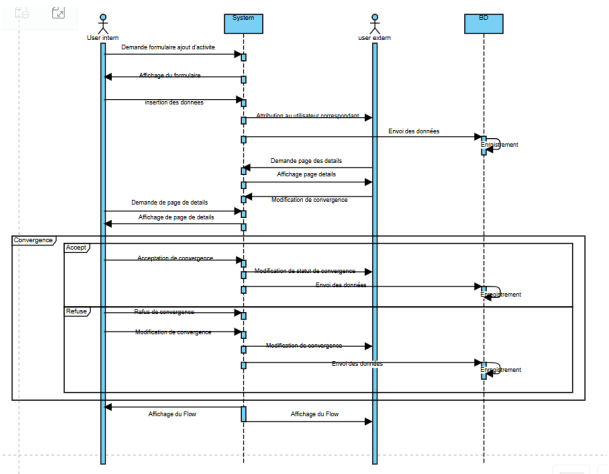

Figure 4.32: Sequence diagram illustrating the process of adding an activity

The sequence diagram above shows the process of adding an activity by an internal or external user. The activity is automatically assigned based on the area of expertise. For an internal activity, the status changes to *Converged*, while an external activity changes to *Waiting for FMI Feedback*, initiating a validation process with stakeholders.

Activity Delivery and Quotation

The second diagram describes the process of delivering an activity, its monitoring, and the quotation by Stellantis. After validation, the FTR KPI measures the quality of the deliverable and the OTD verifies compliance with deadlines. These KPIs are essential for evaluating the performance of deliveries.

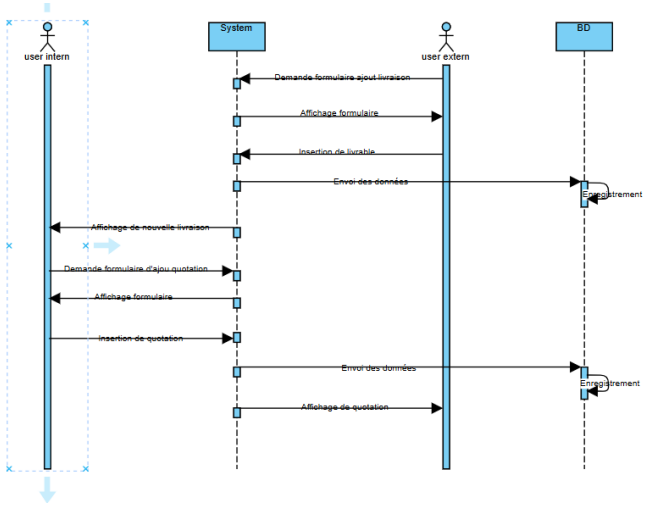

Figure 4.33: Sequence diagram illustrating the delivery and quotation processes of a deliverable.

4.8.3 Implementation

This sprint resulted in an intuitive interface for activity management, including components to track the complete life cycle of activities, from creation to delivery.

Adding an Activity

Adding an activity is done via a form where the user specifies the project, phase, energy, configuration, responsible region, and type of activity (internal or external). The people in charge are also selected. Once created, a notification is sent to the relevant users. The start dates can be calculated automatically via the CAE GO and GAP fields, but remain modifiable.

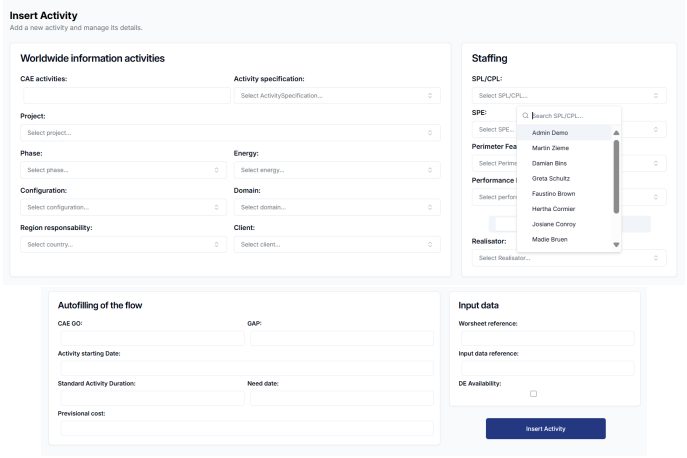

Figure 4.34: Interface displaying the activity insertion form.

