ASSIGNMENT 1 FRONT SHEET

Qualification	BTEC Level 5 HND Diploma in Computing		
Unit number and title	Unit 30: Application Development		
Submission date		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	Duc Minh

Grading grid

P1	P2	P3	M1	M2	D1

☐ Summative Feedback:	☐ Resubmission Feedback:

Grade:	Assessor Signature:	Date:
Signature & Date:		

1. Explore a business-related problem and produce a well-defined Problem Definition Statement supported by a set of user and system requirements (P1).

1.1. Sign-offs

I agree that this document represents our best understanding of the requirements for this project today and the system described will satisfy our needs. I agree to make future changes in this baseline through the project's defined change process. I realize that approved changes might require us to negotiate the cost, resources, and schedule commitments for this project.

1.2. Introduction

1.2.1. Purpose

FPTBook will be a web-based software system that helps customers and bookstore owners manage their books buying and selling involves simplifying and speeding up the selection, ordering, and purchasing process books for customers as well as managing user and product databases for bookstore owners

1.2.2. Scope

Goal: create a web-based software system to assist customers and bookstore owners in managing their book purchases and sales by simplifying and speeding up the selection, ordering and purchasing process books for customers as well as manage the user database and the product database for bookstore owners

Benefits: with our system, it will be really easy to manage and maintain the entire working environment for the store. It also helps to reduce the workload.

Objectives: turn all data to database, made them online so that it can be accessed from anywhere with internet connection, create a friendly user interface so that everyone can use, set up the role and authorities for each person on the system by coding the back-end.

1.2.3. Intended Audience and Reading Suggestions

This document is intended to be used by members of the project teams who will implement and verify the correct functioning of the system.

1.2.4. Project Scope

This product for FPT Co. is a web-based application that will allow users to manage their course and topic about training activity of the company with easy to use user interface. This application can give users and administrators the rights to interact with data based on the level of each of them.

