ASSIGNMENT 1

Qualification	**BTEC Level 5 HND Diploma in Computing**		
Unit number and title	**Unit 30: Application Development**		
Submission date	22/10/2022	**Date Received 1st submission**	
Re-submission Date		**Date Received 2nd submission**	
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Student declaration

I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.

Student's signature	Cong Tuan

Grading grid

P1	P2	P3	M1	M2	D1

□ Summative Feedback:	□ Resubmission Feedback:	
Grade:	Assessor Signature:	Date:
Internal Verifier’s Comments:		
Signature & Date:		

Table of Contents

Table of Figures

I. Introduction

In this development project, I was asked to research, build and develop a training management system for FPT Corporation. The system was explicitly required to have a role for each object instantiated. I have looked at it very carefully and will detail it in this assignment. To be able to bring a specific form with the correct nature of a project, I will choose to build and develop it with the system's requirements specification.

This semester, we collaborated in groups to create the SRS (Software Requirement Specifications), Slide, and Evaluation papers for CMS submission. This assignment has three sections, parts 1 and 2 of which we covered in SRS. We are required to write a personal evaluation report for the third component. In part 1, we will investigate a business-related issue and create a concise PDS backed by a list of user and system needs. In the part that follows, we will list any possible risk factors for the successful completion of our application. And in part 3, which I will present below, I am going to research the use of software development tools and techniques and identify any that have been selected for the development of this application.

For this system requirements specification, I will attach this assignment file. In the following, I will clarify each part and analyze it in detail in this assignment.

II. Scenario

1. UML

1.1. UML Definition

Developers can specify, visualize, create, and document the artifacts of a software system using the unified modeling language (UML), a standardized modeling language. As a result, UML renders these artifacts executable, secure, and scalable. The creation of object-oriented software includes UML as a key component. It produces visual representations of software systems using graphic notation.

UML is meant to help users create expressive, usable visual modeling languages. Additionally, it enables advanced development ideas like frameworks, patterns, and teamwork. UML consists of a number of elements, including:

- Programming Language Statements
- Actors: specify a role played by a user or any other system interacting with the subject.
- Activities: These are tasks, which must take place in order to fulfill an operation contract. They are represented in activity diagrams.
- Business Process: includes a collection of tasks producing a specific service for customers and is visualized with a flowchart as a sequence of activities.
- Logical and Reusable Software Components

There are two sorts of UML diagrams. Six different sorts of diagrams are included in the first type and reflect structural data. The second one contains the final seven, which stand in for generic behavioral patterns. Structure diagrams are used to represent the system under modeling and to document the architecture of software systems. Various structural diagrams include:

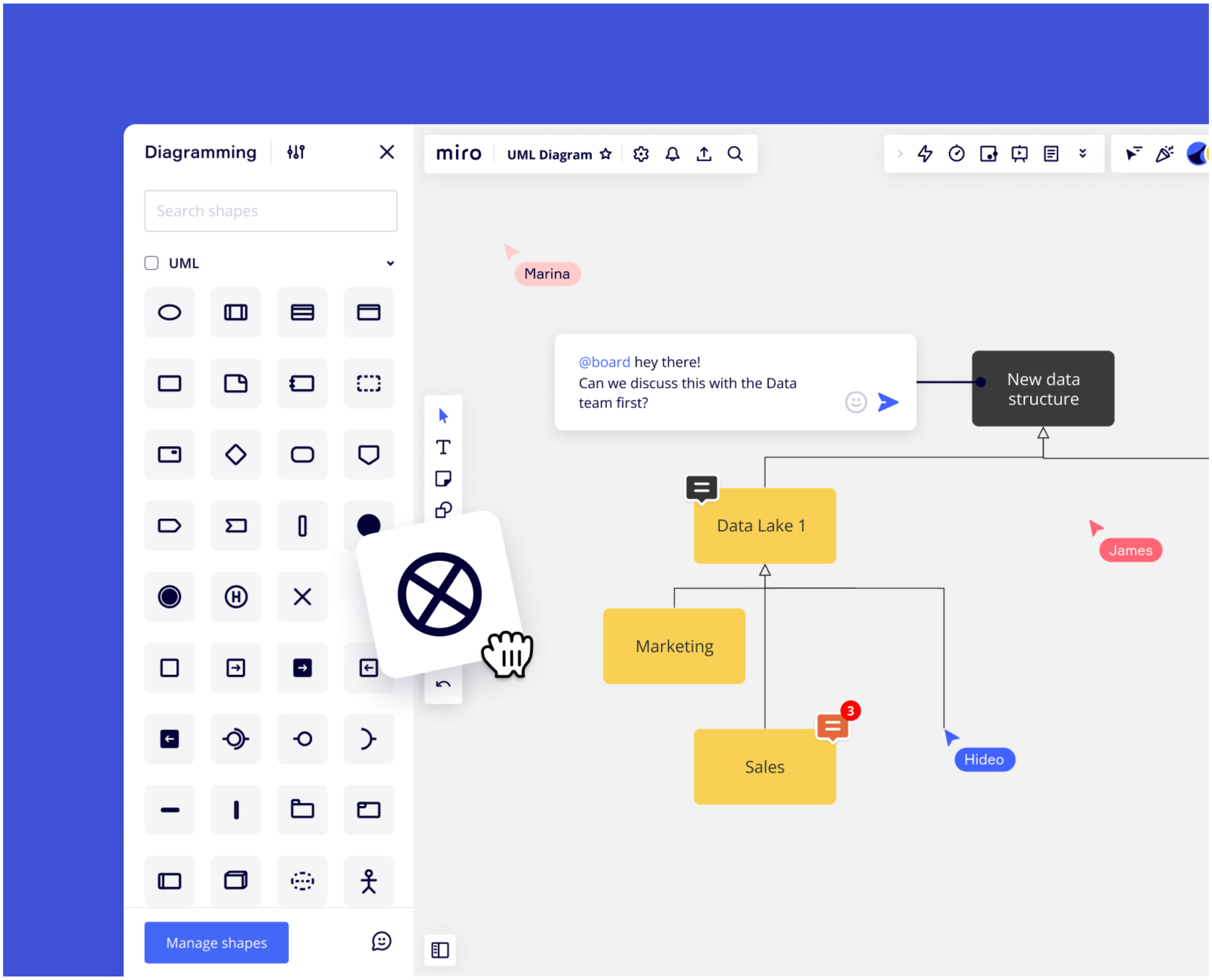
- Class Diagram: represents system class, attributes and relationships among the classes.
- Component Diagram: represents how components are split in a software system and dependencies among the components.
- Deployment Diagram: describes the hardware used in system implementations.
- Composite Structure Diagram: describes internal structure of classes.
- Object Diagram: represents a complete or partial view of the structure of a modeled system.
- Package Diagram: represents splitting of a system into logical groupings and dependency among the grouping.

1.2. Some popular UML Diagrams

1.2.1. Class Diagram

Any object-oriented solution starts with class diagrams as its fundamental building component. It displays the classes in a system, along with their properties, operations, and interrelationships.

A class often includes three components in modeling tools. Name is at the top, followed by attributes, and then by operations or methods. Classes are gathered to form class diagrams in large systems with plenty of linked classes. Different arrow kinds represent various relationships between classes.



@board hey there!
Can we discuss this with the Data team first?

Figure 1 Class Diagram

1.2.2. Component Diagram

A component diagram shows how a software system's components are connected structurally. These are typically utilized while working with intricate systems that have numerous components. Interfaces are used by components to communicate with one another. Connectors are used to connect the interfaces. An example of a component diagram is shown below.

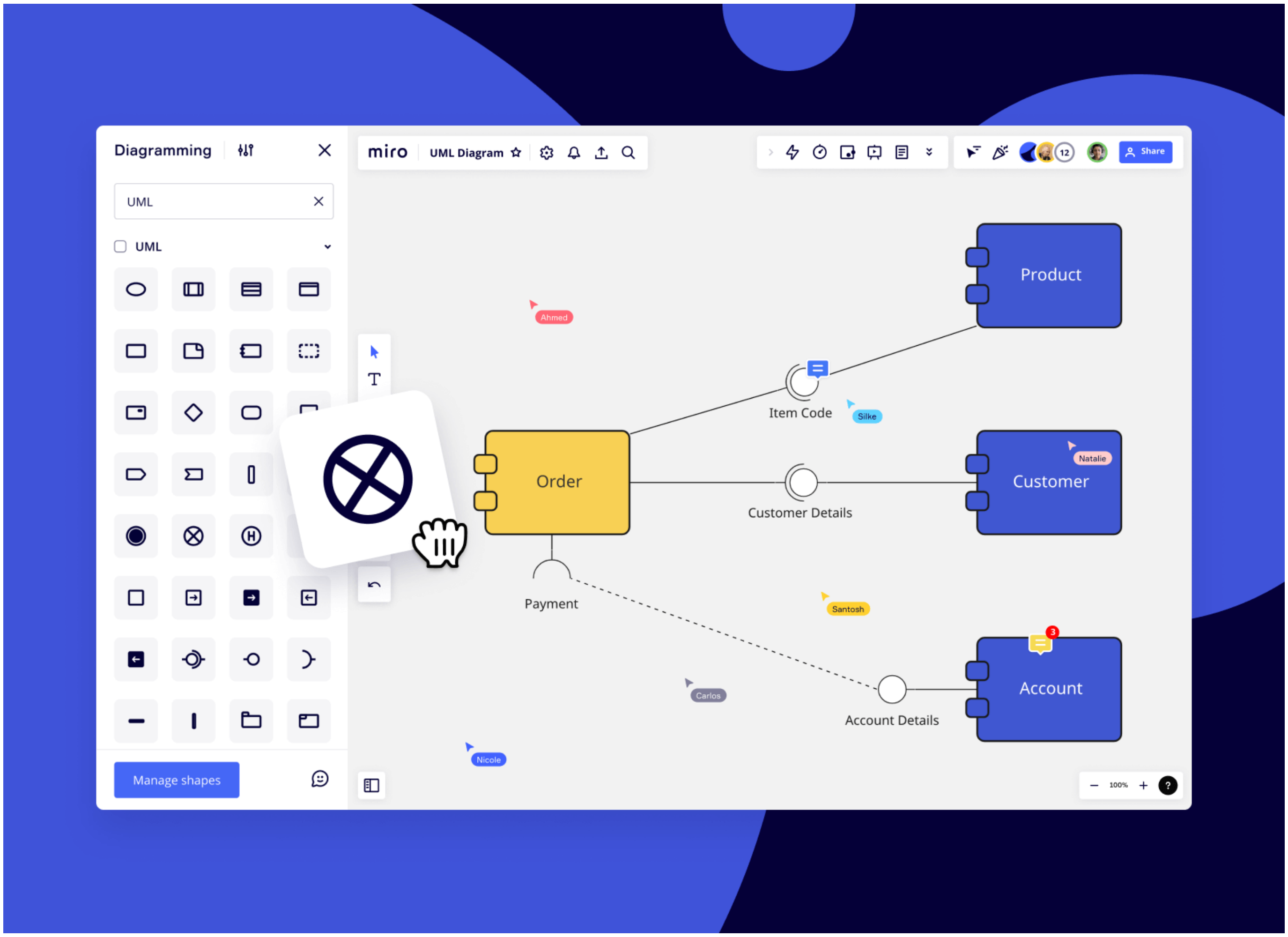


Figure 2 Component Diagram

1.2.3. Use Case Diagram

Use case diagrams, the most popular sort of behavioral UML diagram, provide a visual representation of the players in a system, the many functions those actors require, and the relationships between those functions.

Since the primary players and the system's primary operations can be quickly identified, it is a perfect beginning point for any project conversation. Using our tool, you may draw use case diagrams or utilize our use case templates to get going right away.

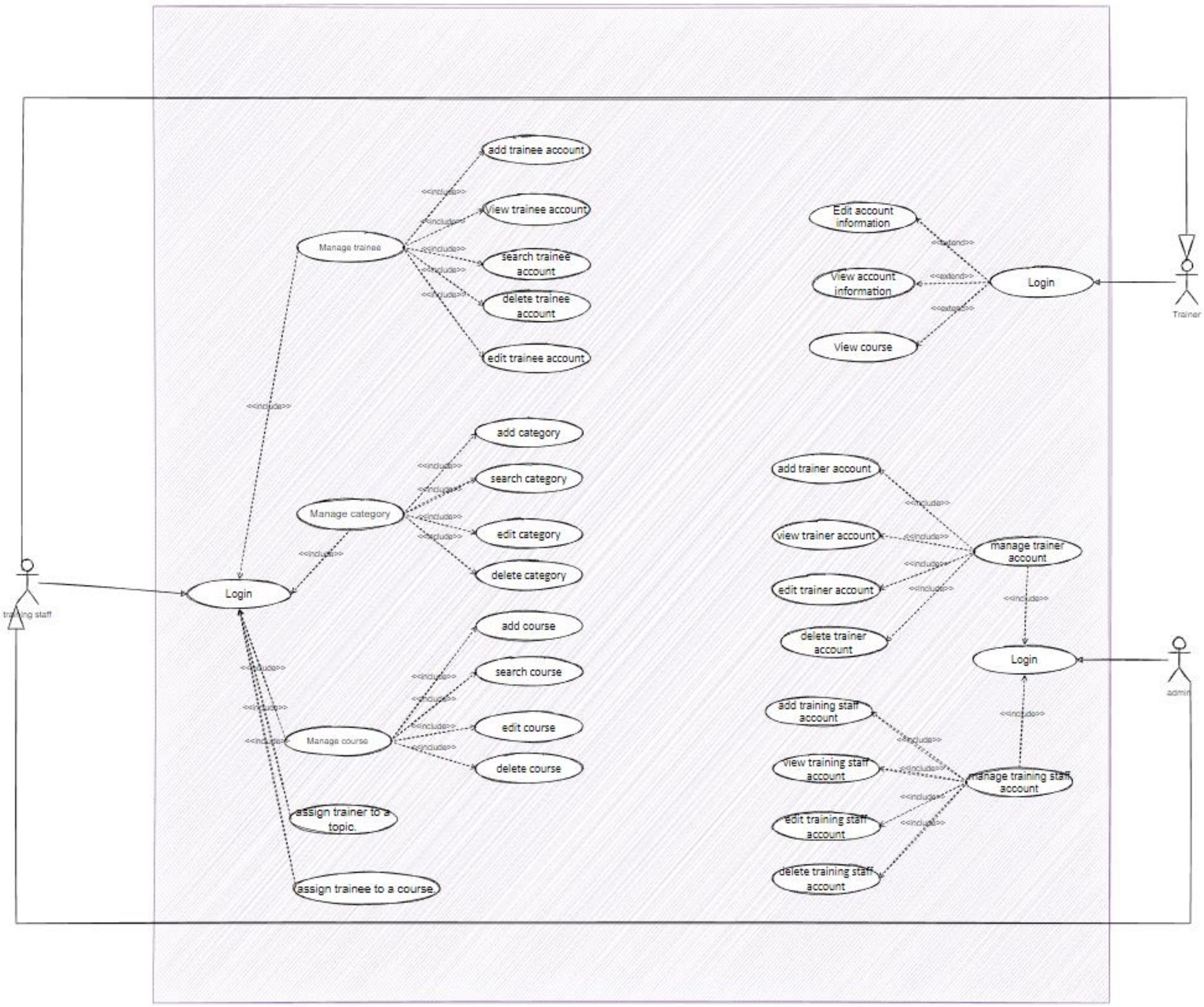


Figure 3 Use Case Diagram

1.3. Use the UML Tool to give examples

UML gives development teams a powerful set of tools to create many types of diagrams. These fall into two major groups: structure diagrams and behavior diagrams. Structure diagrams show the static, architectural parts of a system. Behavioral diagrams show the dynamic parts of a system, or how the system reacts to input. Inside the two categories we have many types of diagrams:

1.3.1. Diagrams.net

In addition to supporting UML, Diagrams.net (formerly draw.io) provides a straightforward drag-and-drop interface for flowcharts and graphs. Although Diagrams.net is effective for a wide range of jobs, certain users might find it lacking in specialized features. Draw.io costs a little less than Lucid chart and gives the same level of usability for non-technical people if you're looking for a drag-and-drop UML solution.

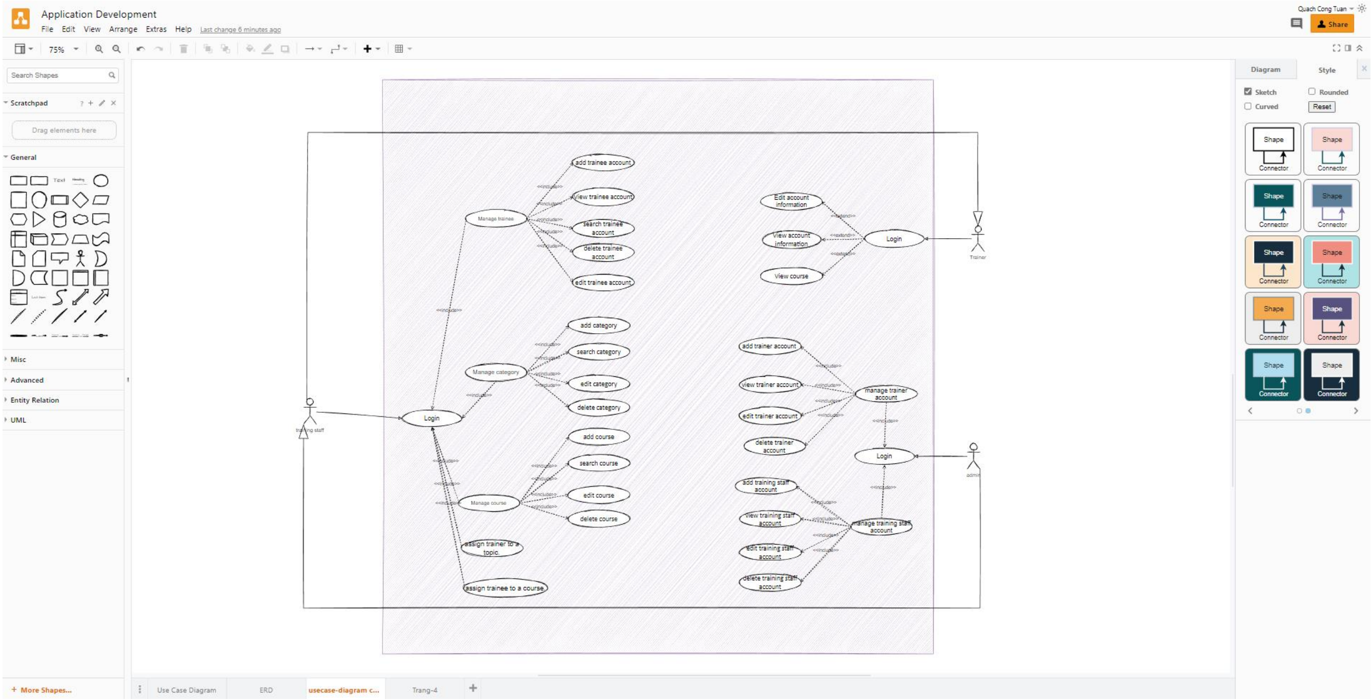


Figure 4 Draw.io

Input type:

- Drag-and-drop

UML diagram types that diagrams.net specializes in:

- Case diagrams
- Sequence diagrams
- Activity diagrams

1.3.2. Lucidchart

The preferred diagramming tool for many developers, Lucidchart offers a number of straightforward functions. Because its coding is built on HTML 5, Lucidchart operates in real time across numerous platforms. In addition to Confluence, MS Team, Slack, and G Suite are all integrated with Lucidchart. From mind maps to intricate system diagrams, Lucidchart can handle them all. Because of its simple drag-and-drop user interface, Lucidchart is popular among development team members who are less technically inclined. To learn more about the features of the software, read our article comparing Draw.io to Lucidchart.

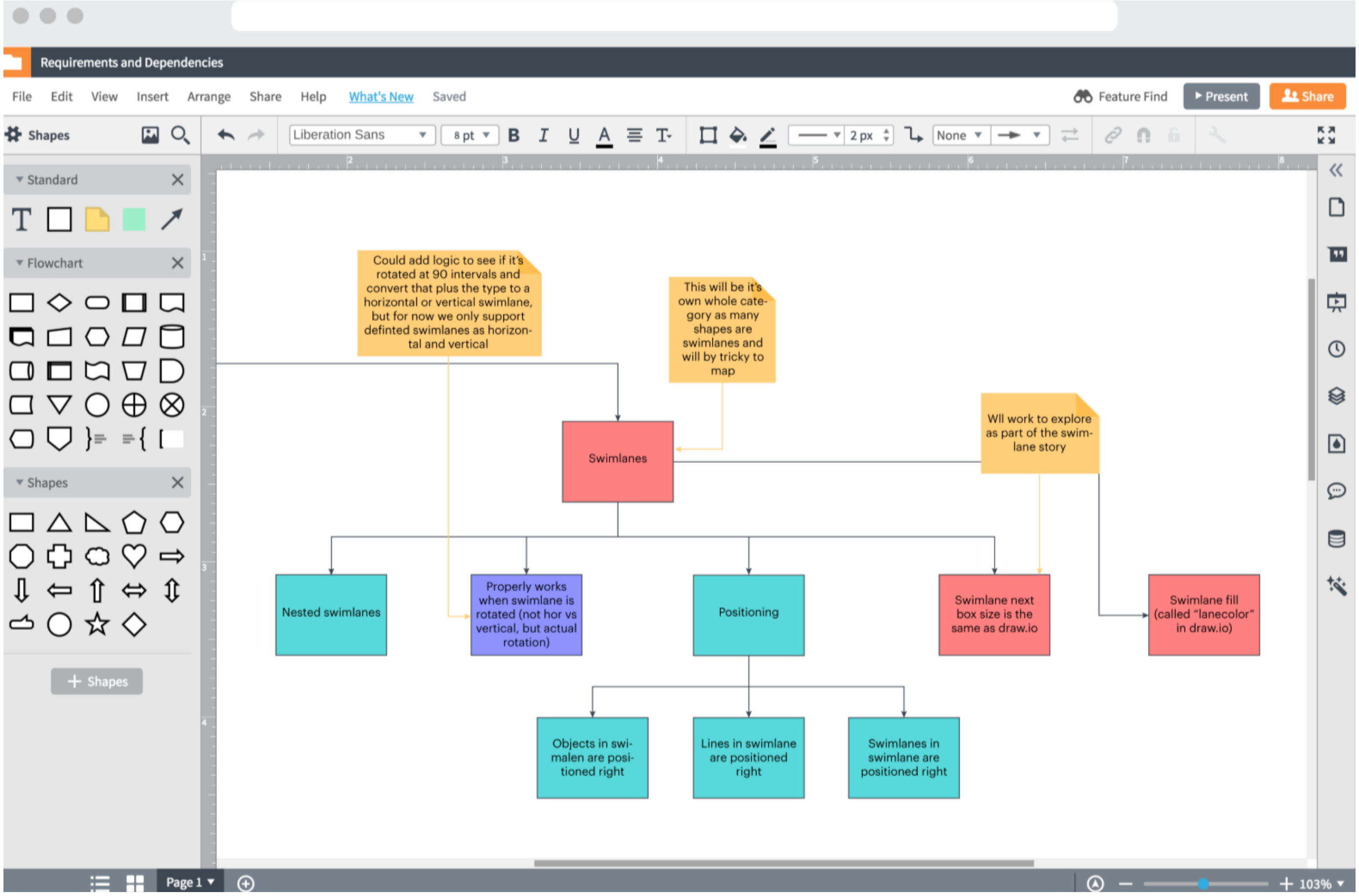

Requirements and Dependencies
File
Edit
View
Insert
Arrange
Share
Help
What's New
Saved
Feature Find
Present
Share
Shapes
Liberation Sans
8 pt
2 px
None
Standard
Flowchart
Shapes
+ Shapes
Could add logic to see if it's rotated at 90 intervals and convert that plus the type to a horizontal or vertical swimlane, but for now we only support definted swimlanes as horizontal and vertical
This will be it's own whole category as many shapes are swimlanes and will by tricky to map
Wll work to explore as part of the swimlane story
Swimlanes
Nested swimlanes
Properly works when swimlane is rotated (not hor vs vertical, but actual rotation)
Positioning
Swimlane next box size is the same as draw.io
Swimlane fill (called "lanecolor" in draw.io)
Objects in swimalen are positioned right
Lines in swimlane are positioned right
Swimlanes in swimlane are positioned right
Page 1
103%

Figure 5 Lucidchart

Lucidchart input type:

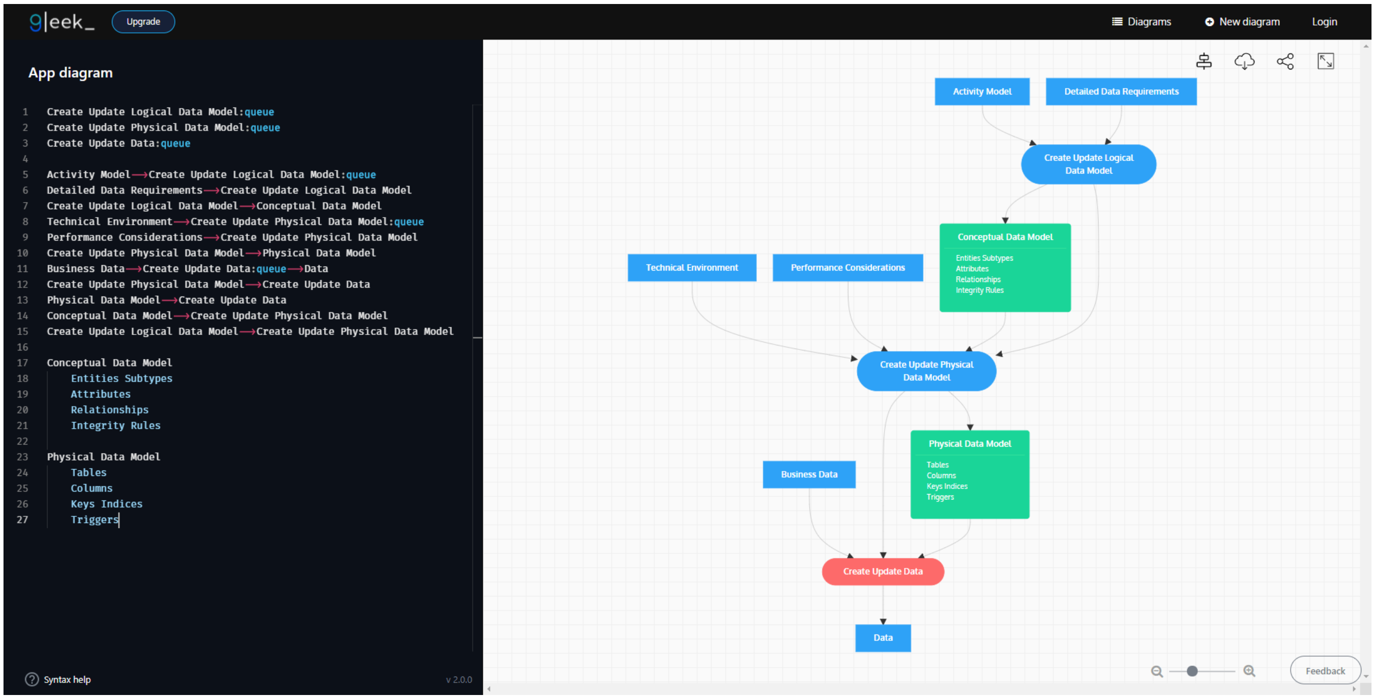
- Drag-and-drop

UML diagram types where lucidchart shines:

- Class diagrams
- Sequence diagrams
- Activity diagrams

1.3.3. Gleek.io

Sequence diagrams, class diagrams, and object diagrams are just a few of the UML diagram types that Gleek.io can produce. Additionally, teams can utilize Gleek.io to make mind maps, flowcharts, org charts, and many other types of diagrams. Power users and programmers are aware that using the keyboard is far quicker than using a mouse. Developers work more quickly with Gleek.io than they do with drag-and-drop diagramming products because of its keyboard-command-based interface. Additionally, Gleek.io offers syntactic help directly in the diagramming window in case you run into trouble.



```
Create Update Logical Data Model:queue
Create Update Physical Data Model:queue
Create Update Data:queue

Activity Model⟶Create Update Logical Data Model:queue
Detailed Data Requirements⟶Create Update Logical Data Model
Create Update Logical Data Model⟶Conceptual Data Model
Technical Environment⟶Create Update Physical Data Model:queue
Performance Considerations⟶Create Update Physical Data Model
Create Update Physical Data Model⟶Physical Data Model
Business Data⟶Create Update Data:queue⟶Data
Create Update Physical Data Model⟶Create Update Data
Physical Data Model⟶Create Update Data
Conceptual Data Model⟶Create Update Physical Data Model
Create Update Logical Data Model⟶Create Update Physical Data Model

Conceptual Data Model
    Entities Subtypes
    Attributes
    Relationships
    Integrity Rules

Physical Data Model
    Tables
    Columns
    Keys Indices
    Triggers
```

Figure 6 Gleek.io

Gleek input type:

- Keyboard, not drag-and-drop

UML diagram Gleek.io does best:

- sequence diagrams
- class diagrams
- object diagrams

2. Chosen design tools

2.1. Integrated development environment (IDE)

A computer program used by software developers to design, debug, maintain, or otherwise support other programs and applications is known as a programming tool or software development tool. The phrase often refers to relatively straightforward programs that may be assembled to carry out a task, much like how many hand tools could be used to mend a real thing. A source code editor and a compiler or interpreter are the most fundamental tools, and they are regularly and widely utilized.

Other tools, frequently used for a specific purpose, such as a debugger or profiler, are utilized in varying degrees based on the language, development style, and individual engineer Tools can be standalone programs that are run from the command line, or they can be components of a larger software known as an integrated development environment (IDE). Simple ad hoc techniques, such as print debugging instead of using a debugger, manual timing (of an entire program or section of code) instead of using a profiler or tracking bugs in a text file or spreadsheet instead of using a bug tracking system, are frequently used instead of a tool, especially for simpler uses. It's difficult to distinguish between tools and apps.

Visual Studio Code

Microsoft's code editor Visual Studio Code has some of the features that developers adore about Gi Kraken. For student developers, VS Code offers a straightforward and clear environment for editing code that includes a clear sidebar, strong defaults, discoverable extensions, and more. Users of VS Code value the option to group files by folder or project. In addition, smart editing is available for built-in languages like JavaScript and Typescript, which can be helpful for students who are often exposed to new coding languages.

Outstanding Features:

- UI Friendly and easy to use
- Can change theme
- Support many languages
- Can install extension
- Can format with prettier
- Can use Gitbash/terminal/NodeJS/… on VSCode

2.2. MVC Pattern

MVC stands for Model View Controller. This is a software model used to create user interfaces on computers. The MVC model consists of three main parts: Model, View and Controller. Each component has different functions and tasks, but between them there is a reciprocal interaction, supporting each other. In there:

- Model has the function of managing and processing data.
- View is responsible for displaying data to the user.
- Controller has the function of controlling interaction between Model and View.

The MVC pattern in Java makes it easy for programmers to separate the way the data is internal from the data displayed. The interaction between the three elements Model, View, Controller creates the best efficiency for programming.

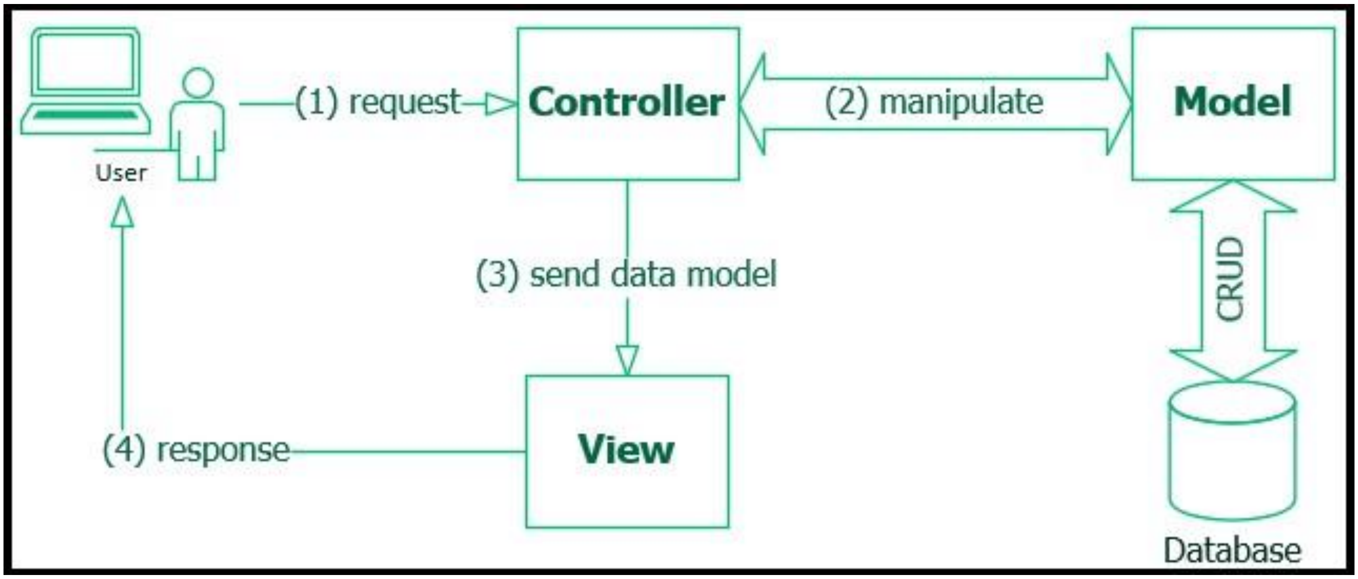


Figure 7 MVC Pattern

1. Model

One of the most important components of the MVC pattern. This is the department responsible for data management. The model has the function of transporting information from the content to display to the user through the screen and processing the information so that the user can easily access it. Model is completely independent of the rest of the components in MVC, and it contains the most necessary tasks for the programming process.

2. View

The next component we will talk about in the MVC pattern is the View. For users, the View has an essential role. It performs the task of creating user interactions and displaying the results from the Controller layer. At the same time, the View also receives the user's activities and requests to pass to the Controller for handling.

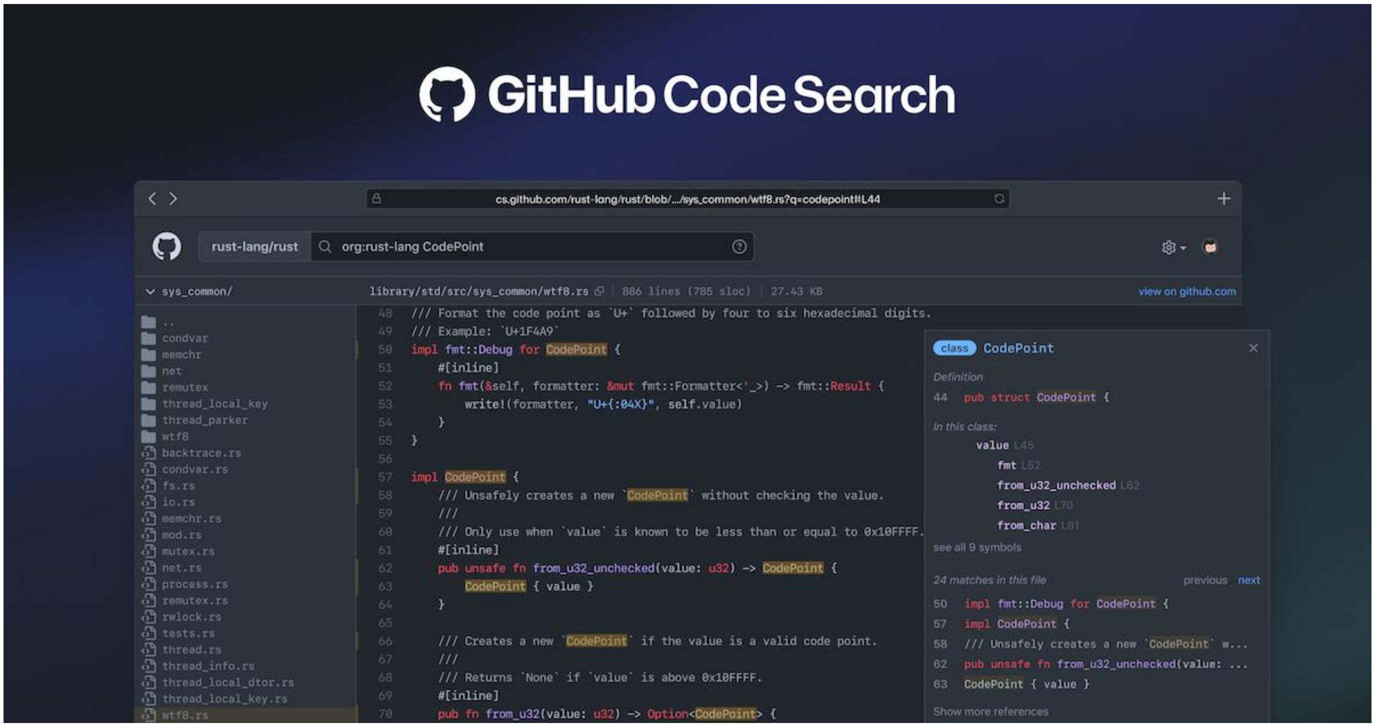
3. Controller

When it comes to components in a certain MVC model, it is impossible to ignore the Controller. Without this component, all Model or View operations are worthless. The controller performs the function of interactive connection between View and Model. It defines commands and executes command processing in the system. The Controller collates user actions from the View and interacts with the Model to convey the necessary information to the user.

2.3. Tools

2.3.1. Source Control: GitHub

A platform for collaboration and version control is called GitHub. It enables remote collaboration on projects between you and other people. You will learn about GitHub fundamentals like repositories, branches, commits, and pull requests in this tutorial.



```
/// Format the code point as `U+` followed by four to six hexadecimal digits.
/// Example: `U+1F4A9`
impl fmt::Debug for CodePoint {
    #[inline]
    fn fmt(&self, formatter: &mut fmt::Formatter<'_>) -> fmt::Result {
        write!(formatter, "U+{:04X}", self.value)
    }
}

impl CodePoint {
    /// Unsafely creates a new `CodePoint` without checking the value.
    ///
    /// Only use when `value` is known to be less than or equal to 0x10FFFF.
    #[inline]
    pub unsafe fn from_u32_unchecked(value: u32) -> CodePoint {
        CodePoint { value }
    }

    /// Creates a new `CodePoint` if the value is a valid code point.
    ///
    /// Returns `None` if `value` is above 0x10FFFF.
    #[inline]
    pub fn from_u32(value: u32) -> Option<CodePoint> {
```

```
class CodePoint
Definition
44  pub struct CodePoint {
In this class:
        value L45
            fmt L52
            from_u32_unchecked L62
            from_u32 L70
            from_char L81
see all 9 symbols

24 matches in this file                    previous  next
50  impl fmt::Debug for CodePoint {
57  impl CodePoint {
58  /// Unsafely creates a new `CodePoint` w...
62  pub unsafe fn from_u32_unchecked(value: ...
63  CodePoint { value }
Show more references
```

Figure 8 Github

Benefit of GitHub

- It makes it easy to contribute to your open source projects
- Documentation
- Showcase your work
- Markdown
- GitHub is a repository
- Track changes in your code across versions
- Integration options

2.3.2. Database Management Tools: MySQL

An open-source relational database management system called MySQL was first made available in 1995. In terms of popularity across all databases, MySQL is regarded as the second most popular, only behind Oracle Database. MySQL is the most widely used open-source database at the moment. In addition to being offered under a number of proprietary licenses, MySQL is licensed under the GNU General Public License. Michael "Monty" Widenius, the creator of MySQL, forked MySQL into MariaDB, a free, open-source database, with the goal of keeping the MariaDB project free and open source forever, before Oracle acquired MySQL AB in 2010.