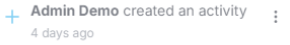

Figure 4.35: Interface displaying the notification that the relevant people receive.

Activity Page

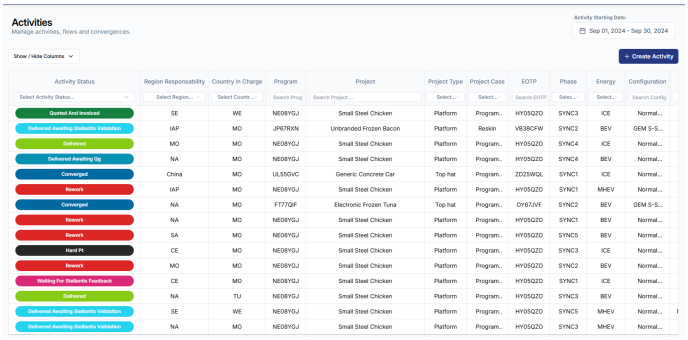

Figure 4.36: Interface displaying the list of activities with their status, project, and detailed information.

The activity page presents a dashboard grouping all ongoing activities, with filtering options by status, project, start date, etc. Statuses are indicated by predefined colors (Converged, Rework, Delivered), facilitating management.

The user can show or hide columns via a "Show/Hide Columns" menu and use additional filters to display only activities matching a specific date or status.

Figure 4.37: Column Filters - Menu for selecting columns to show or hide.

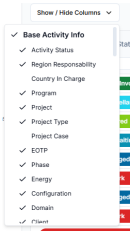

Figure 4.38: Column Filters - Menu for selecting columns to show or hide.

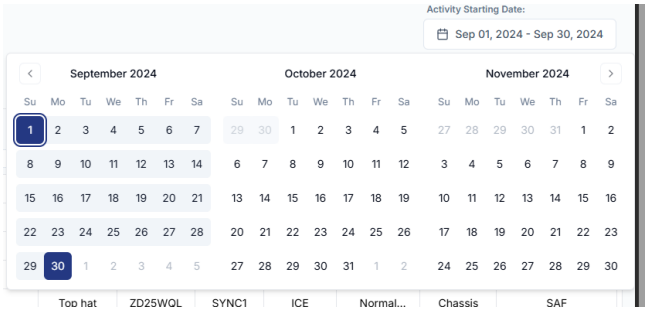

Figure 4.39: Display filters according to a chosen date.

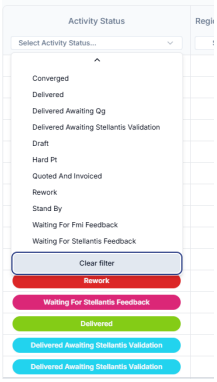

Figure 4.40: Filters for each column for display according to choice.

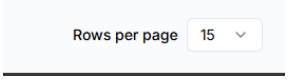

Figure 4.41: Filters on the number of rows to display.

Figure 4.42: Flow after applying one of the filters.

Activity Details

Once an activity is created, the user can access a details page by double-clicking the corresponding row in the table.

