**Ministère de L’enseignement Supérieur et de la Recherche Scientifique**

**Faculté des Science de Bizerte**

**Report of**

**END-OF-STUDY PROJECT**

**In order to obtain:**

**Invoicing System dedicated for …**

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**Internship period**: 2023-02-02 / 2023-06-01

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# **Appreciation:**

I

*would like to express my deepest gratitude and respect to Mr. Mounir Ounissi, my pedagogical supervisor and Professor at the Faculty of Sciences of Bizerte. Throughout the project, Mr. Ounissi provided me with attentive supervision, valuable feedback, and insightful guidance that proved invaluable in the development of my work. His unwavering support, enthusiasm, and personal and professional qualities have been an inspiration to me, and I feel fortunate to have had the opportunity to learn from him.*

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# **Plan**

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# **General Introduction**

I

n this age of technology, digitalization is ubiquitous, and businesses are investing significant resources to streamline their processes and stay ahead of the competition. One area that requires particular attention is the management of invoices and payments. This critical function can be complex and intricate, and businesses must ensure they are organized and efficient to avoid costly mistakes.

Managing invoices and payments requires a keen eye for detail and adherence to legal and regulatory compliance. Businesses must ensure that all their payment processes comply with relevant laws and regulations to avoid legal and financial repercussions.

The recruitment and selection of the right payment management system is also crucial. Companies must identify payment solutions that align with their organizational goals, culture, and values. This process is vital in creating an efficient payment system and driving business growth maintaining a positive relationship with clients and vendors to avoid payment disputes and conflicts.

Efficient invoice and payment management is a critical component of any successful business, and it requires organizations to navigate complex challenges while ensuring prompt and accurate payment processing enabling companies to focus on core business functions and stay competitive.

1. Chapter: Working Context
   1. Introduction

In this chapter, I will introduce the company Zedney Creative, and then we will present the problem and describe the project to be carried out. Finally, we will define the Scrum agile framework as a framework for carrying out our mission.

* 1. Presentation of the company

Zedney Creative is an IT engineering services company (SSII) founded in 2011 and present in Tunisia (Tunis and Bizerte), France (Paris), Emirates (Dubai) and Saudi Arabia (Riyadh), it offers IT solutions adapted to different businesses and industries.

The company is a partner of choice that provides its customers with digital solutions that are perfectly effective in meeting the challenges of agility, performance, and development.

The company specialize in the fields of information systems, IT development, mobile development, process automation and digitalization, provides solutions to meet the needs of companies, relying on a community of consultants who offer their technical expertise to large groups in various fields.



Figure 1 : Company organization chart

This figure shows the hierarchy within a subsidiary founded in Tunisia. There are 3 directions (IT, financial administration and sales) managed by a general management.

My internship takes place within the IT department.

* 1. Issue of the Project
     1. Description of the problem

One of the major problems with invoice management is the potential for errors or inaccuracies. Invoices may contain incorrect information, such as incorrect pricing or quantities, which can lead to overpayment or underpayment. Additionally, invoices may be lost or misplaced, which can cause delays in payment and negatively impact relationships with vendors and clients.

Another challenge with invoice management is the sheer volume of invoices that many businesses receive, managing a high volume of invoices can be time-consuming and require a significant number of resources. This can be particularly challenging for small businesses or those with limited staff and resources. It can also be complicated by the different payment terms and methods used by vendors. Some may require payment by a certain date or using a specific payment method, while others may be more flexible so to keep track of these different requirements and ensuring timely payment will be a great challenge.

A Digital solution can help to streamline and automate many aspects of invoice management, reducing the potential for errors and improving efficiency. the solution can automate approval workflows, enable integration with accounting systems, customize payment terms and methods...

Developing software for invoices, products and client’s management can be a complex and challenging process, we are currently facing hardships concerning data accuracy, integration with other systems and security concerns, therefore the plan is to leverage an existing platform despite its issues and undertake a comprehensive effort to enhance its functionality. Specifically, we aim to improve the core functions of the platform and its underlying architecture to create a more efficient and user-friendly experience.

* + 1. Proposed Solution

In pursuit of our objective to enhance the platform, we will carefully analyze the existing issues and devise a strategy to address them. By focusing on the core functions that require improvement, we will implement modifications to optimize performance and user experience, we are planning to substitute the architecture of the platform to ensure that it is scalable, flexible, and sustainable for future growth

Through our efforts, we aim to exceeds user expectations and delivers value to our stakeholders by delivering a significantly improved system that ensures:

* An intuitive and user-friendly dashboard that provides easy access to key information and features, such as invoices, taxes, contacts, and clients.
* Improved functionality and core features, including the ability to create, manage, and track invoices; calculate taxes automatically; and easily add and manage client and contact information.
* More efficient and streamlined processes that reduce the time and effort required to create and manage invoices and generate documents.
* Robust security and data protection measures to safeguard sensitive information, such as client and payment details, and prevent unauthorized access or data breaches.
* Increased stakeholder engagement and support, by providing timely and accurate information, regular updates, and excellent customer service and support.
  1. Used Technologies:
     1. Objectives & Goals

Zedney Creative currently possesses a copy of the application that was built by a French team. The development of this application utilized Symfony 4, Vue.js 3, and MySQL as the underlying technologies.

The ongoing migration process entails a shift from the old technologies to adopting the React JavaScript library for front-end development, Django framework for back-end development, and the PostgreSQL database for data storage. This transition involves transferring existing code, restructuring the application architecture, and re-implementing functionality using the new technology stack.

The goal is to leverage the benefits and features offered by React, Django, and PostgreSQL, such as enhanced user experience, improved development efficiency, scalability and security. Throughout the migration, careful planning, testing, and data migration procedures are employed to ensure a smooth and successful transition to the new technology stack.

* + 1. Previous Technologies:

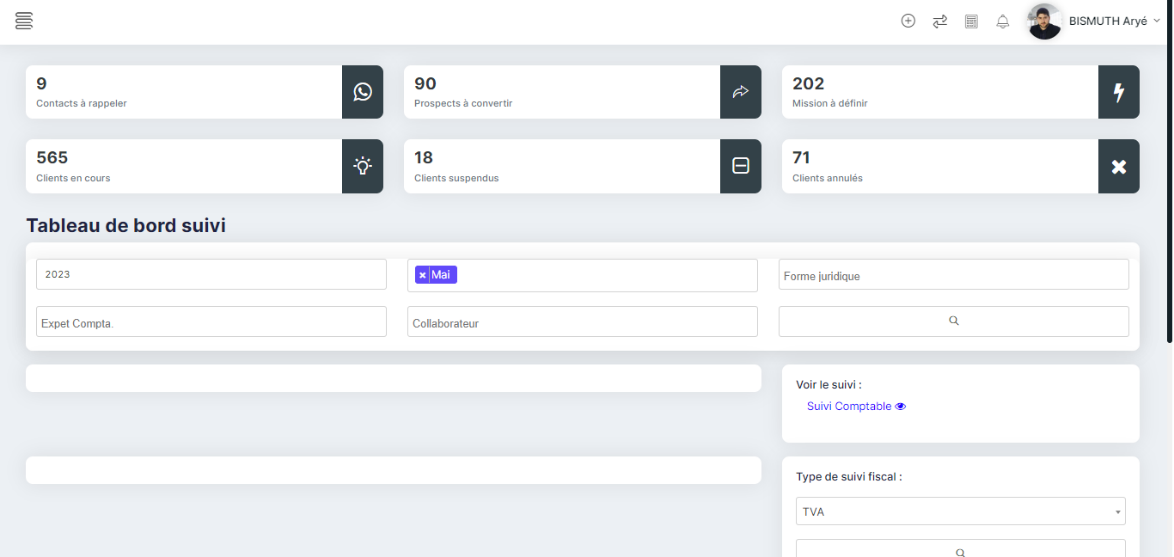


Figure 2 : Screenshot 1

The current dashboard is experiencing functionality issues and is lacking charts/graphs. It requires attention and improvements to ensure proper functionality and include the necessary visual representations of data through charts.

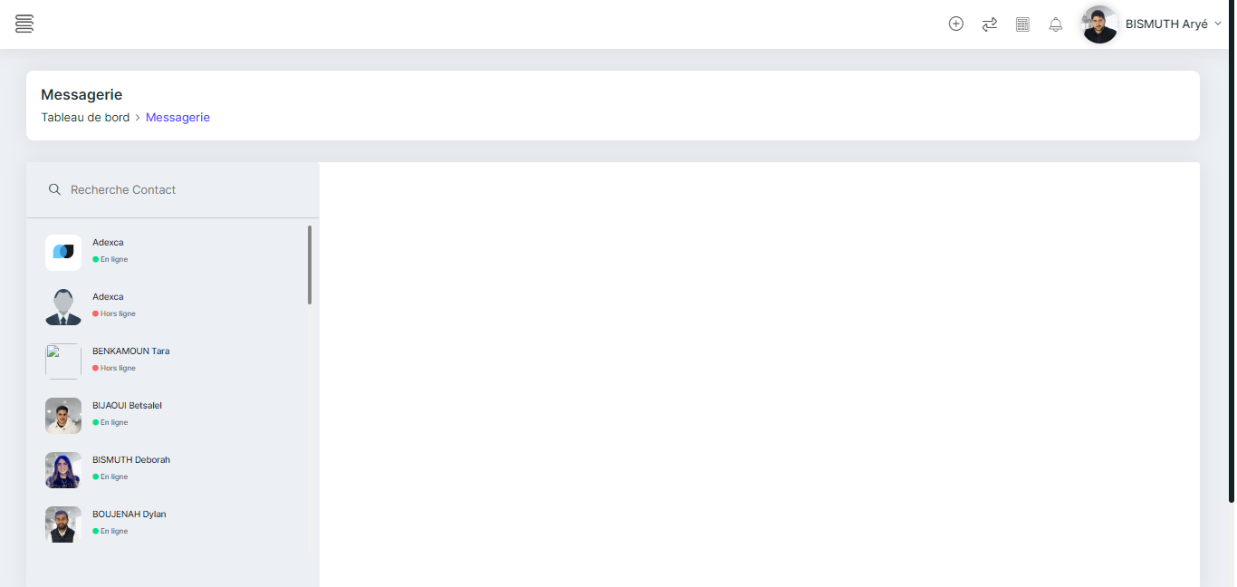


Figure 3 : Screenshot 2

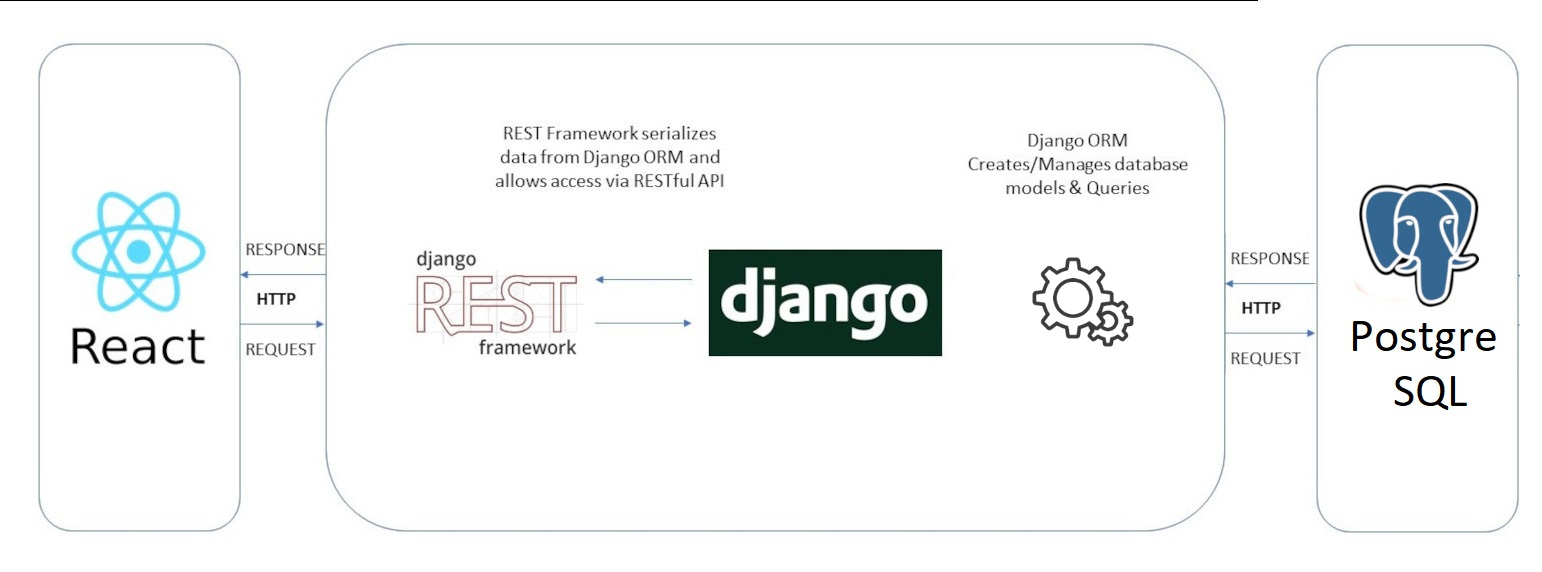
The chat display is ambiguous as it incorrectly shows connected users who are not actually online or actively participating in the chat.

Additionally, the chat functionality is incomplete and not fully operational. There are certain features or capabilities that are missing or not working as intended.

Figure 4 : Screenshot 3

The current data display lacks intuitiveness and ergonomic design, making it difficult for users to fully control and monitor the data effectively. It is crucial to improve the user interface and data presentation to enhance usability and provide a more user-friendly experience.

