

# **Project-Report**

**Subject: Development of a  
M'Backend-AS-A-Service**

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**&**

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**Carried Out At : ESPRIT**

**Academic Year : 2022-2023**

## Summary

This work is part of the fulfillment of our PI project within ESPRIT.

We set an objective to create a web application named backappX share as an E-learning/E-commerce platform based in Tunisia and will be implemented for the future as a startup.

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We would like to express our gratitude to our coaches and mentors Mr Khaled Guedria & Ghassen Klai for their guidance and feedback which made everything clear to us to complete this project.

A very special gratitude goes to all our past teachers, mentor-teachers and administrators and all those who participated in our training. May they find here the expression of our gratitude and deep respect.

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## GENERAL INTRODUCTION

In today's digital age, there is a growing demand for efficient and effective software solutions that cater to various needs. With the proliferation of smartphones, tablets, and other mobile devices, the need for mobile applications has increased exponentially. Additionally, with the emergence of cloud computing, there has been a shift towards using backend-as-a-service (BaaS) solutions to provide seamless integration of frontend and backend development.

In this school project, we have developed an application that utilizes BaaS solutions. Our application is built using ReactJS, NodeJS, and Flutter, which are some of the most popular and powerful web and mobile development frameworks available today.

Our BaaS application provides a comprehensive backend solution that handles all the server-side tasks required to run the application. This includes data storage, authentication, user management, and other backend functionalities. By utilizing BaaS, we were able to focus on the frontend development, and the BaaS provider handled the backend operations, resulting in a faster and more efficient development process.

In this report, we will discuss the key features of our BaaS application, including its architecture, design, and implementation. We will also discuss the challenges we faced during the development process and how we overcame them. Finally, we will evaluate the effectiveness of our solution and discuss its potential for future development and improvements.

On the other hand, unlike other solutions, our BaaS solution built using ReactJS, NodeJS, and Flutter offers more flexibility and control over the backend infrastructure. With our solution, you have the ability to choose and customize the backend components to match the specific requirements of your application. This level of control allows for better optimization, scalability, and security of the application.

Additionally, using open-source frameworks like ReactJS and NodeJS provides greater flexibility, as you are not limited to the features and constraints of a specific BaaS platform. This enables you to create a unique and customized solution that is tailored to your needs.

This report describes the work carried out at ESPRIT; it comprises Three chapters structured as follows:

**The First Chapter** is an introductory chapter illustrating the general context of our project: presentation of the host organization, statement of the problem, the business context of our project, a study of the existing situation in order to achieve the definition of the proposed solution as well as capturing the requirements.

**The Second Chapter** will contain an introduction to engineering design then the graphic design. After that we will talk about the methodology and approach adopted in the development of this project then its process.

And last, we will be talking about the choice of the software engineering workshop and the design process.

**The Third Chapter** will be the realization phase, it will contain an Introduction to the chapter that will have a part for the development environment, a part for the site map and project potential, and last but not least a part for the presentation of examples of interfaces.

# CHAPTER 1: PROJECT INITIALIZATION AND NEEDS SPECIFICATIONS

## 1. Host organization and summary

The **Private Higher School of Engineering and Technology** or ESPRIT, is a private engineering school in Tunisia based in Ariana and accredited by the Ministry of Higher Education and Scientific Research.

ESPRIT offers several specialties and courses: Preparatory cycle for engineering studies, Computer engineering, Telecommunications engineering, Civil engineering, Electromechanical engineering Management science.

## 2. Issues

Many developers face challenges when building full-stack applications due to the complex and time-consuming process of developing the backend infrastructure. They often end up spending significant amounts of time and resources on building and maintaining the backend components, which can limit their ability to focus on the front-end development and the user experience.

Moreover, existing BaaS solutions often lack flexibility and customization options, making it difficult for developers to implement unique features and functionalities that are specific to their application's requirements.

Therefore, there is a need for a BaaS solution that offers greater flexibility and control over the backend infrastructure, enabling developers to focus on creating unique and innovative front-end experiences that meet the needs of their users. Such a solution would not only save developers time and resources but also provide them with the freedom to innovate and create customized solutions that better serve their users.

By providing a more efficient and flexible backend infrastructure, developers can create applications that offer users a wider range of features and functionalities that are tailored to their needs and preferences. This, in turn, can improve the user experience and drive greater engagement and loyalty to the application.

