PRINTING SERVICE SYSTEM FOR PRINT CUBE SHOP

FATEEN NASHUHA BINTI YUSOF

UNIVERSITI TEKNOLOGI MALAYSIA

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PRINTING SERVICE SYSTEM FOR PRINT CUBE SHOP

FATEEN NASHUHA BINTI YUSOF

A thesis submitted in fulfilment of the
requirements for the award of the degree of Bachelor
of Computer Science (Computer Network &
Security)

Faculty of Computing
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DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

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My fellow students should also be recognised for their support. My sincere appreciation also extends to all my colleagues and others who have provided assistance at various occasions. Their views and tips are useful indeed. Unfortunately, it is not possible to list all of them in this limited space. I am grateful to all my family members.

ABSTRACT

Print services refers to digital printing either for soft copy or hard copy materials, as well as printing done in a print shop. Providing professional and responsive services to customers is very challenging for most printing shops including the Print Cube shop. Therefore, this project is to develop a centralized and manageable system that would be useful for the owner, staff and their customers. Additionally, several network and security elements will be implemented into the system in order to make sure the final product of web application is able to protect the client data and information from the criminal, secures the shared data, ensures sustainable access and network performance, and protects against other cyber threats. To generate effective planning for the software development lifecycle, the system uses the waterfall model as the system development approach. Based on the user requirements, all system designs, including the use case diagram, system architecture, Unified Modelling Language (UML) diagram, database design, sequence diagram, activity diagram, and interface design, were built in draw.io. Next, Laravel is the framework that will be used to build this web-system since Laravel is a suitable back-end for PHP-based system development. This system was developed by using a well-known code editor which is Visual Studio Code and using few programming languages include Hypertext Preprocessor (PHP), Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), Bootstrap and JavaScript. All the data in Print Cube shop system stored in cloud database which is MySQL and retrieve the client's data from there when it is requested. The website was then hosted by Hostinger to provide the companies both increased protection and a professional appearance. The system was designed effectively because the users were highly satisfied with it based on the result of user acceptance test (UAT) that have been conducted. Overall, this web-application is expected to provide several benefits to customers and firm employees as it can handle an enormous volume of orders records, reducing staff burdens because it can automate various processes such as email notification and payment processing.

ABSTRAK

Perkhidmatan cetakan merujuk kepada percetakan digital sama ada untuk bahan salinan lembut atau salinan keras, serta percetakan yang dilakukan di kedai cetakan. Menyediakan perkhidmatan profesional dan responsif kepada pelanggan adalah sangat mencabar bagi kebanyakan kedai percetakan termasuk kedai "Print Cube". Oleh itu, projek ini adalah untuk membangunkan sistem terpusat dan terurus yang berguna untuk pemilik, kakitangan dan pelanggan mereka. Selain itu, beberapa elemen rangkaian dan keselamatan akan dilaksanakan untuk memastikan produk akhir aplikasi web dapat melindungi data dan maklumat pelanggan daripada penjenayah, menjamin data yang dikongsi, memastikan capaian yang mampan dan prestasi rangkaian, dan melindungi terhadap ancaman siber yang lain. Untuk menjana perancangan yang berkesan bagi kitaran hayat pembangunan perisian, sistem menggunakan model air terjun sebagai pendekatan pembangunan sistem. Semua reka bentuk sistem termasuk rajah kes penggunaan, seni bina sistem, rajah Unified Modelling Language (UML), reka bentuk pangkalan data, rajah jujukan, rajah aktiviti dan reka bentuk antara muka, telah dibina menggunakan draw.io berdasarkan keperluan pengguna. Seterusnya, Laravel ialah rangka kerja yang akan digunakan untuk membina sistem web ini kerana Laravel merupakan "back-end" yang sesuai untuk pembangunan sistem berasaskan PHP. Sistem ini turut dibangunkan dengan menggunakan editor kod yang terkenal iaitu Visual Studio Code dan menggunakan beberapa bahasa pengaturcaraan termasuk Hypertext Preprocessor (PHP), Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), Bootstrap dan JavaScript. Semua data dalam sistem kedai Print Cube disimpan dalam pangkalan data awan iaitu MySQL dan mendapatkan semula data pelanggan dari pengkalan tersebut apabila ia diminta. Laman web tersebut dihoskan oleh Hostinger untuk menyediakan perlindungan yang lebih baik dan penampilan profesional kepada syarikat. Sistem ini direka dengan berkesan kerana pengguna sangat berpuas hati berdasarkan keputusan dari ujian penerimaan pengguna yang dijalankan kepada semua pengguna system ini. Secara keseluruhan, aplikasi web ini dijangka memberikan beberapa faedah kepada pelanggan dan pekerja kerana ia boleh mengendalikan jumlah rekod pesanan yang sangat besar, mengurangkan beban kakitangan kerana ia boleh mengautomasikan pelbagai proses seperti pemberitahuan e-mel dan pemprosesan pembayaran.

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LIST OF ABBREVIATIONS

FYP	-	Final Year Project
PHP	-	Hypertext Preprocessor
HTML	-	Hypertext Markup Language
CSS	-	Cascading Style Sheets
SQL	-	Structured Query Language
SDLC	-	System Development Life Cycle
UML	-	Unified Modelling Language
RAM	-	Random Access Memory
ROM	-	Read Only Memory
CPU	-	Central Processing Unit
ATM	-	Automated Teller Machine
PSO	-	Particle Swarm Optimization
IDE	-	Integrated Development Environment

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The printing industry has grown dramatically in recent years. Printing services are in high demand across a wide range of industries, including publishing, marketing agencies, healthcare, automotive, financial, and educational institutions. Despite the rapid adoption of digital technologies, printers have become an essential part of education, and some capable parents would purchase a printer for printing their children's school material because teachers and lecturers distribute modules to students online. In fact, many other industries use print products to promote their services, and it may be sufficient for personal needs as well. The examples of printing products include banners, booklets, brochures, business cards, certificates, and stickers. Manufacturing printing ink sales in Malaysia reached approximately 998 million Malaysian ringgit in 2021 (Muller, 2022), as printing has played a significant role as the primary medium for disseminating any knowledge and information. As a result of high customer demand, many printing shops have opened in our country.

Print Cube is a one-stop printing shop in Kubang Kerian, Kelantan. This printing shop provides a variety of printing services such as photocopying, printing for standard files, printing for thesis, e-book printing, poster printing, business cards, button badges, certificates, and binding. Following an interview with the owner, Mr Faiz, Print Cube has a few branches in the Kota Bharu area and currently only provides in-store service to all customers. The printing shop is open from 8 a.m. to 7 p.m. on weekdays and 8 a.m. to 6 p.m. on weekends. Based on the observation, the majority of his customers were Universiti Sains Malaysia (USM) Kubang Kerian students in Kelantan since the shop's proximity to the campus, as well as the very reasonable prices offered. However, the main issues with manual production monitoring are also time-consuming and inconvenient.

1.2 Problem Background

Printing services are extremely important, particularly for students who do not have their own printers. Currently, the Print Cube store's existing service has become difficult for some students because not all of them have their own transportation to get to the shop. First and foremost, students must visit a store. After that, they must wait for their order to be completed or they can leave the material if necessary and then come back again to pick it up. Due to these issues, Mr. Faiz requested that a system be proposed for USM students only. Finding a good provider of printing services is critical because there are so many printing shops out there, including online printing stores. Thus, owners must take all problems that arise in their existing system seriously and work to resolve them.

The issue with current services is that the process may waste customers' time because they may have to wait for a while if there are many customers or they may need to leave the material due to a large number of orders that staff must complete according to first come, first served. Typically, new customers who come into the shop do not know the price for each service because the price varies depending on size, quantity, colour, and type of paper. Then, the main issue that must be addressed is that customers must visit the shop for each printing service, and even worse, they must visit multiple times in some situations, such as when there are many customers at the shop waiting for their turn to print. This shop then employs a calculator to compute the customer's payment, and their staff will provide a paper receipt.

At the Print Cube shop, their staff recording all customer orders, such as the type of service, quantity, and when to pick up, by writing this information on a paper and in a book. As a result, staff may go unnoticed if they have an order status that has yet to be completed. We noticed that these issues could cause major issues, such as the process becoming slow and the requested order might be lost, because the ability of Print Cube staff to perform their jobs effectively and efficiently was reduced. In addition, the print shop currently operates on a cash payment only. This method is actually inconvenient and trivial for some customers, as they must ensure that they have enough money on hand or need to go to the Automated Teller Machines (ATM) to withdraw the appropriate amount of cash in order to manage the total bill.

1.3 Project Aim

Aim of this project is to develop a web-based system that can speed up the order process, improve customer management, and make the Print Cube's services become more manageable.

1.4 Project Objectives

The objectives of the project are:

(a) To identify the user requirements of printing service system by interviewing the shop’s owner.

(b) To design and develop a printing service system based on the user requirements.

(c) To test the functionality of the proposed printing service system according to user requirements.

1.5 Project Scope

The scopes of the project are:

a) The target users are admin, staffs, owner and customers of Print Cube shop.

b) The system is a web-based application used to manage orders and sales in a printing shop.

c) If they have any new services, the system also allows admin/ staff to add the new service to the system.

d) The system provides two options of payment method which are online transfer simulator and cash on delivery.

1.6 Project Importance

The developed system will be beneficial to the target users. In addition, the system will create a paperless environment where all information will be stored in a database and at the same time which can avoid misplacement or data loss. When they have a centralized system, the owner and staff can easily manage their customer's order data. The system also allows the admin or staff to add new services if they have any or delete any services that they no longer provide. Aside from that, the customer can check the price list based on type of paper, printing colour or not, and the quantity selected easily. Then, the system provides a notification feature where the customers will be notified via Simple Mail Transfer Protocol (SMTP) when their order is completed and ready to pick-up. Moving towards a cashless society, the customer can do an online transfer directly through the web application instead of paying in cash.

1.7 Report Organization

This report is divided into six chapters that cover everything from the project's beginning to its conclusion. The project's surface will be introduced in Chapter 1, such as the project's introduction, problem background, project goal, project objective, scope, and project importance. The literature review will be explained in Chapter 2. It will include the project's case study, as well as the organisation structure and manual functioning of the company. A swim lane diagram with a thorough description will be used to examine the current system. Then, the differences between few existing systems and the technology that is being used will discuss.

Then, Chapter 3 will address the system development methodology, which will explain and justify the methodology employed, phases, technology, and system requirement analysis. The main focus of Chapter 4 is the requirement analysis and design. This chapter will cover requirements analysis, project design, database design, and interface design. Finally, the project's implementation and testing described in accordance with the previous chapters in Chapter 5. Lastly, Chapter 6 serves as the report's conclusion, listing all of the accomplishments made throughout this project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter examined the existing manual operation, as well as review and analyse user's current needs, which will serve as current guidelines for the system development process. The study was carried out to obtain a more comprehensive overview and information about the developed system. The study's findings will then be analysed and classified so that the main issues with the current system, as well as the improvements that need to be made, can be clearly defined. This research is crucial to ensuring that the needs and requirements of system users are met.