* + 1. Alternatives

Figure 5 : Project Architecture

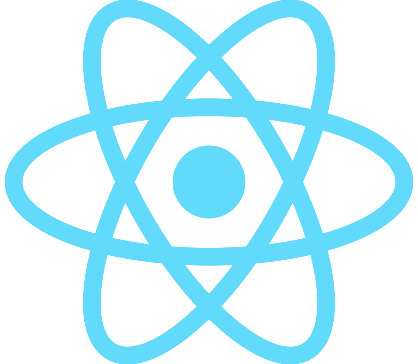
**Python Vs Symfony:** Backend technologies such as Django and PHP are widely utilized for developing the backend components of websites. The backend is a crucial aspect of any website, The evolution of web development leans towards Django as it offers a higher level of versatility, although Django combines the simplicity and elegance of the Python programming language with its extensive range of packages and libraries. This boost will empower the project to be built robust, rich and efficient.

The Python ecosystem provides a wide selection of pre-built modules, making it easier to handle diverse functionalities such as authentication, database management, and API integrations.

Django's flexibility will allow us to adapt modifications in the project requirements and use the extensive Python community for support and collaboration.

By Using Django Rest Framework (DRF) which is a powerful and popular framework for building Web APIs in Django we will be empowered with a set of tools and utilities that simplify the process of creating RESTful APIs.

**React Vs Vue/Twig:** Twig and Vue are commonly used in server-side rendering scenarios, where the templates are rendered on the server and then sent to the client. This approach can provide benefits such as improved SEO and initial page load performance. However, it may have limitations in terms of interactivity compared to client-side rendering frameworks like React.

****I chose to migrate towards React for its scalability, reusability, and modern approach which is a great decision in my personal opinion.

React's component-based architecture allows for the development of scalable and modular applications. By breaking the user interface into reusable components, React enables efficient development and maintenance, saving time and effort in the long run also

React's virtual DOM and efficient rendering mechanism contribute to its scalability, allowing for smooth performance even with complex and dynamic UIs, additionally, React's ecosystem offers a wealth of libraries and tools that enhance development productivity and provide solutions for various challenges.

Unlike Django Template engine, Vue is known for its ability to handle templates directly through One File Components, however, it is important to note that this approach may require making numerous Symfony API calls. While some developers find success with this setup, others may have a less positive experience and encounter challenges.

When utilizing Vue with Symfony, the heavy reliance on Symfony API calls within Vue templates can lead to suboptimal results. It can introduce complexities and potential performance issues, especially as my project scales or the number of API calls of the different entities increases.

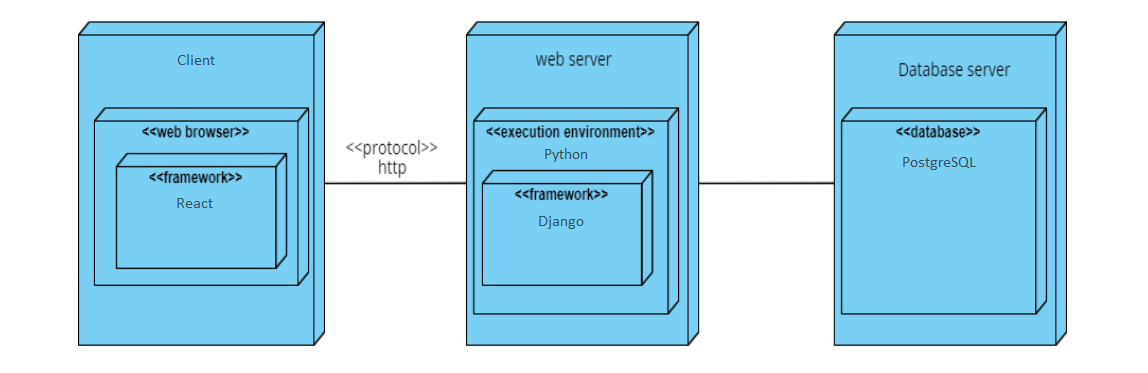
**MySQL Vs Postgres:** While MySQL offers a straightforward setup and administration process, making it ideal for beginners or those with less complex database requirements, PostgreSQL is renowned for its advanced features, extensibility, and strict adherence to data integrity. It offers robust support for complex queries, advanced data types, and custom functions, making it suitable for enterprise-level applications and projects that require sophisticated database functionality.

Managing a project encompassing around 80 entities demands meticulous organization and effective documentation. To navigate the complexities efficiently, it was so crucial to establish a systematic approach to replicate the project efficiently.

* + 1. Architecture

I used The Model/View/Controller (MVC) architecture as a way of organizing an interface graph of a program, consisting in distinguishing three distinct entities which are, the model, the view and the controller each having a specific role in the interface.

* Model: a kernel of the application which manages the data, makes it possible to retrieve the information in the database.
* View: graphic component of the interface which allows to present the data of the model to the user.
* Controller: a component responsible for decision-making, manages the business logic, it acts as the intermediary between the model and the view.

Figure 6 : Deployment Diagram

* 1. Used Methodologies
     1. Project management approach

I opted for an agile approach to project management based on the comprehensive indicators. This decision aims to achieve two main goals: first, to successfully implement as many requested functionalities as possible, and second, to effectively adapt to changes and emerging needs.

Agile software development is a way of organizing the development process, emphasizing direct and frequent communication – preferably face-to-face, frequent deliveries of working software increments, short iterations, active customer engagement throughout the whole development life-cycle and change responsiveness rather than change avoidance. This can be seen as a contrast to waterfall-like processes which emphasize thorough and detailed planning and design upfront and consecutive plan conformance.[1]

Agile is a project management and software development approach that operates in iterations, enabling teams to deliver value to customers more efficiently and with fewer challenges. Rather than relying on a single, extensive launch, an agile approach delivers work in smaller, more manageable increments that are readily usable by stakeholders.

While the origins of agile concepts and tools can be traced back to IT, the application of agile practices has expanded to various industries beyond the realm of information technology. Today, agile methodologies are available and utilized in diverse fields, ranging from innovative services to research and development in heavy industries. Some notable agile methods include Scrum, XP (Extreme Programming), RAD (Rapid Application Development), and DSDM (Dynamic Systems Development Method).

* + 1. Presentation of the used framework

After reviewing the characteristics of the most used agile methods I decided to choose the Scrum method. In fact, scrum indicates that the size of the team can be reduced and this is my case; another reason is that scrum is flexible in terms of the duration of the sprint (between 2 and 4 weeks).

Scrum is a framework for developing and sustaining complex products. Ken Schwaber and Jeff Sutherland developed Scrum; the Scrum Guide is written and provided by them. Together, they stand behind the Scrum Guide. [2]

* 1. Presentation and application of Scrum
     1. Introduction

In this part, I will present the product backlog and the list of actors acting in this project. I will also present the definition of done, one of the artefacts of the Scrum method.