## 4. Existing Solution critics

Existing BaaS solutions such as Firebase, AWS Amplify, and Microsoft Azure provide a range of features and functionalities that enable developers to build full-stack applications quickly and efficiently. These platforms offer a range of services such as authentication, real-time databases, storage, and hosting, among others. However, there are some criticisms to consider when using these existing solutions:

- **FireBase :**



**Figure 1: Firebase Logo**

Firebase is a Backend-as-a-Service (Baas). It provides developers with a variety of tools and services to help them develop quality apps, grow their user base, and earn profit. It is built on Google's infrastructure.

Firebase is categorized as a NoSQL database program, which stores data in JSON-like documents.

### **Pros:**

Easy to Use: Firebase provides an easy-to-use platform for developers with a wide range of features, including real-time databases, authentication, cloud functions, and storage. The platform offers simple APIs and client libraries that make it easy to integrate with different mobile and web applications.

Scalable: Firebase is highly scalable and can handle large volumes of data and traffic. The platform is designed to automatically scale to meet the demands of an application, which means that developers do not need to worry about infrastructure management.

Real-time Database: Firebase's real-time database enables developers to build applications that can synchronize data across different clients in real-time. This feature is useful for building chat applications, real-time gaming, and collaborative applications.

Analytics and Performance Monitoring: Firebase provides analytics and performance monitoring tools that enable developers to track user engagement and application performance. This helps developers to optimize their applications for better user experience and performance.

## **Cons:**

Limited Customization: Firebase offers limited customization options for developers, which can limit their ability to implement unique features and functionalities in their applications. Developers may find it difficult to customize the platform to match the specific requirements of their application.

Pricing: Firebase pricing can be expensive, especially for applications with high data storage and traffic. While Firebase offers a free tier, the costs can quickly add up as the application grows.

Security: Firebase's security features are limited, which can be a concern for applications that deal with sensitive user data. Developers may need to implement additional security measures to ensure the safety of user data.

- **AWS Amplify :**



**Figure 2: AWS Amplify Logo**

## **Pros:**

Scalable: AWS Amplify is designed to scale to meet the demands of an application. The platform can handle large volumes of data and traffic, and it provides auto-scaling capabilities that can automatically adjust resources based on the application's needs.

Wide Range of Features: AWS Amplify provides a wide range of features and functionalities, including authentication, real-time databases, storage, analytics, and hosting. This enables developers to build full-stack applications quickly and efficiently.



**Customizable:** AWS Amplify is highly customizable and enables developers to customize the platform to match the specific requirements of their application. This can help developers to implement unique features and functionalities that are specific to their application's needs.

**Secure:** AWS Amplify provides a range of security features, including encryption and access control, which can help developers to ensure the safety and security of user data.

### **Cons:**

**Complexity:** AWS Amplify can be complex to set up and configure, especially for developers who are not familiar with AWS services. Developers may need to spend some time learning how to use the platform before they can start building their application.

**Cost:** AWS Amplify can be expensive, especially for applications with high data storage and traffic. While the platform provides a free tier, developers may need to pay for additional resources and services as their application grows.

**Limited Flexibility:** AWS Amplify can be less flexible than building a custom backend solution. Developers may find it difficult to customize the platform to match the unique needs of their application.

- **Back4App**



**Figure 3: Back4AppLogo**

Back4App is a backend as a service (BaaS) provider that allows developers to build and manage their applications without the need for server administration. Here are some pros and cons of using Back4App:

### **Pros:**

**Easy to use:** Back4App provides an intuitive interface that makes it easy to manage your backend infrastructure, data, and APIs.

**Scalability:** Back4App is highly scalable and can handle large amounts of traffic and data with ease.

Security: Back4App provides built-in security features such as encryption, authentication, and access control, which can help protect your data from unauthorized access.

Multi-platform support: Back4App supports multiple platforms, including iOS, Android, and web, which makes it a versatile tool for building cross-platform apps. Cost-effective: Back4App offers a range of pricing plans to suit different needs, including a free tier for small projects.

## **Cons:**

Limited control: Since Back4App is a BaaS provider, you may have limited control over the backend infrastructure, which can be a drawback if you need more control over the server environment.

Limited customization: While Back4App provides a range of features and functionalities, there may be limitations in terms of customizing your backend infrastructure. Vendor lock-in: If you use Back4App, you may be tied to the platform, which can make it difficult to switch to a different provider or migrate your data to a different platform.

