





# **Higher Nationals – Assignment Front Sheet**

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Submission Date					Date Received 1st submission				
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Feedback should be against the learning outcomes and assessment criteria to help students understand how these inform the process of judging the overall grade.									
Feedback should give full guidance to the students on how they have met the learning outcomes and assessmentcriteria.									
Grade:	Grade: Assessor Signature: Date:								
Resubmission Feedback:									
*Please note resubmission feedback is focussed only on the resubmitted work									







Grade:	Assessor Signature:	Date:		
Internal Verifier's Comments:				
Signature & Date:				

<sup>\*</sup> Please note that grade decisions are provisional. They are only confirmed once internal and external moderation has taken place and grades decisions have been agreed at the assessment.







# Table of Contents

Sof	ftware	Requirements Specification	10
1.	Intro	oduction	10
	1.1	Document Purpose	10
	1.2	Product Scope	10
	1.3	Intended Audience and Document Overview	11
2.	Ove	erall Description	13
2	2.1	Product Overview	13
2	2.2	Product Functionality	14
3.	Spec	cific Requirements	15
3	3.1	Functional Requirements	15
3	3.2	Use case Diagrams	18
	3.2.	1 Login	19
	3.2.2	2 Create job listing	20
	3.2.3	3 Search job listing	21
3	3.3 Site	e Map	22
	3.3.2	1 Home Page	22
	3.3.2	2 Employer Dashboard	23
	3.3.3	3 Job Seeker Dashboard	24
	3.3.4	4 Admin Dashboard	25
4.	Risk	x Assessment	26







Ev	aluation Report	28
5.	Design Tools	28
	5.1 Introduction	28
	5.2 Chosen tools	30
6.	Front End technology	31
	6.1 HTML	31
	6.2 CSS (including SCSS, SASS, LESS)	33
	6.3 JavaScript library or framework	35
	6.4 CSS framework	38
	6.5 Chosen technology	40
7.	Back End Technology	40
	7.1 C#	40
	7.2 Java	42
	7.3 PHP	46
	7.4 Operating System	48
	7.4.1 Window	48
	7.4.2 MacOS	50
	7.4.3 Linux	52
	7.5 Web Server	54
	7.5.1 Apache	54
	7.5.2 CloudFlare	56







7.6 Database	57
7.6.1 PostgreSQL	57
7.6.2 MongoDB	59
7.6.3 SQL Server	61
7.7 Hosting	63
7.7.1 AWS	63
7.7.2 Azure	65
7.8 Frameworks	67
7.8.1 ASP.NET Core	67
7.8.2 Spring MVC	69
7.8.3 Symfony	71
7.9 Conclusion Which Back End technologies will be used for the development	72
8. Tools for source control management	72
8.1 Git, GitHub, GitLab, etc.	73
8.1.1 Git	73
8.1.2 GitHub	74
8.1.3 GitLab	76
8.2 Conclude which tools will be used for the development	77
9. Software Development Models	78
9.1 Introduction several SDLC models: Scrum, Waterfall, V-Model	78
9.1.1 Scrum	78







9.1.2 Waterfall	79
9.1.3 V-Model	81
9.2 Conclude which SDLC model will be used for the development with explanations	82
References	83







Figure 1: Overview	14
Figure 2: Use Case Diagram	18
Figure 3: Home Page	22
Figure 4: Employer Dashboard	23
Figure 5: Job Seeker Dashboard	24
Figure 6: Admin Dashboard	25
Figure 7: Draw.io	29
Figure 8: Sketch	29
Figure 9: Lucid chart	30
Figure 10: Figma	30
Figure 11: HTML	32
Figure 12: HTML5	32
Figure 13: CSS	33
Figure 14: SCSS	34
Figure 15: SASS	34
Figure 16: LESS	35
Figure 17: React.js	36
Figure 18: Vue.js	36
Figure 19: Agular	37
Figure 20: jQuery	38
Figure 21: Bootstrap	39







Figure 22: Bulma	39
Figure 23: Tailwind	40
Figure 24: C#	41
Figure 25: Java	43
Figure 26: PHP	46
Figure 27: Window	48
Figure 28: MacOS	51
Figure 29: Linux	53
Figure 30: Apache	55
Figure 31: CloudFlare	56
Figure 32: PostgreSQL	58
Figure 33:MongoDB	59
Figure 34: SQL Server	62
Figure 35: AWS	63
Figure 36: Azure	65
Figure 37: ASP.NET Core	67
Figure 38: Spring MVC	70
Figure 39: Symfony	71
Figure 40: Git	73
Figure 41: GitHub	74
Figure 42: GitLab	77







Figure 43: Scrum	78
Figure 44: Waterfall	80
Figure 45: V-Mode	81
Table 1: Login Use Case	19
Table 2: Create Job Listing	20
Table 3: Search Job Listing	21
Table 4: Risk Assessment	28







# **Software Requirements Specification**

### 1. Introduction

I'm making a website called FPTJobMatch. This innovative website simplifies the complexity of recruiting for employers, allowing them to easily manage resumes and select employees. For job seekers, it is an opportunity to find jobs that match their skills, experience and career aspirations. The report provides insight into FPTJobMatch, an innovative web-based platform that aims to revolutionize the job posting and recruitment process. Readers will gain a better understanding of the platform's features and functionality designed to streamline the recruiting experience for both employers and job seekers.

### 1.1 Document Purpose

The product scope of this Software Requirements Specification (SRS) includes the entire FPTJobMatch platform, designed to support the job posting and recruitment process. The SRS outlines the functions and features needed to deploy the platform, including user authentication, job listing creation, application management, job seeker profile maintenance, and administrative tools. It defines the roles of different users (recruiter, job seeker, and administrator) and specifies their respective capabilities within the system. Additionally, the SRS can describe the basic architecture, security considerations, and integration requirements necessary to successfully develop and deploy the FPTJobMatch platform. Overall, this document serves as a comprehensive guide for development teams to understand and implement the functional requirements of the FPTJobMatch platform.

## 1.2 Product Scope

The specified software is FPTJobMatch, a web-based platform designed to revolutionize the job posting and recruitment process. Its purpose is to provide a user-friendly interface that streamlines the recruiting experience for both employers and job seekers. By providing features such as secure login mechanisms, job listing creation, application management, and profile maintenance, FPTJobMatch aims to simplify the complexity of recruiting while enhancing transparency, transparent and effective.

FPTJobMatch's scope includes the entire recruitment process, from creating job listings to selecting and hiring candidates. The platform benefits employers by allowing them to easily create and manage job listings, review applications, and access job seekers' detailed profiles. For job seekers, FPTJobMatch







provides intuitive search functions, a streamlined application process, and profile maintenance tools to enhance their job search experience. Overall, FPTJobMatch aims to optimize the recruitment process, reduce time to hire and promote better connections between employers and candidates, ultimately leading to improved organizational outcomes and opportunities. careers for job seekers.

#### 1.3 Intended Audience and Document Overview

The Software Requirements Specification (SRS) document for FPTJobMatch is intended for various stakeholders involved in the development, management, marketing, testing, and usage of the platform. Here are the different types of readers the document is intended for:

- Developers: This group includes software engineers, programmers, and designers who will be responsible for implementing the features outlined in the SRS. They will focus on understanding the technical requirements, system architecture, and specific functionalities to be developed.
- Project Managers: Project managers will use the SRS to oversee the development process, ensure
  that project goals align with client requirements, allocate resources effectively, and monitor
  progress. They will be interested in understanding the scope, timelines, and dependencies
  outlined in the document.
- Marketing Staff: Marketing staff will use the SRS to understand the key features and benefits of FPTJobMatch, which they will then communicate to potential clients or users. They will be interested in the overview sections, user personas, and unique selling points of the platform.
- Users: Users, both employers, and job seekers, will refer to the SRS to understand how to use the platform effectively. They will focus on sections related to user interfaces, functionalities available to them, and account management.
- Testers: Testers will use the SRS to develop test cases, scenarios, and plans to ensure that the platform meets the specified requirements. They will be interested in understanding the expected behavior of the system, including edge cases and error handling.







 Documentation Writers: Documentation writers will refer to the SRS to create user manuals, guides, and help documentation for FPTJobMatch users. They will focus on understanding the functionalities and user interactions described in the document.

The rest of the SRS contains detailed information about the requirements for FPTJobMatch, organized into sections such as:

- Introduction: Provides an overview of the system, its purpose, and stakeholders.
- Functional Requirements: Describes the functional capabilities of the system, including user authentication, roles, employer features, job seeker features, and admin features.
- Non-Functional Requirements: Outlines the quality attributes of the system, such as performance, security, and usability.
- Use Case Diagram: Illustrates the interactions between actors and the system.
- Site Map: Presents the hierarchical structure of the system's navigation.
- Glossary: Defines key terms used throughout the document.

The suggested sequence for reading the document, beginning with the overview sections and proceeding through the sections most pertinent to each reader type, could be as follows:

- Introduction: All reader types can start here to gain a high-level understanding of the system.
- User Authentication and Roles: Developers, project managers, testers, and documentation writers can delve into this section to understand the system's user authentication mechanisms and role-based access control.
- Functional Requirements:
  - Developers will focus on understanding the technical specifications and implementation details.







- Project managers will ensure that client requirements are properly captured and translated into functional features.
- Testers will use this section to develop test cases and scenarios.
- Documentation writers will use this section to understand the functionalities to be documented.
- Non-Functional Requirements: Developers will focus on technical constraints and performance requirements, while project managers will ensure that quality attributes align with project goals.
- Use Case Diagram: All reader types can refer to this diagram to understand the interactions between actors and the system.
- Site Map: Users, project managers, and documentation writers will find this section useful for understanding the system's navigation structure.
- Glossary: All reader types can refer to this section to clarify any terminology used throughout the document.