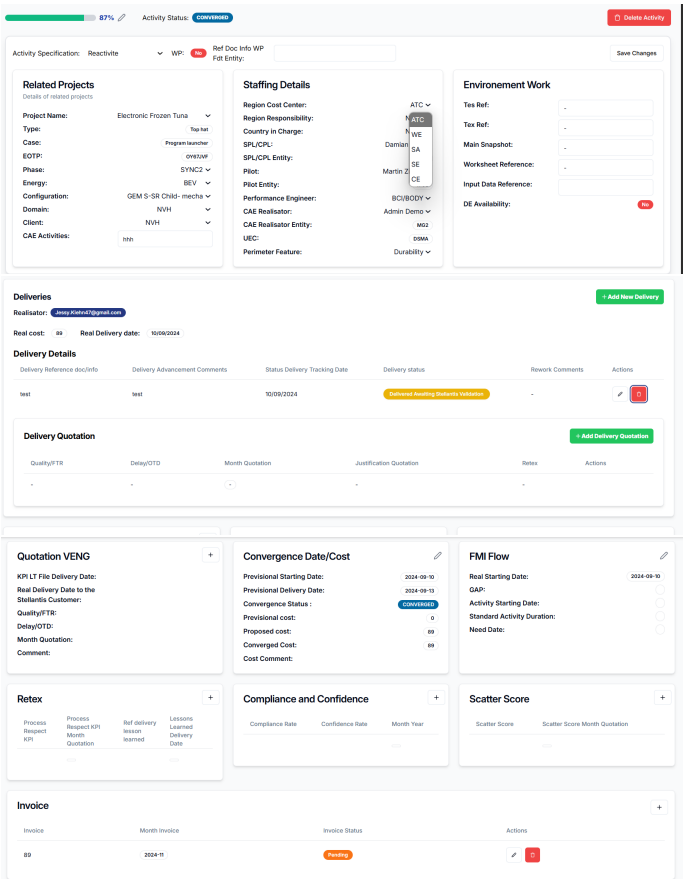

Figure 4.43: Activity details page which allows several options.

This page offers the following functionalities:

- Modification of activity information (domain, phase, configuration, etc.).
- Adding deliveries and quotations after activity validation.
- Monitoring of progress statuses and FTR and OTD KPIs.
- Deletion of the activity, with a notification sent to the pilot for validation before final deletion.

Delivery and Quotation

When an activity is completed, a delivery can be added to the system. This delivery is subject to validation and quotation by Stellantis. The delivery page includes the following information:

- Deliverable reference
- Delivery status (pending validation, delivered, etc.)

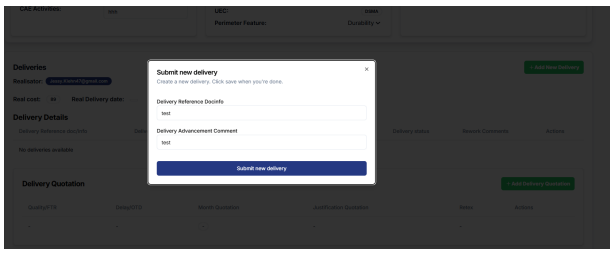

Figure 4.44: Form that allows adding a delivery.

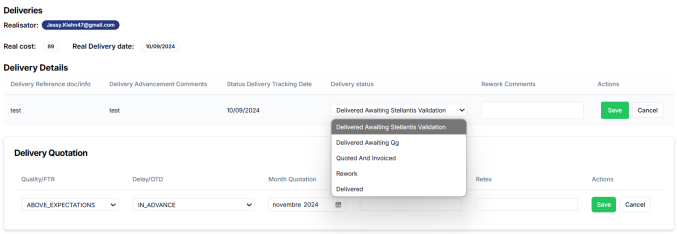

Figure 4.45: Form allowing modification of deliverable information and its quotation.

- FTR KPI to assess the quality of the deliverable
- OTD KPI to assess compliance with deadlines

Once validated, the quotation is saved, and the FTR and OTD KPIs are updated automatically.

Convergence and Status

The convergence process is a key element in activity management. For internal activities, they are automatically marked as *Converged* after their creation. However, for external activities, the status goes through several phases (Waiting for FMI Feedback, Rework, etc.) before reaching the final status.

Notifications are sent with each status change to keep stakeholders informed of progress. The color codes associated with the statuses allow quick reading of the status of an activity in the dashboard.

KPIs and Notifications

The FTR (First Time Right) and OTD (On-Time Delivery) KPIs are essential performance indicators monitored throughout the activity life cycle. They allow measuring the quality of deliveries as well as their timeliness. The system generates automatic notifications when a critical action is performed (activity creation, delivery, deletion, etc.).

Unit Flow and Flows

The system includes advanced activity flow management via an interactive calendar that allows visualization of the flows associated with each activity. The statuses of the activities (with their associated color) are directly reflected in the calendar, thus offering a clear overview of the schedule and progress of the activities.

Each change in the convergence status immediately affects the display of the flow in the calendar. The user can manually adjust the flow dates for better planning.