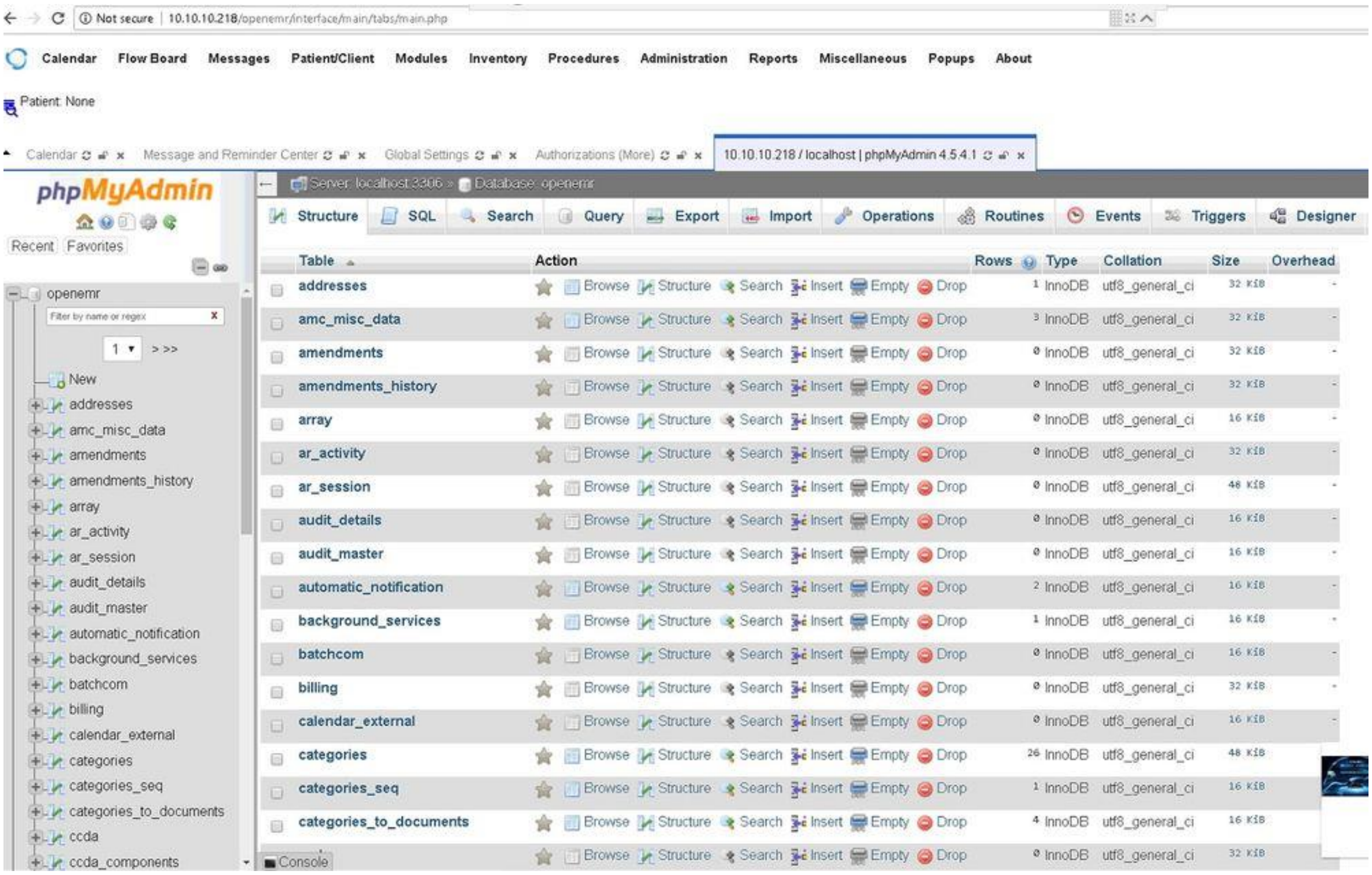


Table	Action	Rows	Type	Collation	Size	Overhead
addresses	Browse Structure Search Insert Empty Drop	1	InnoDB	utf8_general_ci	32 KiB	-
amc_misc_data	Browse Structure Search Insert Empty Drop	3	InnoDB	utf8_general_ci	32 KiB	-
amendments	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	32 KiB	-
amendments_history	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	32 KiB	-
array	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	16 KiB	-
ar_activity	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	32 KiB	-
ar_session	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	48 KiB	-
audit_details	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	16 KiB	-
audit_master	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	16 KiB	-
automatic_notification	Browse Structure Search Insert Empty Drop	2	InnoDB	utf8_general_ci	16 KiB	-
background_services	Browse Structure Search Insert Empty Drop	1	InnoDB	utf8_general_ci	16 KiB	-
batchcom	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	16 KiB	-
billing	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	32 KiB	-
calendar_external	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	16 KiB	-
categories	Browse Structure Search Insert Empty Drop	26	InnoDB	utf8_general_ci	48 KiB	
categories_seq	Browse Structure Search Insert Empty Drop	1	InnoDB	utf8_general_ci	16 KiB	
categories_to_documents	Browse Structure Search Insert Empty Drop	4	InnoDB	utf8_general_ci	16 KiB	
	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8_general_ci	32 KiB	

Figure 9 MySQL

Benefits of MySQL

- Easy to Use
- Secure
- Open Source
- Scalable
- Reliable

2.3.3. Diagram: Draw.io

Draw.io is a proprietary tool created by Seibert Media for creating charts and diagrams. The software gives you the option to design a custom layout or use the automatic layout feature. They offer a wide variety of shapes and several visual components to help you create a unique diagram or chart. A great-looking diagram or chart can be easily created using the drag-and-drop capability.

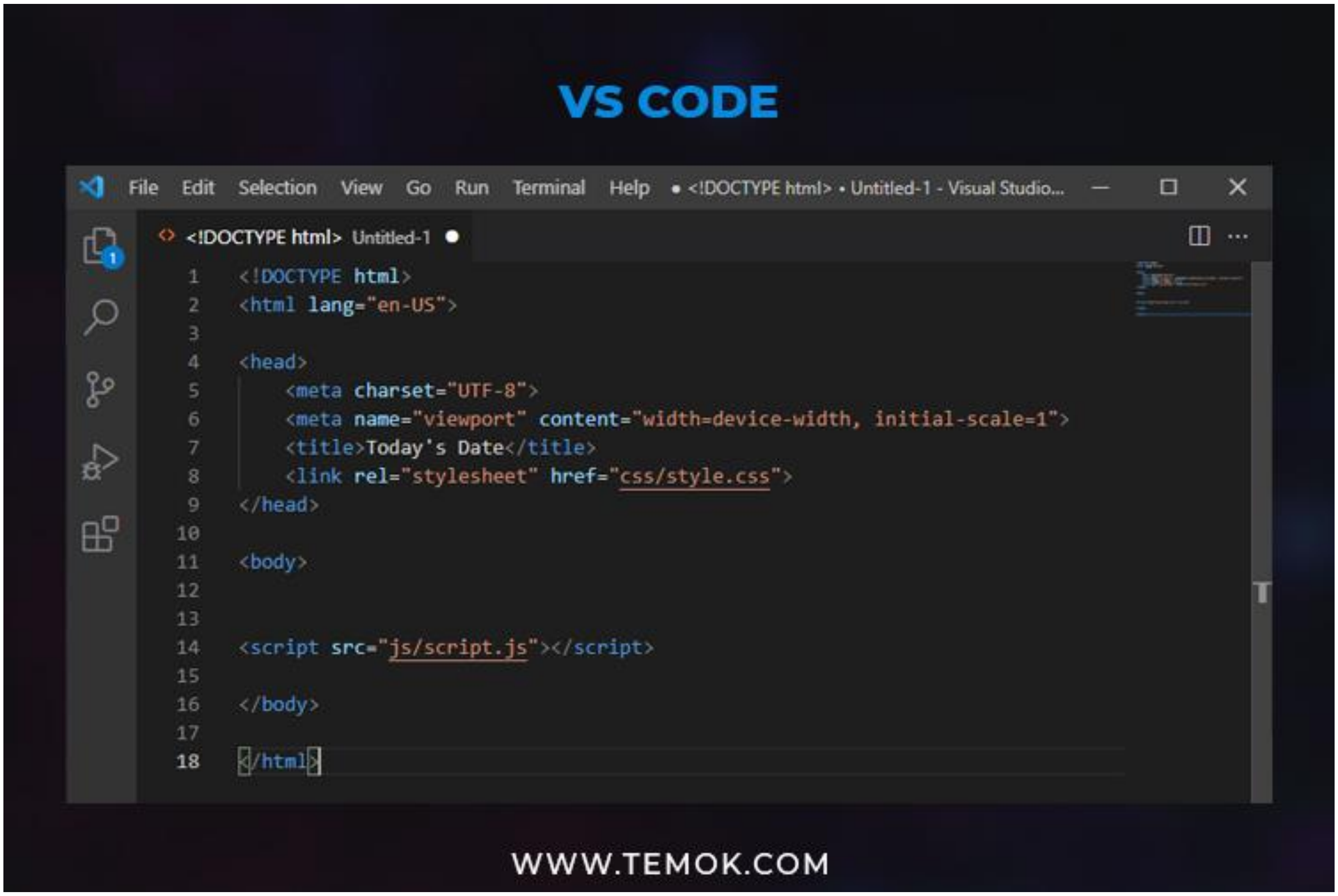
2.4. Compare the differences between the various software development tools and techniques researched and justify your preferred selection as well as your preferred software development methodology (M2)

2.4.1. IDE

Visual Studio Code

On the desktop for Windows, Linux, and macOS, Visual Studio Code is a potent source code editor. Node.js, TypeScript, and Javascript are all supported by this compact system. Additionally, it offers a wide range of extensions for the languages Python, PHP, Java, C++, C#, and Go.

The code completion tool IntelliSense is also included in VSCode. It provides a variety of features that help developers code more quickly and easily, including variables, methods, graphical debugging, imported modules, multi-cursor editing, and parameter hashes. In a short period of time, this code editor has grown in popularity and developed a solid reputation among engineers.


VS CODE
File
Edit
Selection
View
Go
Run
Terminal
Help
● <!DOCTYPE html> • Untitled-1 - Visual Studio...
<!DOCTYPE html> Untitled-1 ●
WWW.TEMOK.COM

```
<!DOCTYPE html>
<html lang="en-US">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <title>Today's Date</title>
    <link rel="stylesheet" href="css/style.css">
</head>

<body>


<script src="js/script.js"></script>

</body>

</html>
```

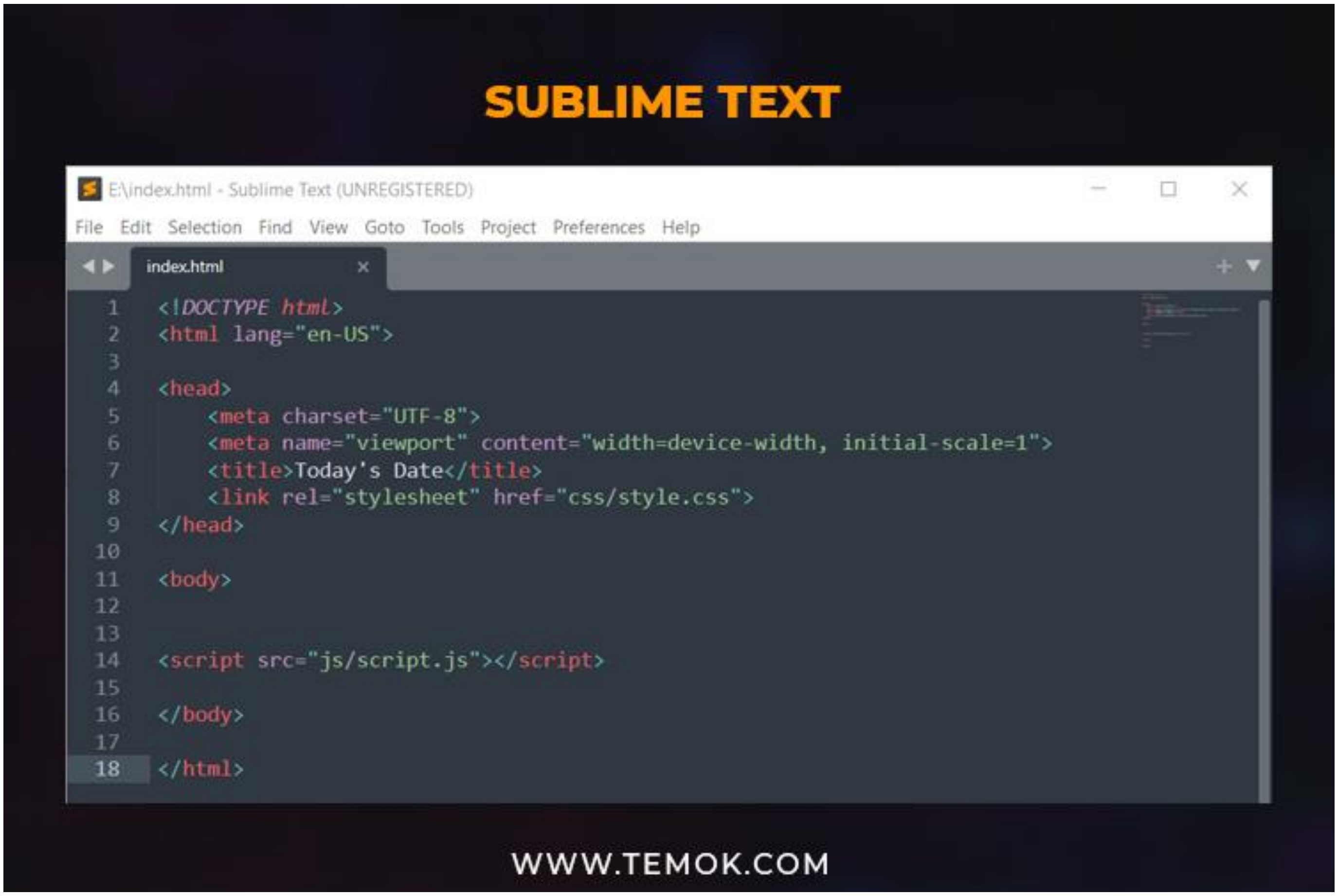
Figure 10 Visual Studio Code

Sublime Text

In comparison to VScode, it is an older code editor. Around 2007, a former Google employee created Sublime Text. Windows, Linux, and macOS all support the use of this code editor. It is a complex editor for markup, writing, and code. It is a cross-platform editor, but you should be aware that you must pay a license fee to use it. Although it gives a free trial to its users, the license charge is 80$, which is significantly more than VScode.