1.2.5. References

1.3. High Level Requirements

1.3.1. Product Perspective

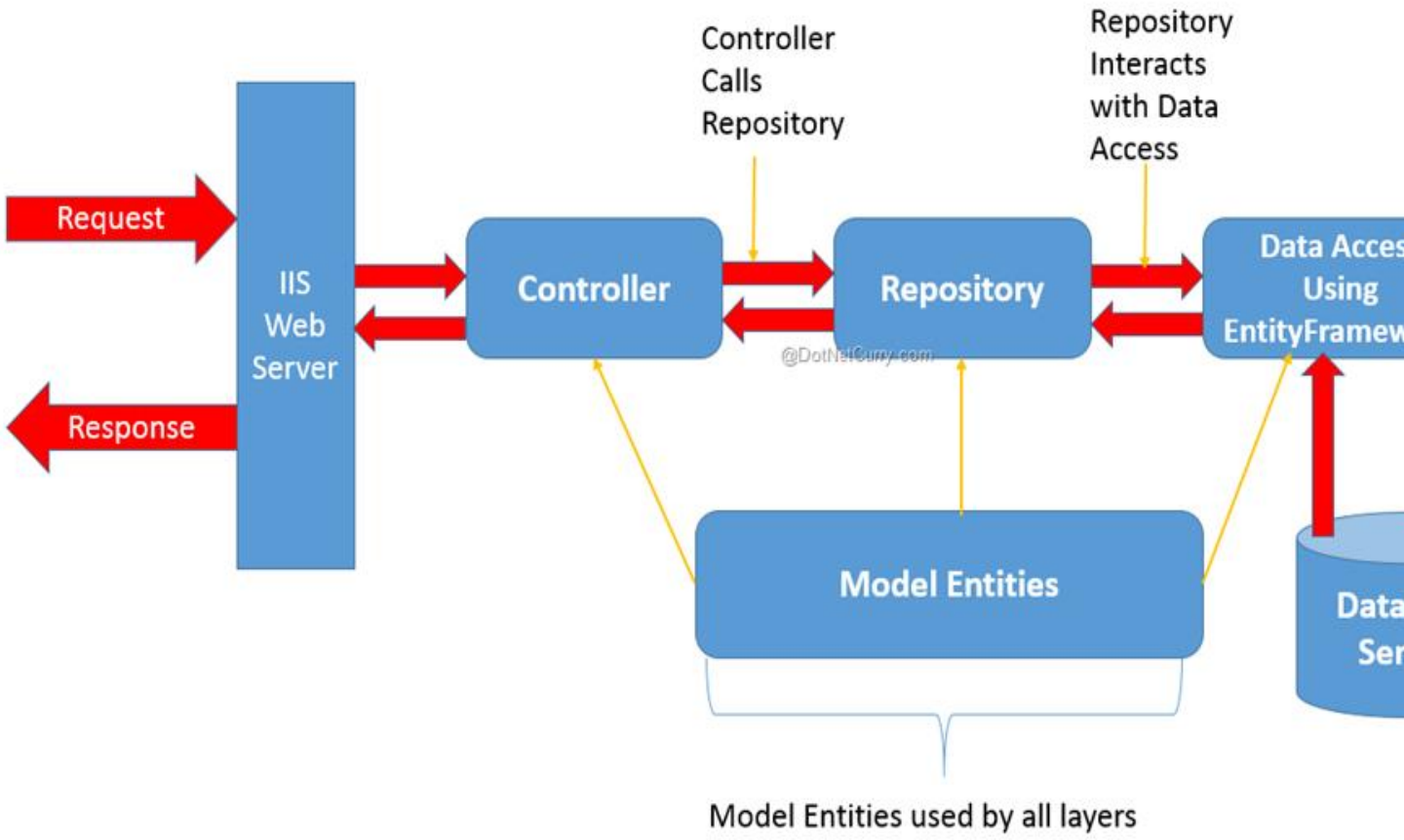

Figure 1. Product Perspective

1.3.2. Product Features

- PF-1: Log in with the correct account
- PF-2: User permissions are divided into levels for clear interaction
- PF-3: seller can add/edit/delete properties of products
- PF-4: seller can manage system and data
- PF-5: Training staff can create training courses for Trainees
- PF-6: the seller can create an account to add or remove customer information
- PF-7: customers can add/update/delete categories
- PF-8: customers can edit their order information before placing an order in the shopping cart.

1.3.3. User Classes and Characteristic

System Administrator	This is the highest one who has full permission to access to the web-based application. They have ability to do all of things that Training Staff and Trainee can do. As this place, the hole system is managed by this one.
	Sellers is people who creates courses, categories about training activities, and Trainers accounts. Their accounts are provided by System Administrators and permissions are limited by System Administrators as well.
	Customer is people who creates/ updates/ deletes topics about courses that they have to train. The courses are assigned to Trainers by Training Staffs. Trainers can assign Trainees into the courses and topics for them as well.

Table 1. User Classes and Characteristic

1.3.4. Operating Environment

OE-1	The system will always be updated and run stably on all web browsers
OE-2	Users can access the system at all times
OE-3	User data will be stored at SQL server, and security is always a priority to avoid exposing user information outside
OE-4	This program is intended for use by customers and booksellers

Table 2. Operating Environment

1.3.5. Design and Implementation Constrains

All data shall be stored on the SQL server

1.3.6. User Documentation

No user documentation information at this time.

1.3.7. Assumptions and Dependencies

AS-1	Users have account can log in to the website.
AS-2	Users have JavaScript enabled.
DE-1	Azure for customer accounts is free.

Table 3. Assumptions and Dependencies

1.4. System Features

1.4.1. Login as correct account

1.4.1.1. Description and Priority

Users has to be login as correct accounts that they had in order to access to the system.

Priority: High

1.4.1.2. Stimulus/Response Sequences

Stimulus:	User request to login
Response:	System retrieves and displays login form
Stimulus:	User request to fill lack of information
Response:	System retrieves and warns users to fill in blank areas
Stimulus:	User request to login with wrong account
Response:	System retrieves and denies login process

1.4.1.3. Functional Requirements

Login View	The system shall provide login form interface

Login Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit
Login Cancel	The system shall check the information of accounts with the database, if it's wrong then notices user login has been denied

1.4.2. Users rights is divided into levels for clearly interacting

1.4.2.1. Description and Priority

Each user has each right based on the level to interact with system. This ensure that the system can work well, prevent external access to some unique functions, and protect the security of the system.

Priority: High

1.4.2.2. Stimulus/Response Sequences

Stimulus:	User request to interact with system as Administrator level
Response:	System retrieves and provides functions as Administrator level
Stimulus:	User request to interact with system as Training Staff level
Response:	System retrieves and provides functions as Training Staff level
Stimulus:	User request to interact with system as Trainer level
Response:	System retrieves and provides functions as Trainer level
Stimulus:	User request to interact with system as Trainee level
Response:	System retrieves and provides functions as Trainee level

1.4.3. Seller can create/ edit/ delete Training Staffs accounts

1.4.3.1. Description and Priority

Administrator build the system basis. They create, edit, or delete Training Staffs accounts and the Training Staffs team will continue build the other things that necessary with system.