All of the features and information included in this chapter demonstrate why it was well suited for implementation in this project. Furthermore, some comparisons between the existing online system by other shops and the proposed system for Print Cube shop will be discussed to ensure that the project is distinct from others. Moreover, the system will be provided with a few system development components that will be fulfilled by using some software to ensure that the application or proposed system works properly.

2.2 Case Study

A case study was conducted to identify the present operating flow of Print Cube Shop as well as the user requirements. Currently, their manual operation has some issues that I found out and it can be described as inefficient and unmanageable. Moreover, the commercial printing industry has been impacted by the decrease in the volume of printed publications as a result of the digital transformation (Romano, F., & Broudy, D., 2010). This could affect Mr. Faiz's business and that is why we have

established an easy and straightforward ordering process for the Print Cube system in order to provide user-friendly printing services to all of their customers.

2.2.1 Company Organization Structure

An organisational structure is a system that defines how specific activities are directed in order to achieve an organization's goals. Every established company requires a company organisation structure to ensure their members know their respective roles, rules and responsibilities. Print Cube shop is a well-known printing shop and has many customers and orders that need to be accomplished every day. By having organization structure, it helps to be stable wherever there are any challenges. Based on Figure 2.1, the top level of the company organization structure is the owner itself which is Mr. Faiz. Under the shop owner, there is a manager who is responsible for overseeing the daily operations of a store, making sure it runs smoothly and effectively. Next, finance processes within the company will be managed by an accountant. There are two staff that work under the manager where all of them will take the order and manage the customer's order.

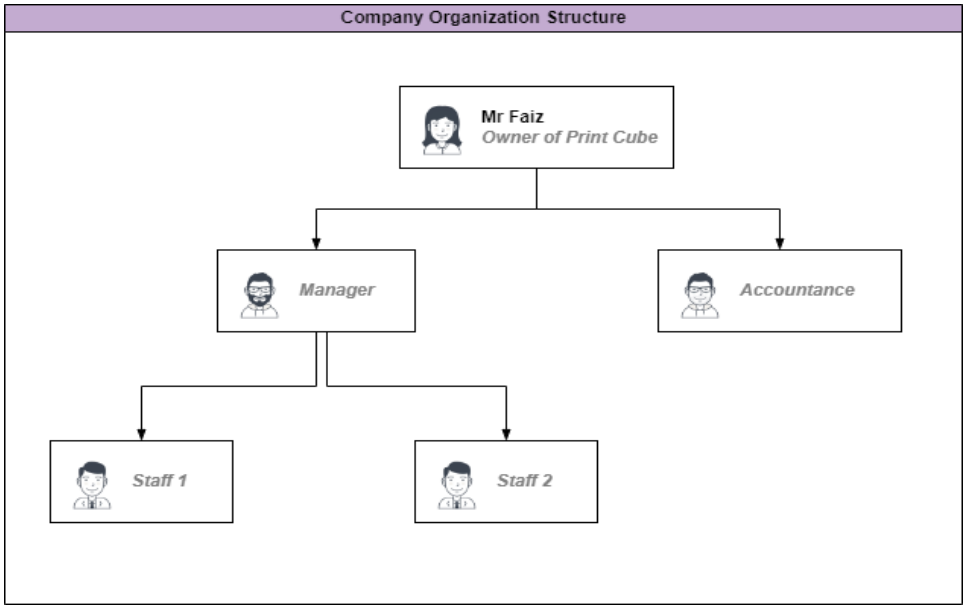

Figure 2.1 Company organization structure for Print Cube shop

2.2.2 Manual Operation

The existing service is a manual operation and has become difficult for some students because not all of them have their own transportation to get to the shop. Then, the main issue that must be addressed is that customers must visit the shop for each printing service, and even worse, they must wait for their order to be completed or they can leave the material if necessary and then come back again to pick it up in some situations. The example of difficult situation faced by customer is when there are many customers at the shop waiting for their turn to print. Due to these issues, Mr. Faiz requested that a system be proposed for USM students only but I hope the final system can be used by all of his customers from anywhere.

The other issue is that the process may waste customers' time because they may have to wait for a while if there are many customers or they may need to leave the material due to a large number of orders that staff must complete according to first come, first served. Typically, new customers who come into the shop do not know the price for each service because the price varies depending on size, quantity, colour, and type of paper. This shop then employs a calculator to compute the customer's payment, and their staff will provide a paper receipt.

Other than that, their staff also will record all customer orders, such as the type of service, quantity, and when to pick up, by writing this information on paper or in a book. As a result, staff may go unnoticed if they have an order status that has yet to be completed. We noticed that these issues could lead to the process of finishing each other becoming slow and even worse the requested order might be lost. In addition, the print shop currently operates on a cash-only basis. This method is actually inconvenient and trivial for some customers, as they must ensure that they have enough money on hand or need to go to the bank or nearest ATM machines to withdraw the appropriate amount of cash in the appropriate denomination in order to manage the total bill.

2.3 Current System Analysis

As shown in Figure 2.2, Print Cube shop are advertising and promoting their shop's information via Instagram. Customers can get some of shop's information from there such as operating hours. Figure 2.3 is the swim lane activity diagram that describes the activity flow between the owner, staff and customer regarding the current process of printing service.

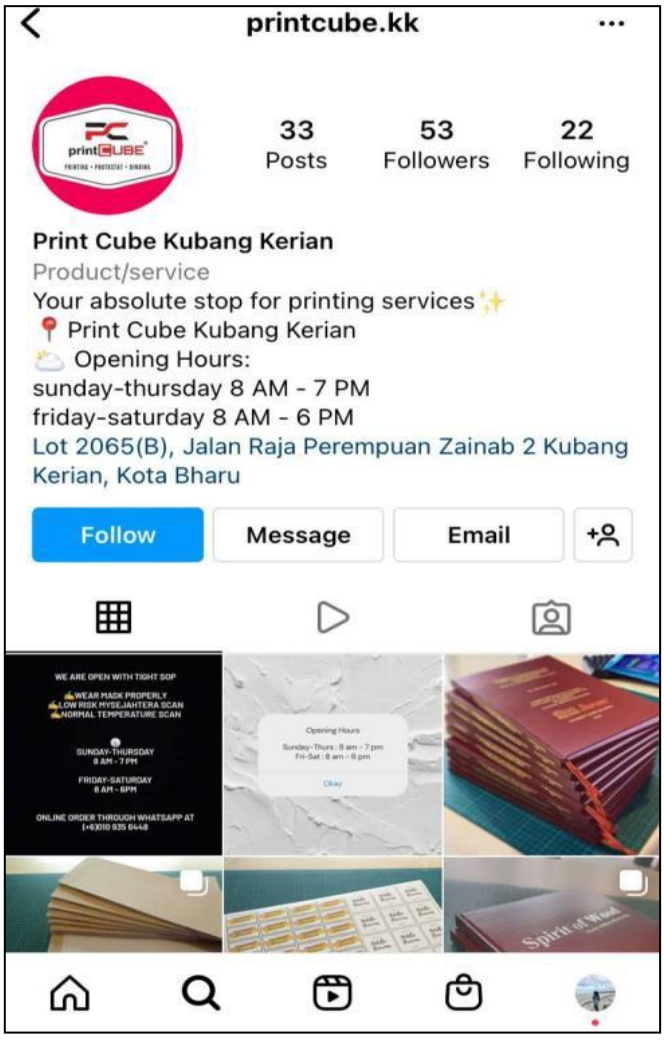

Figure 2.2 Advertising via Instagram

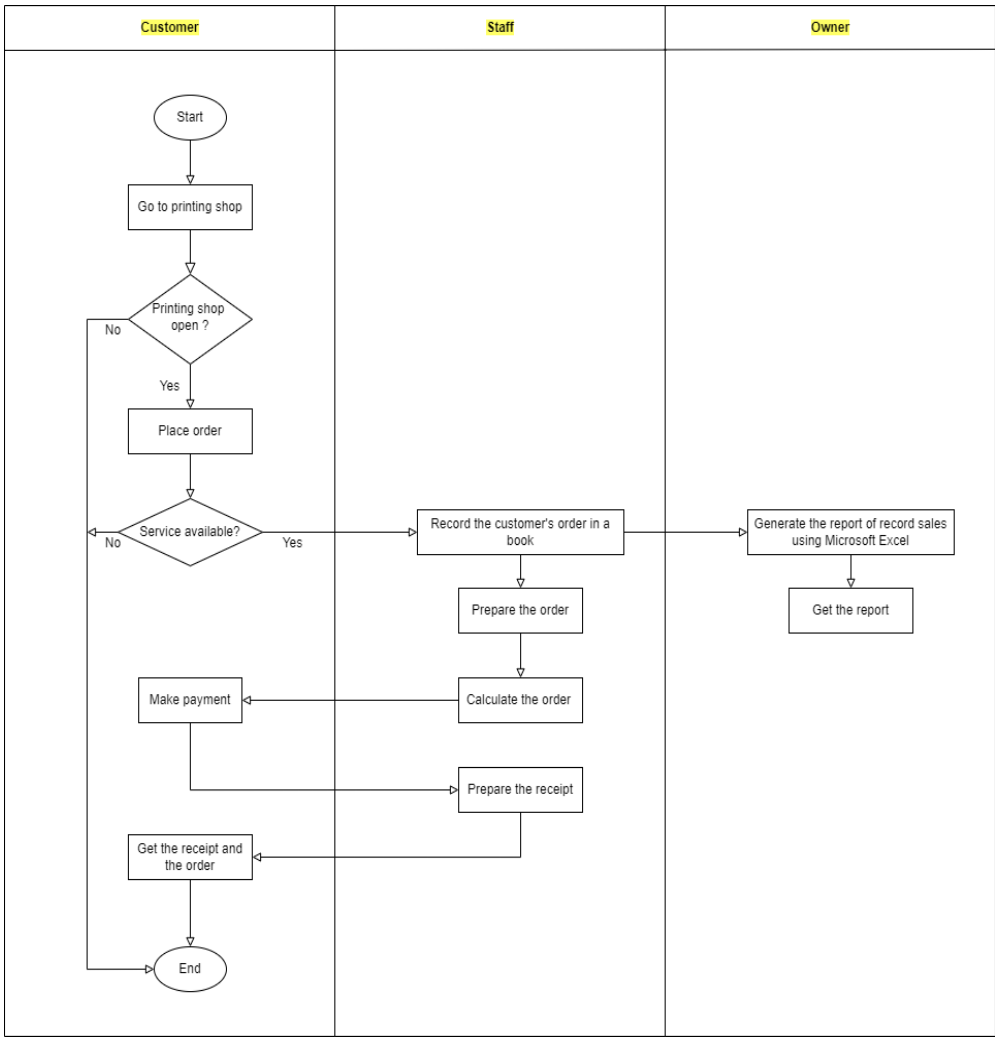

Figure 2.3 Current working flow of Print Cube shop

2.4 Comparison between existing systems

Nowadays, there are countless systems on the market. In this case study, the characteristics, strengths, and weaknesses of existing systems on the market that provide similar system functions and features are examined. The purpose is to gather more ideas for the characteristics and functionality that will be implemented into the developed project. Therefore, some functionalities from existing systems will be used to compare with the proposed solution. The first system to be compared is GogoPrint, and the second system is Western Eastern Printing.