Third-party dependencies: Back4App relies on third-party services and technologies, which can affect the performance and stability of your application if those services experience downtime or disruptions. Additional costs: While Back4App offers a range of pricing plans, you may need to pay additional fees for features such as data storage and API requests, which can add up over time.

## **5. Proposed solution**

### **What is Mastery Share and what is its purpose?**

BACKAPPX BAAS ensures equitable and efficient development of modern applications, providing seamless access to resources for developers and businesses.

On the one hand, developers can easily integrate various features and services such as user management, push notifications, and data storage without the need for extensive backend development.

On the other hand, businesses can leverage BACKAPPX BAAS to save time and money on backend development, allowing them to focus on their core competencies and deliver value to their customers faster.

BACKAPPX BAAS supports a wide range of programming languages and platforms, making it accessible to developers with diverse skill sets and backgrounds.

You can scale your app easily with BACKAPPX 's scalable infrastructure, which can handle millions of users and requests with ease.

And it never gets outdated, as new features and updates are regularly added to ensure that your app stays up-to-date with the latest technologies and trends.

### **Why is it better than every other platform?**

After studying the existing systems and platforms and considering their cons, BACKAPPX BAAS provides a superior development experience because of its ease of use and flexibility.

Developers can easily customize their backend services to meet the unique needs of their application, without having to worry about the underlying infrastructure.

BACKAPPX BAAS also ensures high-quality services by providing comprehensive documentation and support, as well as regular updates and bug fixes.

In addition, BACKAPPX BAAS offers competitive pricing, with flexible payment options and a pay-as-you-go model that allows businesses to only pay for what they use.

Support for the local tech community: By using a BAAS app developed in Tunisia, developers can contribute to building and supporting the local tech community. This can foster collaboration, networking, and knowledge-sharing among developers in Tunisia.

Also this can provide potential job opportunities: As our BAAS app grows and gains more users, there may be opportunities for Tunisian developers to join our team and contribute to the ongoing development and maintenance of the platform.

## **6. Needs identifications**

Needs Identification is the process of determining what and how a customer wants a product to perform.

The analysis of the subject and the study of existing tools allowed me to identify the functionalities that will be offered by my platform. The constraints that the system is subjected to realize and its good functioning will be described here after as non-functional needs.

## 6.1 Functional requirements: what the system should do?

Actor	Module	Submodules	System features	Description
User	User Authentication	Sign-up	Email Verification	A system feature that verifies the email address provided by the user during sign-up
		Login	Secure password storage	A system feature that securely stores the user's password in the database, using techniques like hashing and salting.
		Password reset	Email-based password reset	A system feature that allows the user to reset their password by sending a reset link to their email address.
		Profile management	Email-based password reset	A system feature that allows the user to update their profile

				information, including name, email, and password.
	<b>Project Management</b>	Project catalog	Browse API's	A system feature that displays all available API's, along with relevant information such as the Documentation description, instructor details, and pricing.
		API's Details	Show API details	A system feature that displays detailed information about a API, including its features, instructor, and pricing.
		Search API's	Search bar	A system feature that allows users to search for API's based on keywords or other criteria
		Services enrollment	Enroll in a Service	The ability to enroll in a Service,

				Either by paying a fee or by obtaining approval from an administrator
	<b>API Delivery</b>	Project progress	View progress	progress in a Project, including which APIS they have Used , their Data usage, and any feedback provided by the app (errors , bugs , ..).
		Documentation And KPI	show Documentation And KPI	A system feature that allows users /clients to read a full documentation and a KPI to test the project's API correctly
		Interactive codes	Interactive codes	A system feature that provides interactive codes such as simulations, compilers, online to enhance the learning experience.
		Track progress	Progress	A system feature

			tracking	that allows users to track their progress through the project , seek data usage , bugs ...
	<b>Payment Processing</b>	Bundle payment	Pay in order to subscribe	A payment system that allows users to pay for a bundle in order to be able to enroll in it .
<b>Admin</b>	<b>User Management</b>	-	Add User	The ability to add new users to the platform, including clients, and other administrators.
		-	Remove User	The ability to remove users from the platform, including clients, and other administrators.
		-	Edit User Details	The ability to edit user details, including their contact information, projects enrolment, and access

				privileges.
	<b>Payment Management</b>	Integration with payment gateways	Payment gateway integration	A system feature that integrates the platform with payment gateways such as Stripe to process payments from users.
		Track payments	Payment history	A system feature that allows users to view their payment history, including successful and failed transactions.
		Refund management	Refund request	A system feature that allows users to request a refund for a bundle they have purchased.
	<b>Project Management</b>	-	Bundle Approval	Approve Bundle
		-	Bundle Removal	Remove Bundle
		-	Project Analytics	View Analytics