Priority: Medium

1.4.3.2. Stimulus/Response Sequences

Stimulus:	User request to create account
Response:	System retrieves and displays create account form
Stimulus:	User request to fill lack of information
Response:	System retrieves and warns users to fill in blank areas
Stimulus:	User request to submit created account to the database
Response:	System retrieves and storage account information in the database

Stimulus: User request to edit account

Response: System retrieves and displays edit account form

Stimulus: User request to fill lack of information

Response: System retrieves and warns users to fill in blank areas

Stimulus: User request to edit created account in the database

Response: System retrieves and update account information in the database

Stimulus: User request to delete account

Response: System retrieves and displays list of accounts

Stimulus: User request to execute for deleting created account in the database

Response: System retrieves and delete account information in the database

1.4.3.3. Functional Requirements

Create View	The system shall provide create form interface
Create Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit
Create Submit	The system shall allow a user to submit account to database
Edit View	The system shall provide edit form interface
Edit Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit
Edit Submit	The system shall allow a user to edit account in database
Delete View	The system shall provide list of accounts form interface
Delete Submit	The system shall allow a user to delete account in database

1.1.1. Administrators can manage system and data

1.4.4.1. Description and Priority

Besides creating system basis, Administrator also can manage the information about activities that happed in the system, data in the database and fix bug or modify the website. This is a unique function as Administrator level.

Priority: High

1.4.4.2. Stimulus/Response Sequences

Stimulus: User request to review the data in databaseResponse:System retrieves and displays data in the database as data view

Stimulus: User request to modify the website

Response: System retrieves and displays console view

Stimulus: User request to execute for modifying the website

Response: incorrectly System retrieves and warns user to correct modification

Stimulus: User request to upload modification interface of the website

Response: System retrieves and reboot automatically then upload modification

1.4.4.3. Functional Requirements

Data Review	The system shall allow a user to review data
Modify	The system shall allow a user to modify the website
Modification Incomplete	The system shall check the code in console view that required code is present, and prompt user to fix incorrect code and resubmit
Upload Modification	The system shall check the code, if it's all right then reboot and upload the modification
Create Submit	The system shall allow a user to submit account to database

1.1.2. Training Staffs can create courses about training for Trainees

1.4.5.1. Description and Priority

If the FPT Co. wants their website has trainee, they have to create course about training activity. This one is Training Staffs jobs. Training Staffs creates courses in the website for Trainees.

Priority: Medium

1.4.5.2. Stimulus/Response Sequences

Stimulus: Response: User request to create course
System retrieves and displays create courses form
Stimulus: Response:User request to fill lack of information
System retrieves and warns users to fill in blank areas
Stimulus: Response: User request to submit created course to the database
System retrieves and storage course information in the database

1.4.5.3. Functional Requirements

Create View	The system shall provide create form interface
Create Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit
Create Submit	The system shall allow a user to submit course to database

1.1.3. Seller can create customers accounts

1.4.6.1. Description and Priority

To make the system work properly as the purpose of the application, the system needs Teachers and Students who are Trainers and Trainees.

Priority: Medium

1.4.6.2. Stimulus/Response Sequences

Stimulus: User request to create account
Response: System retrieves and displays create account form

Stimulus: User request to fill lack of information
Response: System retrieves and warns users to fill in blank areas

Stimulus: User request to submit created account to the database
Response: System retrieves and storage account information in the database

1.4.6.3. Functional Requirements

Create View	The system shall provide create form interface
Create Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit
Create Submit	The system shall allow a user to submit account to database

1.1.4. Customers can adding/ updating/ deleting topics

1.4.7.1. Description and Priority

The system also has “cart” and “books” , now it needs the content for courses which is Topics in this system. Through Topics, customer can follow up the instruction of customers in training activity.

Priority: Medium

1.4.7.2. Stimulus/Response Sequences

Stimulus: User request to create topic
Response: System retrieves and displays create topic form

Stimulus: User request to fill lack of information
Response: System retrieves and warns users to fill in blank areas

Stimulus: User request to submit created topic to the database
Response: System retrieves and storage topic information in the database

Stimulus: User request to edit topic
Response: System retrieves and displays edit topic form

Stimulus: User request to fill lack of information
Response: System retrieves and warns users to fill in blank areas

Stimulus: User request to execute for editing created topic in the
Response: database System retrieves and update topic information in the database

Stimulus: User request to delete topic
Response: System retrieves and displays list of topics

Stimulus: User request to execute for deleting created topic in the
Response: database System retrieves and delete topic information in the database

1.4.7.3. Functional Requirements

Create View	The system shall provide create form interface
Create Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit
Create Submit	The system shall allow a user to submit topic in database
Edit View	The system shall provide edit form interface

Edit Incomplete	The system shall check the contents in fields that required information is present, and prompt user to fill out missing data and resubmit

Edit Submit	The system shall allow a user to edit topic in database
Delete View	The system shall provide list of topics form interface
Delete Submit	The system shall allow a user to delete topic in database

1.5. External Interface Requirements

1.5.1. User Interfaces

The functions that appear on the website can use the keyboard to control, in addition to using a mouse and keyboard combination.

1.5.2. Hardware Interfaces

No hardware interfaces have been identified.

1.5.3. Communications Interfaces

CI-1: The system shall send an email message to confirm registration with the system.
CI-2: The system shall send a notification to inform the user of new email messages, instant messages, or calendar event invitations.