Gogoprint is a printing company that offers top quality digital and offset printing products with affordable prices (Gogoprint, n.d.). Figure 2.4 shows the online printing system interface that was created by Gogoprint company. Gogoprint has an online system platform where customers can place orders through online and free delivery all over the country. As of now, Gogoprint is active in Thailand, Malaysia, and Singapore. Meanwhile, Western Eastern Stationery Malaysia offers digital printing services that are focused and famous with the large format colour printing and document scan archiving (Western Eastern Stationery, n.d.). Figure 2.5 is the interface of printing services offered by Western Eastern Stationery. They also provide some similar services including photocopy, scanning, printing business cards, brochure printing, paper folding and many other products. Both of these shops are located in Damansara, Kuala Lumpur, Malaysia.

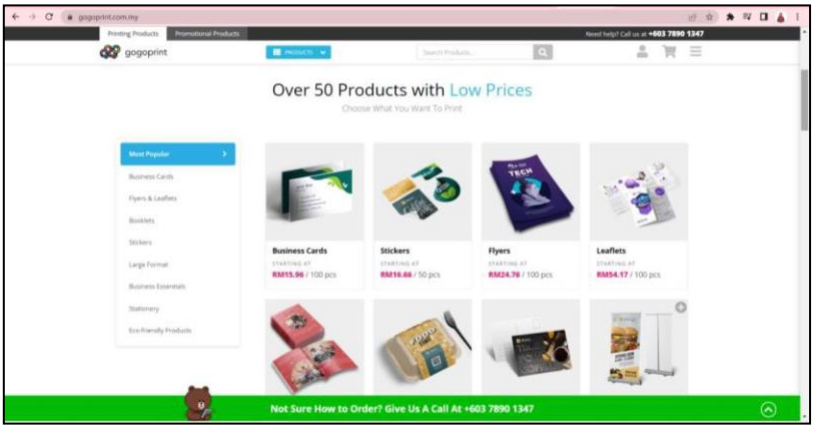

Figure 2.4 User interface at Gogoprint website

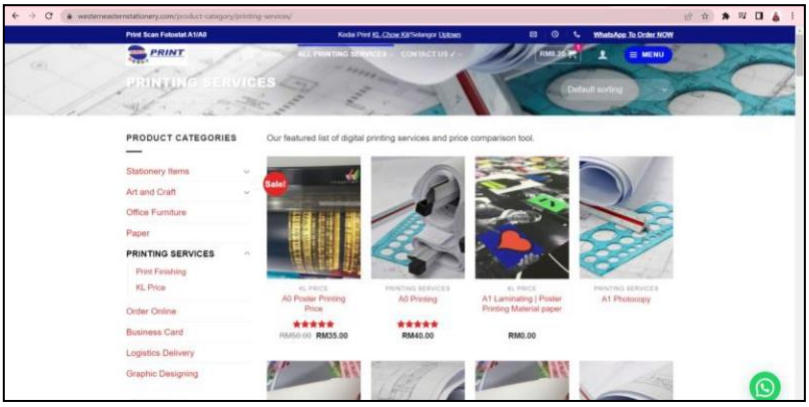

Figure 2.5 User interface at Western Eastern Printing website

Table 2.1 compares the proposed system to other existing systems, focusing on the system features for the customer's interface. Based on the table, it can conclude that all these three systems shared the same features especially in terms of important functionalities for web-based systems.

One of the important features is an e-catalogue where it provides the information on available services together with the list of prices. E-receipt also available for all the comparison systems, which is more convenient since we can reduce the paper usage and customers can get the receipt easily by downloading it after the order was made. Besides that, their customers are able to upload the printing material through the system too and it will reduce the customer's waiting time towards their order to finish because Gogoprint and Western Eastern Printing provide delivery within Malaysia. Meanwhile, the Print Cube system only provides pick-up methods for customers to choose. In order to improve the production process, the proposed system has a function to notify the customers regarding their order status. Once the order is completed, then the staff able to send email notification to the customer together with the order receipt and this function is not belongs to two other systems.

Table 2.1 Comparison between proposed system and existing systems

System	GogoPrint	Western Eastern Printing	Print Cube
Provide E-Catalogue	✓	✓	✓
Generate E-Receipt	✓	✓	✓
Upload printing material via system	✓	✓	✓
Notification via email	×	×	✓
Able to make payment via online	✓	✓	✓
Owner able to view the sales dashboard	✓	✓	✓
Admin able to insert or delete or modify the printing services	✓	✓	✓
Staff can manage the customer's order easily include update the order notification	✓	✓	✓

Furthermore, these three systems also provide a fast and easy integration payment system which is an online transaction for the customers to pay their purchase order. Print Cube e-commerce integrated with PayPal payment gateway in order to ease the ordering process for customer. In terms of sales management, the owner of existing systems and proposed systems were able to generate sales report automatically. It will increase the effectiveness when tracking the business performance. Last but not the least, all the compared systems also allow the staff to add new service, update the existing service or delete unavailable service if necessary. It is important to make sure the content is always updated and fresh.

Online printing services have changed people's perceptions of printing, offering up new frontiers and opportunities for organisations and individuals from all walks of life. However, the weakness found on these existing systems in the market is they do not provide special notification to the customers either via mail or SMS. For instance, the customer of Gogoprint was able to check the progress of their order through the system only. Customers encountered difficulty since they had to login to the site many times to determine whether or their order had been completed or not. Despite there are functionalities in the existing system that the proposed system does not include, but still the proposed system has met the most suitable system in terms of user requirements. This is because the main goal of proposed system was developed to improve the current operation for customer orders and products management at Print Cube shop based on user requirements.

2.5 Literature Review of Technology Used

This section describes all the technology that was used to create the Print Cube System. Technologies used includes the framework, network and security elements that supported through this system development. Each of the tools and technologies had a distinct role and had different benefits and drawbacks for the system.

2.5.1 Framework

Laravel is an open-source PHP-based back-end framework for developing a diverse range of custom web applications. According to Burets (2021), Laravel has been popular among web developers for over a decade and is still one of the best PHP server-side frameworks right now. The benefits of using this web framework includes it allows developers to build code and handle dynamic development requirements ranging from small websites to full-scale business systems. Besides that, a website built in Laravel is secure and protects against a variety of web attacks. Moreover, Laravel also helps to increase the speed of web development and save the time of development process since it is easy to learn and understand.

2.5.2 Programming Language

There are three programming languages that will be used throughout this project of system development. PHP is an abbreviation for Hypertext Preprocessor, a programming language suitable for website development where PHP code can be programmed alongside Hypertext Markup Language (HTML). PHP code is implemented on the server side, which distinguishes it from other programming languages. Secondly, HTML is a markup language that instructs a computer on how to interpret the code for a website. The HTML code will then be generated before being sent to the client. This enables database content to be displayed on a standard web page. Thirdly, CSS is a language style that is used to define the layout of an HTML document. This CSS can be used to define text styles, table sizes, and other aspects of websites that HTML could not previously define. In contrast to HTML, CSS will give the web developers more control over how web pages should look and to make websites more interactive.

2.5.3 Database and Web Hosting

The database and server technology that are going to be used for this project is MySQL and Hostinger Web Hosting. MySQL is an open-source software that is ideal for building data-driven applications because it includes a free database feature. The websites are then hosted on special server which is Hostinger. It is a web-hosting provider, technology and services required for the website to be viewed on the Internet

via clicking the website link only. Furthermore, Hostinger also can connect to the MySQL server remotely by assigning the database created in env file.

2.5.4 Mail Notification

Mail notification is one of the technologies that is going to be used as part of the system to send the status of a customer's order. Registered with the valid email is very important to make the staff able to send the status order notification successfully. Mail notification is the most suitable and efficient to use since it does not require any specific application to be installed and it is more like a direct link to your customers with no barriers. The concept of mail notification benefits for both customers and employees. Customers would receive the information of order status as soon as it became available, and staff can enable the push service without making changes to the web site software, which could be complicated. If it was conducted effectively, notification emails provide an opportunity to promote brand loyalty, increase user engagement, and establish a positive sender reputation in order to increase deliverability (“8 Rules of Great Email Notifications,” 2018).

2.5.5 Password Hashing

The strength of security also depends on how the password is stored on the server side. If there is an attacker who is trying to steal the password information from the database while the password is unencrypted, then he/ she will be able to access the customer’s account. This would affect a problem with the customer's trust. Hashing the storing password is one of the most useful mechanisms that make the password storage become more secure. The most common hashing algorithms used today are Message Digest 5 or well-known as MD5 and Secure Hashing Algorithms 1 and 2 (SHA-1 and SHA-2). Regardless of future security flaws, MD5 will continue to be an important aspect of data infrastructure in a variety of scenarios same goes to this project, MD5 algorithm will be implemented. The MD5 hashing algorithm is a one-way cryptography function that accepts any length of input and returns the output as a fixed length of 128-bits digest value. It is usual practise to save website user credentials in a hashed format to prevent third parties from accessing the passwords. Comparing

password hashes is substantially more private because hash functions always produce the same response for the same input (Shruti, 2023). Strong password hashing acts as an early deterrent to malicious activity and will help the system more efficiently.

2.5.6 User Authentication and Verification

User authentication and verification actually have the same roles as one of the security methods to prevent unauthorized users from accessing the privacy information. The knowledge factors that we used such as user's email and password as a key to validate the respective user's account. In this proposed system, user must create their own account in order to access the web system and user authentication is the process of entering both user's email and password when the user want to login. User verification provides a high level of assurance that the user identity provided is correct when the user has to submit a form of identification to show that they are authentic to access the system.

2.6 Chapter Summary

In conclusion, this chapter has discussed more about the company of Print Cube including their company organization structure, their current working flow and comparison of the features between the existing system and proposed system. The analysis made based on the system's features, benefits, and drawbacks is extremely useful in developing a system. Regarding that, the flaws discovered during the comparison of the present systems that can be used as benchmarks for developing the Print Cube system.