## 6.2 Other requirements : Non functional requirements

<p><b>a. Safety requirements</b></p>	<p>Data Backup: Regular data backup should be implemented to prevent loss of data in case of hardware failures or other unforeseen events. Access control: The platform should have robust access control mechanisms in place to ensure that only authorized users have access to sensitive information. Error handling: The platform should have effective error handling mechanisms in place to prevent crashes and ensure data integrity.</p>
<p><b>b. Security requirements</b></p>	<p>Data Encryption: All sensitive data stored on the platform should be encrypted to prevent unauthorized access. Authentication: Strong authentication mechanisms, such as two-factor authentication, should be used to ensure that only authorized users can access the platform. Vulnerability Scanning: Regular vulnerability scanning should be performed to identify and address any security vulnerabilities.</p>
<p><b>c. Software quality attributes</b></p>	<p>Usability: The platform should have a user-friendly interface that is intuitive and easy to use. Performance: The platform should have fast response times and be able to handle large amounts of data and traffic.</p> <p>Scalability: The platform should be scalable to accommodate future growth and increased demand.</p> <p>Reliability: The platform should be reliable and have a high uptime, with minimal downtime for maintenance or upgrades.</p> <p>Maintainability: The platform should be easy to maintain, with clear documentation and well-structured code.</p>
<p><b>d. Availability</b></p>	<p>Planned system downtime must be scheduled at least 24 hours in advance. The system must allow failovers to occur without disruption to service. Planned system updates, patches and support must occur without service disruption.</p>

## CHAPTER 2: ENGINEERING DESIGN

### 1. Synopsis

This chapter provides an overview of the engineering design process used to develop BackAppX. It covers the methodology and approach adopted, the software engineering workshop of choice, and the design processes, including the analysis phase, which helped to ensure that BackAppX met the needs of its intended users.

### 2. Graphic Design

The graphic design phase of the engineering design process involved creating the visual elements of BackAppX. The goal was to ensure that the user interface was both functional and visually appealing.

#### 3.1 Logo

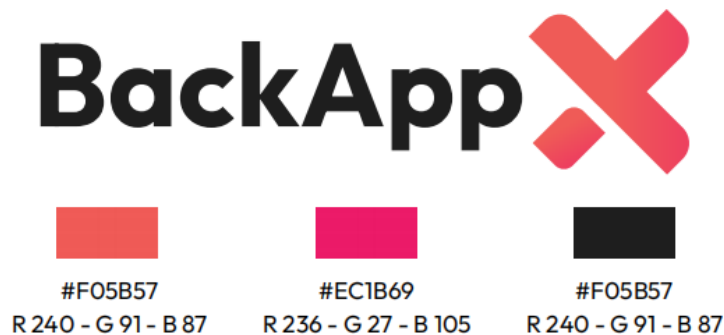


Figure 4: BackAppX Logo

The BackAppX logo was designed with the aim of conveying the purpose and essence of the platform in a visually appealing and memorable way. The logo features the text "BackApp" in a clean and modern font, with an "X" illustration that adds a touch of creativity and uniqueness to the design. The use of bright and bold colors, specifically #F05B57 and #EC1B69, adds energy and vibrancy to the overall look of the logo, making it instantly recognizable and appealing to users. The combination of the text and illustration creates a sense of balance and harmony, while also emphasizing the platform's focus on providing a comprehensive and efficient backend solution for mobile app development.

#### 3.2 Typography

Outfit typography was chosen for BackAppX's branding because it offers a modern and sleek look that aligns well with the platform's design philosophy. It also ensures that the typography is easy to read and recognizable across all marketing and branding materials.

# Outfit

ABCDEFGHIJKLMNOPQRSTUVWXYZ  
abcdefghijklmnopqrstuvwxyz  
1 2 3 4 5 6 7 8 9 0 ! ? , . / ; : @ #

## Outfit Thin

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## Outfit Light

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## Outfit Regular

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## Outfit Medium

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

## Outfit Bold

**Lorem ipsum dolor sit amet, consectetur adipiscing elit.**

## Outfit Extra Bold

**Lorem ipsum dolor sit amet, consectetur adipiscing elit.**

Figure 5: font

## 3.3 Wireframes

In the wireframes phase, the team created sketches of the main pages of the platform to plan the layout and organization of the user interface. This allowed for the visualization of the basic structure of the platform, as well as the placement of specific elements such as buttons, forms, and images.