1.6. Other Nonfunctional Requirements

1.6.1. Performance Requirements

- PE-1: User queries will be processed for up to 8 seconds after the user submits the request
- PE-2: the website will be downloaded in no more than 3 seconds over a 10MBps modem connection.

1.6.2. Safety Requirements

No safety requirements have been identified.

1.6.3. Security Requirements

• SE-1: All activities on the website require the user to log into an account.
• SE-2: The system only allows the seller to modify and update the system, only the seller and the administrator can decentralize other accounts.
• SE-3: The system will not allow non-administrators to view other people's information, they can only manage their own accounts.
• SE-4: All network transactions involving financial information or personally identifiable information will be encrypted.

1.6.4. Software Quality Attributes

No software quality attributes have been identified.

1.7. Appendix A: Glossary

No glossary terms available at this time.

1.8. Appendix B: Analysis Models

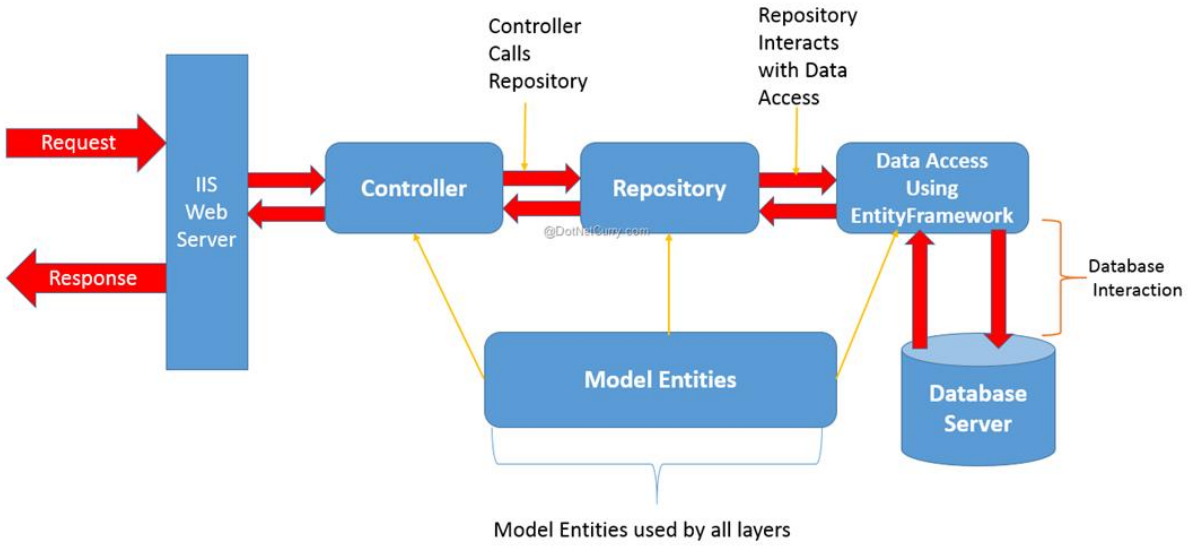

Figure 2. Analysis Models

1.9. Appendix C: Issues List

No issues have been identified.

3. Determine any areas of risk related to the successful completion of your application (P2).

With effective risk management helps prioritize how spend time, money, and materials, and is inarguably one of the most crucial factors behind improving safety and preventing asset failure. Basic on the requirement of the current project and the development process, following each phase within the software development life cycle, we implementing a corporate risk matrix that analyzes the risks of each phase, allowing them to be on plotted the same matrix in order to effectively assess risk across them all. In the following matrix, we will define Consequence of Failures (COF) by labeled five columns with the following titles:

- Business impact: Production loss, repair cost.
- The main of risk
- Owner of risk

- Reason/ Cause (of risk)
- Effect (of risk on the project)

We defined the probability of Failures by built an order of magnitude is an exponential change of minus 1 in the value of a unit or quantity. The following diagram shows how POF can be used within the risk matrix graph, in this risk matrix we are using 1 out of 1, 10, 100, 1000, etc.

In the following matrix illustrated the color codes define the different response levels based on five risk levels:

- Black: Negligible; it will not affect your project
- Green: Low Risk; minimal response efforts
- Yellow: Moderate Risk; team should take actions to keep risks from increasing. Orange: High Risk; team should take action as soon as reasonably possible Red: Extreme Risk; team needs to take immediate action.