* + 1. The development Team

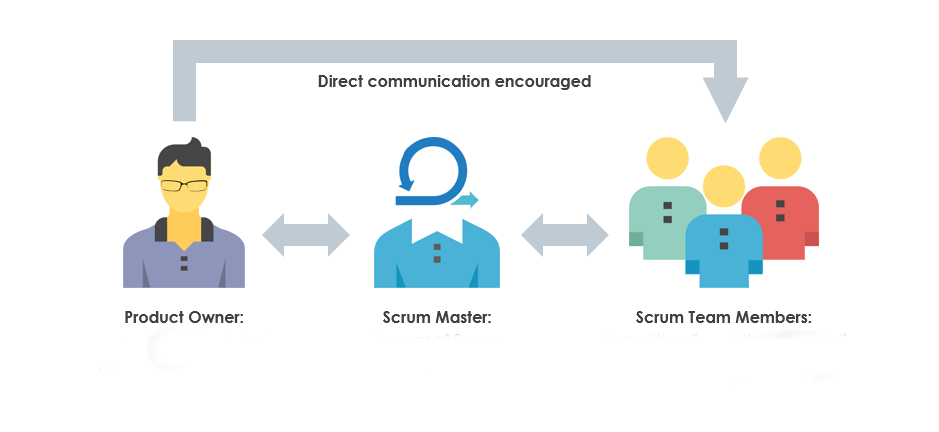


Figure 7 : Scrum Actors

In our development team, Mr. Ounissi serves as the product backlog manager, diligently curating and organizing the list of features and tasks essential to our project's success.

Working closely with him, Mr. Hamda Maghroum takes on the role of the product owner, acting as the bridge between the customer and our team.

With a deep understanding of their needs and aspirations, Mr. Hamda ensures that development efforts align with the product vision. I relied on Mr. Ounissi's expertise in backlog management and collaborate closely with Hamda to prioritize tasks and refine requirements.

Together, we embraced an agile approach, constantly adapting to changing demands and delivering value. Through the collective efforts of Mr. Ounissi, Mr. Hamda Maghroum, and my dedicated work, we strived to create a successful and impactful product.

* + 1. Done

"Done" is the acceptance criteria in the Product Backlog. Specifically, in this project, "done" consists of:

* Successfully completing the UML [3] diagrams accurately and comprehensively.
* Successfully completing the validation stage of functionalities.
  + 1. Le Time box

The Time box of a sprint is defined by the team and does not change. During the project; it allows to define an estimate of the duration of each sprint and to produce potentially deliverable increments with the most business value, particularly, in our project the time box is 2 weeks.

* + 1. Why Scrum

The choice of Scrum for our project was based on its strength. It can be described as a flexible method and its good for its responsiveness to our needs for improving the outdated application.

A great ability to adapt to change thanks to short iterations. The most important thing is that Scrum brings together both theoretical and practical sides and comes very close to reality.

* + 1. Modeling and design method

The success or failure of software development largely refers to the modeling phase. Before blindly attacking the code, the modeling of the system greatly facilitates its implementation and eliminates the risk of shipwreck of the project The UML [3] is a graphical computer modeling language which allows to popularize the aspects related to the design and the architecture, specific to the software, to the customer. Also, it provides a quick understanding of the program to other external developers in case of recovery of the software and facilitates its maintenance.

* + 1. Product backlog

A product backlog is a list of the new features, changes to existing features, bug fixes, infrastructure changes or other activities that a team may deliver in order to achieve a specific outcome. The product backlog is the single authoritative source for things that a team works on, the study of the existing allowed me to identify the services and the needs of the client.

To meet project requirements efficiently, the identified needs were organized and prioritized based on their importance. This process involved grouping and sorting the needs according to their relative priority, once prioritized, the needs were then distributed across the various sprints.

* 1. Conclusion

In conclusion of this preliminary study, the improvement of functioning within the company directs us towards the upgrading and fixing of the invoice project, among the first steps for the fulfilling our task, it is essential to define the different functionalities and to create the product backlog.

1. Chapter: Product Backlog Planning
   1. Introduction:

This chapter focuses on determining the functionality of each user within the project, identifying different user types and actors, and creating a comprehensive product backlog. The functionality analysis and user categorization are crucial for understanding user needs, while the product backlog serves as a prioritized list of features and tasks for development.

* 1. Identification of User Profiles

In our system, there are two distinct roles that individuals can assume: an admin of the cabinet or a collaborator who’s working to contribute in the management tasks.

The admin of the cabinet holds a position of authority and responsibility, entrusted with overseeing the overall operations, decision-making processes, and strategic direction of the system. They are responsible for managing resources, coordinating activities, and ensuring effective communication within the organization.

On the other hand, the collaborator plays a crucial role in our application, actively contributing to its development and growth. They work in tandem with the admin, providing valuable input, executing tasks, and actively participating in collaborative efforts. Collaborators bring their expertise, skills, and ideas to the table, making valuable contributions to the application's progress.

Both users can perform a large set of tasks based on the tab they choose:

* The user can perceive an overview of cabinet’s financial activities.
* The user can manage and organize the cabinet contacts.
* The user can store and manage the customers information’s.
* The user can track and manage prospects which they are more assured contacts and business opportunities.
* The user can manage the “Facturation” rates applicable to the cabinet’s products or services.
* The user can manage articles and products.
* The user can group items by categories for more efficient management.
* The user can manage the information and permissions of collaborators.
* The user can witness the social aspects of cabinet’s business, such as payments and benefits.
* The user can easily track the cabinet’s tax obligations and pay taxes.
* The user can manage documents such as legal sheets, couriers and internal document.
* The user can communicate with administrators and other collaborators via messages.
  1. Non-functional needs

Non-functional needs are needs that have a visible aspect for the user, but which are not directly related to the behavior of the system.

The goal is to create a versatile solution that is both high-performing and durable. Merely focusing on functionality and operations does not ensure user satisfaction and loyalty. Therefore, I had to consider non-functional criteria during the design and implementation of the solution. Some of these requirements include:

* + 1. Performance

The application should provide quick response times to ensure a comfortable and user-friendly experience, A high-performance invoice system would typically exhibit the following characteristics:

* + Responsiveness: The system should have low response times, ensuring that users can quickly access and interact with invoices without experiencing delays or lags.
  + Processing Speed: The system should process invoices swiftly, including tasks such as generating invoices, calculating totals, applying discounts, and updating records. This allows for smooth and efficient invoicing processes.
  + Reliability: The system should consistently perform its tasks accurately and reliably, reducing the chances of errors or discrepancies in invoice generation, calculations, or data storage.
    1. Modularity:

It should be easy to add new services or components without significant changes to the existing structure.