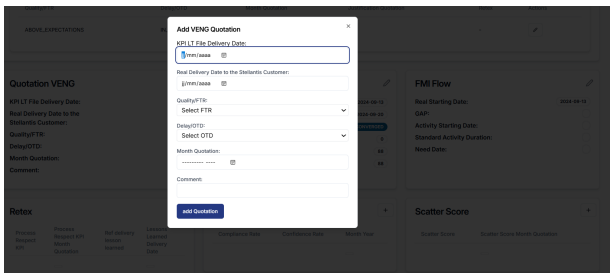

Figure 4.46: Form that allows adding a quotation.

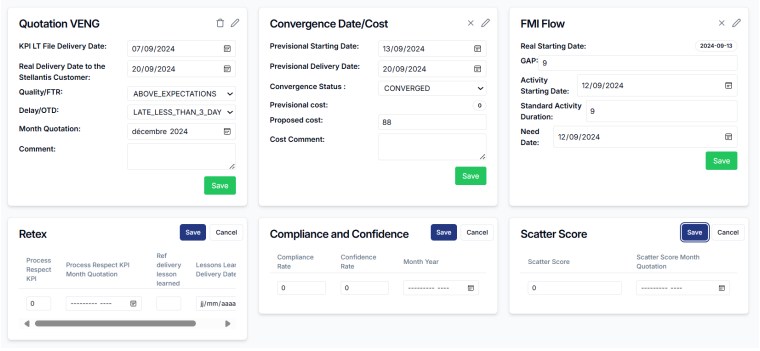

Figure 4.47: Form allowing modification of several information (convergence process, quotation...).

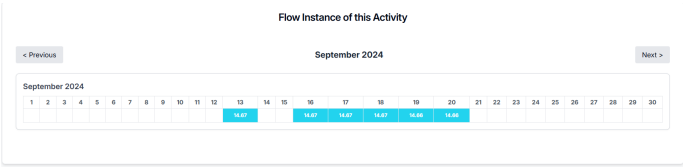

Figure 4.48: Unit flow for each activity.

4.8.4 Conclusion

This sprint delivered a complete solution for managing activities and deliverables. Thanks to the integration of FTR and OTD KPIs, and optimized management of progress statuses (convergence, delivery, quotation), the system offers a global and precise view of the status of projects. The ability to filter activities, add deliveries, and manage flows via an interactive calendar allows users to efficiently monitor and manage their projects. The automated notification feature ensures that each actor is informed in real time of critical actions to be taken, thus facilitating team collaboration and responsiveness.

4.9 Sprint 6: Capacity Management

4.9.1 Objective

Sprint 6 aims to create a capacity management system to track the capacity and invoiced amounts per STELLANTIS entity each month. The PCO user can view, add, modify and delete capacities via an intuitive interface, with selection of years, months, and UECs. The objective is to compare capacities with the sum of activity invoices for each UEC over a given month.

4.9.2 Sequence Diagram

The sequence diagram below illustrates the interactions between the PCO user and the system during capacity insertion.

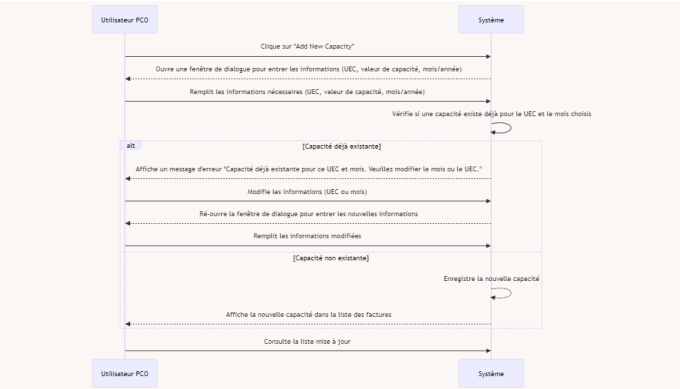

Figure 4.49: Sequence diagram for inserting a capacity

4.9.3 Implementation

This section describes the interactions between the PCO user and the system during capacity management. The main steps are described below:

- **Access to the Invoices section:** The PCO user accesses the "Invoices" section via the side menu.
- **Displaying the invoice list:** The system displays the list of existing invoices, including capacity information, month/year and UEC. The user can apply filters to refine the search, as shown in the image below.