# 2. Overall Description

#### 2.1Product Overview

The product perspective of FPTJobMatch is one of integration within the broader ecosystem of job recruitment and hiring. FPTJobMatch serves as a centralized platform connecting two primary user groups: employers and job seekers. In the context of the broader environment, FPTJobMatch interacts with external entities such as job boards, social media platforms, and educational institutions. Employers utilize the platform to post job listings, manage applications, and streamline their hiring processes. Job seekers, on the other hand, leverage FPTJobMatch to search for job opportunities, submit applications, and manage their profiles. The platform operates within the larger framework of the job market, facilitating the exchange of information and interactions between employers and job seekers. This interaction diagram illustrates FPTJobMatch as the central hub connecting employers and job seekers,







with various external entities facilitating communication and information exchange between the platform and the broader environment.

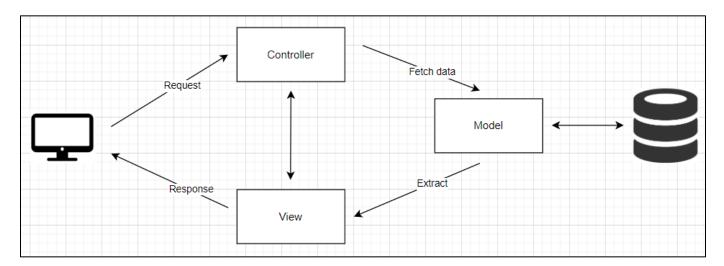


Figure 1: Overview

### 2.2 Product Functionality

#### Authenticate users and roles:

- Secure login mechanism for employers and job seekers.
- Classify users into two roles: Recruiter and Job Seeker.

### **Employer's features:**

- Ability to create and post job listings.
- Include details such as job title, description, qualifications, and deadlines in the job listing.
- View and manage incoming job applications.
- Tools for shortlisting, evaluating and responding to job applications.
- Access job seekers' detailed profiles.







• Sort and filter candidates based on relevant criteria.

#### Job seeker features:

- Ability to search job listings based on various criteria (e.g. title, location, industry).
- Apply for recruitment through self-introduction or sending a resume and cover letter.
- Confirmation notification upon successful application.
- Maintain a personal and professional profile.
- Update your profile, including your resume and contact information.

#### Administration features:

- Manage user accounts, including creation, suspension, and deletion.
- Password reset function for employers and job seekers.
- Review and approve/reject new work items as requested by employer.
- Automated notifications to notify employers about category approval status.

# 3. Specific Requirements

### 3.1 Functional Requirements

### **Employers:**

- As an employer, I want to be able to create a new job listing, so that I can attract potential candidates.
- As an employer, I want to specify the job title, description, required qualifications, and application deadline when creating a job listing, so that applicants have a clear understanding of the job requirements.







- As an employer, I want to be able to view and manage incoming job applications for my listings, so that I can efficiently review candidate profiles.
- As an employer, I want to have tools to shortlist, review, and respond to job applications, so that I can effectively communicate with potential candidates.
- As an employer, I want to be able to view detailed profiles of job seekers, including their resumes and contact information, so that I can make informed hiring decisions.
- As an employer, I want to be able to sort and filter candidates based on relevant criteria such as experience, skills, and education, so that I can identify suitable candidates more easily.

#### **Job Seekers:**

- As a job seeker, I want to be able to search for job listings based on various criteria such as job title, location, and industry, so that I can find relevant job opportunities.
- As a job seeker, I want to be able to apply to job listings by submitting my resume and cover letter, so that I can express my interest in a particular position.
- As a job seeker, I want to receive confirmation notifications upon successful application submission, so that I know my application has been received.
- As a job seeker, I want to maintain a profile with my personal and professional information, so that employers can learn more about me.
- As a job seeker, I want to be able to update my profile, including my resume and contact information, so that my information is always accurate and up to date.







#### **Administrators:**

- As an administrator, I want to be able to manage user accounts, including account creation, suspension, and deletion, so that I can ensure the security and integrity of the platform.
- As an administrator, I want to provide password reset functionality for both employers and job seekers, so that users can regain access to their accounts if needed.
- As an administrator, I want to review and approve/reject new job categories requested by employers, so that I can ensure the integrity and relevance of the job listings.
- As an administrator, I want to send automated notifications to inform employers of the status of their category approval requests, so that they are kept informed throughout the process.







# 3.2 Use case Diagrams

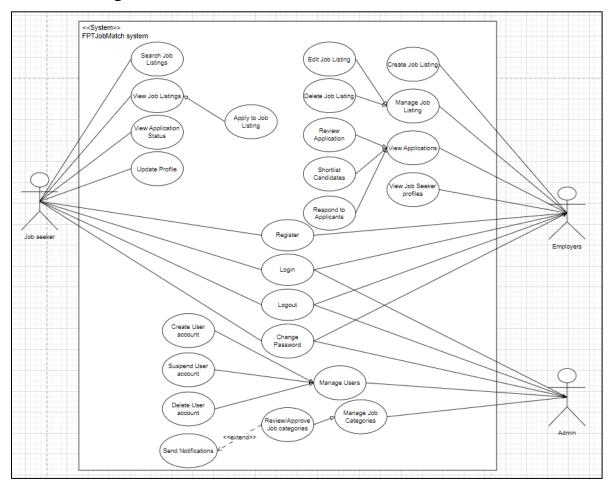


Figure 2: Use Case Diagram







## **3.2.1 Login**

Login Use Case	
Actors	Employer, Job Seeker, Admin
Description	Users authenticate themselves to access the system
Goal	To provide secure access to the system for authorized users
Pre-condition	The user is not logged in
Trigger	The user attempts to access a protected area of the system
Post-condition	The user is authenticated and granted access to the system
Normal flow	User navigates to the login page.
	User enters their username and password.
	System verifies the credentials.
	If the credentials are valid, the user is logged in and directed to their respective dashboard.
Alternative flow	If the credentials are invalid, the system displays an error message and prompts the user to enter valid credentials
Exception flow	If the system encounters an error during the authentication process, it displays a relevant error message and prompts the user to try again

Table 1: Login Use Case







## 3.2.2 Create job listing

Create Job Listing	
Actors	Employer
Description	Employers create new job listings to advertise available positions
Goal	To inform job seekers about job opportunities within the organization
Pre-condition	The employer is logged in and navigates to the job listing creation page
Trigger	The employer wants to advertise a new job opening
Post-condition	A new job listing is created and added to the system
Normal flow	Employer navigates to the "Create Job Listing" section of their dashboard.  Employer fills in details such as job title, description, qualifications,
	and application deadline.
	Employer submits the job listing.
	The system validates the input and adds the job listing to the database.
Alternative flow	If the employer encounters errors while entering the job listing
	details, they are prompted to correct them before submission.
Exception flow	If the system fails to add the job listing due to technical issues, an error message is displayed, and the employer is prompted to try again.

Table 2: Create Job Listing







## 3.2.3 Search job listing

Search Job Listing	
Actors	Job Seeker
Description	Job seekers search for relevant job listings based on their preferences.
Goal	To find job opportunities that match the job seeker's skills and interests.
Pre-condition	The job seeker is logged in and navigates to the job search page.
Trigger	The job seeker wants to explore available job opportunities.
Post-condition	The job seeker finds relevant job listings matching their criteria.
Normal flow	Job seeker navigates to the "Search Job Listings" section of their dashboard.
	Job seeker enters search criteria such as job title, location, and industry.
	System retrieves job listings matching the search criteria.
	Job seeker reviews the search results.
Alternative flow	If there are no job listings matching the search criteria, the system
	displays a message indicating no results found.
Exception flow	If the system encounters errors while retrieving job listings, an error message is displayed, and the job seeker is prompted to try again.

**Table 3: Search Job Listing** 







### 3.3 Site Map

### 3.3.1 Home Page

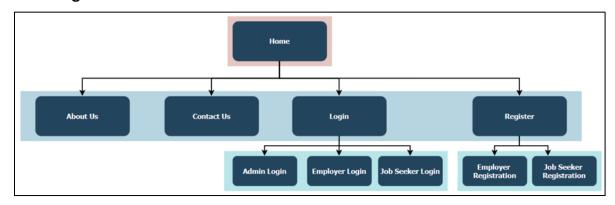


Figure 3: Home Page

About Us: This page provides information about the FPTJobMatch platform, its purpose, and mission.

Contact Us: Users can use this page to get in touch with the administrators or support team for inquiries, feedback, or assistance.

Login: Users can access their accounts by logging in. Separate login options are provided for employers, job seekers, and administrators.

Register: New users can create accounts on the platform. Registration options are available for both employers and job seekers.







### 3.3.2 Employer Dashboard

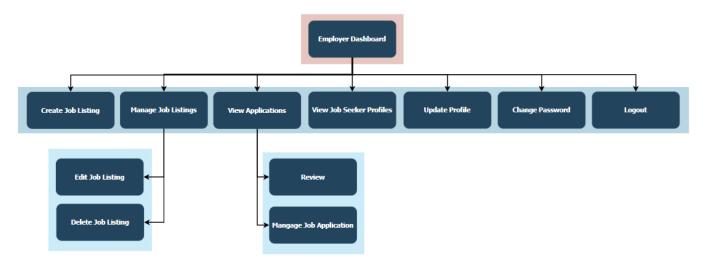


Figure 4: Employer Dashboard

Create Job Listing: Employers can create new job listings to advertise job openings within their organizations.

Manage Job Listings: Employers can view and manage existing job listings, including editing or deleting them as needed.

View Applications: Employers can review and manage incoming job applications for their job listings.

View Job Seeker Profiles: Employers can view detailed profiles of job seekers who have applied for their job listings.

Update Profile: Employers can update their own profiles, including contact information and preferences.

Change Password: Employers can change their account passwords for security purposes.

Logout: Employers can log out of their accounts to end their current session.







#### 3.3.3 Job Seeker Dashboard

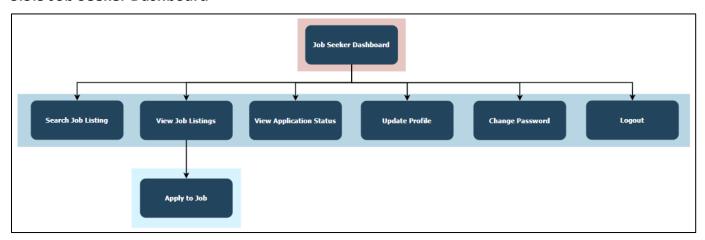


Figure 5: Job Seeker Dashboard

Search Job Listings: Job seekers can search for job listings based on various criteria such as job title, location, and industry.

