COS60010 - Technology Inquiry Project

Semester 1 - 2024

Individual Research Report

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Course: Master of Information Technology – MIT-1 – Software Development specialisation

Workshop: Thursday – 14:30-16:30 -Room EN207

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Total Word count (excluding the report title page, list of content,   : **1480**

Acknowledgment to country and references)

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Acknowledgement to Country

Today's modern-day Melbourne and Swinburne University of Technology is situated in what was originally the Kulin Nation of the past. As a Swinburne student, who is truly grateful and proud to study at this esteemed institution, I would like to humbly pay my deepest respects to the Wurundjeri People of this nation who are the traditional owners of these lands.

Additionally, I would also like to sincerely thank the students, alumni, partners, and guests of Swinburne who are from Aboriginal and Torres Strait Islander background.

It is my honour and I feel proud to recognise and acknowledge the link of spirituality, history and culture of this place to the Wurundjeri country.

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1.Introduction

Building and developing a fully functional software application is a complex task that involves many challenges. The goal of this report is to dwell into the specific challenge of integrating the different component subsystems of the application, such as the front-end user interface, which interacts with the client user, the backend system, which fulfils the client requests by providing the functionality requirements, the database, which stores all the vital information, as well as the necessary security protocols, which are paramount in today's world, which is swarmed with cyber threats.

The core idea is to first identify the current technical knowledge gaps and to find a way to address and narrow them down as much as possible through research, followed by further study and reflection as a part of preparation for the ultimate goal of designing, developing, and implementing an interactive game or quiz or web discussion forum support application for the Technology Inquiry project unit.

2. Technology Specification and Research Topic Identification

2.1. Identification of the knowledge gaps

After a good dive through study and some effective reflecting, it was recognised that certain topics had to be looked into for further research and study to implement proper integration of the application subsystems in the main Technology Inquiry project.

A list of well-attested, reliable, and recognised books, journals, and research papers from the Swinburne Library, as well as other trustworthy online sources, was inquired and studied in detail to reflect upon, assimilate, and create this research report. All of the referred resources have been duly credited and cited in this report.

The Initial Idea which was to be further worked upon has been shared below:

- To implement an efficient integration, it is crucial to understand how web browser-based front-end technologies like JavaScript, HTML, and CSS fundamentally differ from a compiler- or interpreter-based backend language such as PHP, Java, or Python, as well as from a query-based relational database management system.
- Each of the above subsystems read, interpret and manipulate data in a totally different way. So, it is a norm to next look at a data interchange format like JSON to facilitate data and other connection-related information flow between these components.
- The whole project is only possible and useable if the integration is done in a secure way where the data is properly protected from hackers and other entities with malicious intentions. Henceforth, cybersecurity measures and the corresponding protocols to be implemented are also to be discussed and studied. **(Andrew, Ullman, Waters,2003).**

2.2 Questions to be addressed and learnt through the research

2.2.1 Need for an Integration

On a deeper note, HTML and CSS are markup languages which mark-up content into hypertext which the browser can display as a static webpage, and JavaScript is a scripting language which brings the webpage to life and makes it interact with the user and other systems. In All, these three are basically browser-based languages that do not need an external compiler or interpreter. **(Simpson,2023).**

However, on the other hand, a backend language or relational database, which is crucial for defining and fulfilling the functionalities of the application and for data storage and management, needs a compiler, an interpreter, or a server to run and execute.

Therefore, these are completely different heterogeneous systems that cannot directly communicate or work with each other, and hence, need an integration to co-exist and work together, so that they act as a complete full-stack application. **(Full,2020).**

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2.2.2 The different component subsystems to be Integrated

The next step was to choose a specific tech stack is to be chosen first, and the below stack was chosen for the purpose of this research.

- **HTML and CSS** can mark up and design useable data into hypertext that is understood and displayed by the browser.
- **JavaScript** converts the static web page into a live, dynamic website with features.
- **PHP** enables and offers the proposed functionality of the website's features. Moreover, it also a language that is easy and flexible to learn with a neat and accessible syntax, is cross platform compatible and can be easily connected to a database, when compared to other languages like Java, C++ or C#.
- **MYSQL** is an SQL-based RDBMS that can store and manipulate user data as per their needs.
- **JSON** is a data exchange standard that transfers data from JavaScript to the PHP script. **(Smith,2015).**
- **SSL/TLS encryption and decryption** – was studied to understand more about how to integrate security into the application. It was learned that, in the beginning, data on the Web was originally transmitted as plaintext, which could be read by anybody who intercepted the communication. To solve this problem, SSL encryption was invented. SSL basically encrypts the data sent over the internet to provide a high level of privacy. This means that if someone attempts to intercept this data, they will only see a randomly jumbled string of characters that are almost impossible to decipher. **(Davies,2011).**

The very first step was to learn and get familiarised with the syntax, methods, use cases, and flow of control of the afore-mentioned languages. This learning curve was attained through constant practice and hands-on programming activities. **(Delisle,2006; Nixon,2021)**

2.2.3 Carrying the Integration process forward

Moving forward, to interpret and use the integration in a practical way, a possible sample case was constructed and worked upon.

The use-case scenario:

A user enters and submits the data to the website through a html form, which is securely transferred and saved for further usage in a database.

This entire integration process to do this task was researched, studied and learnt, and the learnings and the reflections are shared below.

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3. Further Research, reflection, useful learnings, and takeaways.