CHAPTER 3

SYSTEM DEVELOPMENT METHODOLOGY

3.1 Introduction

Methodology is a method for solving issues through a series of methodical and sequential actions by conducting research and determining effective procedures for answering the case study problems. The method that will apply for this system will be discussed in this chapter. This chapter also includes a summary of the technique and why it was adopted. There is also research on the hardware and software that are used during the system development process as well as during the testing phase.

3.2 Methodology Choice and Justification

Agile and waterfall are the common methodologies in current system development. According to the requirements for the Print Cube system, waterfall methodology has been chosen because it is the most suitable for this project. It is to ensure there are no phases that will overlap since the waterfall method will be implemented sequentially. The waterfall Software Development Life Cycle (SDLC) involves six (6) phases of system development as shown in Figure 3.1.

The developer is only able to move from a phase to the next phase after the previous phase is fully completed. If the customer’s needs are outlined clearly and specifically, then it is less susceptible to change throughout the project's development. Due to a strict reporting system in this method, it provides the client with easy control and accountability. Moreover, the number of issues can be reduced when the project development structure is carefully planned at this initial stage.

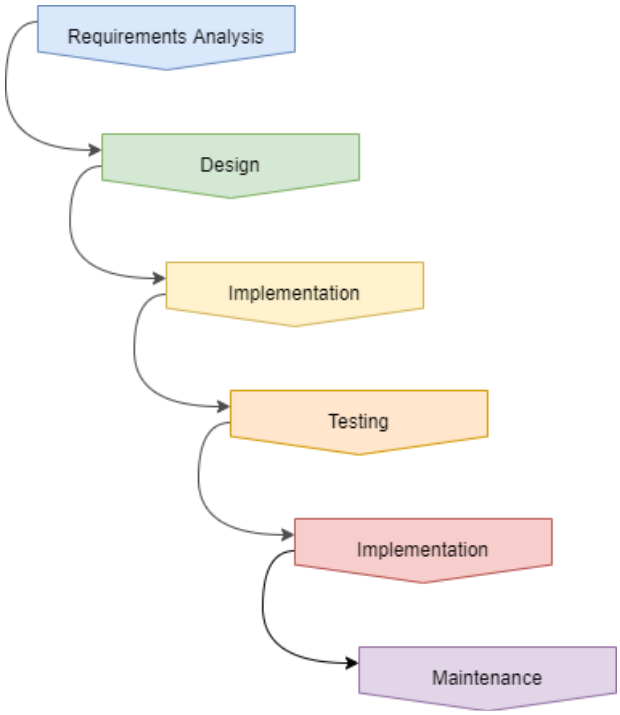

Figure 3.1 Waterfall methodology (SDLC – Waterfall Model, n.d.)

The waterfall model is simple to understand and apply, particularly for projects with well-defined conditions. The development of the Print Cube system is primarily the developer's responsibility because only minimal stakeholder involvement. Because the requirements are simple and testable, the waterfall model can produce the best outcomes. The waterfall model allows for restructuring planning and documentation, which facilitates in providing accurate estimates for project resources and deadlines.

3.3 Phases of the Chosen Methodology

There are six (6) phases in waterfall methodology which includes the requirement analysis, design, implementation, testing, deployment and maintenance. Each stage of the system development follows a strict timeline, so that the developer can easily estimate the time to develop a system. In a waterfall model, each phase must be completed before the next phase can begin, and the phases do not overlap because the process is linear sequential (SDLC – Waterfall Model, n.d.).

3.3.1 Requirements Analysis Phase

Requirements analysis is the initial phase and the goal of this phase is to identify all potential system requirements of the proposed system. A lot of studies have been conducted to identify the ideal system development methodology, technology, software, and hardware that can be used throughout this project. Furthermore, a literature review and comparison of similar available applications in the market which are Western Eastern Printing and Gogoprint, are carried out. The aim is to obtain ideas on what appropriate functionality to be adapted to the proposed application. Moreover, the detailed requirements need for the proposed system are gathered by having an interview session with the owner of the Print Cube shop that can be referred in Appendix A. Mr Faiz helped by recounting the problems faced in the current operation and gave the suggestion on how to improve their service from his perspectives during the interview session.

3.3.2 Design Phase

This phase studies the requirement specifications from the first phase and prepares the system design. It is able to clarify the overall system architecture and specify the hardware and software requirements. The proposed solution is intended to address the issues with the current manual operation. The results of the requirements gathering and analysis phase are used in this phase to create and produce system diagrams includes the use case diagrams, sequence diagrams, class diagrams, and activity diagrams. In addition, the system database design, data dictionary, and Entity Relationship Diagram (ERD) also were created. Furthermore, a project plan is scheduled in Gantt Chart to track project progress and ensure that the project is delivered as planned. Draw.io is used to create all these system diagrams and charts. Meanwhile, the user interfaces wireframing were designed using Canva software because it capable of delivering high-quality interface designs that are visually appealing and user-friendly.

3.3.3 Implementation Phase

On this implementation phase, the technical execution begins by writing project source code for the proposed system using the Laravel framework. The system features were designed based on the user requirements and the code is written in accordance with system modules. In this project, PHP, HTML, and CSS were chosen as the programming languages to develop this Print Cube web-system. Then, all the data stored in one place which is, in MySQL database. At the same time, multiple users can read and alter the data. Database is searchable and sortable that allowing the developer to find the required information quickly. Besides, Microsoft Visual Studio Code is chosen as the IDE tool for writing and editing programme code. After that, the system project was hosted into a web-hosting provider as mentioned above, Hostinger.

3.3.4 Testing Phase

Testing is the most crucial part in system development. Before a product can be distributed to customers, it must be tested to ensure that it is error-free and that all requirements have been met. They will have a positive experience with the programme created if they are satisfied with our system development. There are two types of testing that conducted towards the Print Cube shop system which are white-vox testing and end-user testing or known as UAT. The White Box Test is a method used by software developers to test software while considering its internal workings. Following the development of each module, all system modules are subjected to unit testing to validate their functionality before being integrated into a complete system in the following phase. The testing is then reviewed by the client. Any flaws discovered throughout the testing process will be rectified and reported.

3.3.5 Deployment Phase

The deployment phase happens when this proposed system is considered fully functional, and then the product will be deployed to our client. This stage includes several activities such as ensuring that the domain is active, ensuring that the system met all exit criteria in the previous testing phase, and ensuring that no severe or critical

defects remain open. The domain was paid and created with the name of “printcube” in Hostinger web-hosting. Several actions were completed during this phase, including publishing the system project files to the server, configuring the server, importing the MySQL database, and testing the system. Despite the system was tested on localhost, the environment between localhost and a web server is different. As a result, testing was repeated after the system was deployed and before granting access to the user for testing. Several issues discovered during testing have been corrected and re-published to the server.

3.3.6 Maintenance Phase

Maintenance will be performed on a regular basis to keep the system functional and ensure that it can perform its expected functions. This phase provides support to the system if any errors are discovered when used, such as discovering bugs and inadequate features, in order to ensure the system runs smoothly. The modification regarding the problems found in testing phase should be improve in the system. However, due to time constraints in the project's limited time of study, this phase is not carried out in this project. Before completing each phase of the waterfall model, a quality assurance test is run to evaluate the outputs and confirm the results. Meanwhile, during the waterfall model's life cycle, documentation is developed and generated.

3.3.7 Gantt Chart

Gantt chart will be used to be a plan for the system development of the Print Cube shop. It will help the developer to manage the time and task without any delay. Figure B.1 depicts the timeline for the documentation process in PSM1, whereas Figure B.2 depicts the Gantt Chart for the system development process in PSM2. These two schedules can assist the developer in organize the project, increase overall project visibility, and keep the development process on track.

3.4 Technology Used Description

This subtopic defined all the technology that used when developing the Print Cube system. The technologies used in terms of framework, network elements and security elements have been discussed in detailed at Section 2.5. Meanwhile, the Table 3.1 focused on the explanation of hardware tools and software tools used and its specifications to develop the system.

Table 3.1 List of hardware and software used for the system development

Tool(s)	Specification
Hardware	
Laptop	Dell Inspiron 15
Random Access Memory (RAM)	16 GB
Processor	11th Gen Intel(R) Core (TM) i5-1135G7
Hard Drive	Solid State Drive (SSD)
Input/Output Devices	Mouse, Keyboard / Printer
Smartphone	iPhone 14 iOS 16
Software	
Operating System (OS)	Window 11
Browser	Google Chrome, Microsoft Edge, Safari
Integrated Development Environment (IDE)	Visual Studio Code
Web Application Framework	Laravel
Development	Hostinger, MySQL
Cloud Storage	Google Drive
Documentation	Microsoft Word, Draw.io, Canva

3.5 System Requirement Analysis

The system requirements analysis's goal is to determine what needs to be procured, allowing developer to establish a schedule, determine what needs to be procured, how it should be obtained, and what the likely costs, and equipment will be to complete the project at hand. This phase can influence the system's behaviour and limitations. Then, similar to this project, there are minimum hardware and software specifications that must be met in order for the proposed Print Cube system to function properly once it is deployed as shown in Table 3.2.

Table 3.2 Hardware and software specifications for the proposed system

Tools	Minimum Requirement
Hardware	
Processor	AMD Ryzen, Intel Pentium, 550 MHZ
Random Access Memory (RAM)	At least 2GB or above
Read Only Memory (ROM)	1TB or above for HDD / 512GB or above for SSD
Input/Output Devices	Laptop, Mouse, Keyboard, Smartphone
Software	
Operating System	Windows 8 or above
Web Browser	Google Chrome, Microsoft Edge, Safari

3.6 Chapter Summary

This chapter describes the waterfall system development methodology that have been implemented during this project development. To ensure that the system runs smoothly, the study is planned as thoroughly and methodically as possible. It is critical for obtaining satisfaction from product users. Following that, all of the hardware and software specifications are thoroughly explained to ensure that the project is developed with appropriate technologies.

CHAPTER 4

REQUIREMENT ANALYSIS AND DESIGN

4.1 Introduction

Chapter 4 discussed the details of requirement analysis and design for the Print Cube system. The requirement analysis was reevaluated about the system design included a use case diagram, a sequence diagram, an activity diagram, and a class diagram. Other than that, this chapter also contains the overall system architecture, the database design and the use interface design of this web application system. All of these diagrams are very needed as the overview and guideline to the developer on the flow of the web application system that will be developed.

4.2 Requirement Analysis

Requirements analysis guarantees that your ideas are strong before moving forward to the next phase. In this subsection, the requirement analysis for Print Cube shop will be illustrated by using diagrams which are use case diagram, sequence diagram and activity diagram. These visualizations will support the study and to produce a smooth system flow that meets the user's requirements.