View Job Listings: Job seekers can view details of available job listings and apply for positions they are interested in.

View Application Status: Job seekers can track the status of their job applications and view any updates or responses from employers.

Update Profile: Job seekers can update their personal and professional information, including resumes and contact details.

Change Password: Job seekers can change their account passwords to maintain security.

Logout: Job seekers can log out of their accounts to end their current session.







### 3.3.4 Admin Dashboard

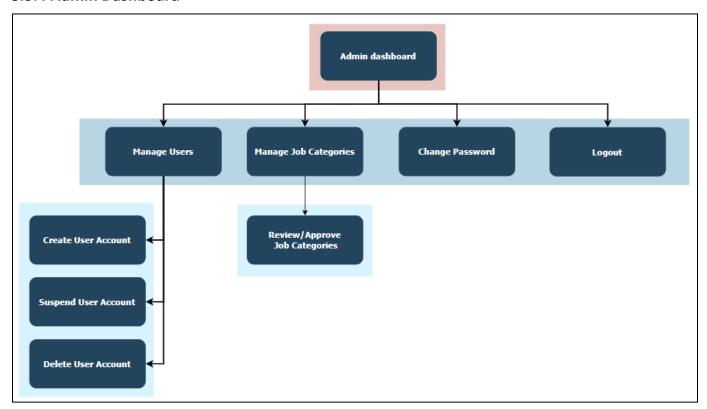


Figure 6: Admin Dashboard

Manage Users: Administrators can manage user accounts, including creating, suspending, or deleting accounts as necessary.

Manage Job Categories: Administrators can review and approve/reject new job categories requested by employers.

Change Password: Administrators can change their account passwords for security purposes.

Logout: Administrators can log out of their accounts to end their current session.







# 4. Risk Assessment

Risk categories	Risk	Probability	Impact	Suggestions
Technical	Technical complications may arise during the implementation phase, leading to delays in the development process.	High	High	Conduct thorough technical feasibility studies and create prototypes before full development. Implement agile development methods to solve recurring problems. Maintain a skilled and adaptable development team capable of promptly addressing technical challenges.
Security	Vulnerabilities in the system can lead to data breaches or unauthorized access.	High	High	Use strong security measures such as encryption of sensitive data, secure authentication mechanisms, and regular security testing. Follow best practices and industry compliance standards to ensure privacy and data protection.
Scope Creep	Project scope may expand beyond initial requirements, leading to time and budget overruns.	High	High	Define project scope and requirements clearly from the beginning. Implement change management processes to evaluate and approve any changes to scope. Regularly







				communicate with stakeholders to effectively manage expectations and prioritize features.
Resource Constraints	Limited resources, including budget and personnel, can affect project implementation.	Medium	High	Conduct comprehensive planning and resource allocation. Prioritize tasks based on importance and available resources. Consider outsourcing certain tasks or leveraging partnerships to strengthen internal capabilities.
User Acceptance	Users may not fully adopt or engage with the platform as expected, leading to low user satisfaction.	High	Medium	Involve users in the design and testing phases to gather feedback and ensure alignment with user needs. Provide comprehensive training and support resources to facilitate user engagement and adoption. Continuously collect user feedback and iterate on the platform based on user preferences and pain points.
Regulatory Compliance	Failure to comply with relevant regulations and legal requirements may	Medium	High	Stay up to date on current regulations and compliance standards related to data







result in penalties or	privacy, employment laws,
liability.	and industry-specific
	regulations. Implement
	measures to ensure
	compliance, such as data
	encryption, consent
	management, and audit trail.
	Regularly review and update
	policies and procedures to
	align with changing legal
	requirements.

**Table 4: Risk Assessment** 

# **Evaluation Report**

# 5. Design Tools

### 5.1 Introduction

**Draw.io:** Draw.io is a free, web-based diagramming tool that supports UML diagramming and user interface design. It offers a simple interface with drag-and-drop functionality for creating diagrams. Draw.io allows collaboration and supports exporting diagrams to various formats, including PDF and image files.









Figure 7: Draw.io

**Sketch:** Sketch is a popular design tool for creating user interfaces and visual designs for digital products. It offers features for vector-based design, symbol libraries, and prototyping. Sketch supports plugins and integrations with other tools for collaborative design workflows.



Figure 8: Sketch

**Lucidchart:** Lucidchart is a cloud-based diagramming tool that supports UML diagramming, including use case diagrams, class diagrams, sequence diagrams, and more. It also offers features for wireframing and designing user interfaces. Lucidchart allows real-time collaboration and integration with other tools like Jira, Confluence, and Microsoft Office.









Figure 9: Lucid chart

**Figma:** Figma is a collaborative interface design tool that allows teams to create, prototype, and iterate on designs in real-time. While not specifically focused on UML diagramming, Figma's versatility and collaborative features make it suitable for creating interactive prototypes and user interface designs, which can include elements of UML diagrams or system architecture.



Figure 10: Figma

### 5.2 Chosen tools

Based on the project requirements for FPTJobMatch, we use both Figma and Draw.io because of valuable features, here are the reasons:

### Figma:

 Collaboration and Real-Time Editing: Figma excels in collaborative design environments, allowing team members to work together in real-time. Given the project's likely need for concurrent design work and feedback iteration, Figma's collaborative features can facilitate efficient teamwork among designers, developers, and stakeholders.







- Interactive Prototyping: Since FPTJobMatch aims to revolutionize the job posting and hiring
  process, creating interactive prototypes can be instrumental in visualizing the user experience
  and gathering feedback early in the design phase. Figma's prototyping capabilities make it wellsuited for creating interactive mockups that simulate user interactions and workflows.
- Cloud-Based Accessibility: With Figma being a cloud-based tool, team members can access design files from anywhere with an internet connection. This flexibility can be particularly beneficial for remote teams or team members who need to work from different locations.

#### Draw.io:

- Cost-Effectiveness: Draw.io is a free and open-source tool, making it an attractive option for projects with budget constraints. If the project team is looking to minimize expenses while still maintaining robust diagramming capabilities, Draw.io provides a cost-effective solution.
- Simple Interface: Draw.io offers a straightforward interface that is easy to use, making it suitable for quickly creating UML diagrams and other types of diagrams. If the project team prioritizes simplicity and ease of use, Draw.io's intuitive drag-and-drop functionality can streamline the diagramming process.
- Wide Range of Diagram Types: While the project primarily requires UML diagrams, Draw.io supports various other diagram types as well. If the project team anticipates the need for creating different types of diagrams beyond UML, Draw.io's versatility may be advantageous.

# 6. Front End technology

#### **6.1 HTML**

HTML (Hypertext Markup Language) is the standard markup language for creating web pages. It provides the structure of web pages and defines the content.









Figure 11: HTML

HTML5 is the latest version of HTML and includes new features and elements that enhance web development.



Figure 12: HTML5







## 6.2 CSS (including SCSS, SASS, LESS)

CSS (Cascading Style Sheets) is used for styling HTML elements and controlling their appearance on the web page.



Figure 13: CSS

Preprocessors like SCSS, SASS, and LESS extend the capabilities of CSS by adding features like variables, mixings, nesting, and inheritance.

SCSS (Sassy CSS) is a superset of CSS3 syntax, providing more features and flexibility in writing stylesheets.









Figure 14: SCSS

SASS (Syntactically Awesome Style Sheets) is an older version of SCSS with a slightly different syntax.

```
$blue: #3bbfce;
                                 $blue: #3bbfce
$margin: 16px;
                                 $margin: 16px
.content-navigation {
                                 .content-navigation
 border-color: $blue;
                                    border-color: $blue
 color: darken($blue, 9%);
                                    color: darken($blue, 9%)
.border {
 padding: $margin / 2;
                                    padding: $margin / 2
 margin: $margin / 2;
                                    margin: $margin / 2
 border-color: $blue;
                                    border-color: $blue
         SCSS more similar to CSS
```

Figure 15: SASS







LESS is another CSS preprocessor that offers features similar to SCSS and SASS.

```
.rounded-corners (@radius: 5px) {
                                           #header {
 -webkit-border-radius: @radius;
                                             -webkit-border-radius: 5px;
 -moz-border-radius: @radius;
                                             -moz-border-radius: 5px;
 -ms-border-radius: @radius;
                                             -ms-border-radius: 5px;
 -o-border-radius: @radius;
                                             -o-border-radius: 5px;
 border-radius: @radius;
                                             border-radius: 5px;
                                           #footer {
                                             -webkit-border-radius: 10px;
#header {
                                             -moz-border-radius: 10px;
                                             -ms-border-radius: 10px;
#footer {
                                             -o-border-radius: 10px;
  rounded-corners(10px);
                                             border-radius: 10px;
```

Figure 16: LESS

### **6.3 JavaScript library or framework**

JavaScript is a programming language used for adding interactivity and dynamic behavior to web pages. Choosing a JavaScript library or framework can significantly enhance the development process by providing pre-built components, data binding, routing, and more.

Popular JavaScript libraries/frameworks include:

• **React.js:** A component-based library developed by Facebook for building user interfaces. It offers a virtual DOM for efficient rendering and a rich ecosystem of libraries and tools.







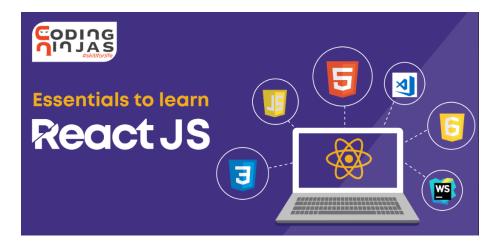


Figure 17: React.js

• **Vue.js:** A progressive JavaScript framework for building interactive web interfaces. It's lightweight, easy to learn, and offers features like two-way data binding and component reusability.



Figure 18: Vue.js







• **Angular:** A comprehensive JavaScript framework maintained by Google for building web applications. It provides a full-fledged MVC (Model-View-Controller) architecture, dependency injection, and robust tooling.