Developers can customize Sublime Text. The developers can increase their productivity and provide better results thanks to being one of the quickest and lightest code editors. For developers that want to

For developers, Sublime Text offers customization possibilities. As one of the quickest and lightest code editors, it enables developers to work more efficiently and produce higher-quality results. For developers looking for stability and performance, it may be a wise choice.


SUBLIME TEXT
E:\index.html - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
index.html
WWW.TEMOK.COM

```
<!DOCTYPE html>
<html lang="en-US">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <title>Today's Date</title>
    <link rel="stylesheet" href="css/style.css">
</head>

<body>


<script src="js/script.js"></script>

</body>

</html>
```

Figure 11 Sublime Text

Sublime Text vs VSCode Editor | Comparing the Differences (M2)

Sublime Text	VS Code
You can download Sublime Text for free, however, officially it is not	Visual Studio is Microsoft's free text editor that runs on Windows, Linux and MacOS
Sublime has native support for a few dozen programming language	VS Code allow you edit code in multiple programming languages
Sublime comes with code autocompletion for user-created variables & code folding	In VS Code, intuitive keyboard shortcuts and easy customization let you navigate your code with ease.

2.4.2. Design Pattern

MVC Pattern

A popular application design methodology for creating contemporary user interfaces is MVC, which stands for Model-View-Controller. As it developed from the object-oriented design community, the MVC pattern is at the core of contemporary object-oriented software development. In 1979, it was given the name Thing-Model-View-Edit; however, it was later made simpler and given the term Model-View-Controller. It is mostly employed in the design and creation of mobile and online applications. Model, View, and Controller are divided into three separate sections that make up an application's user interface.

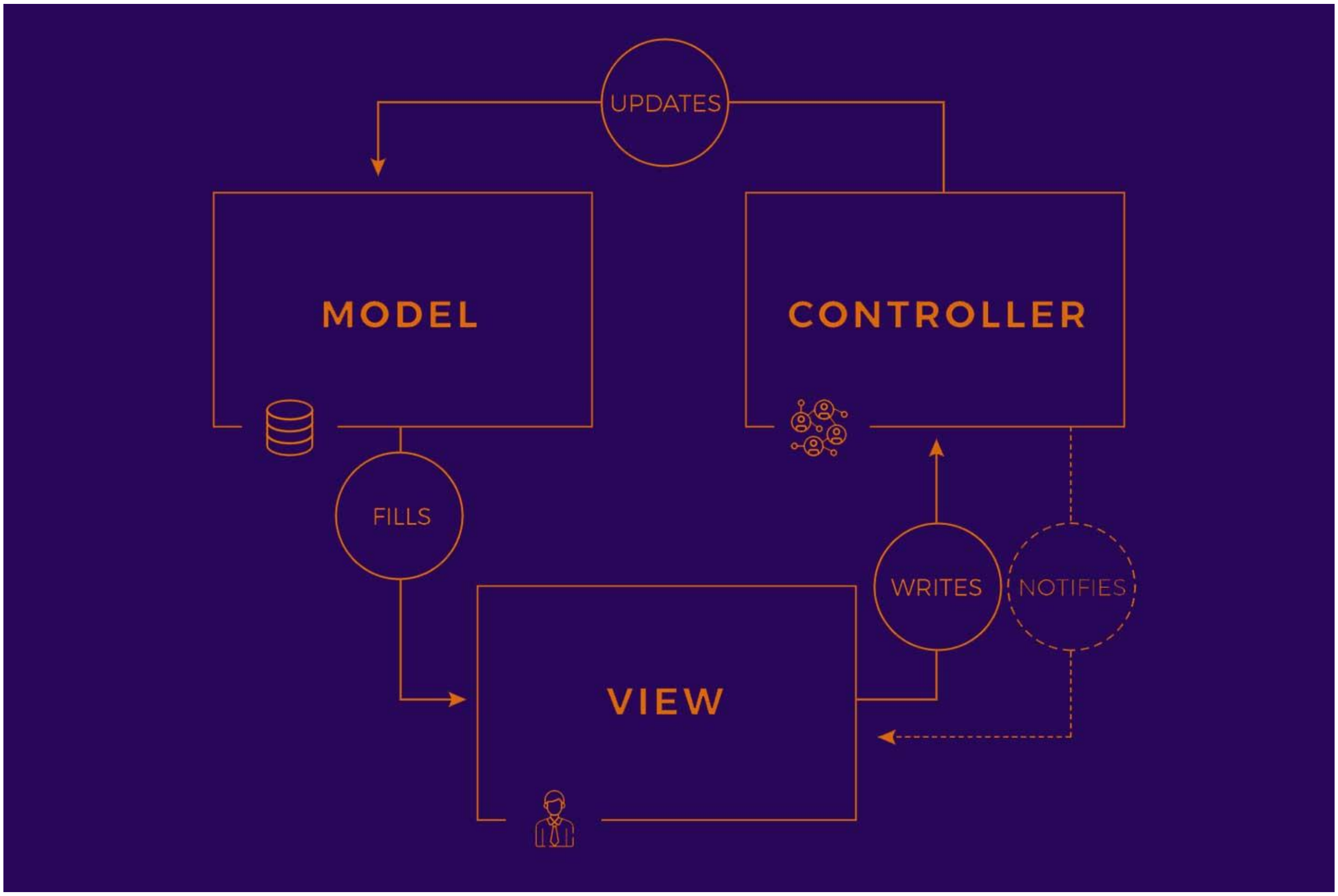


Figure 12 MVC Pattern

MVVM Pattern

MVVM, also known as Model-View-ViewModel, is a well-liked software architectural style frequently used for creating reusable and simple to test web applications. The MVC model is the foundation of MVVM, which enhances it by adding a new class called ViewModel that controls the data particular to the view. The main goal of the MVVM model is to effectively separate the components of the model and the view. Model, View, and ViewModel are the three main parts of the model.

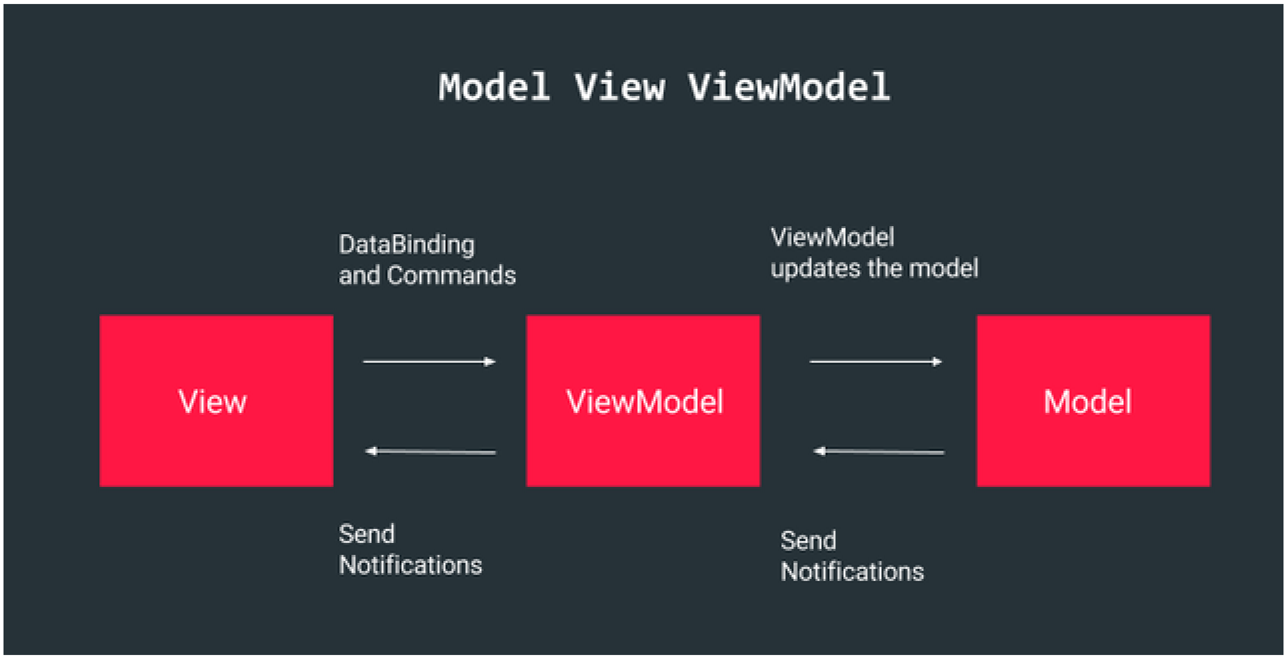


Figure 13 MVVM Pattern

Differences between MVC and MVVM (M2)

MVC	MVVM
MVC is an application design model commonly modern user interface.	MVVM is also an application design pattern used developing reusable and easily testable web applications.
The controller is responsible for managing the communication between a Model and a View	The View Model helps to keep the view separate from model and acts as the controllers
It creates a separation of concerns between the Model and the View components.	It allows the model and view to communicate with each other with the help of data binding.

III. Development tools and techniques

1. Cloud Provider

Building, managing, and delivering both small- and large-scale online and mobile apps are made possible by cloud service providers. They provide you access to a variety of online resources, like big data analytics, IoT, computation, and more, through virtual server hosting to speed up development. With plug-and-play features, cloud resources are frequently provided, enabling you to employ just the resources you require at the time you require them.

1.1. Some cloud providers

1.1.1. Amazon Web Services

Amazon Web Services (AWS) is the world-leading cloud vendor with over 200 integrated features and services. AWS offers a free tier that enables you to test various services free of charge and without any commitments. With 77 Availability Zones and 24 geographic regions, AWS makes up over 30% of the cloud market share.

Figure 14 Amazon Web Services

Advantages of using AWS

AWS is a fantastic platform, and there is an extensive list of advantages to using this provider. The list includes:

- Cost-effective
- Discount for long-term commitment
- Discount for high-volume usage
- Reliability
- Multiple deployment regions

- Vast and growing product offerings

1.1.2. Microsoft Azure

Like AWS, Microsoft Azure offers an abundance of on-demand computing services designed for efficient building in the cloud. Azure offers four different kinds of cloud computing: Infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), and serverless.

1.1.3. Heroku

Heroku is a trusted PaaS offering acquired by Salesforce in 2012. Its advantages include a free tier, easy-to-use / developer-centric platform, and scalable hosting. The limitations include sleeping apps, expensive price structure, and limited data center locations. Heroku's key features include a comprehensive PaaS platform, database services, collaboration tools, and enterprise-grade solutions.

Figure 15 Heroku

Advantages of using Heroku

Heroku is a fantastic cloud platform for web and mobile apps development, and there is an extensive list of advantages to using this provider. The list includes:

- Ready-to-use infrastructure
- Easy deployment process
- DevOps team looking after the infrastructure 24/07
- Infrastructure management
- Faster app development and time to market
- Works with several programming languages and databases

- Developer-centric
- Built-in security

Google Cloud Platform

The Google Cloud, also known as Google Cloud Platform (GCP), is a platform of cloud computing technology that allows individuals, organizations, businesses, and agencies to build, develop, and operate Run your applications on the software system created by Google. Very popular applications today are used a lot by people such as Chrome browser, Google Map application, Google Apps, YouTube channel ...

Google Cloud provides all management solutions for businesses, helping businesses develop their technology systems correctly and modernly. Besides, GC also helps users and businesses solve problems such as Developer (development), Management (Management), Computer Engines, Mobile, Storage, and Big Data...

Another difference that GC brings compared to other cloud services is that the Datacenter system is always stable and has extremely high data security, helping to protect user and customer data from prying eyes. and unauthorized intrusion of technology hackers.

Advantages of using Google Cloud Platform

- Faster time to market. You can spin up new instances or retire them in seconds, allowing developers to accelerate development with quick deployments
- Scalability and flexibility
- Cost savings
- Better collaboration
- Advanced security
- Data loss prevention

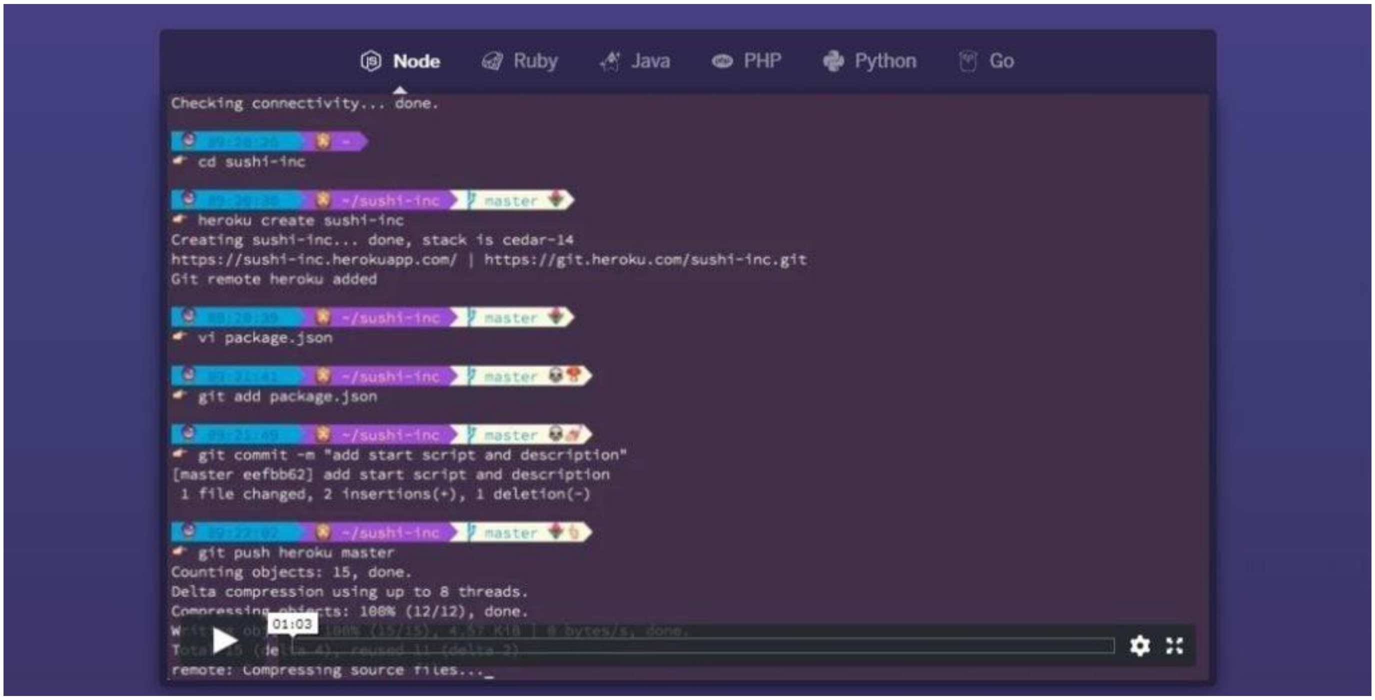
1.2. Different between AWS and Heroku (M2)

Both AWS and Heroku are well-liked cloud services that are considered by developers and companies across the world for their needs in the creation, maintenance, and deployment of mobile apps. Despite having a connection, the two are not nearly the same. The PaaS service, Heroku, was created on the AWS infrastructure.