		Business Impact (Production Loss, Repair Cost)	The main of risk	Owner of risk	Reasion/ Cause	Effects	General Risk Matrix								
Consequence of Failure(s)	11	10500$ - 13500$	Lack of the information, the requirment	Project Management	Delays in business analysis process	Increase in time due to un-clearly information such as requirement, constrait, time.	High	High	High	High	Exteme	Exteme	Exteme	Exteme	Exteme
	10	6000$ - 10500$	Underestimation of design budget	Project Management	Budget may not be suffcient to cary out designing tasks	Deterionation of design quality	Med	High	High	High	High	Exteme	Exteme	Exteme	Exteme
	9	6000$ - 10500$	Acceptance of unrealistic deadlines in contract	Project Management	Fauty contractual provision	Deterionation of design quality of failure to meet the deadline	Med	Med	High	High	High	Exteme	Exteme	Exteme	Exteme
	8	6000$ - 10500$	Inccorrect information from investor lack of guidelines	Project Management	Design may be issued with duplicate error or deleted error can generate timing constrains	Vertification of error will increase costs and increase time due to the development of the next revision of design	Med Low	Med	Med	High	High	High	Exteme	Exteme	Exteme
	7	6000$ - 10500$	Lack of the project charter	Project Management	Delays create the project charter	Increase in time of the project and delay starting time	Low	Med Low	Med	Med	High	High	High	Exteme	Exteme
	6	750$ - 6000$	Staff do not have suffcient knowledge about the subject of design	Design Office	Errors in design	Verification of error will increase time due to the repeated checks of designing work.	Low	Low	Med Low	Med	High	High	High	Exteme	Exteme
	5	750$ - 6000$	Lack of human resource	Project Management	The employee move to other team, or leave team	Increase in time cause do not prepare the preventive manpower	Negligable	Low	Low	Med Low	Med	High	High	Exteme	Exteme
	4	750$ - 6000$	Delays and difficulties in obtaining options and permits	Project Management	Delay of designing work unknow scope of design	Disturbed designing process	Negligable	Negligable	Low	Low	Med Low	Med	Med	High	Exteme
	3	750$ - 6000$	Too optimistic assessment of employee workload	Design Office	Approval of unrealistic deadlines for individual work	Delay of designing work	Negligable	Negligable	Negligable	Low	Low	Med Low	Med	Med	High
	2	750$ - 6000$	Lack of acceptance by investor	Investor	Delay in approval	Increase in costs due to the suspension of work of the design team.	Negligable	Negligable	Negligable	Negligable	Low	Low	Med Low	Med	Med
	1	0$ - 750$	Conflict among designing team members	Design Office	Insuffcient flow of information among team members	Disturbed designing process	Negligable	Negligable	Negligable	Negligable	Negligable	Low	Low	Med Low	Med
							A	B	C	D	E	F	G	H	I
							$>10^{-6}$	10^{-6}- 10^{-5}	10^{-5} - 10^{-4}	10^{-4} - 10^{-3}	10^{-3} - 10^{-2}	10^{-2} - 1/10	1/10 - 1/1	1/1-10/1	>10/1
							Rare/ unhead of	Occured once in industry	Has occurred several times in industry	Has occurred once in company	May occur in facility's life	Will occur in facility's life	Likely several times in facility's life	Likely once/ year	Multiple times/ year
							Probability of Failure (Failure Rate= events/year/equipment)								

4. Research the use of software development tools and techniques and identify any that have been selected for the development of this application (P3).

4.1. MVC model

4.1.1. What is MVC model?

As a model used to develop user interfaces, the application will be divided into 3 model-view-controller sections and linked together to separate internal information representations from presentation and acceptance. Get information from users. Besides, it allows code reuse and parallel development. This architecture is very popular in designing web applications. Popular programming languages like JavaScript, Python, Ruby, PHP, Java, and C # have MVC frameworks used in web application development straight out of the box.

4.1.2. Components

- Model: is the dynamic data structure of the application independent of the user interface. It manages application rules, data and logic.
- View: shows visualization of data that the model contains.
- Controller: it works on both model and view, controls measuring data into model objects and updates views every time data changes.

Advantages and Disadvantages:

Advantages	Disadvantages
- Simultaneous development	- Code navigability
- High cohesion	- Multi-artifact consistency
- Loose coupling	- Undermined by inevitable clustering
- Ease of modification	- Excessive boilerplate
- Multiple views for a model	- Pronounced learning curve
	- Lack of incremental benefit

Pros & Cons of MVC Model

4.2. Deployment

4.2.1. Visual Studio

4.2.1.1. What is Visual Studio?

Visual Studio is an IDE (Integrated Development Environment) software development kit developed by Microsoft. Visual Studio is also software used by programmers to build software products. This is suitable software for use in developing software because:

- Supports programming in many languages such as C / C ++, C #, F #, Visual Basic, HTML, CSS, JavaScript. The Visual Studio 2015 edition has Python support.
- Visual Studio is a powerful, easy-to-use Debugging Tool (Break Point, see the value of the variable at runtime, support for debugging each command).
- The Visual Studio interface is easy to use for beginners.
- Visual Studio supports development of MFC desktop applications, Windows Forms, Universal App, mobile Windows Phone 8 / 8.1 applications, Windows 10, Android (Xamarin), iOS and Web site development, ASP.NET MVC and Microsoft Office development.
- Visual Studio supports drag and drop to build applications in a professional way, enabling beginners to access faster.