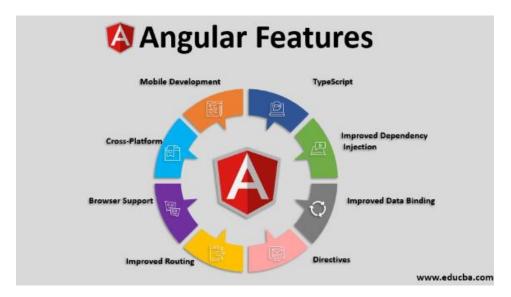


Figure 19: Agular

• **jQuery:** A fast, small, and feature-rich JavaScript library for simplifying DOM manipulation, event handling, and AJAX interactions. While its usage has declined with the rise of modern frameworks, it's still widely used in legacy projects.







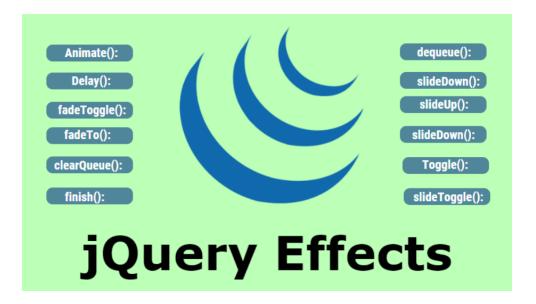


Figure 20: jQuery

### 6.4 CSS framework

CSS frameworks provide pre-designed stylesheets and components for creating responsive and visually appealing web layouts. Choosing a CSS framework can speed up development and ensure consistency across the application.

Popular CSS frameworks include:

• **Bootstrap:** A widely used CSS framework developed by Twitter. It offers a grid system, responsive utilities, and pre-styled components for building responsive web pages.







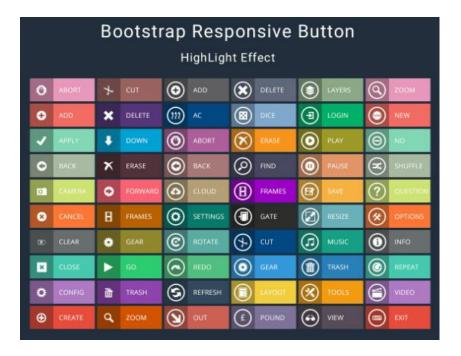


Figure 21: Bootstrap

• **Bulma:** A modern CSS framework based on Flexbox for building flexible and modular web layouts. It emphasizes simplicity and flexibility, allowing developers to customize the design easily.

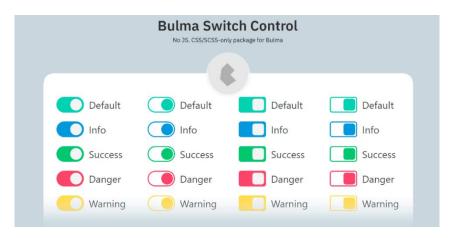


Figure 22: Bulma







• **Tailwind CSS:** A utility-first CSS framework that provides low-level utility classes for building custom designs without writing custom CSS. It offers a highly customizable approach to styling and encourages a functional programming paradigm.



Figure 23: Tailwind

# 6.5 Chosen technology

Based on the project needs and requirements, the front-end development stack for the FPTJobMatch project could include HTML5, SCSS for enhanced CSS capabilities, React.js for building dynamic user interfaces, and Bootstrap for responsive design and pre-styled components.

# 7. Back End Technology

### 7.1 C#

Define:

Basic programming language C#, sometimes referred to as C sharp, is regarded by programmers as being straightforward but incredibly contemporary and powerful. The development team at Microsoft







launched C# for the first time in 2000. Programming language team members C++ and Java are the two "great trees" upon which C Sharp is mostly built and developed. A programming language that combines many of the benefits of complicated computer languages, it is seen as a compromise between Java and C++.

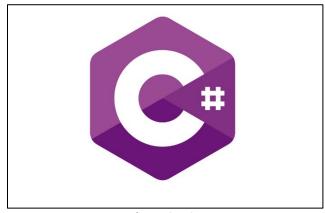


Figure 24: C#

# Advantages and Disadvantages of C#:

### **Advantages:**

- **Easy learning curve:** Because of its high level and simple learning curve, programmers of various experience levels may use it.
- **Security:** It has built-in security mechanisms that aid in defending the program from flaws and threats.
- **Rapid development:** Code may be written more quickly by developers, with fewer mistakes and problems.
- Productivity: It makes code authoring and debugging easier with its high-productivity development tools, such as IntelliSense and sophisticated debugging.
- Cross-platform support: It makes it easier to create apps for Linux, macOS, and Windows.
- **Strong community:** It features a robust and vibrant developer community that offers assistance, materials, and fixes for typical issues.
- **Profitability:** Programming languages with this level of demand and profitability can lead to lucrative careers for those who become proficient in them.

### Disadvantages:







- Limited to Microsoft platforms: first with a Windows emphasis.
- Lower performance than native languages: less productive than languages that are converted into machine code.
- **Runtime overhead:** There may be certain runtime costs associated with the Common Language Runtime (CLR) virtual machine.
- Moderate learning curve: Finding the easier programming languages may take more time.
- Less suitable for lol-power systems: Not recommended for highly optimized low-power device applications.

#### When to use C#:

In the following situations, C# is a wise option:

- Creation of desktop software for Windows, including games, accountancy software, and productivity tools.
- Creation of web apps with outstanding quality and scalability.
- Thanks to Unity and other game production tools, it is possible to create games for Windows and Xbox in addition to other platforms.
- Creation of mobile apps using Xamarin for Windows, Android, and iOS.
- Creation of Internet of Things (IoT) solutions, such as back-end and device-controlling apps.
- Because of its scalability, security, and connection with the.NET platform, it may be used to construct commercial applications.

### 7.2 Java

#### Define:

For more than 20 years, Java has been a vital programming language in software development due to its versatility and popularity. Its uses span from building desktop software and Android mobile applications to developing large-scale business applications. We will examine the various benefits and drawbacks of using Java for programming in this lesson, highlighting the language's pros and shortcomings.









Figure 25: Java

James Gosling and a group of researchers at Sun Microsystems invented Java in the middle of the 1990s. Java was created as a programming language for consumer electronics, and with the growing popularity of embedded development and the Internet of Things (IoT), it can still be useful in that field.

# Advantages and Disadvantages:

- Platform Independence: As previously mentioned, Java's WORA concept is a major selling
  point for the language since it allows programs to be produced on a single platform and run
  on any platform that supports the JVM, which is the majority of current systems. Because of
  this, Java has a high degree of portability and compatibility.
- Object-Oriented Programming: Java is a great language for modular design and reusable
  programming because of its OOP characteristics. It encourages the use of best coding
  practices for ideas like polymorphism, inheritance, and encapsulation, which results in code
  that is easier to maintain and scale.
- **Reliability:** With regular upgrades to its functionality and security, Java has been around for a number of decades and is well-supported. Strong coupling, which requires data types to be declared at creation, built-in exception handling to handle mistakes and code problems







before they become a problem, and automated memory management, sometimes referred to as garbage collection, are just a few of the characteristics that give Java robust grammar.

- Java Standard Library (JSL): Java has a robust standard library called the Java Standard Library (JSL) or Java API (depending on who you ask), albeit it's not nearly as big as rival Python's library. These many pre-built code modules provide useful tools and utilities for typical tasks related to error handling, data structures, networking, input/output operations, and much more.
- Multithreading and Concurrency: Because Java has strong built-in support for concurrency
  and multithreading, writing concurrent applications is significantly simpler for programmers.
  This is especially helpful if you are developing highly scalable server applications or responsive
  user interfaces, where efficiency is crucial.
- **Community:** Programmers that use Java extensively and actively provide helpful support in addition to third-party libraries, frameworks, and tools for software development. This aid is provided via written tutorials, forum discussions, and other learning materials that are intended to assist other programmers in learning how to debug and repair Java programs.

### Disadvantages:

- Slower Execution Speed: Platform independence is a significant plus for Java, but it comes at a performance cost. Java programmes execute somewhat slower than their natively built "cousins," such as C and C++, on average. Nonetheless, many of these performance problems have been lessened by a variety of elements, including improvements in the processing capacity of contemporary hardware, JVM enhancements in more recent Java versions, and additional performance enhancements provided by Java's integrated garbage collector. That being said, you might want to look at alternatives like C or C++, which are both quite good at manipulating low-level hardware resources, for applications that call for more access to this kind of functionality.
- **Syntax Verbosity:** Because of the verbose syntax of Java, programmes built in Java typically need a higher number of lines of code compared to alternatives like Python or Kotlin. It's







important to bear in mind that using verbose syntax and boilerplate code might result in longer development times and more maintenance work when choosing a language for a project.

- Memory Usage: Although Java is an excellent language for creating corporate software and
  mobile apps, it's vital to remember that Java uses more memory than languages like C and
  C++. To better optimise and manage memory resources, keep this in mind while designing on
  mobile devices or in environments with limited resources. In these cases, think about
  integrating and expanding Java with Kotlin or another language in the C family.
- Low-Level Access: Java purposefully restricts low-level access to system resources in order to improve portability and security. This improves the security and cross-platform usability of Java programmes, but it also reduces Java's attractiveness as a platform for system-level apps that need extensive access to hardware manipulation.
- Lack of Multiple Inheritance: Classes in Java can only inherit from a single superclass, even if Java's OOP characteristics allow for single inheritance. This has advantages and disadvantages. On the plus side, it relieves developers of some of the hassles related to multiple inheritance. However, it may also restrict the design patterns that programmers may use to solve typical issues.
- Compatibility with Legacy Code: The Java ecosystem has a problem with a lot of legacy code
  accumulation, despite the fact that Java has benefited from several upgrades and revisions to
  its core. When incorporating newer language features and libraries, developers may find it
  difficult to upgrade existing applications and retain legacy code that was written on earlier
  versions of Java. When working with older programmes, remember this at all times.
- Learning Curve: Java might be challenging to learn because of its extensive library ecosystem
  and verbose, heavily typed syntax. This is especially valid if you've never programmed before.
  While it is simpler to learn than the C-family of languages, Java is more difficult to master
  than Python. Having said that, learning Java will be simpler if you have experience with C or
  C++ programming, as these languages share many features and syntactical conventions.