	AWS	**Heroku**
Overview	Largest cloud provider	Cloud platform to build, run, and operate apps.
Category	IaaS	PaaS
Created	2006	2007
Parent company	Amazon	Salesforce
Core products	Compute Storage Databases Networking and CDN Analytics Machine Learning Security & Identity	Container platform Continuous delivery and integration Workflows Metrics, auto-scaling, alerts, etc Managed databases Team collaboration
Ease-of-use	Easy	Very easy
Managed service	Most of the products are self-managed, but it also offers some managed solutions.	Yes
Flexibility	High	Medium
Control	High	Medium
Needs DevOps maintenance	Yes	No
Ready-to-use environment	No	Yes
Regions	27	2 – for regular plans 6 – for private spaces
Pricing	Less expensive	More expensive

1.3. Chosen Cloud

After research and development, I have chosen Heroku to be the Cloud for the project we develop. This is one of the Clouds we have selected based on comparisons and reviews with other Clouds. Of course, Heroku all meet the requirements that we set forth. It's one of the right Clouds.



```
Checking connectivity... done.

 ~
cd sushi-inc

 ~/sushi-inc  master
heroku create sushi-inc
Creating sushi-inc... done, stack is cedar-14
https://sushi-inc.herokuapp.com/ | https://git.heroku.com/sushi-inc.git
Git remote heroku added

 ~/sushi-inc  master
vi package.json

 ~/sushi-inc  master
git add package.json

 ~/sushi-inc  master
git commit -m "add start script and description"
[master eefbb62] add start script and description
 1 file changed, 2 insertions(+), 1 deletion(-)

 ~/sushi-inc  master
git push heroku master
Counting objects: 15, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (12/12), done.
Writing objects: 100% (15/15), 4.57 KiB | 0 bytes/s, done.
Total 15 (delta 4), reused 11 (delta 2)
remote: Compressing source files..._
```

Figure 16 Heroku Cloud

Here are five reasons why that's a good thing

- **Simplicity**: The genius of Heroku is that we never have to consider servers. Heroku conceals all of the server's complexity behind a user-friendly web interface. Deployments are easily accomplished with a single click after your app is up and running on the platform. Making a new "release branch" in our version control system, then clicking a button to deploy that branch to each of your environments, is all it takes to release a new version of your program (first to staging, and eventually to production). We can just concentrate on the code and leave the implementation to Heroku.
- **Security**: Maintaining servers' security patches can be a full-time effort, particularly when there are numerous servers running various complicated online applications, each of which has numerous components and dependencies. Heroku assumes responsibility for the servers' security by abstracting away the servers.
- **Stability**: Heroku may assist with issues with your application code in addition to providing platform-level problem-solving services. Heroku's runtime platform instantly recognizes an application failure or crash and launches a new instance of the app, smoothly redirecting traffic to the new instance and erasing the previous one. Your clients won't even be aware.
- **Uniformity**: Heroku makes sure all our applications function uniformly by enforcing a strict structure for how software is packaged and deployed. Because they immediately understand what needs to be done to

deploy a new release to production, the operations team doesn't need to think too much about the context. We can move more quickly and effectively.

2. Development languages

2.1. Programming languages

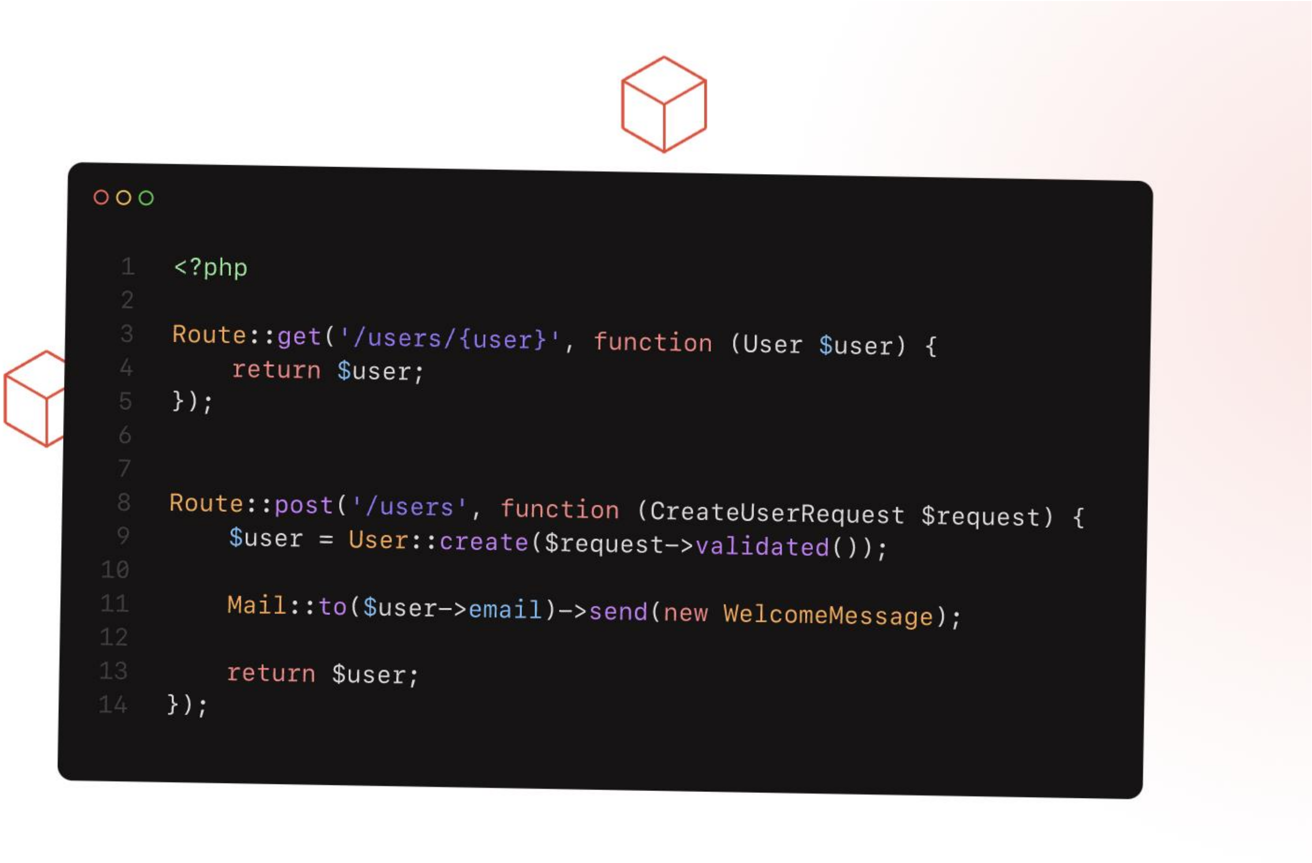
PHP Core

The abbreviation PHP stands for Hypertext Preprocessor: PHP. The server-side scripting language PHP was created primarily for building websites. Being open source, it is available for free download and use. It is incredibly easy to use and learn. The files have the ".php" extension.

2.2. Framework

Laravel

Laravel is a reliable and simple to use open-source PHP framework. It adheres to the model-view-controller pattern of design. Laravel makes use of pre-existing parts from other frameworks to build online applications. The resulting web application is more organized and practical.



```php
<?php

Route::get('/users/{user}', function (User $user) {
    return $user;
});


Route::post('/users', function (CreateUserRequest $request) {
    $user = User::create($request->validated());

    Mail::to($user->email)->send(new WelcomeMessage);

    return $user;
});
```

Figure 17 Laravel

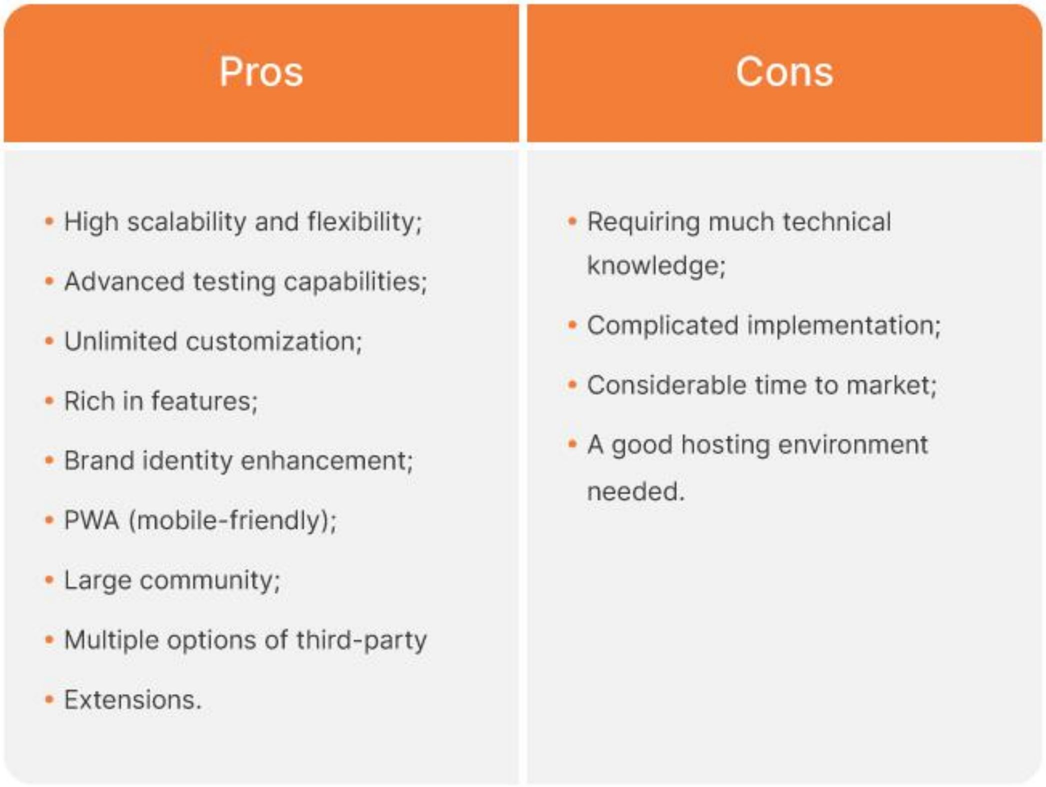
2.3. Compare advantages and disadvantages of Laravel (M2)

Advantages

- Easy to get started thanks to great documentation and community support and an intuitive interface
- The syntax is easy to understand and use, making it easy even for beginners to use
- Built-in libraries
- Easy to deploy to major cloud service providers such as AWS
- Powerful Blade Templating Engine
- Comes with security and authorization out-of-the-box
- Robust and scalable

Disadvantages

- Slower than some frameworks
- Less built-in support
- Has basic security features, but is still limited by the inherent insecurities of PHP



Pros	Cons
• High scalability and flexibility; • Advanced testing capabilities; • Unlimited customization; • Rich in features; • Brand identity enhancement; • PWA (mobile-friendly); • Large community; • Multiple options of third-party • Extensions.	• Requiring much technical knowledge; • Complicated implementation; • Considerable time to market; • A good hosting environment needed.