4.2.1 User Requirement

This section concluded the functions that available on this proposed system that can overcome the problems faced by existing systems based on information that was analysed in an interview session with the owner. Thus, we can see how the proposed solutions correspond to the current problems in the Table 4.1.

Table 4.1 Mapping the problems with the solution

Current problems	Proposed solutions
Unsystematic since all the order's information are stored manually	All orders and other information stored in secured database
Time consuming because the customer had to wait for their order to be completed	Customer just pick up their order once get the order status is completed via mail notification
Only provide cash payment method	Add on online transaction
Miscalculate of the order	Automatically calculate the customer's order
Difficult to analyse the current sales	Owner can view the sales report on dashboard
Customer need to walk in to send their printing material	Able to upload the printing material through website
Manual receipt process	Paperless environment since the customer will receive the e-receipt

4.3 Use Case Diagram

Figure 4.1 shows a use case diagram for overall system of Print Cube shop.

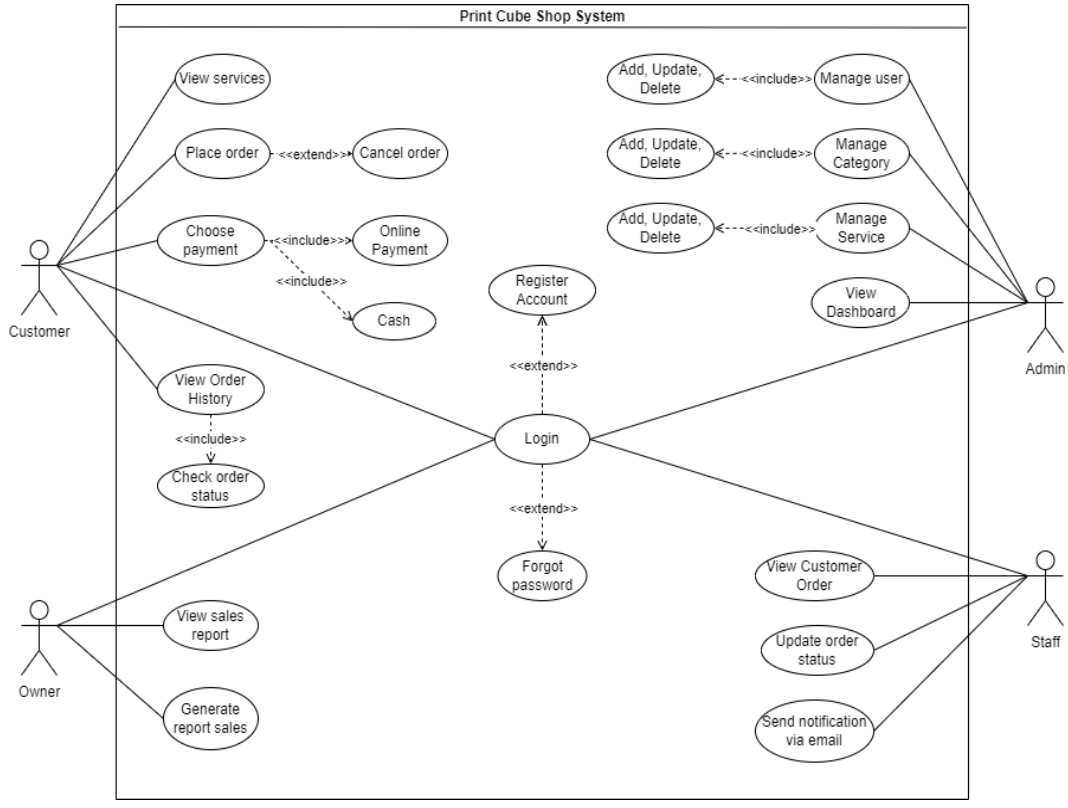

Figure 4.1 Use case diagram for overall system

Use case diagram is a representation of interaction between the actors and the system's functionality. It illustrated a general view without going deep into the inner workings of Print Cube shop system with four elements which are use cases, actors and its relationship between the actors and use cases The importance of use case diagrams described what features the system does and which one is authentic for each role. Admin plays a significant role in managing the category, services, and users. Next, the customer can view the services, view his/her order and choose using one of two payment methods. The staff then assumes responsibility for handling the customer's order, which includes viewing the specifics of orders to be prepared and updating the order status. Furthermore, the car owner can simply analyse the sales performance using his dashboard. The detailed function of each use case was briefly described in the Table 4.2.

Table 4.2 Use case explanation

Use Case	Explanation
Register account	Each users need to register account for the first-time user
Login	Each of the users need to login to use the web-system
Forgot password	User can reset their password if they forgot
View printing services	Customer can view the list of printing services provided with its list of prices
Place order	Customer is able to place order directly using the system
Make online payment	Customer allows to make an online payment either to make full payment or pay for deposit only
Upload material	Customer can upload their printing material into the system
Get order notification status	Customer will get the order notification status if their order is already completed and ready to pick-up
View sales report	Owner is capable of analysing the sales report via dashboard
Update order notification status	The staffs can update the order status for each order to notified the customer
Download printing material	The staffs are able to download the printing material before proceed to process it

Update sales report	The staffs can update each of the sales into the system for customers walk-in to their shop
Update service	The staffs are able to add new service into the system or delete the unavailable services from this system
Add user	Admin will add new users that register new account
Delete user	Admin able to delete the user account
Send order notification status	Admin will proceed to send the order notification status to the customer once the staff update/submit it

4.4 Sequence Diagram

Sequence diagrams sometimes refer to event diagrams. This diagram is widely used by most system developers to understand the requirements of the proposed system. Sequence diagrams basically have four (4) notations including the actors representing the type of role that will be used in the development system. The second notation is lifelines that are shown as a box with a dashed line connected to it and which represent the object instances that partake in the sequence diagram. Third is the message that is placed above the arrow line and it represents the operation carried out by the receiving object's class. The last notation is known guards for informing software developers about the constraints associated with a particular process.

This diagram represents the interaction logic between the objects in the system in the order in which the interactions occur first by using the diagram's vertical axis to represent what and when the messages are sent. There are a total of four sequence diagrams were created to illustrate the important functionalities within the developed system. However, there is only two important sequence diagrams highlighting in this subtopic which are sign in process and the procedures required for the customer to place an order, while the rest of the diagrams can be referred to in Appendix C.

4.4.1 Sequence Diagram for User Login

Figure 4.2 shows the flows for users to login into the web-system. This login feature will be used by all four users which are customers, staff, owner and admin. However, the user needs to register their account first by submitting their email, password and re-confirm password. Once the information is entered correctly, then the user automatically registered into the system. During the login process, the system will validate the user by comparing the keyed-in email address and password with the data stored in the database. Since the password undergo encryption process using MD-5 algorithm before stored in the database, then the decryption process for password also implemented during the comparison at login page. If the entered email address and password are found and same in the database, then the user is able accessed and redirected to his/her authenticate page assigned. Otherwise, the user will be unable to access the Print Cube system.

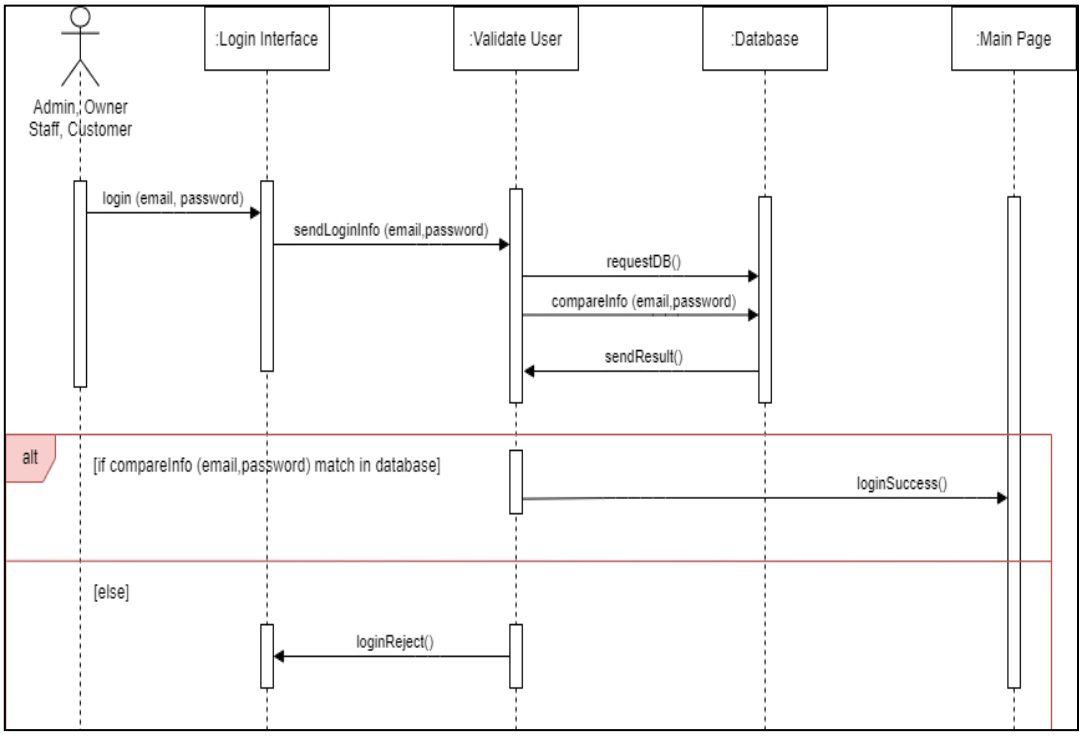

Figure 4.2 Sequence diagram for login feature

4.4.2 Sequence Diagram for Place an Order

Figure 4.3 shows the sequence for a customer to place an order. Basically, the customer needs to login successfully before they want to place an order. If they try add to cart the product before login and it should not work. The system redirected them to the login first page. Once login, customer can view and choose the list of available services includes its information such as price, type of paper, colour or not. Next, the customer can add the order item into a cart by entering the quantity that want to be printed and upload the document file before proceed to payment. At the checkout page, customer should get his/her information that filled in the profile because the system retrieved the customer's profile information likes phone number and address from database directly. After that, customer can choose two options of payment either cash or using online payment gateway. Once the order is completed, then customer will be redirected to "thank you" page.