- **Action - Add:** The PCO user clicks on "Add New Capacity" to add a new capacity. Each capacity relates to a chosen UEC and month, as well as the sum of activity invoices for that month.
- **System:** A dialog box opens (as shown in the image), allowing the PCO user to fill in the necessary information (UEC, capacity value, month/year).

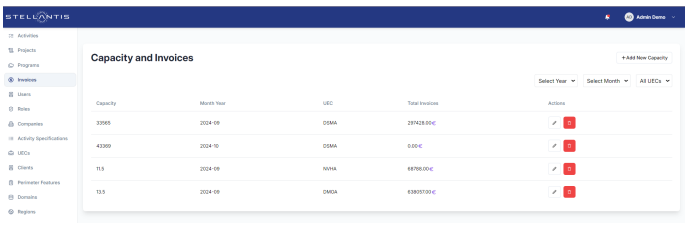

Figure 4.50: Interface displaying the list of capacities and the total invoices per UEC and per month.

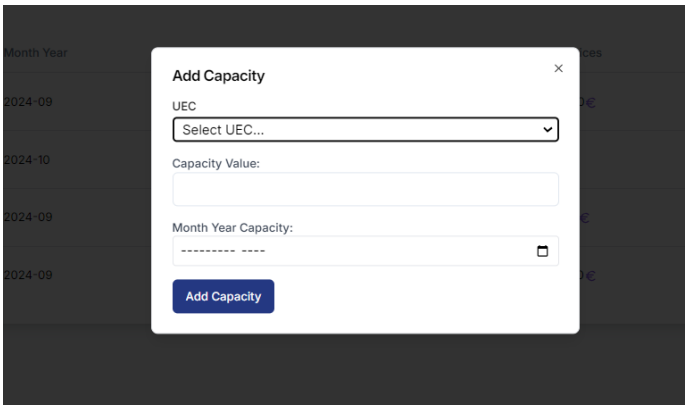

Figure 4.51: Interface displaying a form to insert a capacity by choosing a UEC, a month and a capacity.

- **Action - Modify/Delete:** The PCO user can also choose to modify or delete an existing capacity from the list.

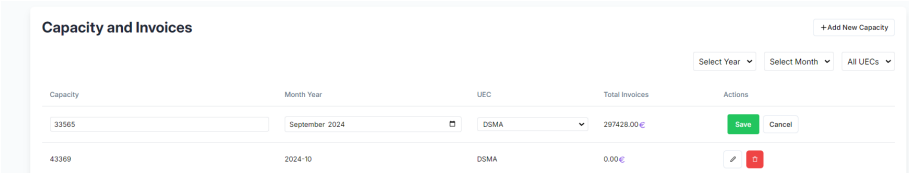

Figure 4.52: Interface allowing modification of capacity information.

4.10 Conclusion

This chapter described the design and development of the web portal for the management of digital simulation activities. Using Scrum, we designed a modular and scalable system, adapted to the needs of Stellantis and its subcontractors.

The technological choices (TypeScript, React.js, Next.js, PostgreSQL) ensured performance, security and scalability. Key features, such as user, role, permission, notification and activity management, were successfully implemented.

Modularity allows for the addition of future functionalities, although optimization of response times for large data volumes remains to be improved.

In summary, this chapter highlighted the importance of careful design and methodical development to guarantee the robustness of the solution.

Chapter 5

PowerBI Summary

5.1 Introduction

The integration of PowerBI into the project aims to offer an overview of the activities and performance related to numerical simulations. PowerBI allows for the centralization of data, visualization of key indicators, and facilitates decision-making through interactive dashboards.

5.2 Objective

The objective of implementing PowerBI is to provide a tool for monitoring key performance indicators (KPIs), tracking progress made by subcontractors and Stellantis, and analyzing the costs and timelines associated with simulation activities.

5.3 Dashboards

The PowerBI dashboard presents various metrics essential to activity management, including delivery times, costs, and project convergence indicators. Users can visualize this data in real time, filter by project, subcontractor, or business area, and generate automatic reports for more in-depth analysis.

5.3.1 Home

The dashboard illustrated below allows for the analysis of deliverables and delivery details of activities according to different filters. It displays information such as total programs, active projects, as well as planned and actual costs associated with modeling, analysis, optimization, and simulation activities.