* + Functional Modularity: the invoice system is divided into separate functional components or modules based on their specific tasks or responsibilities. Each module focuses on a specific function, promoting a clear separation of concerns and facilitating easier development, testing, and maintenance.
  + Data Modularity: Data modularity involves organizing and structuring the data used in the invoice system. Each entity has its own set of attributes and relationships, and the data is stored and managed separately for each entity. This approach allows for efficient data retrieval, manipulation, and integrity.
  + Service-Based Modularity: the invoice system is built as a collection of loosely coupled services that communicate with each other through well-defined interfaces. Each service represents a specific functionality, such as invoice generation, payment processing and reporting.
    1. Maintainability:

The code should be well-commented, easily maintainable, and built upon established "best practices.

* + Code Readability and Documentation: Writing clean, well-structured, and self-explanatory code is essential for maintainability.
  + Testability: Incorporating automated testing practices, such as unit testing and integration testing, improves the maintainability of the invoice system. A comprehensive test suite allows for confident refactoring and modification of the codebase.
  + Error Handling and Logging: Implement robust error handling mechanisms in the invoice system to gracefully handle exceptions and error scenarios. Proper logging of errors, warnings, and information can assist in diagnosing issues and providing insights into system behavior during maintenance and debugging.
  + Version Control: [4] Utilize a version control system to manage code changes, track modifications, and collaborate with other developers effectively.
  + Dependency Management: Keep track of the external libraries, frameworks, or dependencies used in the invoice system. Regularly update and manage these dependencies to benefit from bug fixes, performance improvements, and security patches.
  + Adherence to Best Practices and Standards: Following established software development best practices and industry standards enhances the maintainability of the invoice system.
  1. User Story & Technical Story

Every feature request is transformed into a concise narrative or short story. The Product Backlog consists of User Stories (US) and Technical Stories (TS), prioritized based on their business value. These stories essentially convey:

* The intended recipient of the feature (the end user)
* What the user wishes to accomplish
* The underlying motivation behind their desire to do so

It is confirmed by acceptance criteria written at the same time as the story and expressed in this way: As a **<role>**, I want to **<do something>** to achieve **<business value>**

* 1. Implementation of Product Backlog

The table below presents these needs which will be the subject of our work.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ID | Type of Story | Story | Estimated Days | Priority | Sprint |
| 1 | TS1 | As a Developer I want to Adapt and familiarize myself with the outdated project technologies in order to become proficient with them. | 14 | 9 | 1 |
| 2 | TS2 | As a Developer I want to transfer the previous models from the outdated database and ensuring all necessary actions are carried out accordingly. | 6 | 7 | 2 |
| 3 | US1 | As a user I can access an intuitive interface to conveniently input the necessary information in multiple forms as needed. | 8 | 9 | 2 |
| 4 | TS3 | As a Developer I want to strategically organize the components within the forms to promote efficient and effective organization. | 7 | 8 | 3 |
| 5 | US2 | As administrator I can securely log in to my account and securely access my information. | 2 | 6 | 3 |
| 6 | US3 | As an administrator I can securely modify my personal information, which includes updating my profile picture, email address, and password. | 1 | 5 | 3 |
| 7 | US4 | As an administrator I can include users, referred to as collaborators, and assign them various roles within the enterprise, as well as the ability to modify them when needed. equipe | 4 | 7 | 3 |
| 8 | US5 | As an Administrator I can effectively manage and add contacts, clients, and prospects within the system. repertoire | 7 | 9 | 4 |
| 9 | TS4 | As a Developer I want to effectively give control to administrator and regulate permissions between the administrator and collaborators. | 1 | 5 | 4 |
| 10 | US6 | As a User I can handle a variety of documents, including letters and couriers, legal documents, and internal documents. document | 6 | 7 | 4 |
| 11 | TS5 | As a Developer I can conduct a thorough review, revision, and edit of the implemented business logic. | 2 | 5 | 5 |
| 12 | US7 | As a User I can effectively handle tax management, invoice processing, and article management. facturation | 12 | 8 | 5 |
| 13 | US8 | As a User I can monitor financial and legal aspects in a more detailed manner. suivi | 13 | 8 | 6 |
| 14 | TS6 | As a Developer I want to get started with technologies that enable the creation of detailed charts and graphs. | 1 | 5 | 6 |
| 15 | US9 | As a User I can access the dashboard, while also execute efficient search functionality. | 14 | 8 | 7 |

Table 1 : Product Backlog

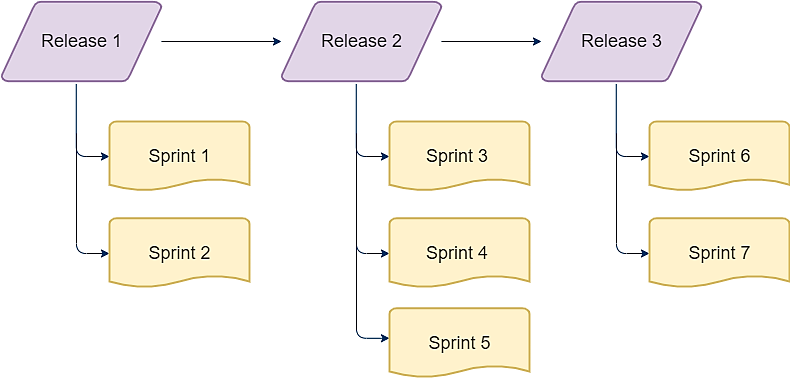


Figure 8: Organization of releases

We have chosen to divide the Sprints that we have identified into three Releases presenting as follows:

By organizing the sprints into these releases, we can effectively plan and prioritize the development and delivery of features, ensuring a systematic and structured approach to the project while assuring the completion of the project in time.

* 1. Conclusion:

In conclusion, the product backlog is a vital component of the agile development process for the invoice system.

It serves as a comprehensive repository of user stories and technical stories, prioritized based on their business value. The backlog captures the desired features, functionalities, and improvements that are ready to be implemented throughout the development lifecycle.

1. Chapter: Release 1
   1. Introduction:

This chapter will include the backlog, the different diagrams and the description for the realization of the first release with its graphical interfaces.

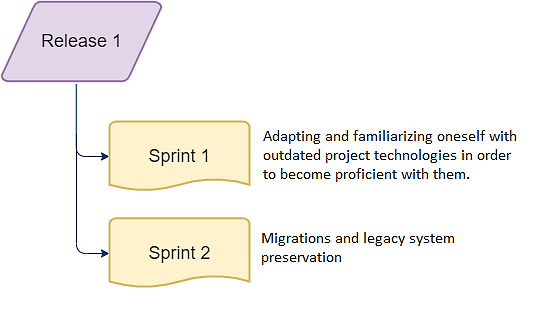


Figure 9 : Release 1

* 1. Sprint 1: « Adaptation to the old Technologies »
     1. Objectif

The goal of this Sprint is to familiarize ourselves with the technologies utilized in the old project namely **Symfony**, **Vue.js**, **Twig**, and **MySQL**. The primary goal is to understand the interactions of these technologies and their implementation within the existing codebase, enabling us to gain a thorough understanding of the existing codebase.