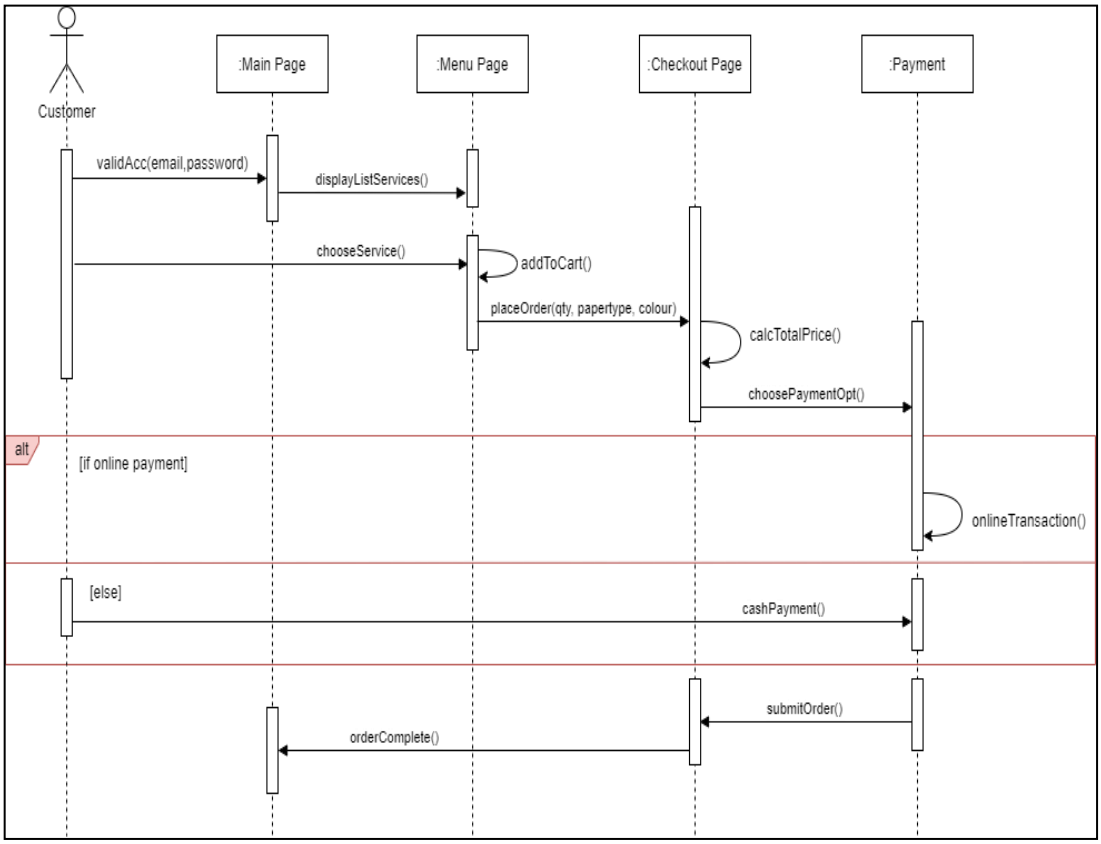

Figure 4.3 Sequence diagram for place an order

4.5 Activity Diagram

An activity diagram is a graphical representation of the flow from a process to another process and the user's actions that seems to be similar with the flowchart. Activity diagrams are one of the UML diagrams that are really important in system development since they are used not only to simulate the dynamic nature of a system, but depicts the process of entering information together with its results, the operations and the procedures, and use cases in the system. However, there are four elements that should be identified to draw this diagram including activities, association, condition and constraints (Tutorials Point, n.d.). Every user includes the owner, staff, customer and administrator will be provided access to the system by authenticating the user's email and password during login.

4.5.1 Activity Diagram for Admin

This section describes the activity diagram for admin as illustrates in Figure 4.4. The login process also kicked off the admin activity. The admin will be taken to the admin panel after successfully logging into the system. Admin panel shows the information about the category, product and user. The administrator can manage existing users, including editing and deleting them, as well as creating new ones. The administrator must enter the user's name, email address, password, and the role which can be owner, admin, staff, or customer. The admin also can then manage the category and products that provided by the shop and it the same way how the admin can manages the user.

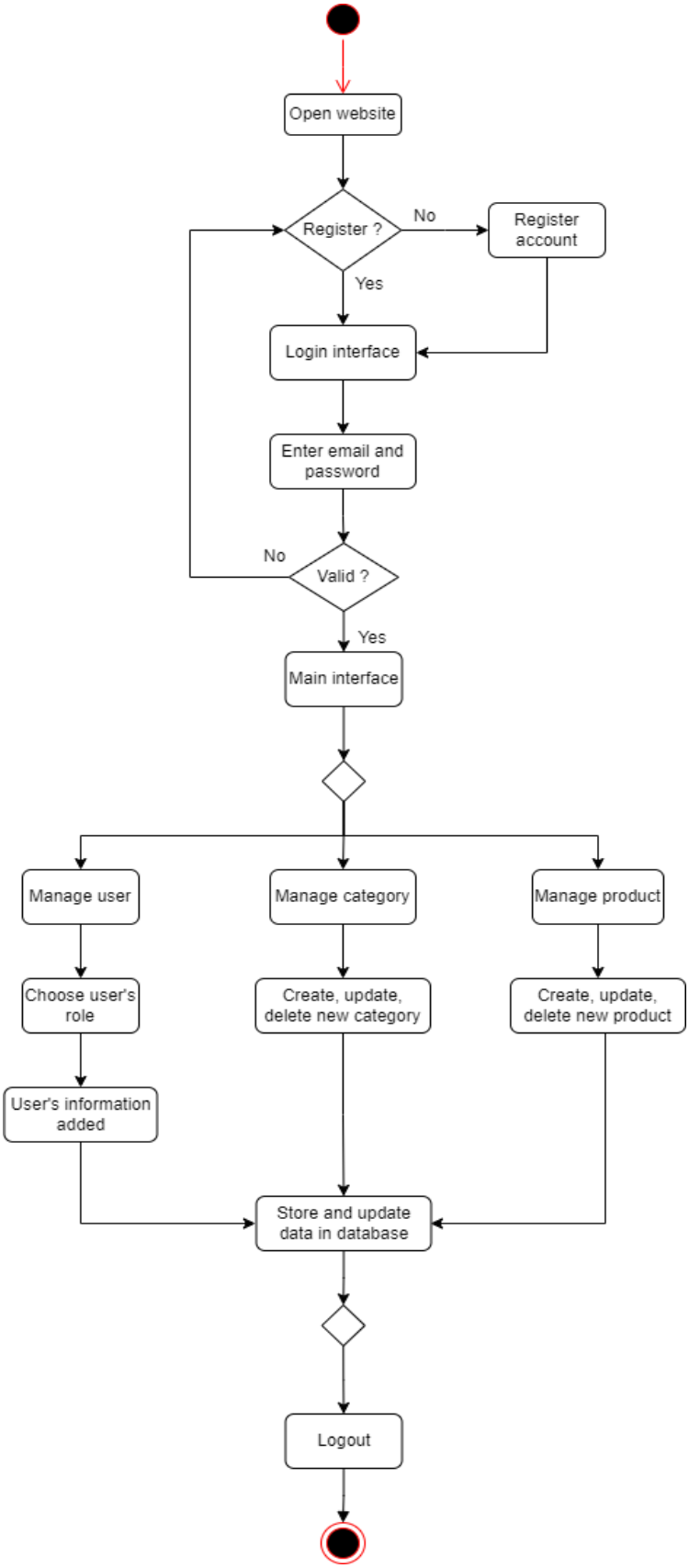

Figure 4.4 Activity Diagram for Admin

4.5.2 Activity Diagram for Owner

The activity diagram for the owner is discussed in this section as represented in Figure 4.5. The activity flow is very simple where the owner can start with the login process and then he is taken to the sale dashboard. The dashboard presents about the sales information via chart and excel file. There is card information displayed current total of category, total of product and total of order. Additionally, there are two types of graphs displayed on the dashboard too which are pie chart of number of products sold and bar chart for quantity of products sold by month.

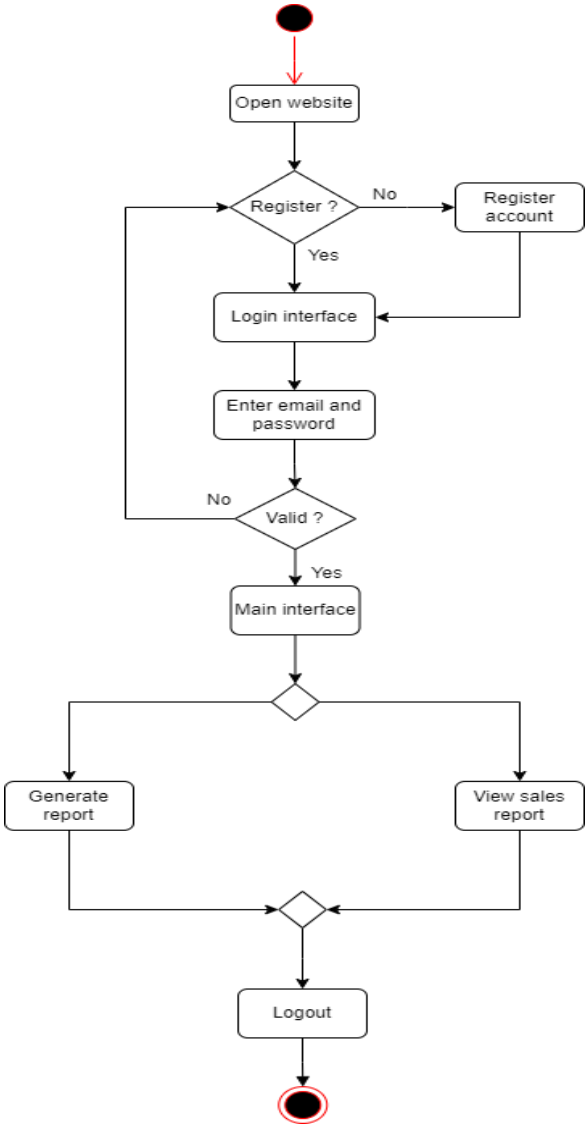

Figure 4.5 Activity Diagram for the Owner

4.5.3 Activity Diagram for Customer

The activity diagram for customer users is discussed in this section. Figure D.1 in Appendix D shows an activity flow for a customer who wants to order the printing of notes in pdf format. Before placing an order, the customer logs into the system. For customers who want to use this online system for the first time, they must first register an account by submitting their email address, and password. When the user attempts to login, the system validates the user by comparing the entered email address and password to the database data. If the entered email address and password are found and match in the database, the user will be redirected to the main page. Customers can place an order by selecting the service, input the quantity and then upload the file material to the system. After that, he/she can proceed the checkout process by choosing the payment method either online transfer or cash.

4.5.4 Activity Diagram for Staff

This section shows and describes the activity diagram for staff refers to Figure D.2 in Appendix D. The staff begin the activity by logging into the system. This procedure is the same as the procedure for customer users. Upon successful entry, the staff will be taken to the main page, where the most recent order will be displayed. If the staff start preparing the order, then they need to update the order status to “pending” and once the order is complete, they need to change the order status to “completed”. The updated order status can be viewed by customer on his/her page too. Once the status order is completed, staff can send mail notification for customer that their order is ready to pick up together with the invoice of order receipt. All changes and additions will be saved and updated in the database.