Furthermore, since Kotlin is based on Java, learning it will be simpler once you are familiar with Java.

### **7.3 PHP**

#### Define:

PHP, which stands for Hypertext Preprocessor, is a server-side scripting language. This means that programs written in it may execute on web servers independently of web browsers. The syntax of PHP is comparable to that of C. Designed by Rasmus Lerdorf, it debuted in 1995. PHP is one of the primary languages used by developers to create new apps and is frequently used in web application development.



Figure 26: PHP

# Advantages and Disadvantages:

- The fact that PHP is free and open-source is by far its greatest benefit. It is easily available for usage with online apps or events and may be downloaded from any location.
- It is independent of platforms. Applications built using PHP may operate on any OS, including Windows, Linux, and UNIX.







- PHP-based applications that are connected to a database may be loaded with ease. Its speedier rate of loading over sluggish internet speeds than other programming languages is the major reason it is employed.
- Because it is easy to use and uncomplicated, there is less of a learning curve. Working with PHP is simple for someone with C programming experience.
- With the help of ongoing support for several versions, it is more reliable for a few years.
- It facilitates the reuse of similar code and eliminates the need to develop complex and long code for web application events.
- It helps in managing code easily.
- It may employ a variety of function modules for data representation because to its robust library support.
- The database connection modules that PHP comes with make it simple to connect databases, which saves time and effort when developing web apps and content-based websites.
- A portion of the developer communities that have emerged as a result of PHP's success might be suitable candidates for employment.

### Disadvantages:

- Because it is open-source and the ASCII text file is frequently accessible, it is not very secure.
- Large content-based online apps are not a good fit for it.
- Because of its poor kind, consumers may receive inaccurate information and knowledge.
- Online applications perform poorly when they employ additional functionality from the PHP framework and tools.
- PHP prohibits altering or modifying an online application's basic functionality.







- The behaviour of the PHP frameworks differs, as do their features and performance.
- Even though PHP has a large community and a wealth of reference material, there are simpler programming languages that are better suited for web applications.
- Because it's not competently modular, it's quite difficult to manage. It already mimics several
  aspects of the Java language.

### 7.4 Operating System

#### **7.4.1 Window**

### Define:

One kind of operating system that uses a graphical user interface is the Windows Operating System (GUI). It uses graphical components, like as symbols, images, colors, and so on, to establish an interface (communication screen) between the user and the computer. This is why it is termed a graphical user interface.

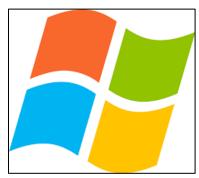


Figure 27: Window

Microsoft Company created the Windows operating system. In the world of computer operating systems, Windows is among the most widely used. Its incredibly user-friendly design is the main factor in its widespread appeal. Virtual memory management and other features are also offered by the Windows operating system.

Advantages and Disadvantages:







### **Advantages:**

- User-Friendly Interface and Simple Operation: When compared to other operating systems like Linux and MAC, the Windows operating system's user interface on the computer screen is very user-friendly. Additionally, there are a few commonalities among all Windows operating system versions, including Windows 7, 8, 10, and 11, which facilitate version switching for consumers. Because Windows operating systems are built on Graphical User Interfaces (GUIs), anyone familiar with computer basics may operate a computer without any problems.
- **Compatible to All Hardware:** Given that Windows is the most widely used operating system on computers. Over 95% of consumers worldwide utilise it. For this reason, drivers for the Windows operating system are produced by all computer hardware vendors.
- **Support Plug and Play Feature:** Plug and play functionality is made possible by the majority of hardware drivers being preloaded in the Windows operating system. Consequently, we do not need to manually install the device driver because a Windows-based computer system is capable of automatically detecting plug-in hardware devices to play.
- Provide Software Development Support: The Windows operating system environment is the
  most practical for software developers. This is due to the fact that Linux users are unable to
  develop Windows-compatible apps. Therefore, using the Windows operating system to build
  applications is a superior option. Because of this, Windows is the operating system that
  programmers and software engineers utilize to create games, utilities, and other
  programmes.
- **Provide Support for Both Touch Screens and Desktops:** The Windows 10 and Windows 11 operating systems are designed to work with both touch-screen and desktop computers.

#### Disadvantages:

• **Security Concerns:** When it comes to security risks, the Windows operating system is comparatively dangerous. Because of this, hackers may simply enter into the system by







compromising its security measures. For this reason, Windows users should strongly rely on antivirus software to shield their data from harmful threats.

- Paid Software: The Windows operating system requires commercial application applications. For instance, a membership price is required to access the anti-virus software's services. The requirement to upgrade Windows frequently in order to keep it updated with security updates is another significant problem with the operating system.
- **Expensive:** We cannot use the Windows operating system for free legally as we need to obtain a license from Microsoft in order to use it on a computer. Purchasing a duplicate Windows license comes at a steep price. In addition to the license charge, users also have to pay a software subscription fee because the majority of Windows application software is paid for.
- Poor Technical Support: For the most part, Windows customers receive really poor customer service. Only a few significant organizations receive technical support services from the Windows support team. Consequently, in order to fix their technological issues, individual users must consult forums and other external resources.
- High-Performance System Requirement: Given that Windows is a top-notch graphical user interface operating system. For it to function, a system with high performance is needed. In order to install Windows, a computer system needs a strong CPU, lots of RAM, a huge storage drive, a decent graphics card, and more.
- Need for System Rebooting: When many apps and programs are loaded concurrently on Windows operating system-based computers, the system becomes slower and may even hang. We must restart the system in such cases.

#### **7.4.2 MacOS**



📥 Define:

The desktop and laptop operating systems (OS) for Apple computers are called MacOS. Powering every Mac is a proprietary graphical operating system.









Figure 28: MacOS

In 1984, MacOS was released to operate Macintosh personal computers (PCs). Operating systems communicate with a computer's hardware by assigning it the resources it needs to do tasks that are assigned to it, such as executing an application. Operating systems assign memory, computing power, and file storage among other resources. MacOS is typically fast and responsive since the operating system is tailored to the particular hardware. Almost a year, Apple released an update for macOS.

### Advantages and Disadvantages:

- **Fewer virus attacks:** Since macOS is the second most popular operating system and has fewer users than its competitors, it also experiences less malware threats. Its UNIX connection, which is more secure than Windows OS, is the second factor contributing to virus safety.
- **Good customer support:** When compared to other operating systems, the Mac support team responds to users promptly. Apple employs highly qualified engineers that assist users in resolving problems with both their hardware and software.
- **Similar GUI for all the products:** The graphical user interface (GUI) of macOS is identical to that of other Apple devices, including iPads and iPhones. If they switched from other Apple products, they find that macOS is more comfortable to use.







- Performance and long life: Apple produces both software and hardware, which enhances
  performance and allows for highly effective hardware connection. The hardware and
  operating system function flawlessly. In comparison to other computers, Apple computers
  last longer. Mac computers also have longer battery life.
- **Default apps:** Windows comes with pre-installed software that bogs down your computer when you install it. Onedrive is one such app. However, this isn't the case with macOS; it has strong programmes that don't interfere with your system's speed. iPhoto and iMovie are two of the pre-installed programmes on macOS.
- **Can run Windows:** If macOS is installed on your computer, you may use Bootcamp or Parallels software to run Windows.

### **Disadvantages:**

- **Expensive:** A Mac computer costs more than \$1000 at least. For \$1000, you may purchase a decent Windows PC with greater hardware specifications.
- Fewer games and software: Due to their higher user base, Windows OS is the platform of
  choice for most game developers. There are fewer games accessible for Mac users. Moreover,
  Mac computers lack the graphical power to execute games with good visuals. Certain
  software, like Adobe Premiere Pro, is only available for Windows users and is not available to
  Mac users.
- Less hardware used: Less USB ports are supported by the latest macOS version of computers, and they do not come with a CD or DVD writer.

#### 7.4.3 Linux



An open-source operating system that has grown in popularity recently is called Linux. It's a free system with a Unix-like interface that anybody may alter and share thanks to its opeo-source code. As a result, there is already a sizable and vibrant community of developers working to enhance and manage the system.







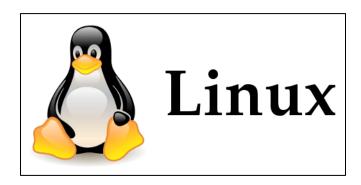


Figure 29: Linux

### Advantages and Disadvantages:

- Open-source nature: Software that is produced cooperatively by a group of programmers
  who make their source code available to the public is known as open-source software. This
  implies that the programme is openly viewable, editable, and distributable by everyone. On
  the other hand, proprietary software is created by a single firm and usually has to be licenced
  in order to use.
- Stability and Reliability: One of Linux's main advantages is that it is renowned for its dependability and stability. Linux is built to function for lengthy periods of time without the need for a reboot and can manage heavy workloads. This is because of its capacity to effectively manage system resources and manage several processes at once.
- Customizability and Flexibility: Linux is an open-source operating system that offers its users
  a great deal of flexibility and customizability. Linux gives users full access to the source code,
  unlike closed-source operating systems like Windows and macOS, enabling them to alter it to
  suit their needs.
- **Security:** Security-conscious people frequently choose Linux because of its strong security features.







• **Cost-effectiveness:** Linux may be downloaded, installed, and used without cost by users because it is offered under open-source licences. On the other hand, users of other operating systems, including Windows and macOS, must buy a license in order to use the programme.

### **Disadvantages:**

- **Software compatibility:** Another possible drawback of Linux might be the lack of widespread availability of certain programs and apps. This is due to the fact that many software developers concentrate on creating applications for the more popular operating systems, Windows and macOS.
- **Hardware Compatibility:** Some hardware devices have very little or no support in Linux. There might be a number of reasons for this, such as the manufacturer not offering Linux-compatible drivers or the device not having an open-source driver.
- Lack of Standardization: One further thing that might be classified as a drawback of Linux is the absence of ecosystem standardization. Linux has a more decentralized approach to software distribution and standardization than other operating systems like Windows or macOS, with a wide variety of distributions and package formats.