By dedicating this Sprint to technology familiarization, we aim to assess the current state of the codebase, identify any dependencies or limitations, establishing a solid foundation of knowledge that will facilitate future development tasks and decision-making.

By understanding the intricacies of the old project's technologies, we will be better equipped to plan and execute subsequent development Sprints effectively, this familiarity will allow us to make informed decisions regarding code refactoring, improvements, and potential enhancements, ensuring a smooth transition to the new app while preserving the invoices and clients’ essential functionalities.

* + 1. Sprint Backlog

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Story ID | Task ID | Tasks | Estimated Days | Priority |
| 1 | **1** | Learning about the necessary technologies and gaining familiarity with php composer. | 8 | 9 |
| 1 | **2** | Installation of packages while disregarding any deprecated dependencies. | 6 | 7 |

Table 2 : Sprint 1 Backlog

* + 1. Sprint Analysis
       1. Task 1
* **Composer**

Composer is a PHP tool that facilitates dependency management within your projects. It provides a straightforward way to declare the libraries or packages that your project relies on, and Composer takes care of installing or updating them accordingly. [5]

It's important to note that Composer operates differently from traditional package managers like Yum or Apt.

While it handles packages, it focuses on managing dependencies on a per-project basis.

This means that Composer installs the libraries specifically for your project, storing them in a designated directory such as "vendor."

* **FOSUserBundle**

The **FOSUserBundle** [6] adds support for a database-backed user system in Symfony2+. It provides a flexible framework for user management that aims to handle common tasks such as user registration and password retrieval, its features include:

* + Users can be stored via Doctrine ORM or MongoDB/CouchDB ODM
  + Registration support, with an optional confirmation per email
  + Password reset support
  + Unit tested

The bundle offers pre-mapped base classes that simplify entity creation by providing default mappings for common fields. The previous Dev Team performed:

* + The inheritance from the base User class found in the Model folder.
  + The Mapping of the id field, ensuring that it would be marked as protected since it is inherited from the parent class.
* **Vue.Js Rendering with Twig**

Vue can take charge of the frontend and seamlessly communicate with the rendered DOM by Twig in order to ensure the dynamic behavior to the page using the Vue application, it is crucial that the client-side rendered DOM and the server-side rendered DOM are in sync.

This approach also feasible to utilize Vue variables in conjunction with Twig’s, though this require a minor configuration adjustment and this configuration can either be handled individually for each Vue instance or set up globally.

This solution has several drawbacks, summarized as follows:

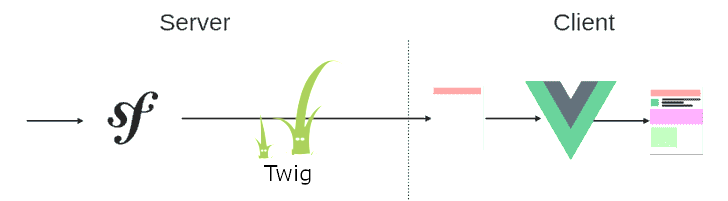
* + The lack of the ability to highlight or navigate to Vue variables directly within the Twig template.
  + When including another Twig template containing additional Vue components, the variables and methods of the deeper components may not function correctly within the given component. The parent component may intercept the logic calls, causing conflicts or unexpected behavior.

Figure 10 : Symfony & Vue Communication

* **Doctrine ORM:**

Symfony provides all the tools you need to use databases in your applications thanks to Doctrine, the best set of PHP libraries to work with databases. These tools support relational databases like MySQL and PostgreSQL and also NoSQL databases like MongoDB. [7]

Doctrine ORM simplifies and streamlines the process of working with databases by mapping database tables to PHP objects and vice versa.

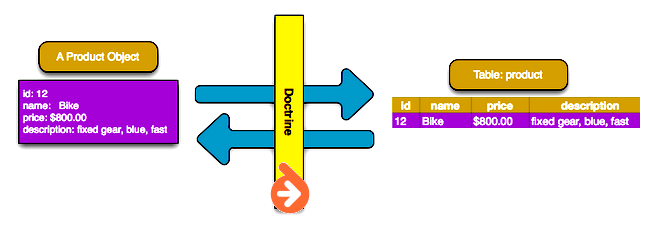
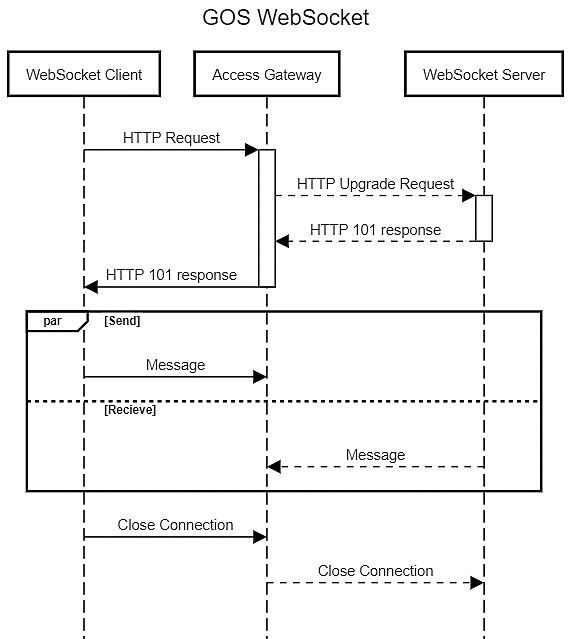


Figure 11 : Doctrine Object Mapping

* **GOSWebSocketBundle**

The **GosWebSocketBundle** [8] is a Symfony bundle that brings together WebSocket functionality in a user-friendly application architecture.

The bundle follows an event-driven architecture, allowing the definition of event listeners and handlers to process WebSocket messages and perform specific actions.

This approach promotes decoupling and enables the development of scalable and high-performance WebSocket applications.

Figure 12 : GOS Web Socket

#### Task 2

By employing the composer dependency manager, we gained immediate access to packages, frameworks, and various components to install the missing requirements.

This eliminates the need to download them individually except for one package called “**DOMPDF”** [9] which a CSS 2.1 compliant HTML layout and rendering engine written in PHP. It is a style-driven renderer: it will download and read external stylesheets, inline style tags, and the style attributes of individual HTML elements. It also supports most presentational HTML attributes.

When installing packages in Symfony while disregarding any deprecated dependencies, it involves intentionally ignoring warnings or deprecation notices related to outdated or deprecated features or dependencies within the packages being installed.

When we choose to disregard deprecated dependencies, we are essentially opting to continue using outdated components without making the necessary updates or adjustments to align with the latest best practices or recommendations.

* + 1. Sprint Review

While these technologies and bundles provide powerful tools for enhancing Symfony applications, it's essential to carefully consider their trade-offs and potential disadvantages. Proper planning and consideration of project replacements were crucial to mitigate these challenges and ensure successful implementation.