Figure 5.1: Dashboard for the home section, displaying metrics related to deliveries and costs of activities.

The dashboard includes:

- Navigation bar with tabs: Home, Billing, RATING FMI AND VENG, HR.
- Year selector (2024-2025) and menu for the month.
- Counters: 15 programs, 11 projects, 3K activities.
- Pie chart for convergences by activity.
- Line graph for tracking deliveries by specification.
- Detailed table of deliveries (specifications, dates, costs, etc.).
- Filters on the right to refine the data.

This dashboard provides an overview of activities, allowing for tracking progress, costs, and deliveries.

5.3.2 Billing

The following dashboard highlights the evolution of invoices based on the work capacity per entity (UEC). It also shows the evolution of the workload per project and domain. The graphs allow for comparison of the billed capacity and the actual need, as well as tracking monthly billing by UEC.

Figure 5.2: Dashboard for the billing section, illustrating the evolution of workloads and capacities by UEC.

5.3.3 FMI and VENG Evaluation

This section presents a comparative analysis of the evaluations for FMI (Faurecia Modules Interior) and VENG (Vehicle Engineering) based on two key performance indicators: FTR (First Time Right) and OTD (On-Time Delivery). The data is visualized through a series of line graphs, offering insights into performance across different UECs (Elementary Design Units).

Figure 5.3: FTR and OTD Evaluations for FMI and VENG across UECs

The Figure 5.3 displays four graphs:

1. **FMI Evaluation (FTR) :** Shows the FTR performance for FMI by UEC, with the variation in the quality of deliverables from subcontractors.

2. **VENG Evaluation (FTR) :** Presents the FTR performance for VENG by UEC and the quality of delivered activities.

3. **FMI Evaluation (OTD) :** Illustrates the OTD performance for FMI by UEC, showing the deadlines for submitting deliverables.

4. **VENG Evaluation (OTD) :** Depicts the submission deadlines for VENG by UEC.

The graphs use a color code for the FTR categories (ABOVE EXPECTATIONS, ACCEPTABLE, BELOW EXPECTATIONS, UNACCEPTABLE) and OTD (AHEAD

OF SCHEDULE, LATE). Time filtering (2024-2025) and monthly filtering allows for detailed analysis, facilitating FMI/VENG comparison and the identification of UECs to improve.

5.3.4 Analysis of Performance Indicators

This dashboard monitors the KPIs of simulation activities, with interactive filters to explore data by domain, project, or subcontractor. The graphs offer an overview while allowing for detailed analysis of costs and deadlines.

5.4 Conclusion

The integration of PowerBI improves visibility on simulation activities, optimizing resource and deadline management. The interactive dashboards facilitate collaboration between Stellantis and subcontractors, strengthening decision-making and process management.

General Conclusion

The project presented in this report is part of an innovation and process improvement dynamic within the Stellantis group. The implementation of a web portal dedicated to the management of numerical simulation activities has addressed several challenges faced by internal teams and subcontractors, particularly in terms of information centralization, communication optimization, and effective project tracking.

Thanks to the use of the Agile methodology, specifically the Scrum framework, we were able to progress iteratively, ensuring the gradual integration of features and continuous validation of the results obtained. The developed portal now allows for better role and permission management, more detailed tracking of key performance indicators (KPIs), as well as the centralization of deliverables and notifications.

The success of this project is largely due to the active collaboration between the various stakeholders, the adoption of modern technology, and the application of best project management practices. The use of tools such as TypeScript, React.js, and PostgreSQL also contributed to ensuring the system's robustness, scalability, and security.

However, although the project has achieved its main objectives, several areas for improvement remain. The first concerns the optimization of portal performance to handle even larger volumes of data. Furthermore, the integration of advanced data analysis tools, such as Business Intelligence modules, could further enhance the portal's features and provide a more comprehensive view of key indicators for decision-making.

In conclusion, this project has provided a concrete and effective solution to a real problem, while paving the way for new development opportunities for the Stellantis group. The increasing digitalization of processes and the implementation of efficient collaborative tools represent a major challenge for companies in the automotive sector, and this project is a concrete illustration of that.

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