4.6 Class Diagram

Class diagram is a static diagram that provides a static view of the web-system application as shown in the Figure 4.6. This diagram represents the classes and interfaces, as well as an overview of how they interact with one another and then it

helps the developer to comprehend the problem domain requirements and identify its components. There are several classes and the sub-classes to model the component that reflects the proposed system for Print Cube shop.

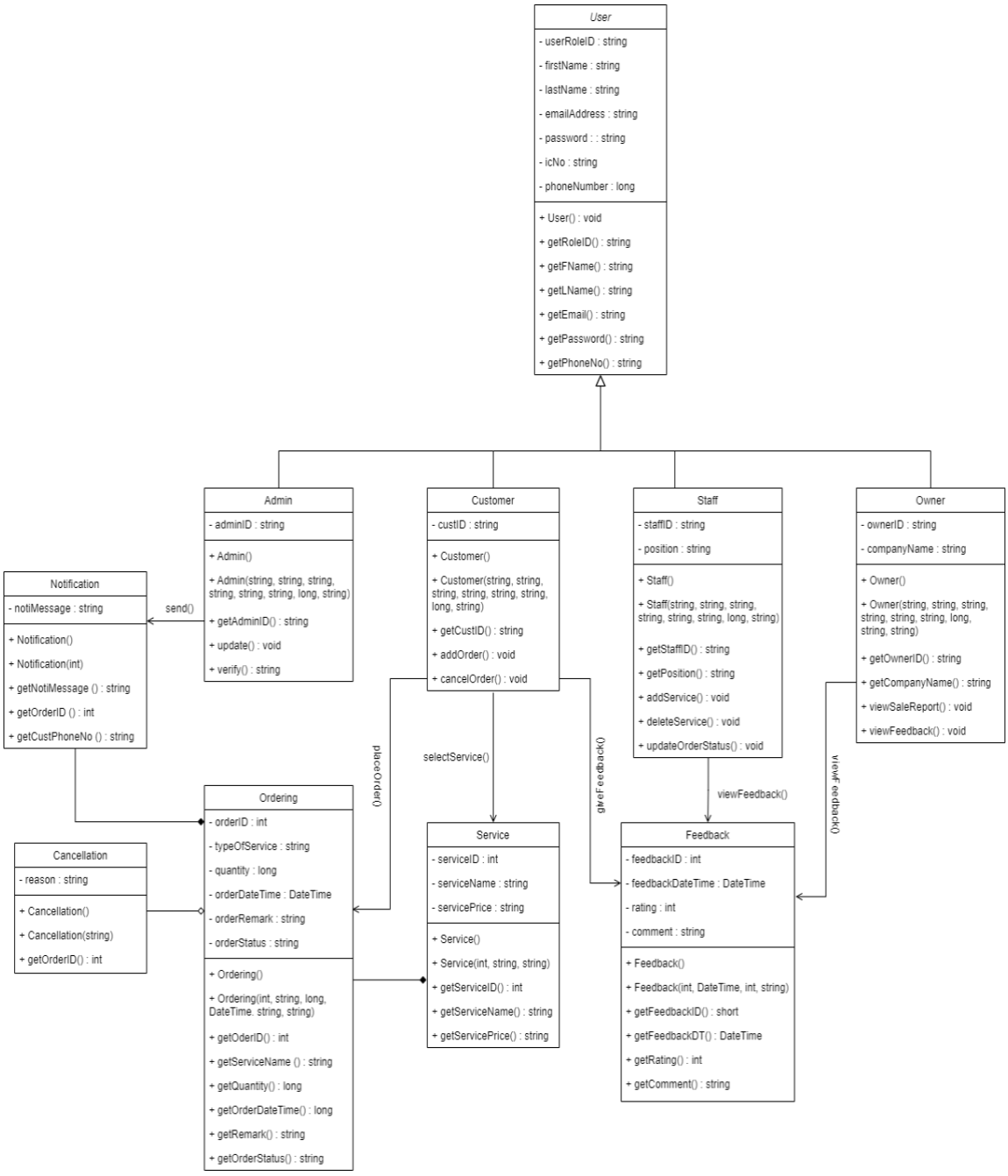

Figure 4.6 Class diagram for overall system

4.7 Project Design

A project design is the strategic organisation of ideas, materials, and processes to achieve a specific goal for the proposed system. To overcome the current existing problems faced by customers of Print Cube shop, a proposed system is designed to make the services offered by this shop become a more convenient, efficient, and time-saving solution to the problems. The Print Cube shop system will be implemented in the client-server model using cloud databases and apply network security technology such as password strength verification, user authentication and verification, password hashing, and push notification service via email as illustrated in Figure 4.7. For example, when the staff get notified that there is a new order placed by a customer, they need to proceed by preparing the order and lastly update the status of the order once it is completed. The order status will be sent to the customer via email, so that customer can just come to the shop and pick up the printed material.

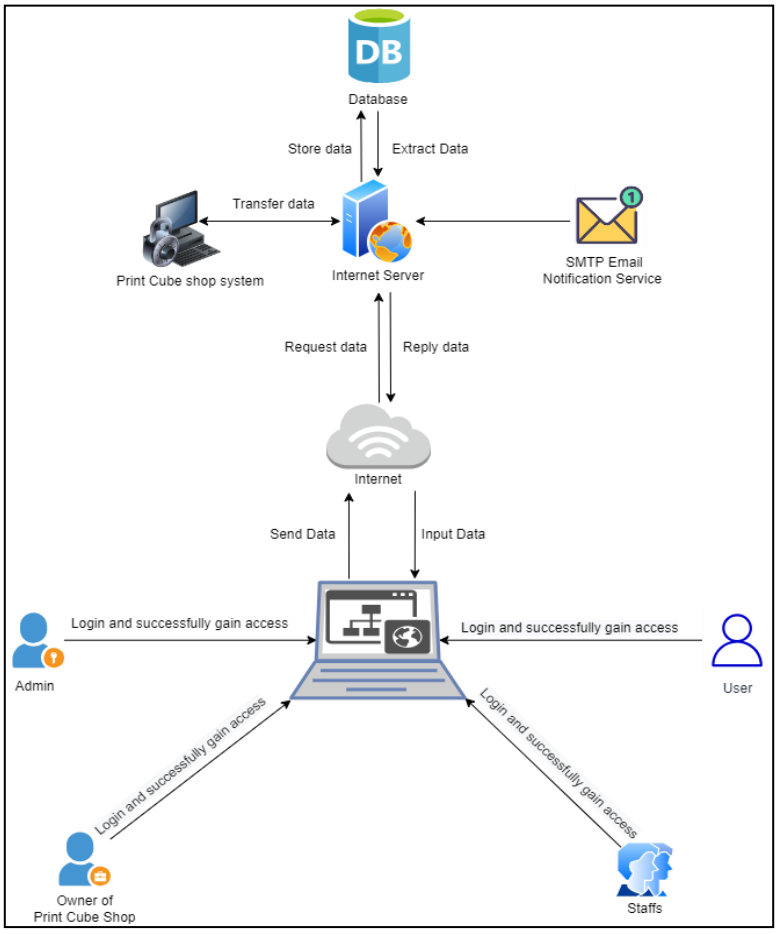

Figure 4.7 System architecture for overall system

4.8 Database Design

Database design plays an important role in a system because all information will be stored in the database and they serve as the "back end" of the websites you see on the internet. A database is used to store and organise all the data that is required for the operation of this system. However, the databases must also be well maintained and highly secure in order to function properly and to ensure the sensitive data stored inside is protected from the hackers. In a database design, Entity Relationship Diagram or well-known as ERD is used to represent its diagram. An ERD includes different symbols and connectors that depict two important pieces of information which are the he major entities within the system scope and their interrelationships (Visual Paradigm, n.d.). Refers to the Appendix E, an ERD was created for this proposed system with eight entities as the database structure for Print Cube shop system.

4.9 Interface Design

The interface design is a sketch of a system that includes its various functionalities. The interface is a screen together with input and output that connects users to Print Cube shop web-system applications. It serves as a display for users to access information and data retrieval centres. The designed system interface would be user-friendly, simple to understand, and well-organized so that users will not confuse the flow of the system. Figure 4.6 depicts the interface for registration form for customer since the other user will manage by admin. Next, Figure 4.7 show the interface planned for login page that required user to enter their email and password to login. Besides, the system will create a reset-password form as shown in Figure 4.8, in case there will be some users having issue in remembering the credential password. Meanwhile, the other mock-up interface of Print Cube shop system for the customers, staff, and owner can be referred in Appendix F.