#### 7.5 Web Server

### **7.5.1** Apache



The Apache HTTP Server Project is an open-source web server programme that runs on UNIX and Windows, among other operating systems. Its software is therefore open source and editable, and its creators are always trying to make the project better.







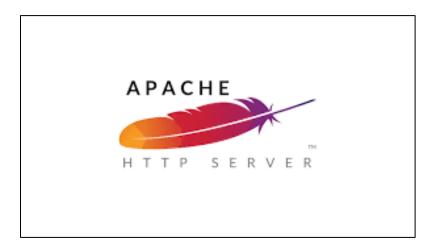


Figure 30: Apache

It's critical to know that Apache is not the actual server. Web servers are machines that handle browser requests and store the files for your website. These servers take requests, get data, and present it to users using software (like Apache or NGINX).

# **Advantages and Disadvantages:**

- Because it is open-source, you may use it for free and customise it to your liking.
- The programme receives regular updates to enhance its functionality and minimise security flaws, and it is typically dependable.
- It is rather simple to learn and suitable for beginners.
- The program is compatible with several systems.
- Python and PHP are two programming languages that function well with Apache.







• There is a sizable developer community and assistance available in case you encounter any problems.

### **Disadvantages:**

- It can struggle with high traffic numbers.
- Changing the default configurations may expose you to security risks.
- Software updates are required on a regular basis; your web host should normally take care of this for you.

### 7.5.2 CloudFlare

### **Define:**

A tool that can help your website operate and load faster is called Cloudflare. It offers free domain name server (DNS) services, CDN, and defense against DDoS attacks. It provides the outcome considerably more quickly by caching your website's static information. Your website's static pages will all be downloaded to the server, which will then rapidly display the content to users. Cloudflare retrieves material from the closest data center based on geographic location whenever a user submits a request to your website. As a result, the website loads more faster and has a significantly shorter loading time.



Figure 31: CloudFlare

Advantages and Disadvantages:







- For basic users, Cloudflare is free and relatively simple to set up.
- Because your IP address is concealed, hackers are unable to easily compromise the server.
- It keeps hackers away from your website.
- The website's resources are conserved and its performance is enhanced by limiting access to just authorised users.
- Your website is shielded from DoS and DDoS attacks by Cloudflare.
- Cloudflare will continue to provide the cached files even if your website becomes sluggish until it returns to normal.
- It offers an SSL certificate for free.

### **Disadvantages:**

- Utilising CloudFlare makes sense only if you need to safeguard your website from hackers or if it receives a sufficient amount of traffic.
- Because Cloudflare serves as a mediator, your website will also go down if it goes down.
- You also have the option to ban legitimate visitors from your website.
- It is necessary to verify if Cloudflare can access shared hosting if you are using it.
- The options for security are limited.

### 7.6 Database

### 7.6.1 PostgreSQL



Open source PostgreSQL is a database management system suitable for corporate use. For flexibility and SQL compliance, it allows relational and non-relational queries in both SQL and JSON formats. Advanced







data types and performance optimisation features that are only found in pricey commercial databases like Oracle and SQL Server are supported by PostgreSQL. Another name for it is Postgres.



Figure 32: PostgreSQL

### Advantages and Disadvantages:

- As an alternative to the LAMP architecture, PostgreSQL can operate dynamic webpages and web apps.
- Write-ahead logging in PostgreSQL makes it a very fault-tolerant database.
- The opeo-source license for PostgreSQL allows for free access to its source code. This gives you the flexibility to utilize, alter, and apply it in accordance with your business requirements.
- PostgreSQL may be used for geographic information systems and location-based services since it supports geographic objects.
- PostgreSQL may be used as a geographical data store for location-based applications and geographic information systems since it supports geographic objects.
- With Postgres's ease of use, learning it doesn't require any training.
- PostgreSQL requires less upkeep and management for embedded and business applications.







### **Disadvantages:**

- No single entity owns all of Postgres. Therefore, even though it is fully featured and similar to other DBMS systems, it has had difficulty gaining recognition.
- PostgreSQL places more emphasis on compatibility than MySQL, therefore changes intended to increase performance will take more work.
- PostgreSQL may not be supported by many opeo-source applications, whereas MySQL is.
- It is slower than MySQL in terms of performance measures.

### 7.6.2 MongoDB

### Define:

Strong and reliable, MongoDB is an excellent database for managing large amounts of data and ensuring its constant availability. It makes use of collections and documents, which are versatile data storage methods. An organization may process an increasing amount of data without experiencing any lag. It's important to keep in mind that MongoDB is licensed under the Server Side Public Licence (SSPL), which some people believe to be quite restrictive. Nevertheless, despite this, a large number of businesses worldwide, spanning several sectors, have embraced MongoDB. A strong database engine that is available to many enterprises due to its excellent performance, availability, and scalability is the result.



Figure 33:MongoDB

Advantages and Disadvantages:







- **Schema Not Required:** Predefined schemas are not required by MongoDB, however, schema migration may be required for changing data structures. But compared to conventional relational databases that are schema-restricted, it provides more freedom.
- **Document Queries:** The document-oriented structure of MongoDB is compatible with dynamic queries. Unlike static table-based RDBMS queries, it permits a wide range of flexible and variable query actions based on the type of the documents.
- **Simplified Performance Optimization:** Because of its design and internal data management, MongoDB's performance optimization is relatively easier than that of relational databases.
- **Efficient Memory Utilization:** Internal memory is used by MongoDB to store data. As a result, it improves overall speed and retrieves the data quickly.
- **Ease of Maintenance:** Because of its adaptable schema and streamlined optimization procedures, MongoDB is widely regarded as being simpler to manage than conventional databases.
- Replication and Workload Distribution: MongoDB makes sure that the information is
  constantly accessible and that the system operates quickly by creating copies of the data and
  distributing the work across several components. This occurs as a result of the duties being
  distributed among several locations rather than just one, which speeds up and improves
  reliability.

### **Disadvantages:**

- **Limited Transactions Scope:** Transactions in MongoDB operate within each document, or piece of data, but they do not completely handle scenarios in which you need to do several operations simultaneously over large amounts of data. For applications where flawless execution is essential, this might be challenging.
- **Limited Join Capabilities:** In contrast to conventional relational databases, MongoDB does not provide the same level of join capabilities. While manually using code to do join-like tasks is feasible, it can impact speed and slow down execution.







- **Data Redundancy and Memory Usage:** Because of the restrictions of joins, MongoDB maintains key names with every value pair, resulting in some data redundancy. This redundancy may cause more RAM to be used than is really necessary.
- **Document Size Limit:** The largest document size that MongoDB allows is 16 MB. To fit under this restriction, larger papers may need to be processed differently or split into smaller pieces.
- **Nested Document Levels:** In MongoDB, document nesting is feasible up to a maximum of 100 layers deep. The extent to which you may structure and arrange your data within documents may be affected by this limitation.

### 7.6.3 SQL Server



A popular and potent computer language for maintaining and modifying relational databases is called Structural Query Language (SQL). Since its initial development by IBM researchers in the 1970s, the language has been widely accepted for database management and querying on a variety of systems and in a range of sectors. Complex database processes including searching, adding, updating, and removing data are made possible via SQL. Even non-technical people can interface with databases and retrieve data because of its straightforward syntax, which eliminates the need to create complex lines of code. Additionally, SQL offers a standardized interface for interacting with databases, guaranteeing uniformity and consistency of data across various systems.









Figure 34: SQL Server

## Advantages and Disadvantages:

### **Advantages:**

- **Increase Data Security:** It guarantees database security, particularly when using the MS-SQL Server database administrator service.
- **Ease of Configuration:** The installation and configuration of this database management system is simpler than that of another.
- **Optimized Data Storage:** We can use a new device and yet use the same database without the need for additional data storage. Additionally, it makes data upkeep and troubleshooting simple.
- **Data Recover Support:** Data may get damaged in the event of a power outage or server shutdown, therefore Microsoft SQL Server's data recovery and restoration tools reduce the possibility of data loss.

### **Disadvantages:**

• **Cost:** If you want some more advanced features and database applications you can make investments for a higher version also.







- Restricted Compatibility: If you would want to utilize less Microsoft infrastructure, you may still use Microsoft SQL Server on your platform by making some additional investments in Microsoft software.
- **Hardware Restriction:** If your hardware is outdated, you may need to upgrade since newer versions of Microsoft SQL Server require sophisticated technology to function.

# 7.7 Hosting

#### 7.7.1 AWS

Define:

AWS is a cloud computing platform launched by the eCommerce giant Amazon in 2002. In 2006, they advanced to Cloud products. About 200 cloud services have been released by AWS successfully to date. Pay-as-you-go computing, which enables users to more easily scale up service requirements as needed, is its unique selling point.



Figure 35: AWS

Platform, software, and infrastructure services are all combined under AWS. They provide several different products, ranging from analytics and remote computing to storage. It is now simpler for a business to run a website without a server thanks to AWS. They take great precautions to monitor data security and have their data centres dispersed across the world. The number of start-up businesses has increased over the past century, and AWS offers the ideal environment for starting a company from the ground up.







### Advantages and Disadvantages:

#### **Advantages:**

- **Easy to Use:** The main advantage of AWS is its ease of usage. The platform's fundamental design has been optimized to enable users to utilize it effectively. Quick access to built-in services and apps, as well as the ability to build new SAAS applications, are features of the AWS Management Console.
- Pay-On-the-Go service: The reason small businesses love the AWS platform is because of its
  affordability. There are no significant upfront costs for the consumer. The system's adaptable
  architecture allows the user to increase the amount of space utilized in accordance with
  company needs.
- Effortless Migration: Users may upload any kind of software or service to AWS, a virtual storage box. Additionally, a variety of AWS services can be selected, including the preferred operating system, database, computer language, etc. It is easier to migrate to AWS because to this flexibility.
- **Data Privacy:** The AWS Cloud Computing platform draws businesses that are focused on data. As a result, protecting data security should be the top priority. Organizations have the ability to automate security processing. The integrated solutions allow the user to select which processes to automate and which to enable visibility control. To control retention, data might be transferred and encrypted.
- **Trustworthy:** To maintain dependability, AWS uses design principles. When it comes to failure recovery, the key performance indicators operate automatically. Cloud computing giant AWS has more servers than any of its rivals.