- Visual Studio allows us to integrate external extensions such as Resharper (support for fast coding and management in .Net languages), or quick installation of libraries via Nuget.

4.3. What is Stack Solution (Software Stack)?

The bundling of software that comprise back- end of the site- including everything from the operating system and web servers to APIs and programming framework is called “Stacks”. Each component gives a layer for their compatibility, and bundling them makes them easier to download and deploy all at once. The components of a stack can range from typically, for example, the Mac OS X operating system- to very detailed, similar to a particular PHP framework.

4.4. The part of a Software Stack

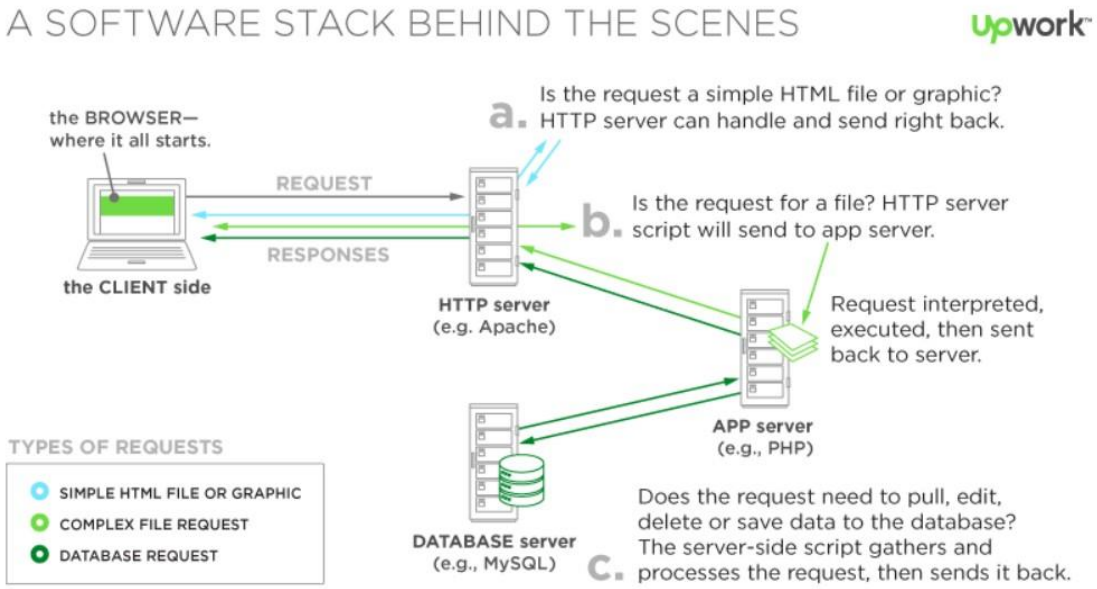

Figure 6 A software stack behind the scenes.

Applications that have four tiers , and three of which are on the server-side. In the Figure 1, illustrates the inner workings of a stack- the client is where it all starts and ends.

Four tiers of an application, includes:

- The client tier- this layer is the only component in the browser.

- The web tier- the web server or HTTP server.
- The business tier- the application server, comprising the development platform, frameworks, and server- side programming languages.
- The database tier- the database server often depends on the business tier.

The tier each include an operating system, server, database and server-side scripting languages. These tiers can interchangeable rely on the needs and customizable.

4.5. The common software stacks

4.5.1. LAMP: Linux/ Apache/ MySQL/ PHP

LAMP- standing for Linux (operating system), Apache (web server), MySQL (database), PHP (programming languages). LAMP is considered the most popular back-end stack and it have the high scalability.

It includes open- source software components that work especially well for dynamic website and applications. It made up of all free and it is the most traditional stack model and incredibly solid.

The benefits of LAMP: It's flexible, customizable, easy to develop, easy to deploy, secure, and comes with a huge support community since it is open-source. Besides, SQL database are great for organizing massive amounts of highly structured data.

Variations include:

- WAMP (Windows/ Apache/ MySQL/ PHP)- A Microsoft Windows OS equipment, it is all-inclusive and easy to get started with. The WIMP stack is similar but has the IIS Server.
- LAPP (Linux/ Apache/ PostgreSQL/ PHP)- A PostgreSQL database variation which is optimized for enterprise- level projects.
- MAMP (Mac OS/ Apache/ MySQL/ PHP)- A Mac OS X operating system variation, it is available for both Windows and Mac.
- XAMPP (Linux/ Mac OS X/ Windows/ Apache/ MySQL/ PHP/ Perl)- A more complete bundle, it comprises an FTP server that is cross- platform, able to run on Linux, Window, and Mac operating systems.

Figure 7 Overview LAMP stack model.