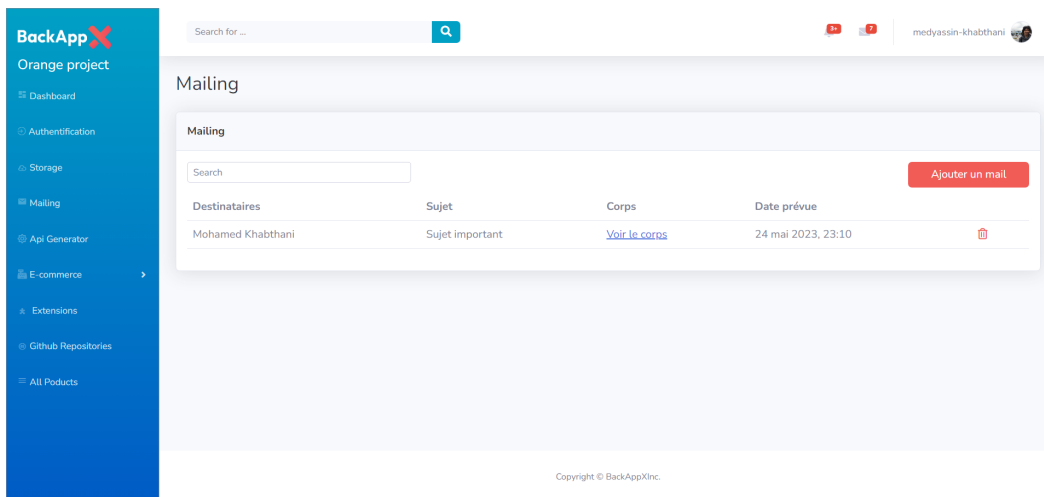



Figure 6: Mailing Page

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## Premium Pack

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Authentication	<pre> 1 Auth.auth().addStateChangeListener ( auth, user ) =&gt; { 2   if let user = user { 3     let email = user.email 4     // ... 5   } 6 } 7 Auth.auth().signInWithEmailAndPassword ( user, password ) =&gt; { 8   if let user = user { 9     // ... 10  } 11 }</pre>
Api Usage	
Save Image	
Querying Data	
Calling Functions	