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## **Disadvantages:**

- **Confusing Bills:** The most frequent problem that customers report having with the AWS system is this one. Although the platform is designed to work even for non-technical users, the billing mechanism is not. This is among the causes behind the hiring of AWS specialists or resellers by service customers. However, Amazon makes sure that the invoices are clear.
- **Limited Resources:** One drawback of AWS that is being considered is region-based resource access. There are restrictions on EC2 and VPC consoles. New restrictions on the use of user resources have been put in place to stop system hacking by malevolent users.
- Less Number of AWS Experts: To manage the operations, experts with AWS certification are desperately needed. Complex structures are involved in AWS, which is a recent innovation.
   There is now a shortage of AWS-certified professionals as a result.
- **Cloud Computing Concerns:** There are still a number of issues with cloud computing, despite the fact that it has completely transformed the IT sector. Due to power outages or network problems, millions of consumers might experience outages.

#### **7.7.2** Azure

Define:

The public cloud computing platform Microsoft Azure, originally known as Windows Azure, aids in the efficient development of IT solutions. It enables a variety of enterprises to manage their projects and meet organizational objectives by either replacing or adding to on-premises servers.



Figure 36: Azure







### Advantages and Disadvantages:

### **Advantages:**

- High Availability: Azure is incredibly beneficial for IT companies that collaborate with distant DevOps professionals because of its high availability. Businesses may collaborate with highly qualified developers no matter where they live.
- Network Security: The security of the Microsoft Azure platform is a top priority. Azure also
  has robust cybersecurity measures, which let DevOps teams take use of the platform's
  numerous certifications for compliance. The end user is likewise secured, in addition to the
  Azure platform itself.
- **Scalability:** When working with limited funds, DevOps initiatives may really benefit from Azure. Experts in DevOps can make sure that their clients' finances are not wasted and that they only pay for what is necessary.
- Cost-Effective Solutions: Creating and maintaining your IT infrastructure requires a far less
  investment than what cloud services need. You may avoid paying for hardware and upkeep
  when using a cloud environment like Azure. Rather, you just pay for the actual amount and
  timing of your usage.
- Language, Framework, and Tool Flexibility: DevOps teams may utilise any language, framework, or tool with Azure, which enables them to rapidly and efficiently turn concepts into workable solutions. DevOps engineers may continue to be productive while creating software solutions in their preferred language. Rather of wasting their time and energy trying to figure out how to handle it, they can fully concentrate on the code.

### **Disadvantages:**

• Management Requirements: Despite its advantages and tremendous scalability, Microsoft Azure doesn't help you with data center administration. You will want a committed expert to handle your data management, which includes patching and server monitoring. That means

07.03-BM/ĐT/HDCV/FE 1/0







you will have to hire committed specialists to execute this for you, or you will have to learn it yourself.

- **Expertise Requirements:** Azure isn't a tool for beginners. To make sure that everything functions well and that you aren't splurging on features and tools that you aren't utilizing or maximizing, it takes experience.
- Possible Speed Issues in Some Regions: Not every location that Azure services benefits from
  fast data access, even with its high availability. Even while Azure is constantly growing both
  globally and in terms of availability, certain areas may continue to have performance
  problems.

### 7.8 Frameworks

### 7.8.1 ASP.NET Core

Define:

The new modular web framework for Windows that is developed by Microsoft and the.net community is called asp.net core.Net Framework and cross-platform software, such as Linux and Mac.



Figure 37: ASP.NET Core

Asp.Net Core is cross-platform compatible and open source, thanks to the introduction of the CLI (Command Line Application, or dotnet.exe). Based on ASP.NET core, Asp.Net core (formerly known as vNext) allows for development and deployment on Linux, Mac, and Windows platforms. Additionally,







mobile, cloud, IOT-based solutions, and mobile back-ends all leverage ASP.NET core. Cloud-based environments are also provided by Asp.Net Core.

# Advantages and Disadvantages:

### **Advantages:**

- Cross-platform: In contrast to past times, choosing the Microsoft framework does not imply adopting Azure or Windows Server infrastructure. It may be hosted on Linux, AWS, or Google Cloud. In essence, Linux, macOS, and Windows can all run ASP.NET Core. Other OS (Operating Systems) can also run it.
- **Microsoft Support:** Microsoft offers.NET Core support. Long-term investments in.NET-based apps are secure and prudent when backed by a reputable business.
- Simple Application Maintenance: Because C# is a tightly typed language, development tools
  can detect the majority of errors early on. Intellisense from Visual Studio contributes to the
  project code base's assistance. It makes the onboarding process of new developers easier and
  more seamless.
- **Web API support:** The framework has Web API, which is readily connected with Swagger. Documenting API apps is a smart idea while developing them. It makes it easier for other developers to work with your product. The code automatically generates documentation and integrates Swagger with ease.
- Open Source: The platform built on.NET Core is open sourced. A framework that accelerates
  framework development and raises overall quality is one that any developer can contribute
  to.

### **Disadvantages:**

• Legacy: Despite the fact that Core 3.0 is scheduled for release in the second half of 2019, and Core 1.0 was published in the summer of 2016, many eCommerce and CMS systems still rely

07.03-BM/ĐT/HDCV/FE 1/0







on non-Core versions of.NET, which prevents the use of.NET Core capabilities and benefits. The complete upgrading of current.NET Core-based products will take several years.

- Learning Curve: Even though there are many.NET developers available, the ASP.NET Core
  framework has many new features and is a significant improvement over the ASP.NET
  Framework. Developers must put in more time and effort to become proficient with this new
  technology.
- **Windows-based Development Tools:** Visual Studio was published for Mac by Microsoft. However, there are several alternative development tools that are more compatible with Windows, and it will take some time for them to be cross-platform as well.

# 7.8.2 Spring MVC

#### Define:

The Front Controller, or the Dispatcher Servlet, is the centre of attention for the Model-View-Controller architectural design pattern used by the Spring MVC Framework. Every incoming HTTP request is handled by the Dispatcher Servlet, which then forwards it to the relevant controller. As default request handlers, it makes use of @Controller and @RequestMapping. Annotating a class with @Controller indicates that it is a controller. Web requests are mapped to Spring Controller methods using the @RequestMapping annotation. The following are the definitions of model, view, and controller:

- **Model**: The application data is included in the Model.
- **View**: View creates HTML output that can be interpreted by the client's browser after rendering the model data.
- **Controller**: Requests from the user are processed by the Controller and then sent to the view for rendering.









Figure 38: Spring MVC

### Advantages and Disadvantages:

### **Advantages:**

- The container employs a lightweight servlet and is used for application development and deployment.
- It makes fast development possible in parallel.
- The application is developed quickly.
- It is simple for several developers to collaborate.
- Updates to the program are simpler.
- The application has numerous tiers, which makes debugging easier.

### Disadvantages:

- Developing apps with this architecture is quite complicated.
- Small apps that have an impact on the functionality and design of the application should not use it.







### 7.8.3 Symfony

### Define:

An open-source, dynamic PHP framework with an MVC (Model View Controller) architecture is called Symfony. SensioLabs initially released it as free software in 2005, and it was later made available under the MIT Licence. It is one of the most widely used application frameworks among the community of open-source developers. Well-known for its excellent speed, agility, and tried-and-true MVC design, Symfony is a stable framework that can handle important business activities.



Figure 39: Symfony

# Advantages and Disadvantages:

- Reliable: This is software that has proven to be reliable since it was launched in the market. It
  has been working properly and without errors and that is why the software is supported by
  many businesses.
- **Save time:** The most essential thing about Symfony framework is to make work easier for developers. The time saved can be used to perform other productivity development activities.
- **High Flexibility:** Flexibility is an important factor in a web development project to operate the application or website properly. Symfony is designed with incredible features that provide maximum flexibility. It includes components including plugins, stylesheets, PHP files, images,







JS, and many more features. The main feature of packages is that they are decoupled. It's easy to reuse and reconfigure components to build multiple websites and applications

- Provides improved security: These framework components are supported by timely upgrades
  to improve the security of websites or applications under development. This makes it a more
  suitable framework for web development projects.
- **Ease of maintenance:** Using the Symfony development framework when building websites or applications improves their structure and functionality. The improved functionalities are easy to maintain when problems arise with the developed website.

### **Disadvantages:**

- **Performance**: Symfony has quite low performance, especially for real-time high-load applications that occur when many users are using a website or application at the same time.
- **Takes time to build and launch:** Because Symfony uses design patterns that require a lot of skill and technical know-how, it can take a long time to complete and launch.

# 7.9 Conclusion Which Back End technologies will be used for the development

The decision to utilize ASP.NET Core as the back-end framework and SQL Server as the database for the development of FPTJobMatch was based on several key considerations. ASP.NET Core was selected for its modern architecture, cross-platform compatibility, and extensive feature set, making it well-suited for building scalable and high-performance web applications. Its robust security features, built-in support for essential functionalities, and strong community support were also significant factors in the decision-making process. Additionally, SQL Server was chosen as the database due to its reliability, performance, and comprehensive set of features for managing and querying data. As a widely adopted relational database management system, SQL Server provides advanced capabilities for data integrity, security, and scalability, making it an ideal choice for storing and managing the vast amount of data generated by FPTJobMatch. Overall, the combination of ASP.NET Core and SQL Server provides a solid foundation for developing a secure, scalable, and feature-rich platform that meets the needs of FPTJobMatch and its users.







# 8. Tools for source control management

## 8.1 Git, GitHub, GitLab, etc.

#### 8.1.1 Git

#### Define:

Git is a free and open-source software development platform that can efficiently manage software development projects of all sizes. Git was once intended to be a low-level distributed version control system (DVCS), but since then, it has evolved into a comprehensive content-tracking system. Git makes it simple for programmers to keep track of changes made to software or apps' source code while adding new features or repairing bugs. Git is designed to promote data integrity, speed, and distributed non-linear processes.