4.5.2. MEAN: MongoDB/ Express.js/ AngularJS/ Node.js

MEAN which is an shorten letter of MongoDB (database), Express.js (application framework), AngularJS (fontend framework), Node.js (runtime environment). The stack structure is different within in MEAN stack model, because it comprises both the back-end and the font-end development tools, and it is more correct to call it a full stack. MEAN is an implementation of the JavaScript concept that using the same programming language both client-side and server-side. The back- end is relied on Node.js, the first platform to use JavaScript in the back- end development. It is high performance and flexibility, as well as a smooth learning curve since it uses the same language across all components.

The benefits of MEAN stack are: It supports the MVC pattern, uses NoSQL's native JSON for data transfer, offer access to Node.js's JavaScript module library, and is open-source. In addition, it is mobile- friendly, based on AngularJS's flexibility, and can easily incorporate JS testing frameworks. It's excellent for businesses looking to be agile and scalable, but the core benefit is language uniformity. Developers working on the client- side can understand the server- side code by using JavaScript across the font-ends and the back-ends. Besides, there is less time spent writing SQL, more flexibility with how data is structured, and better productivity for team in the long run by switching to a document- based NoSQL database.

Variations include:

- MEEN- A stack substituting Ember.js for AngularJS.

Figure 8 Overview of MEAN stack.

4.5.3. MERN (MongoDB/ Express/ React / Node.js)

MERN comprising MongoDB (a cross- platform document database), Express (a back-end web application framework), React (a JavaScript library for building user interfaces) and Node.js (a cross-platform JavaScript runtime environment). Considering the popularity of React.JS in front-end development and Node.JS in back-end development, this combination is logically referred to as the most used JavaScript stack for building single-page applications. high class. Except for one's programming language on all the benefits of the elite, MERN also offers a short learning curve, high productivity and enhanced agility. When comparing MEAN and MERN, the choice focuses on React or Angular and it is important to take into account the requirements and objectives of the project, as well as the familiarity of the JavaScript developer (s) with tools. This front technology.

MERN's benefits: The main benefit for developers using MERN stacks is that all lines of code are written in JavaScript. This is a programming language used everywhere, both client-side code and server-side code. With a language on the floors, there is no need for context switching. To stack software with multiple programming languages, developers must find a way to communicate them with each other. With the JavaScript stack, developers only need to master JavaScript and JSON. Overall, using MERN stacks allows developers to build highly effective web applications.

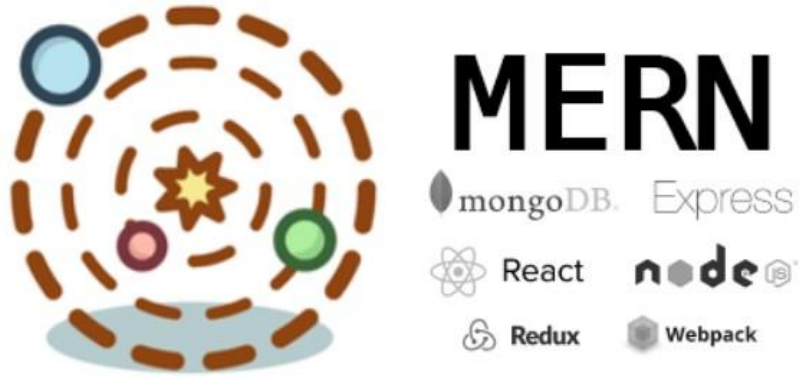

Figure 9 MERN Stack.

4.5.4. WINS (Windows/ IIS/ .NET/ SQL Server)

WINS include Windows Server (operating system), IIS (Internet Information Service web server), .NET (programming languages), SQL Server (database management system).

Figure 10 Overview WINS stack.

4.6. Comparison table between LAMP, MEAN, MERN, and WINS stack

Based on the definition and characteristics of each stack, we analyzed their advantages and disadvantages of each

type and created the following comparison table.			MERN	MongoDB, writing
Stack The advantages system.	WINS Using .NET Framework and programming languages. Core is open- sources and available on no Windows	MEAN Using JavaScript as that is the primary feature- rich thoroughly battle- tested. Besides, .NET	JavaScript everywhere: The best part about MERN that there is a single language used everywhere . Using JavaScript for client side code as well as server-side code. Even if have database scripts in	them in JavaScript. LAMP It maintained and support very well, because it used by hundreds of thousands of companies.

	Using ASP.NET which is an MVC-based framework featuring robust infrastructure for authentication, bundling and routing that integrates with many non-Microsoft technologies such as Bootstrap and AngularJS.	Everything can be set up quickly and done in JS.	JSON everywhere: When using the MERN stack, object representation is JSON (JavaScript Object Notation) everywhere- in the database, in the application server and on the client, and even on the wire.	It easily to adapt it based on the needs, because it have more endless modules, libararies and add-ons available.
	With the myriad of configuration options and hooks, Windows Communication Foundation (WCF) allows to custom-serialize data, log, intercept, route message, use peer-to- peer and queuing, and much- much more	MongoDB is very popular for its easy schemaless data persistence and is faster than MySQL.	Node.js performance: Due to its event driven architecture and non-blocking I/O, the claim is that Node.js is very fast and a resilient web server.	Being Linux based, too easily to find help for any topic in the large open source community.
	SQL server excels at its primary role of a data keeper with a myriad of features for transactions, referential integrity, backups, mirroring and replication.	Angular is maintained by Google. It receives new releases and functions on a constant basic.		MySQL is a very reliable and scalable solution.
	It's easily testable	The ability to easily build mobile or desktop apps.		PHP is in version 7 and is also supported by a mature and big community. PHP is also very fast and integrates well with the rest of the stack.
		Code and components can easily be reused or added.		The developers can control the server and decide which versions and software you install, thus the developers do not have to depend on the client's browser.