* + 1. Sprint Retrospective

The retrospective is a meeting during which the Scrum team uses its experience over the past sprint to improve its organization in order to be more efficient.

|  |  |
| --- | --- |
| **What worked well** | **What can be improved** |
| * The coherence of the notes we took concerning the old technologies | * Time Management |

Table 3 : Sprint 1 improvement plan

* 1. Sprint 2: « Migration & legacy System Preservation»
     1. Objectif

The migration process is all about the choices of useful strategies such as data migration, code refactoring, and extracting scripts that will facilitate the transition while preserving the integrity of the legacy system.

This sprint describes the profits we gained by extracting and transforming data and methods from the legacy system into a new compatible and useful resources aiming to help with the development of the target system.

By preserving the legacy system's key aspects, we can leverage their previous investments, knowledge, and established business processes while benefiting from the advancements and efficiencies offered by the technologies we aim to switch.

* + 1. Sprint Backlog

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Story ID | Task ID | Task | Estimated Days | Priority |
| 2 | **1** | Execute Doctrine, a powerful object-relational mapper bundled with Symfony, to map objects into a MySQL database. | 3 | 9 |
| 2 | **2** | Migrate the database into Django models by inspecting the MySQL database and reconstructing the php classes into Python | 3 | 6 |
| 2 | **3** | Filtering Tables and relations and removal of the FOSUserBundle constructed tables | 4 | 8 |
| 3 | **4** | Integrate Metronic template into the project's frontend for enhanced UI/UX. | 4 | 10 |

Table 4 : Sprint 2 Backlog

* + 1. Expression of “Sprint 2” needs
       1. Doctrine Execution

Symfony equips developers with a comprehensive suite of tools for efficient database integration in their applications, powered by Doctrine – a renowned collection of PHP libraries designed specifically for seamless database interaction. [7]

The process begins with installing “Doctrine” dependency then we go thorough creating the database by running the command “**php bin/console doctrine:database:create**”.

This command will create the database based on the configuration specified in our classes, once the database is created, we can start managing schema changes and versioning.

The “Doctrine Migrations Bundle” provides automatic generation of migration files by running the command “**php bin/console make:migration**”, this command analyzes any changes the entities or annotations and generates a migration class that captures those changes.

Once the migration file is generated, we applied the changes to the database by running the command “**php bin/console doctrine:migrations:migrate**”, This command executes the pending migrations and updates the database schema accordingly. This way we ensured that our database schema matches the defined structure in entity classes.

The following is the sequence diagram describing “Doctrine” Migration

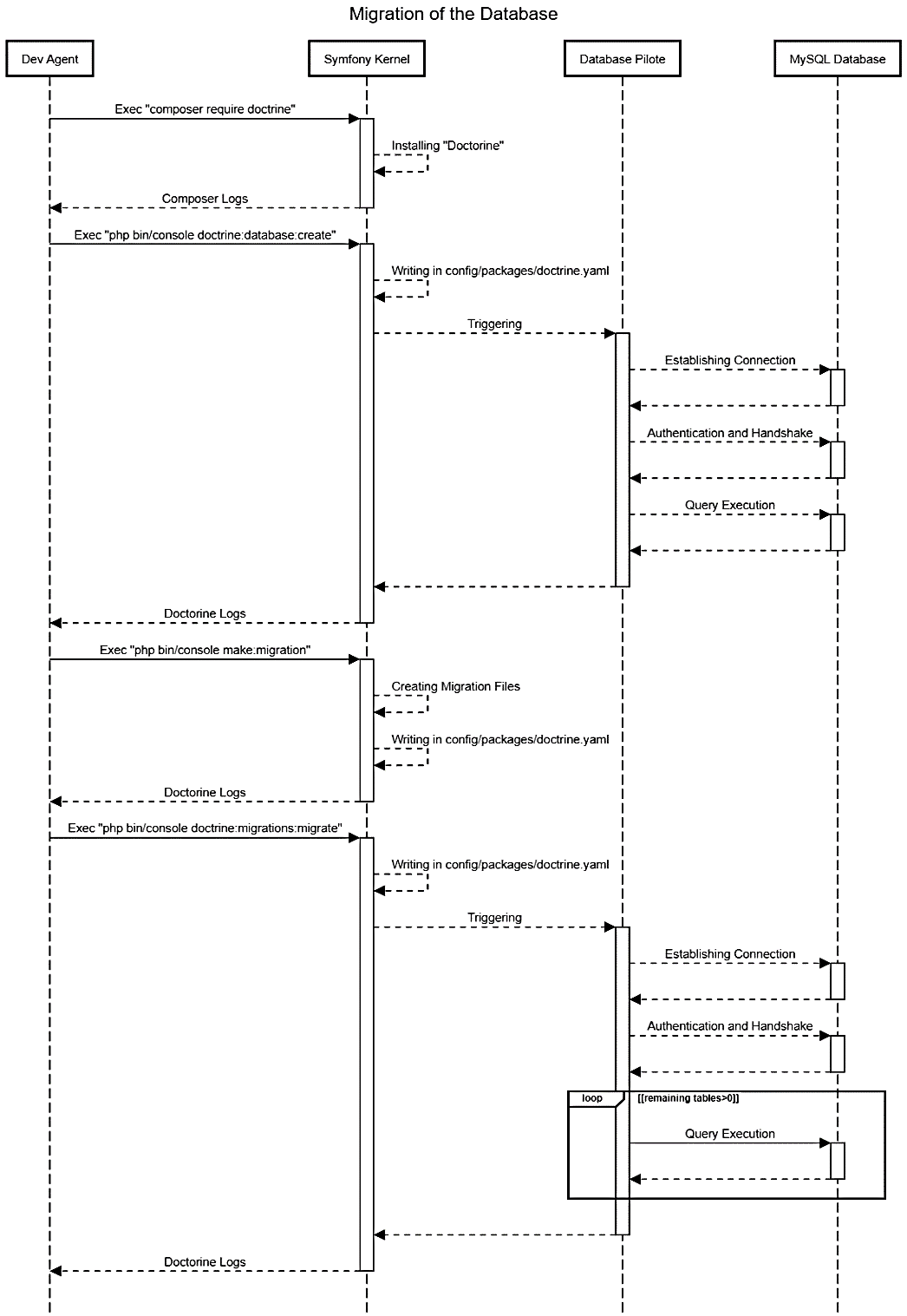
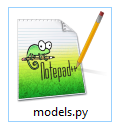


Figure 13 : Migration Sequence Diagram

* + - 1. Database Inspection

To generate Django model definitions based on our existing database in MySQL, we used the “inspectdb” management command of Django Framework.

By running “**python manage.py inspectdb > models.py**” in the terminal or command prompt within a shallow project, Django will analyze the database tables and automatically generate model definitions while the generated definitions will be saved in a file named models.py.