3.1 The steps of the process of Integration

1. A regular Notepad++ editor has been used to create the **.html, .css, .js, .php** files.
2. A form in HTML is created to accept a data input and is styled using a CSS file that is created separately and linked to it.
3. The user feeds the input data into the form.
4. A separate JavaScript file that has been created is then linked to the HTML page. It picks up the user data from the document through the event listener.
5. The JavaScript file converts the user data into JSON data and sends it to a PHP script, which has been created in a separate file, through the JavaScript 'fetch' method.
6. A new Data base and a table is created in the MySQL server for getting and storing this data.
7. The PHP script receives the user data. It makes a connection to the specific MySQL database that has been created. Now, an 'insert' query is written in the PHP script to enter the user data into the database.
8. The MySQL database has the user data stored, thereby completing the integration of all the component subsystems.
   (Bassett, 2015; Gehani, 2011; Prettyman,2020).

9. The **.html, .css, .js, .php** files have been uploaded to a web server that has SSL/TLS protocol enabled and the MySQL server is ensured to be an SSL enabled one as well.
10. All the URL calls which are made from the browser are ensured that they are https calls.

Basically, in a https call, the browser first reaches out to the target web server expressing a request to setup a secure connection. The server sees this and sends an SSL certificate with a public key. The browser first checks if the certificate is genuine and valid and if successful, it then creates a what is called as a symmetric session key. The browser then encrypts this session key with the public key and sends it to the server. The server decrypts the session key with the help of its private key. Now, both the browser and server have the session key and can establish a secure connection and channel for exchanging data. After this, the browser and the server encrypt and decrypt all the data that is transferred through, using the session key. **(Davies,2011).**

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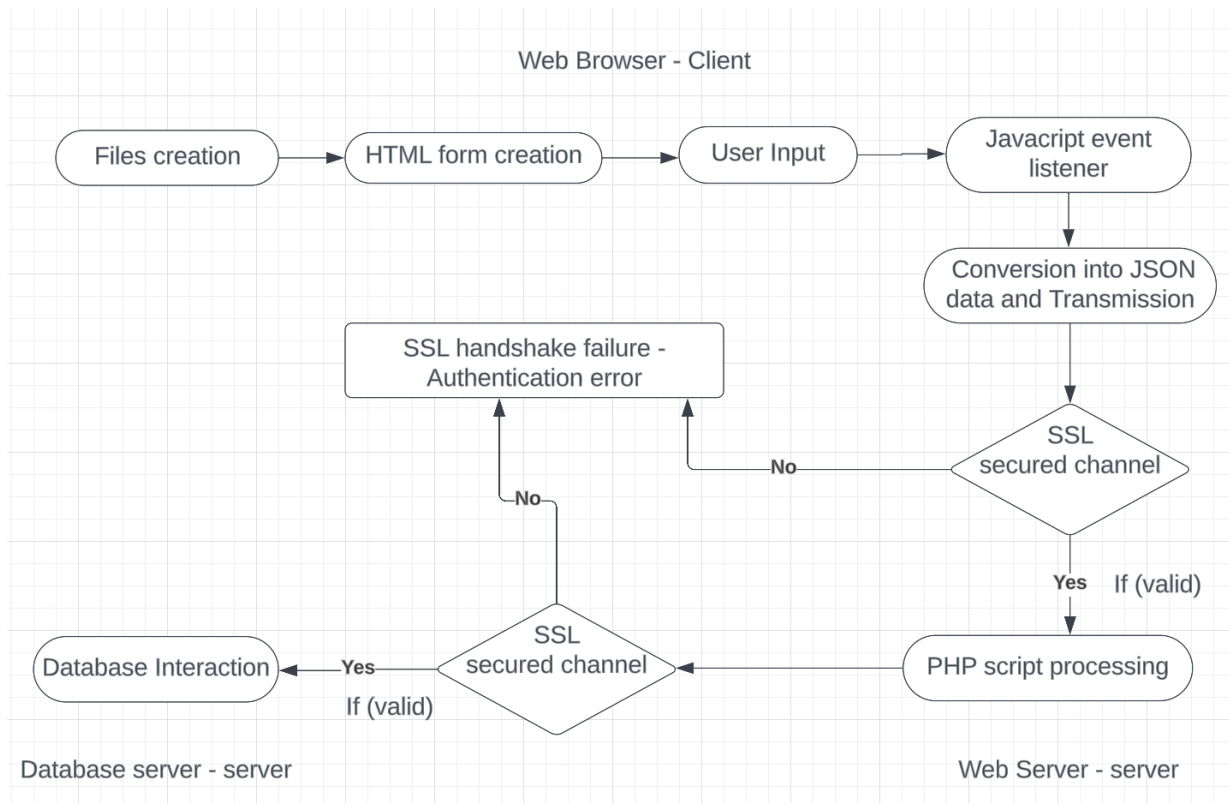
3.2 Activity Diagram showing the Integration of the systems

Fig 1. A flow chart representing a high-level control flow for the full system stack after a full integration of the components

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4. Summary and Conclusion

To summarise and wind up, the identified learning gaps, the very need for an integration, the choice and subsequent study of different components of subsystems of an application (HTML, CSS, JavaScript, PHP, and MySQL) and knowing their differences, the detailed process of integration with the steps and challenges involved, and all of this, along with how to securely encrypt the layers through SSL encryption, were inquired and studied. This has now effectively reflected in the significant narrowing of the learning gap from about **85%** at the beginning to **10%** and has set forth a good platform to further proceed with the specific technology stack to be used for the next steps of modelling, design, simulation, and development of the intended main project.

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