Voir les documents



Don't waste your time

We will make it easy for you

Start building



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Figure figure 7 homepage

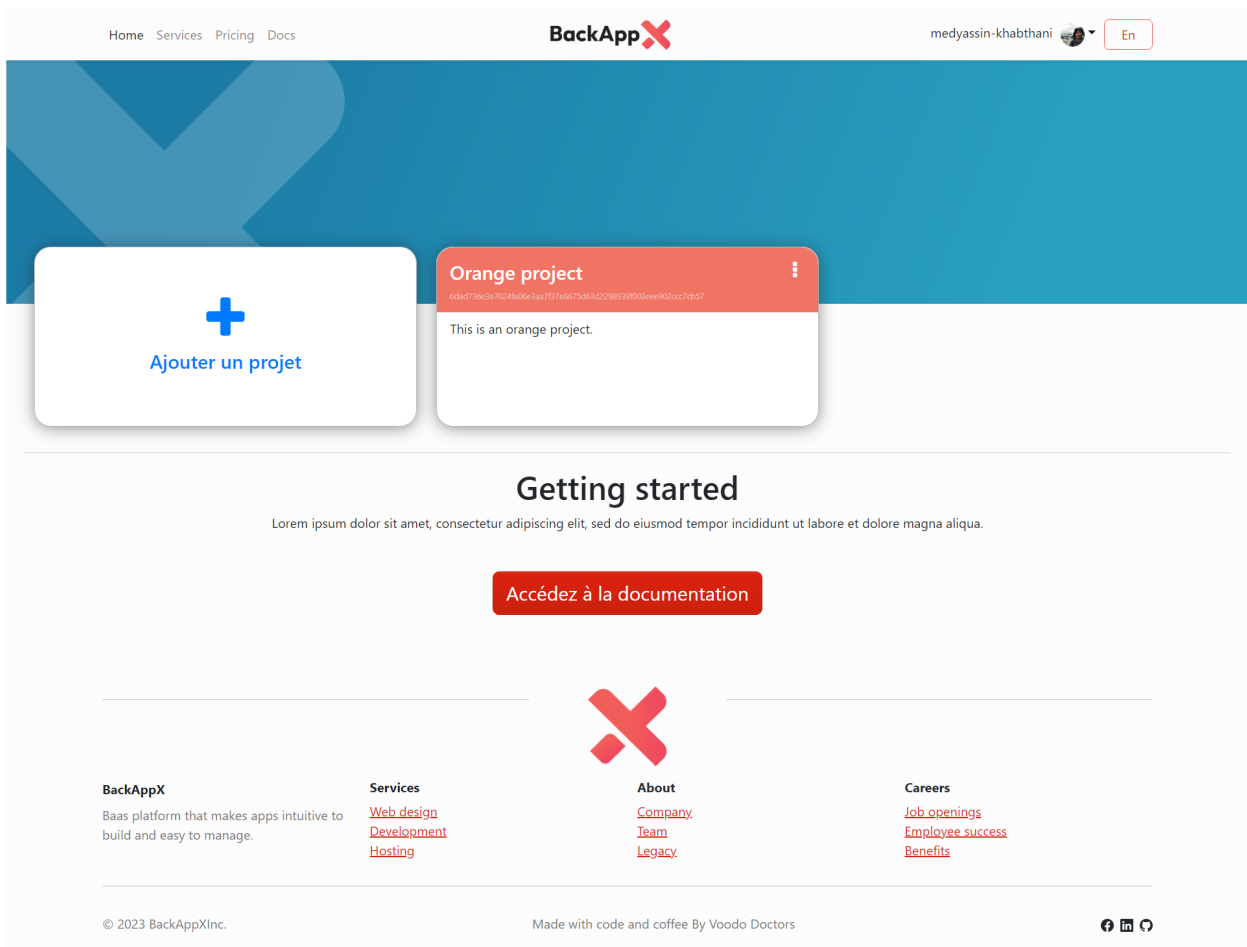


Figure 8: projects page

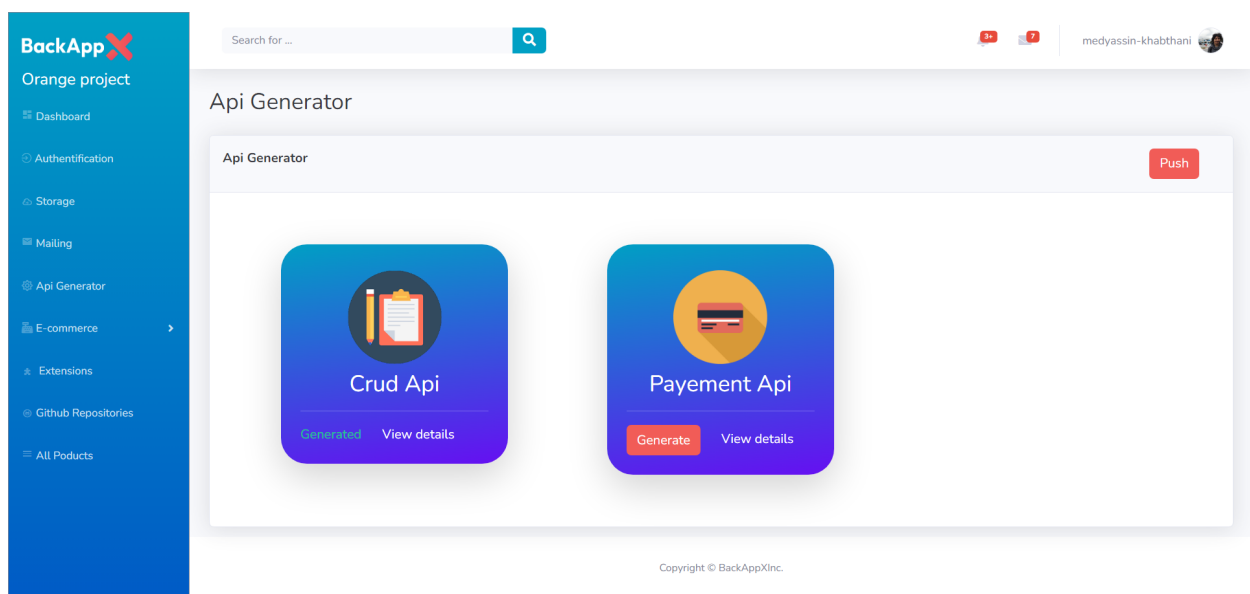


Figure 9: api gen

## 1. Methodology and approach adopted

Scrum is a management framework that teams use to self-organize and work towards a common goal. It describes a set of meetings, tools, and roles for efficient project delivery. Much like a sports team practicing for a big match, Scrum practices allow teams to self-manage, learn from experience, and adapt to change.