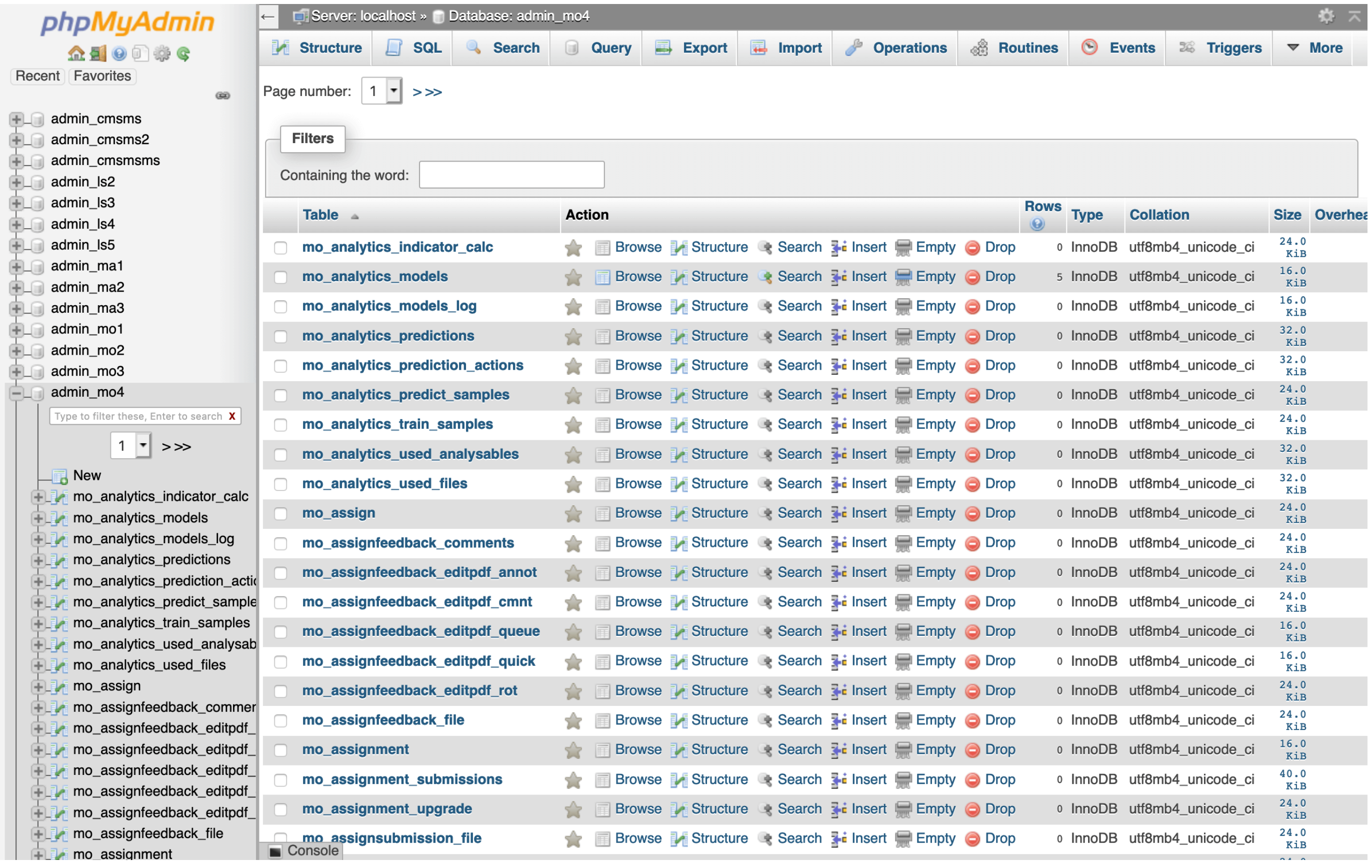
3. Database server

3.1. MySQL

In terms of popularity across all databases, MySQL is regarded as the second most popular, only behind Oracle Database. MySQL is the most widely used open-source database at the moment. It was given the name My, after the founder's daughter, and is regarded as one of the most dependable and effective databases available. My is known for classifying data into one or more data tables where different data kinds are associated to one another. Since relational databases are created, modified, and extracted using the SQL programming language, these relations aid in data structuring.

The MySQL server offers a database management system with querying, connectivity, and good data structure capabilities, as well as the ability to integrate with several platforms. In extremely demanding production applications, it is capable of reliably and quickly handling massive databases. The MySQL server also offers a variety of useful features, including connectivity, speed, and security, which make it excellent for database access.

A client and server system is used by the MySQL server to operate. A multi-threaded SQL server, many client applications and libraries, administrative tools, and a large number of application programming interfaces (APIs) are all included in this system.



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Filters

Containing the word:

	Table	Action	Rows	Type	Collation	Size	Overhea
□	mo_analytics_indicator_calc	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_analytics_models	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_unicode_ci	16.0 KiB	
□	mo_analytics_models_log	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	16.0 KiB	
□	mo_analytics_predictions	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	
□	mo_analytics_prediction_actions	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	
□	mo_analytics_predict_samples	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_analytics_train_samples	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_analytics_used_analysables	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	
□	mo_analytics_used_files	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	32.0 KiB	
□	mo_assign	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignfeedback_comments	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignfeedback_editpdf_annot	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignfeedback_editpdf_cmnt	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignfeedback_editpdf_queue	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	16.0 KiB	
□	mo_assignfeedback_editpdf_quick	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	16.0 KiB	
□	mo_assignfeedback_editpdf_rot	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignfeedback_file	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignment	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	16.0 KiB	
□	mo_assignment_submissions	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	40.0 KiB	
□	mo_assignment_upgrade	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	
□	mo_assignsubmission_file	Browse Structure Search Insert Empty Drop	0	InnoDB	utf8mb4_unicode_ci	24.0 KiB	

Figure 18 MySQL

You can utilise the free open-source MySQL database. With this programme, you can effectively manage your data because it is a very strong, reliable, and stable solution. The use of MySQL has the seven benefits listed below.

- Data Protection
- Scalability on Demand
- High Efficiency
- 24/7 Uptime
- Outstanding Transactional Support
- Excellent Workflow Control
- Lower Total Ownership Cost

The MySQL system is unique in that it assures continuous uptime. Aside from that, it provides a plethora of options, such as slave/master replication settings and unique cluster servers.

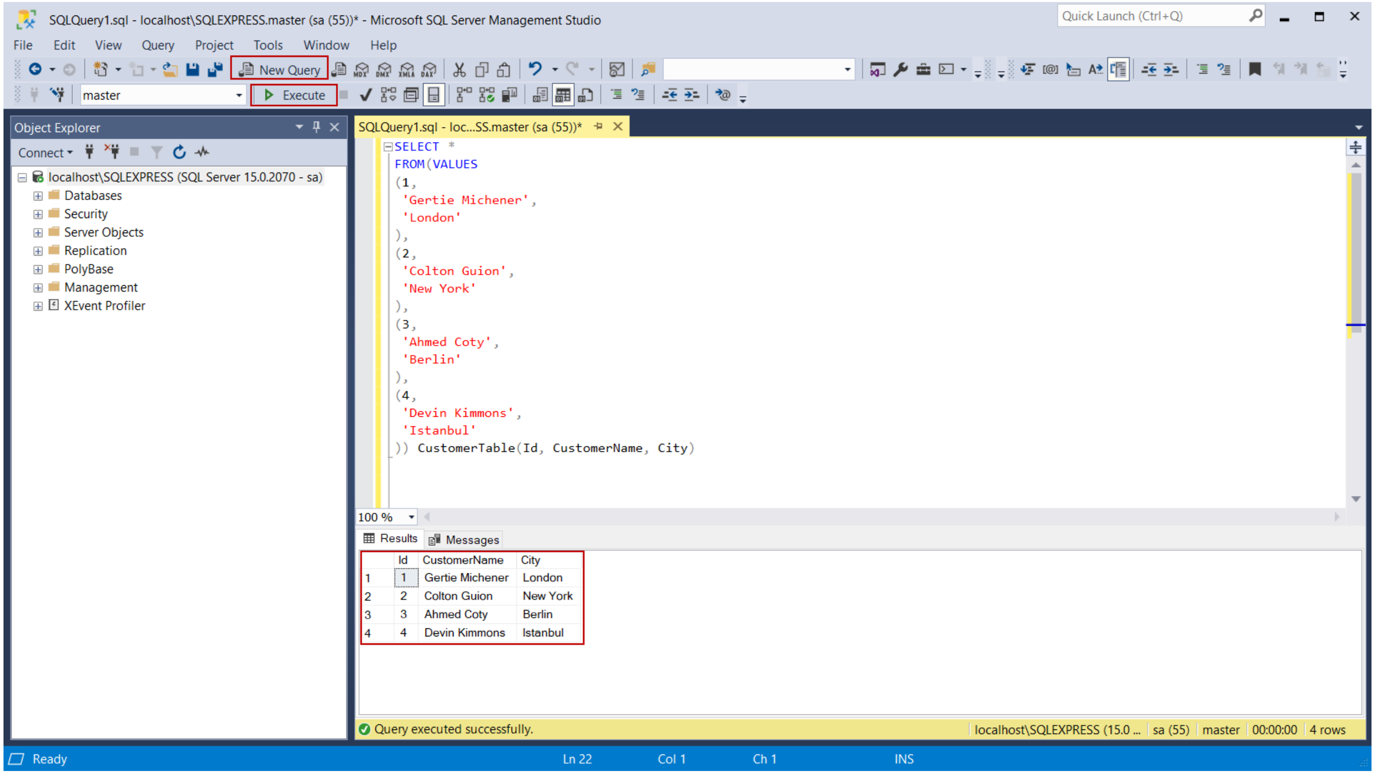
3.2. SQL Server

Microsoft created the relational database management system (RDBMS) known as SQL Server. It was created largely to compete with MySQL and Oracle databases. The standard SQL (Structured Query Language) language is supported by SQL Server.

Microsoft introduced a data engine called SQL Server. It offers a setting for setting up and managing databases. It enables effective and safe storage. It offers additional parts and services that enable the business intelligence platform create reports and aid in data analysis.

We can configure, manage, and administer SQL Server database engines using the sophisticated development environment known as Microsoft SQL Server Server Management. Due to the following benefits, SSMS is highly regarded and employed by database administrators and developers:

- Cost-free
- Advanced user experience
- Various add-in options
- Easy installation



```
SELECT *
FROM(VALUES
(1,
 'Gertie Michener',
 'London'
),
(2,
 'Colton Guion',
 'New York'
),
(3,
 'Ahmed Coty',
 'Berlin'
),
(4,
 'Devin Kimmons',
 'Istanbul'
)) CustomerTable(Id, CustomerName, City)
```

	Id	CustomerName	City
1	1	Gertie Michener	London
2	2	Colton Guion	New York
3	3	Ahmed Coty	Berlin
4	4	Devin Kimmons	Istanbul

Query executed successfully.

Figure 19 SQL Server

3.3. Difference between MySQL and MS SQL Server

The term "SQL" stands for "Structured Query Language." It is employed to access, modify, and retrieve data from databases.

Based on Structured Query Language, MySQL is an open-source Relational Database Management System (RDBMS) (SQL). Operating systems like Linux, UNIX, and Windows are supported.

Microsoft Corporation is the owner and developer of SQL Server. The main job of SQL Server is to store and access data as needed by other applications, whether those apps are running on the server computer or on other computers linked to a network.

MS SQL Server	MySQL
Developed by Microsoft.	Developed by Oracle.
It supports programming languages like C++, JAVA, Ruby, Visual Basic, Delphi, R etc.	MySQL offers extended running support for languages like Perl, Tcl, Haskey etc.
Expects a large amount of operational storage space.	Expects less amount of operational storage space.
It enables for stopping query execution.	It doesn't allow query cancellation mid-way in the process.
Doesn't block the database while backing up the data.	Blocks the database while backing up the data.
It is not free.	It is open source. It is freely available.
It is a highly secured and doesn't allow any kind of database file manipulation while running.	It allows database file manipulation while running.
It is available in multiple editions, such as Enterprise, Standard, Web, Workgroup, or Express.	It is available in MySQL Standard Edition, MySQL Enterprise Edition, and MySQL Cluster Grade Edition.

4. Software Models

The planning, creation, testing, and deployment phases of a project are referred to as the application development methodology. What individuals and businesses consider to be appropriate development methods might vary widely.

My team prefers the following methodologies.

- Waterfall methodology
- Spiral Model

4.1. Spiral Model

Like the incremental model, but with a stronger focus on risk analysis, is the spiral model. The planning, risk analysis, engineering, and evaluation phases make up the spiral model's four stages. These stages are iterated through repeatedly in a software project. In the planning stage, needs are obtained as part of the baseline spiral, and risk is evaluated. The foundation spiral is built upon by each succeeding spiral.

The requirements phase is when they are gathered. To identify risk and potential solutions, a procedure is used in the risk analysis phase. At the conclusion of the risk analysis phase, a prototype is created. In the engineering phase, software is created, and testing is done at the end of the phase. Before moving on to the next cycle in the project, the evaluation phase enables the client to assess the results of the project thus far. The spiral's radius in the spiral model stands in for expense, whereas the angular component indicates progress.

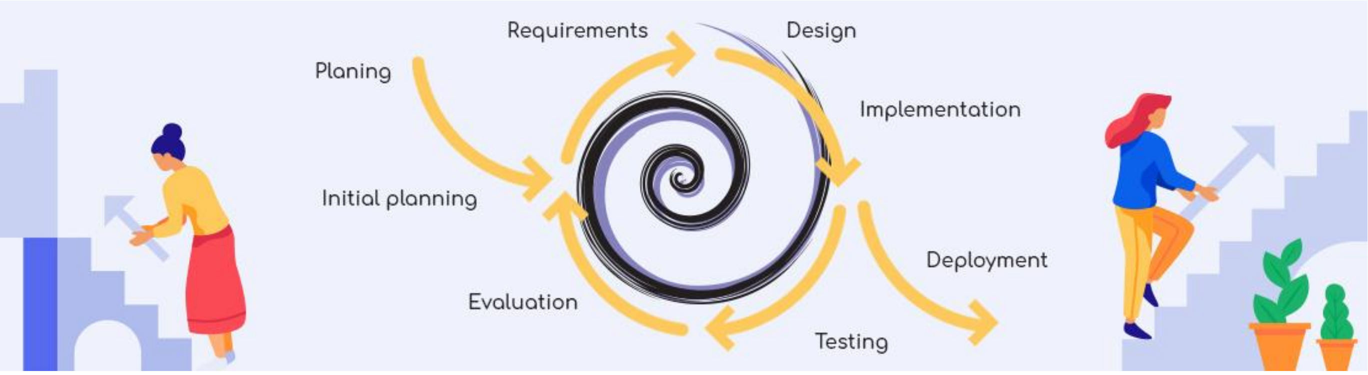


Figure 20 Spiral Model

Positive Situations

- Thorough evaluation of hazards
- Effective for sizable and strategic endeavors.
- Early in the product life cycle, software is developed.

Weaknesses

- Using this model might be expensive.
- Conducting risk analysis calls for very explicit mastery.
- The stage of risk investigation is particularly important to the success of the project.
- Doesn't perform well for little projects.