Figure 40: Git

## Advantages and Disadvantages:

## **Advantages:**

- **Distributed**: Due to the distributed nature of the Git version control system, every developer has a copy of the codebase. As a result, working offline and collaborating with others without a centralized server is made simple.
- Security: The codebase is shielded from unwanted access by a number of security mechanisms offered by Git, including encryption and authentication.







- **Branching**: Git makes it simple to experiment with new features or bug fixes without impacting the main source by allowing developers to build various branches of the codebase.
- Large community: Git boasts a sizable and vibrant development community, which implies an abundance of tools and assistance.

## **Disadvantages:**

- **Command-line interface:** Because Git is usually used through a command-line interface, developers who are more accustomed to graphical user interfaces can find it unsuitable.
- **Learning curve:** Git requires some getting used to, especially for those with little experience with version control systems. Starting to use the system might be difficult as a result.
- **Complexity**: Configuring and setting up Git may be challenging, particularly for novice software engineers. Starting to use the system might be difficult as a result.

#### 8.1.2 GitHub

Define:

Forging is another name for GitHub, which is a collaborative development site. That is a platform that encourages developers to work together to promote and distribute their software (though it has gradually been used for purposes other than software development).



Figure 41: GitHub







It is based on the Git version control system, as its name implies. As a result, one may work with the programs' source code and conduct an organized development process. Additionally, Ruby on Rails is used to create this platform.

## Advantages and Disadvantages:

## **Advantages:**

- **Simplifying Open-Source Contributions:** Using GitHub to contribute to open-source projects is a simple process. It is the preferred platform for project management and offers open-source projects free access. Its encompassing features, which include an issue tracker and wiki, make thorough documentation and feedback easier. To contribute, just clone a project, make your modifications, then use the GitHub web interface to send a pull request.
- **Streamlined Documentation:** GitHub provides a productive way to write high-quality documentation. Their extensive resources for developers are ensured by the large range of subjects covered in their help section and guidelines connected to Git.
- **Showcasing Your Work:** GitHub is a great resource for engineers that want to draw in recruiters. In order to find fresh talent for their projects, many businesses now go via GitHub profiles. Even without a highly esteemed educational history, having an approachable profile makes you more likely to get hired.
- **GitHub as a Public Repository:** The main purpose of GitHub is as a repository, which makes it possible for the public to see your work. With its status as one of the biggest coding communities, GitHub gives your projects a lot of exposure.
- Efficient Tracking of Code Changes: It can be difficult for collaborative projects to maintain track of code updates, including who made changes, when they were made, and where the files are kept. By keeping an exhaustive log of every modification uploaded to the repository, GitHub fixes this problem. GitHub's version history guarantees that earlier versions are preserved, much like document versioning in programmes like Google Drive or Microsoft Word.







• Integration Capabilities: GitHub easily connects to well-known services like Google Cloud and Amazon. It also offers syntax highlighting for more than 200 programming languages and supports services like Code Climate for tracking feedback.

### **Disadvantages:**

- **Learning Curve:** If you're new to version control systems and collaborative platforms, GitHub may be a challenge. Learning concepts like dispute resolution, pull requests, branching, merging, and merging may take some time.
- **Limited Privacy for Free Accounts:** There are restrictions on privacy settings for GitHub free accounts. Code stored in public repositories is available to all users, therefore it might not be appropriate for projects that need private or secret code.
- **Dependency on External Service:** Being a cloud-based platform, GitHub depends on external infrastructure and an internet connection. Access to repositories and collaborative features may be momentarily impeded by outages or disturbances.
- Lack of Customization: GitHub offers a standardised interface with few options for project management tools and repository layout customisation. For people who want customised processes or certain project management tools, this could be limiting.
- **Difficulties with Large Repositories:** GitHub may have performance problems while working on big repositories or long-running projects. Cloning, fetching, and querying these repositories are examples of resource- and time-intensive operations.

#### 8.1.3 GitLab

## Define:

Another forging website that is built on Git and has a web service and version control system is called GitLab. It is a rival to GitHub. Naturally, it was designed to host open-source projects and facilitate development, but it differs in a few ways from the previous version.









Figure 42: GitLab

Apart from version control and repository management, this website also provides wiki hosting and a bug-tracking system. A full suite to build and manage any form of project, since projects with more than just source code are already hosted, similar to GitHub.

## Advantages and Disadvantages:

#### **Advantages:**

- The free plan is unlimited, although it has a paid plan.
- It's an open-source license.
- Self-hosting is allowed on any plan.
- It is very well integrated with Git.

## **Disadvantages:**

- Its interface may be a bit slower than the competition.
- There are some common problems with repositories.

# 8.2 Conclude which tools will be used for the development

It has been agreed to use GitHub and Git for the web application development, based on the debate thus far. Git is a robust and adaptable version control system that offers several tools and capabilities for tracking changes made to the codebase over time. In contrast, GitHub is a web-based platform that offers a variety of versioning, security, and collaboration tools for hosting and working together on Git projects. Git and GitHub work together to offer a powerful and dependable collection of tools for managing the web application's development process, including project management, code review,







version control, and issue tracking. All things considered, it is anticipated that this set of tools would offer all the capabilities and tools required to create a scalable, high-quality online application.

# 9. Software Development Models

## 9.1 Introduction several SDLC models: Scrum, Waterfall, V-Model

#### 9.1.1 Scrum

## Define:

Scrum is a project framework. It is categorized as an agile approach and outlines roles, protocols, tools, and processes to guarantee timely and successful project delivery through iterative development cycles. This technique is essentially applied in situations when a high level of stakeholder participation and the development process are required. Throughout the project's progress, software development is continuously monitored via the scrum approach.

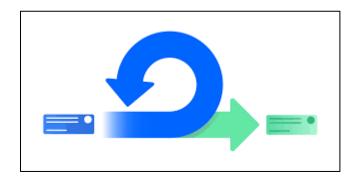


Figure 43: Scrum

# Advantages and Disadvantages:

#### **Advantages:**

- Teams using Scrum may finish project deliverables more rapidly and effectively.
- Time and money are used efficiently thanks to Scrum.







- Big projects are broken up into smaller sprints.
- Coding and testing of developments take place during the sprint review.
- Works effectively for development projects that move quickly.
- The scrum meetings provide the team with clear visibility.
- Scrum is agile and welcomes input from stakeholders and consumers.
- Changes based on feedback are easier to implement during short sprints.

### **Disadvantages:**

- Scrum often leads to scope creep due to the lack of a defined end date
- The possibility of project failure is very high if individuals do not have commitment or cooperation
- Applying the Scrum framework in large teams is challenging
- The framework can only be successful with experienced team members
- Daily meetings sometimes frustrate team members
- If any team member leaves mid-project, it can have a huge negative impact on the project.

## 9.1.2 Waterfall

#### Define:

The first Process Model to be introduced was the Waterfall Model. It is also known as a life cycle model that is linearly sequential. It is quite easy to use and comprehend. Each step in a waterfall model needs to be finished before moving on to the next. This kind of software development paradigm is mostly applied to small projects with well-defined needs.







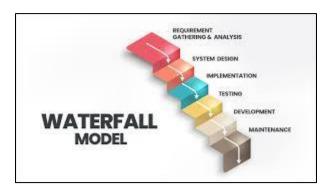


Figure 44: Waterfall

## Advantages and Disadvantages:

#### **Advantages:**

- This model is simple and easy to understand and use.
- The model's rigidity makes it simple to manage because each step has clear deliverables and a review procedure.
- Each phase is handled and finished in turn in this methodology. Phases don't cross across.
- Smaller projects with well-defined and known needs benefit greatly from the waterfall paradigm.

## **Disadvantages:**

- It is quite difficult to go back and make changes to an application that was not carefully considered at the idea stage once it has entered the testing phase.
- Until the very end of the life cycle, no functional software is developed.
- High amounts of risk and uncertainty.
- Not a good model for complex and object-oriented projects.







- Poor model for long and ongoing projects.
- Unsuitable for projects with a moderate to high chance of changing needs.

#### 9.1.3 V-Model

## Define:

One kind of SDLC model is the V-model, in which the process runs in a V-shape in a sequential manner. The Verification and Validation model is another name for it. Its foundation is the assignment of a testing phase to every related development step. Every step's development is closely related to the testing stage. The subsequent phase does not begin until the preceding phase is finished, i.e., there is a testing activity for every development activity.

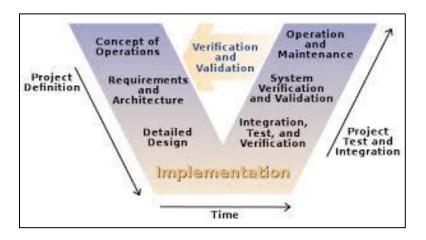


Figure 45: V-Mode

## Advantages and Disadvantages:

#### **Advantages:**

Simple and easy to use.







- Testing processes such as planning and developing tests take place long in advance of coding.
   It saves a great deal of time. hence having a better likelihood of success than the waterfall paradigm.
- Defects are discovered early on thanks to proactive defect monitoring.
- Functions well for small projects with clear needs.

### **Disadvantages:**

- Very rigid and least flexible.
- Software is not designed in advance of implementation; instead, it is developed during that process.
- The requirement documents and test documents must be updated if there are any modifications made in the middle.

## 9.2 Conclude which SDLC model will be used for the development with explanations

Based on the project requirements and goals, Scrum will be the appropriate SDLC model for development. Scrum is an Agile approach that is widely used that prioritizes customer happiness, teamwork, and incremental and iterative development. Scrum would work well for this project since it requires regular customer check-ins, which enable modifications and input to be made while the project is being developed. By doing this, you can make sure that the finished product satisfies the needs and demands of the client.

Better results and a more favorable work environment can result from Scrum's encouragement of teamwork and communication. Scrum is a flexible and adaptable methodology that works well for projects whose needs change or evolve because it makes necessary modifications quickly and easily. Scrum may assist the development team in maintaining organization, focus, and momentum while putting the needs of the client and producing a high-caliber end product first.







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