below, the scrum life cycle model:

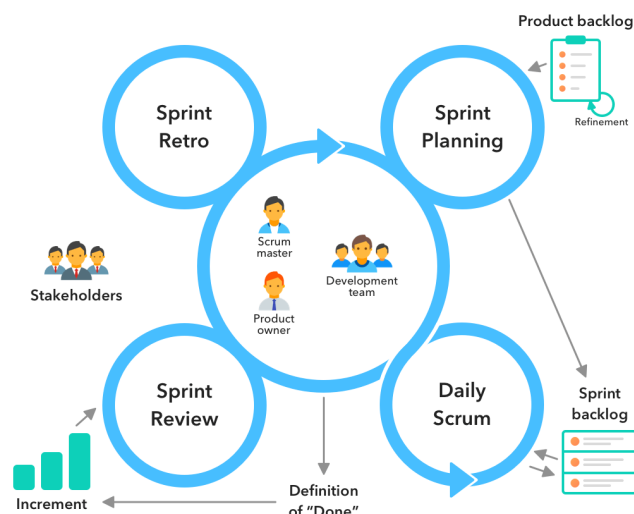


Figure 10: scrum

## 2. The choice of software engineering workshop

To better present the architecture of my web application, I chose the most adopted modeling language UML (Unified Modeling Language) because it has several advantages:

- It facilitates the understanding of complex abstract representations.
- Its versatile character and flexibility make it a universal language.
- It's ability to frame the analysis.

In fact, UML is designed to represent, specify and document applications and brings great rigor, offering a better understanding of applications and allowing to capture relevant aspects to meet customer needs.



Figure 11: draw.io Logo

### 3. The design processes

The design process is a series of steps that we follow to come up with a solution to a problem. Many times, the solution involves designing a product (like a machine or computer code) that meets certain criteria and/or accomplishes a certain task.

#### a. Actors

An actor represents the abstraction of a role played by external entities.

In our web application, we mainly distinguish three actors which are the following:

##### Visitor:

This is the person who uses the web application to be inspired by the content and make discoveries.

##### User/Client:

It is the person who uses the application to consult the Projects/APIs and who can consult his online profile.

##### Administrator:

This is the person who manages the administration of the web application such as the management of Projects, Users, Admins, etc.

#### b. Expression of needs

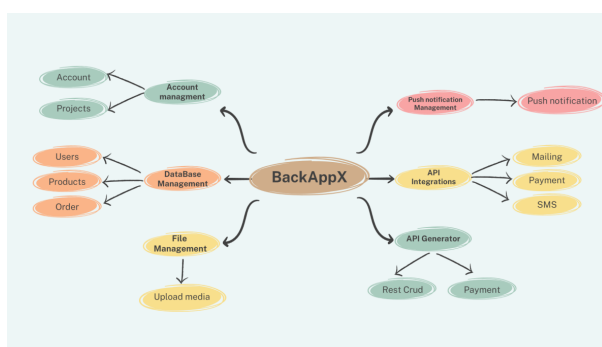


Figure 12: mindmap Logo

# CHAPTER 3: REALIZATION

## 1. Introduction

After having affected the study and design of my web application, We will move on to the realization phase.

This chapter presents the result of the work carried out during this end of studies project.

We will be presenting the potential of the project itself then we will also present the hardware and software environment and the development tools used.

And finally, we will end this chapter with some screenshots demonstrating the functionalities of our web application.

## 2. Project potential

Starting your own business as a startup is always a difficult prospect. You want to make it the best place to work in the world but that's easier said than done. You have to build an online reputation as well and protect yourself from defamation and much more.

However, the idea of this project is that it is not limited to PI Project, but it is a strong start for us to reach out the best of it in the future.

In our free time during the realization of this work, we tried to start a solid plan for it by writing a business plan and build its future from that day because it is an innovative Idea for a startup.