	Development on .NET can be slow Too difficult to develop a web form on .NET without the experience	In the case of JavaScript disablement, it may render website can create issues between the user and website owner. The MEAN stack is slow and not as scalable as the LAMP stack as it has a non- blocking structure. JavaScript tends to make websites slower to load, and this could reduce its	React is simply a JavaScript library, thus too difficult to maintaining the code available. It eliminates security when both the server supports Linux and the client codes are the same. Insufficiency with computation heavy back end or Python and then use JavaScript or	Developers do not have control of the libraries that are ineffective. This LAMP stack only operating It is challenging to switch between PHP popularity. HTML.

4.7. The appropriate stack for the web-based application project

For the web-based system project and the above comparison table (Table) in section 4.6, my team decides using the WINS stack for this project rely on the following reason:

Firstly, as you knew, Windows is an operating system that almost people knew, because it often installed on the computers. Windows server is more secure than Linux server, because with the Linux server, Openssl is installed on all Linux platforms. All the Linux server were impacted by heartbleed. Openssl is the package that handle SSL protocol everywhere. It is used for Https, SSL over VPN, secure SMTP, IMAP, SSHD. So, it easy to lead the virus on the computer. In addition, by working in Windows server, it is easy to set up a backup strategy in Windows and it is easy to restore windows backup too. On the other hand, we developed the web-based applications based on Visual Studio. Besides that, all team member using the Windows server for their computer and devices. Thus, choosing the Windows server for this project is very reasonable.

Secondly, .NET framework by Microsoft is still one of its most popular services. When using .NET to develop a web application, it facilities creation of high-performing, robust, and complex applications with great simplicity and ease. In addition, the caching system in .NET is robust and simple to use. It is also designed to extensible. Moreover, with .NET Core is a cross-platform .NET implementation, it has a fully open source code which ensures that a wide engineering community can continuously contribute to its developments. ASP.NET has built-in automated monitoring. Windows Web Server closely monitors the websites and applications running on it. In case any problems such as memory leaks or infinite loops occur, it will immediately warn them. This allows you to directly correct these behaviors and create new processes. Monitoring ensures greater stability and transparency of .NET applications. On the other hand, our strength in programming languages is C# and the .NET framework for this programming languages. Microsoft always keep C# up- to- date with new programming paradigms.

Thirdly, with ASP.NET is an MVC- based framework featuring robust infrastructure for authentication, bundling and routing that integrates with many non- Microsoft technologies such as Bootstrap and AngularJS. ASP.NET

sites look nice on a wide range of from factors. More than these advantages, its web ASP capabilities make exposing web services a breeze. The framework has been open- source for a number of years, so if we get stuck on a problem, the source is available on GitHub.

With Windows Communication Foundation (WCF), everything become simply; behaviors, endpoints, and bindings were overwhelming. With API web and WCF, we easy to build a simple web, if we need full control with the web API, we can fall back on WCF and with the myriad of configuration options and hooks, WCF allows custom serialize data, log, intercept, route message, use peer-to- peer and queuing, and much more.

In addition, SQL Server excels as a data keeper with loads of features for transactions, referential integrity, backups, duplication and replication, and how well SQL Server integrates with the rest. Microsoft stack. With computational power, the .NET Framework is loaded in-process with SQL Server, meaning you can embed .NET code as stored procedures, functions, or collections without sacrificing performance. Paired with the fact that SQL Server comes with in-memory tables and can offer some real-time solutions that cannot be implemented fast enough just by SQL and regular tables.

Besides, we choosing the Visual Studio to develop the web- based application for FPT Co., because it is an IDE has more features to help developers, such as debugger, etc. And the main reason that made we chosen it is it support to work with C# and .NET to develop API.NET (MVC) web-based application. Otherwise, it also support for other services like Azure Cloud and GitHub.

Finally, ASP.NET has built-in automated monitoring. Windows Web Server (ISS) closely monitors the websites and applications running on it. In case any problems such as memory leaks or infinite loops occur, it will immediately warn them. This allows you to directly correct these behaviors and create new processes. Monitoring ensures greater stability and transparency of .NET applications.

To sum up, based on the reason that we mention above, WINS is the most appropriate stack model for the webbased application which we team will develop.