4.2. Waterfall methodology

The waterfall model is the common method for developing applications. This model, which is most certainly the most well-established paradigm, is widely used by the government and many significant institutions. With this process, planning is prioritized early on, ensuring that setup errors are avoided before they happen. Additionally, because of its superior track record and organization, it excels for projects where quality control is a top priority.

The pure waterfall lifespan has a few distinct stages, as seen in the accompanying diagram. The framework prerequisites and programming needs are first created, and then the model moves on to engineering configuration, detailed configuration, coding, testing, and maintenance. The cascade model functions as a yardstick for several other lifecycle models.

The following overview describes how to use the cascade beginning coding in more detail. Between stages, there is no cover. However, it is possible to discover problems during the design or coding phases that highlight errors or gaps in the requirements.

Returning from one stage to another, like as from the plan stage to the requirements stage, is not prohibited by the waterfall approach. This includes pricey modifications, in any case. Formal audits and extensive documentation updates are necessary for each completed stage. Therefore, it is expensive to correct mistakes made during the requirements phase. One waits a bit before seeing benefits because the true improvement always comes later than expected. The board may find this postponement frustrating.

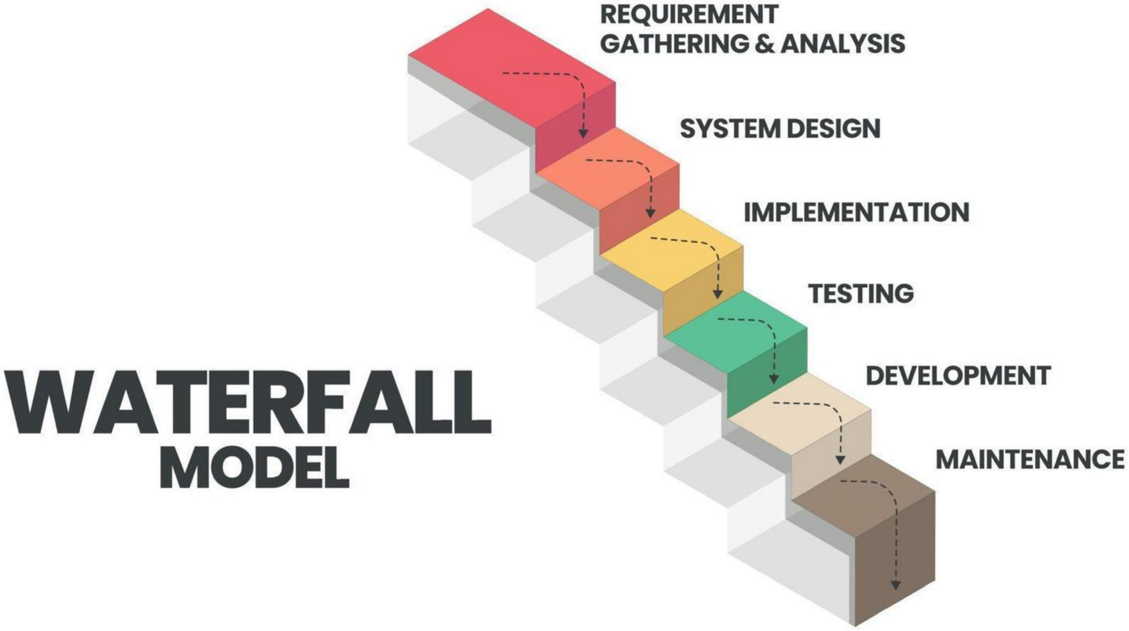


Figure 21 Waterfall

Advantages:

- Simple to understand and implement.
- Widely used and well-known.
- Strengthens excellent tendencies: Explain before-plan and before-code structure
- The distinction between goals and results.

Disadvantages:

- Idealized and poorly synchronized with reality does not reflect the exploratory shift of events' iterative idea.
- To start the project by anticipating precise needs is unrealistic.
- Software is delivered toward the end of the work, delaying disclosure of real errors.

4.3. Difference between Waterfall Model and Spiral Model (M2)

Waterfall Model	Spiral Model
The Waterfall model is simple and easy.	The spiral model is a lot more complex.
The waterfall model works in a sequential method.	While the spiral model works in the evolutionary method.
In the waterfall model errors or risks are identified and rectified after the completion of stages.	In the spiral model errors or risks are identified and rectified earlier.
The waterfall model is adopted by customers.	While the spiral model is adopted by developers.
The waterfall model is applicable for small projects.	While the Spiral model is used for large projects.
In waterfall model requirements and early-stage planning is necessary.	While in spiral model requirements and early-stage planning is necessary if required.
Flexibility to change in waterfall model is Difficult.	Flexibility to change in spiral model is not Difficult.
There is high amount risk in waterfall model.	There is low amount risk in spiral model.
Waterfall model is comparatively inexpensive.	While cost of spiral model is very expensive.
Customer involvement is minimum in Waterfall Model	In the Spiral Model Customer involvement is high.
It requires least maintenance.	It requires typical maintenance.
It is based on linear framework type.	It is based on linear and iterative framework type.
Testing is done after the coding phase in the development life cycle.	Testing is done after the engineering phase in the development cycle.

Waterfall Model	Spiral Model
Reusability is extremely unlikely.	To a certain extent, reusability is possible.
Customer control over the administrator is very limited.	Customers have control over the administrator as compared to waterfall model.

IV. Conclusion

In this assignment, I have presented the definition of UML and given some specific UML building tools above. There are many prominent types of UML built and developed based on Behavior and Structure. Next in section II.2 I presented the design tools that I chose.

With the design tools selected I used ***Diagrams.net (Draw.io)*** to build and develop the Use Case Diagram. With this tool, I have felt it provides my project with the necessary and complete features and benefits it brings. We built on that design. To learn more, we have a detailed presentation at SRS.pdf.

My team and I discussed and decided to choose the ***Waterfall software development model*** to build and develop the project for the following reasons:

- With the Waterfall model we can impose a tightly structured organization
- Allows early design changes

Besides, thanks to the 6 stages of Requirement - Design - Implementation (build) - Verification - Deployment - Maintenance we can clearly define the task and steps we need to implement the project. judgment.

For the development environment, I have chosen ***Visual Studio Code*** as one of the IDEs that I trust and use. I have presented a comparison of VS Code with Sublime Text in II.2.4.1 all my proofs are given clearly and completely. For VSCode I found, the IDE helps us have a good format, and the structure for development based on the MVC model is also clearly presented. And accordingly using VSCode will make it easier for us to install more extensions so that we can have other tools to support the development process.

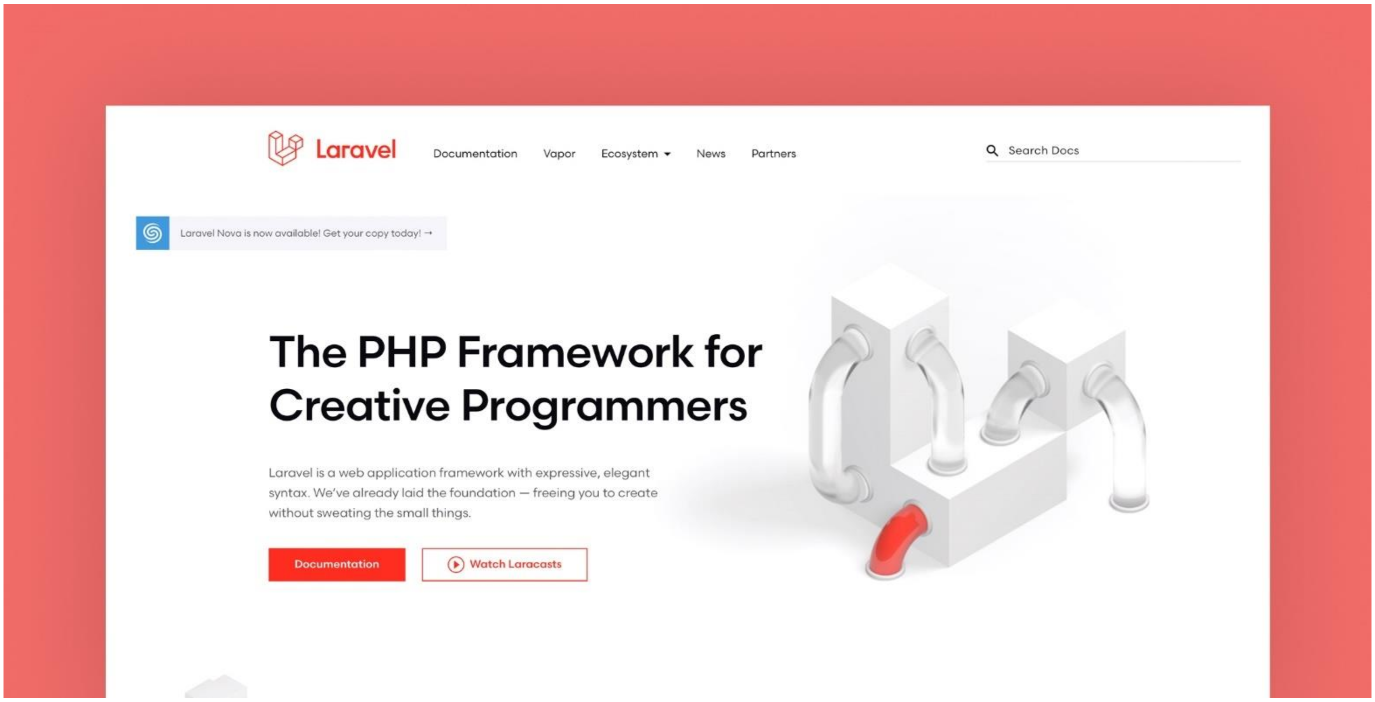
In application and project development, our goal is to build a training management system. The selection of tools and languages, libraries, and frameworks are selected by us to suit the requirements and optimization of the system.

For the interface (Frontend), we will develop based on ***Boostrap 5.2 library***, I believe with Boostrap we will be easy and fast in determining and developing optimal UX/UI for users. That is also one of the important issues we aim at in this project.

```
<!DOCTYPE html>
<html>
<head>
  <title>Template</title>
  <link rel="stylesheet"
href="css/bootstrap.min.css">
</head>
<body>
```

Figure 22 Boostap

Along with that, on the backend side, we chose the PHP programming language and developed based on the Laravel framework to develop the project according to the original choice model. With ***<u>the MVC model, Laravel</u>*** is a very supportive framework and is also showing its structure when implementing and developing.



Laravel Nova is now available! Get your copy today! →

The PHP Framework for Creative Programmers

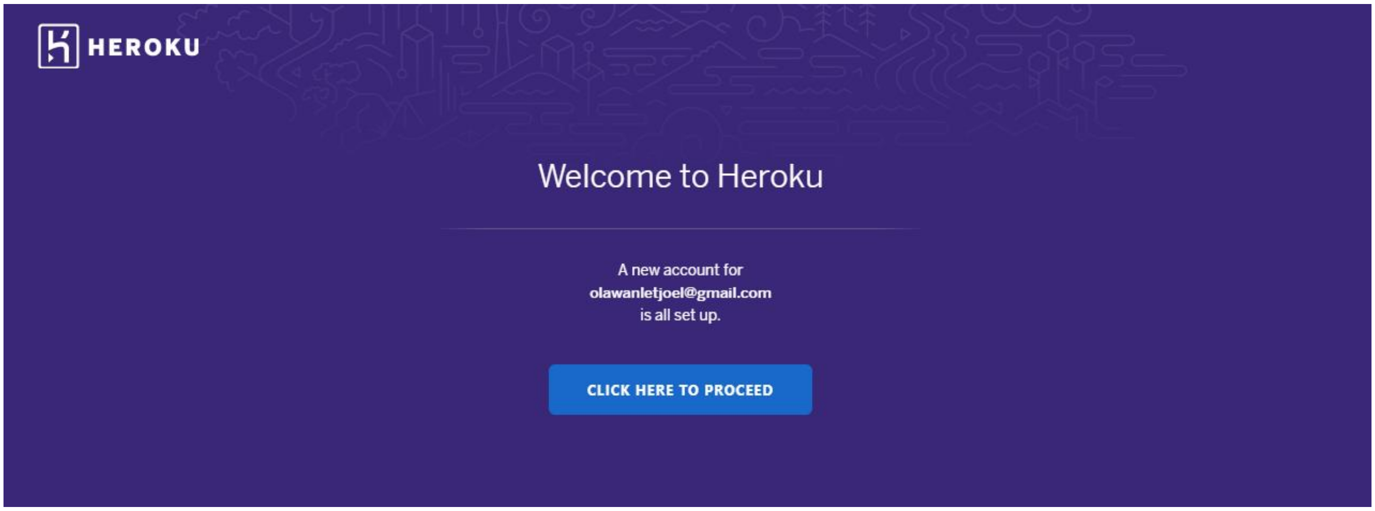
Laravel is a web application framework with expressive, elegant syntax. We've already laid the foundation — freeing you to create without sweating the small things.

Figure 23 Laravel

Besides, the database is one of the equally important development steps. To be able to combine smoothly with the PHP/Laravel programming language, we have chosen ***<u>MySQL</u>*** as one of the most suitable databases for project development. As part III.3.3 I also clarified the comparison of the strengths and weaknesses of MySQL for the training system I am developing.

Figure 24 MySQL

Finally, after the steps were developed, we reviewed and selected ***Heroku*** as a hosting and cloud service provider to put the entire system we built. I also clarified the usage of Heroku and AWS in section III.1.2.



Welcome to Heroku

A new account for
olawanletjoel@gmail.com
is all set up.

Figure 25 Heroku

In summary, I have presented clearly and in detail, all the requirements of the system and the FPT Co. was given. In addition, detailed development versions of the system specification requirements have also been presented and clarified in the **SRS.pdf** file (attached). All our development will be built and developed based on the requirements defined above.

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