## 3. Development environment

A development environment is a collection of procedures and tools for developing, testing and debugging an application or program.

### a. Hardware environment

My work was carried out with one laptop which has the following characteristics: Brand:

Asus Rog

Processor: Intel Core i7

Memory: 16GB



## Software environment

After presenting the hardware resources that the project was carried out on, we will discuss in:

### -Development tool: VS CODE

I used Microsoft Visual Studio Code for writing and debugging my react based application. Visual Studio Code is a useful tool that assisted me with quickly writing and updating my scripts. It is lightweight and has a number of nice built-in features, such as automatically highlighting the same variables in the interface.



**Figure 13: visual studio code Logo**

### -Design tool: FIGMA

Figma is a web-based graphics editing and user interface design app. I used it to do all kinds of graphic design work from interfaces, prototyping designs and everything in between.

Figma is different from other graphics editing tools. Mainly because it works directly on my browser. This means I get to access my projects and start designing from any computer or platform without having to buy multiple licenses or install software.



**Figure 14: FigmaLogo**

## -DESIGNING TOOL: PHOTOSHOP

Adobe Photoshop is a software application for image editing and photo retouching for use on Windows or MacOS computers. Photoshop offered me the ability to create, enhance, or otherwise edit images, artwork, and illustrations. It was a good tool that helped me personalize my content as much as I wanted thanks to its performance tools



**Figure 15: Adobe Photoshop Logo**

## Tasks Management tool Jira

Jira is a proprietary issue tracking product developed by Atlassian that allows bug



**Figure 16: Jira Logo**

## 4. Languages used

Choosing a programming language for a project is different than choosing one to learn. Often, people will tell you that there's no choice. Certain languages are chosen as the industry standard, and you just have to adapt. With as little freedom as you have, there are still some considerations to be made when choosing a programming language. After all, it will impact the main constraints on your project, such as time, budget, resources, and maintainability... That's why I chose the languages below:

### REACT JS

React JS is a JavaScript library used in web development to build interactive elements on websites. I chose it because of its very simple library that made it easy to learn.

In fact, the ability to reuse the components made it so much faster for the development process. It is indeed one of the most trending frontend technologies as well and has a strong community and support.

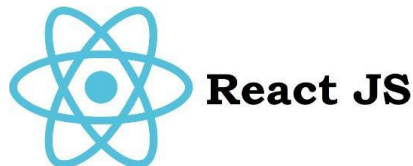


Figure 17: React js Logo

### NODE JS

Node.js is a server-side JavaScript run-time environment.

Knowing JavaScript made it so easy for me to learn node js in no time, and its robustness made it my choice which allows organizing full-stack JavaScript development ensuring the speed and performance of the application aside with its scalability which makes my application can easily grow with my business.



Figure 18: node jsLogo

## Express js

Express.js is a framework of Node.js which means that most of the code is already written for programmers to work with. You can build a single page, multi-page, or hybrid web application using Express.js. Express.js is lightweight and helps to organize web applications on the server-side into a more organized MVC architecture.



**Figure 19: Express JS Logo**

## MongoDB

MongoDB is a source-available cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas. MongoDB is developed by MongoDB Inc. and licensed under the Server Side Public License which is deemed non-free by several distributions.



**Figure 20: MongoDB Logo**

## Dart

Dart is a general-purpose, class-based, object-oriented programming language designed by Google. It was created with the goal of providing an efficient, easy-to-learn language that can be used for both client-side and server-side development. Dart features a modern syntax and a strong type system, as well as support for asynchronous programming using the "async/await" keywords. One of its key advantages is that it can be compiled to native machine code or to JavaScript, allowing developers to write code that runs seamlessly on multiple platforms.



**Figure 21: Dart Logo**

## Postman

Postman is a collaboration platform for API development. Postman's features simplify each step of building an API and streamline collaboration so you can create better APIs—faster.



**Figure 22: Postman Logo**

## **GENERAL CONCLUSION**

Throughout this project, We have been led to design and implement an application that we will prepare for the future as a startup thanks to ESPRIT.

This project was very beneficial, this work was the opportunity to apply in a professional framework the knowledge acquired during our training, indeed, it combined several disciplines and allowed us to take advantage of the studies of the previous semesters and to perfect our knowledge in subjects already studied.

Finally, the features offered by this application are immense, and have a huge potential in the Tunisian market and we are looking forward to finishing studying the project and realizing a huge educational platform.