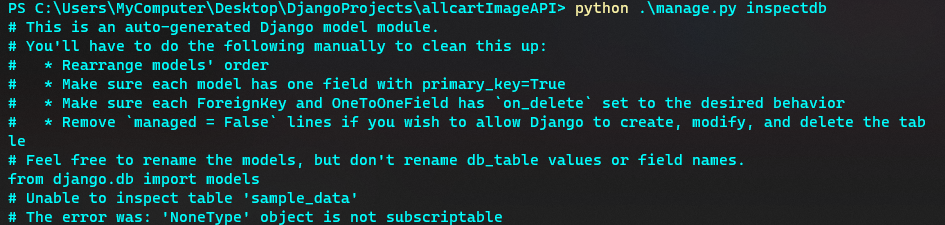
Once we have reviewed and customized the model definitions, we will be including progressively the classes from within “models.py” file by placing it within the new created app's directory.

Figure 14 : inspectdb Command

This process saves time and effort, especially when working with an existing database schema in our case.

The “**inspectdb**” command in Django allows us to leverage an existing database by automatically generating model definitions.

This feature is particularly useful when you want to integrate Django with an established database schema.

The following is the sequence diagram describing the database inspection

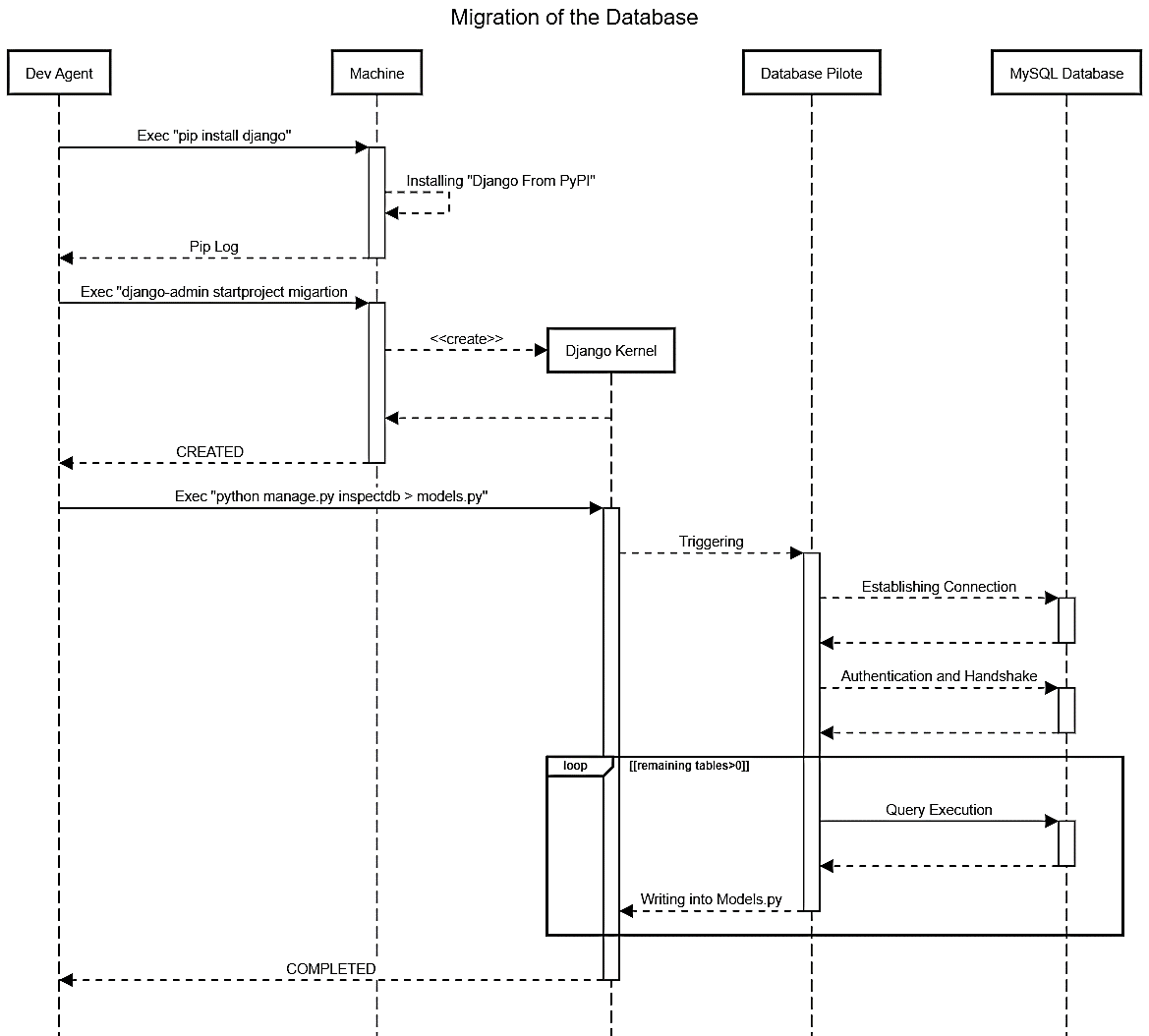
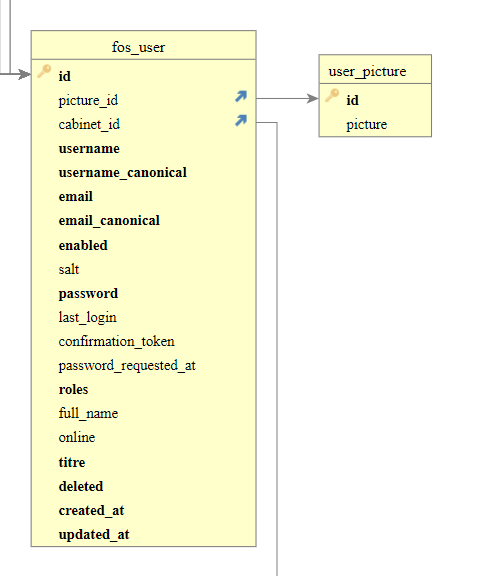


Figure 15 : Migration Sequence Diagram

* + - 1. Entity Filtering

Some previous system entities will not be needed or used in the new environment, The entities that are no longer relevant or required for the operation of the new application have been carefully evaluated as part of the migration plan.

We wanted to simplify the migration procedure, optimize the database design, and improve the overall speed and maintainability of the new application by removing these superfluous items.

By making this choice, we can concentrate on moving and integrating the crucial entities, assuring a smooth transition while removing extra complexity and any compatibility problems.

We refined the model definitions by removing the “**FOSUserBundle**”, we will be incorporating the “models.py” file in a more scalable way by making the classes easy to update.

Figure 16 : FOS User Entity

The “**FOSUserBundle**” [6] is a Symfony bundle in PHP that provides user management features for Symfony applications. It offers a set of ready-to-use functionalities to handle user registration, authentication, and other related tasks, however we will not be transitioning this bundle into the new project because of the existing user support available natively with the Django farmwork.

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|  |  |
| --- | --- |
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