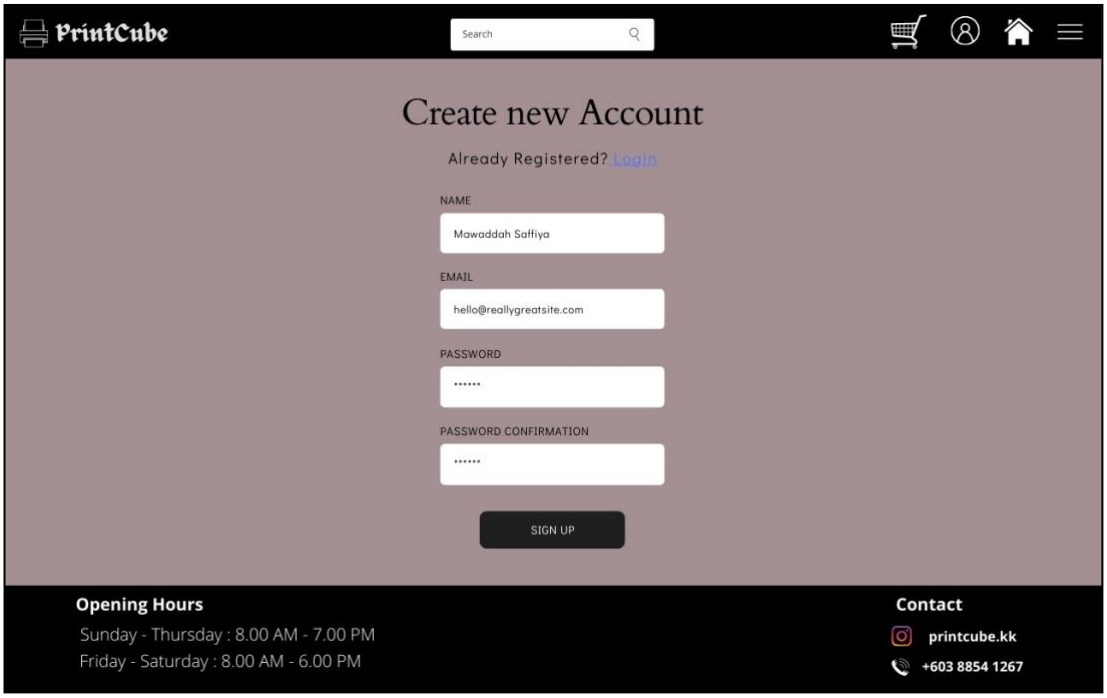

Figure 4.8 User interface for register account

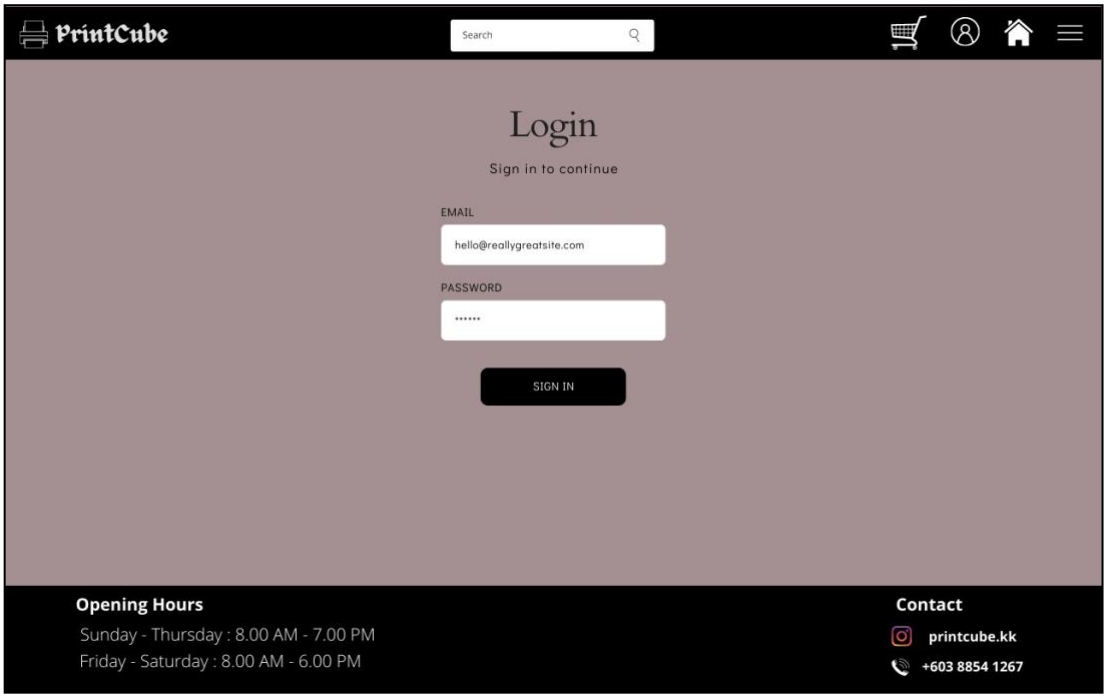

Figure 4.9 User interface for login

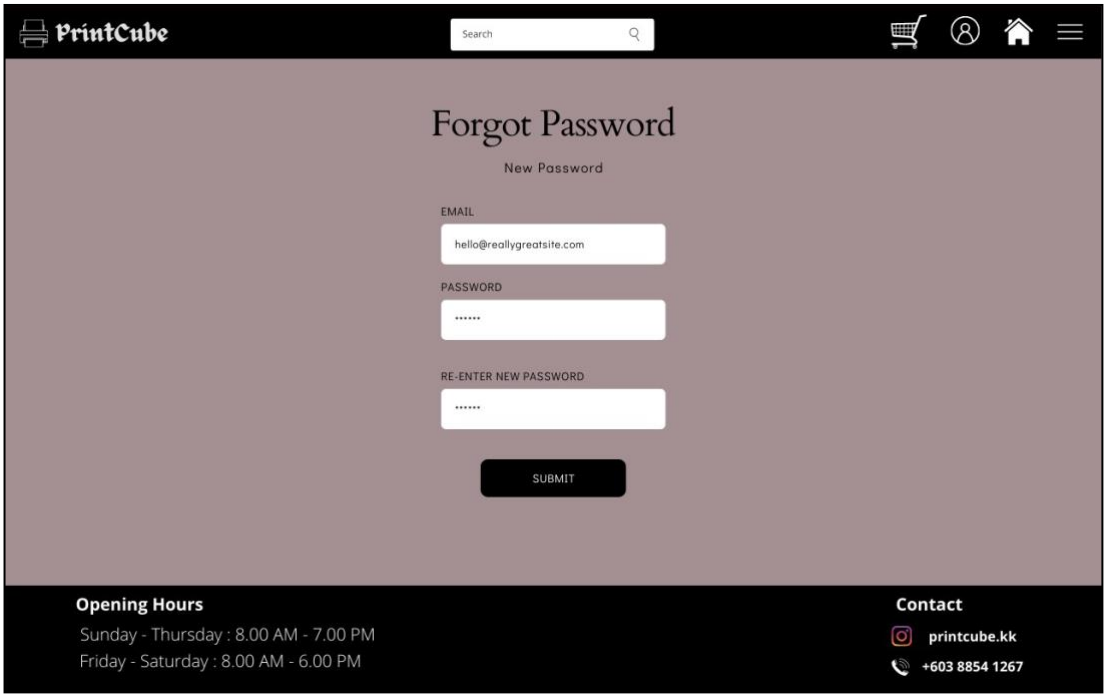

Figure 4.10 User interface for reset password

4.10 Chapter Summary

In short, this chapter provides a brief overview of the system design and the proposed system functions. To provide a more detailed description of each user's functionality, various diagrams such as use cases diagram, sequence diagrams, activity diagrams, class diagram, Entity Relationship Diagram (ERD) and the system interfaces are included. Use case diagrams are used to describe interactions between system users and the environment system, whereas sequence diagrams describe interactions between an activity and an object found in this system. Next, the class diagram shows the relationship between the classes and describes the service that they provide. Besides that, the activity diagram is illustrating the flow from an action to another action for each user. The relationships between entities and attributes are also discussed in the database design section. The entity relationship diagram is used to make the database's initial design understandable. Furthermore, the project design that will be used, which is the client-server model, is discussed in this chapter too.

CHAPTER 5

SYSTEM IMPLEMENTATION AND TESTING

5.1 Introduction

Chapter 5 will provide a brief overview of the Print Cube Shop's printing services system implementation and testing. The coding and interfaces of application key functionalities will be covered in this chapter to provide deep insights into system that was developed. Furthermore, there are numerous tests that are performed on real users who use printing service to ensure that the application meets the requirements and performs as intended, such as black-box testing, white-box testing, and user acceptability testing (UAT). Subsequently, this chapter will explain detail the application's development and implementation, as well as the results of testing that have been conducted towards the stakeholders and users.

5.2 Coding of System Main Functions

Print Cube Shop System is a web development that was created to help customers, employees, and owner manage orders with the help of admin. For example, a simple database was set up to manage the order rather than the traditional method which they used paper and pen for numerous operations, which leads to writing errors and other complications. Laravel was used as the programming framework for the Print Cube Shop System. Front-end development employs Hyper Text Markup Language (HTML), Syntactically Cascading Style Sheets (SCSS), and JavaScript (JS). MySQL is used to manage the database that was connected to the system. All the coding for the main functions as well as the interface for admin, customer, staff, and owner will be thoroughly explained.

5.2.1 Security Elements

The following subtopic will go through the security elements that have been incorporated in this project. A security system could help organizations in protecting sensitive information, adhering to relevant legislation, and keeping their data and systems safe from cyber threats.

5.2.1.1 Password Hashing

Password hashing is the process of converting the password in plaintext format into an incoherent string of numbers and letters by running it through a hashing algorithm. The password will be hashed before being stored in the database, as illustrated in Figure 5.1, using the *Hash* function offered by the Laravel Framework Service Providers. This function will hash the user registration password and it is critical for basic security hygiene because any compromised passwords are unreadable to the bad actor in the event of a security breach. Figure 5.2 depicts the hashed password that is stored in the database.

Figure 5.1 Password hashing during registration

Figure 5.2 Hashed password in database

5.2.1.2 Access Control

Access control verifies various login credentials, such as usernames and passwords, PINs, biometric scans, and security tokens, to identify users. After a user has been authenticated, access control authorizes the appropriate level of access and actions associated with that user's credentials. One of the security measures utilized in this system development is role-based access control (RBAC). RBAC gives access based on established business where the idea is to give users access to only the data that is required for their roles within the organization. This popular strategy is built on a complicated set of role assignments, authorizations, and permissions ("What is Access Control?", n.d.). Laravel contains a middleware that ensures the user's is authenticated. If the user is not authenticated, the middleware will redirect the user to the login screen of the web application. If the user is authenticated, then the middleware will allow the user request to continue inside the web application.

By default, everybody who registers directly into the system is registered as a customer, and the value of "role_as" is set to 0 in the database. Meanwhile, other users such as admin, owner, and staff can only be registered by admin because only admin has access to this system. Each of role have different values assigned in the database which are value 1 is set to admin, 2 is set to staff and 3 is set for the owner. Figure 5.3 shown the value assigned in "role_as" column of database determined which page that the user will be redirected once they login into the system.

```
protected function authenticated()
{
    if(Auth::user()->role_as=='1')
    {
        return redirect('admin/dashboard')->with('message', 'Welcome to Admin Dashboard');
    }
    else if(Auth::user()->role_as=='2')
    {
        return redirect('staff/dashboard')->with('message', 'Welcome to Staff Dashboard');
    }
    else if(Auth::user()->role_as=='3')
    {
        return redirect('owner/dashboard')->with('message', 'Welcome to Owner Dashboard');
    }
    else{
        return redirect('/home')->with('status', 'Logged In Successfully');
    }
}
```

Figure 5.3 Middleware for access control

5.2.1.3 Input Validation

As the developer is not capable to control the user input, input validation is carried out in the text fields of Print Cube System interfaces. Each of input required enter by customer have their input validation checked. For example, Figure 5.4 depicts the input validation for the attributes of name, email, and passwords during registration page. All these attributed is required to enter in string format. Email that will be registered must be unique for each account since it will use during the login process. Each password should be at least 8 characters long. Input validation ensures that the input data is properly formatted and stored in the database. Other than that, an error validation message is also provided to tell users about the input error so that they can enter a valid input as shown in Figure 5.5.

```php
protected function validator(array $data)
{
    return Validator::make($data, [
        'name' => ['required', 'string', 'max:255'],
        'email' => ['required', 'string', 'email', 'max:255', 'unique:users'],
        'password' => ['required', 'string', 'min:8', 'confirmed'],
    ]);
}
```

Figure 5.4 Input validation on registration

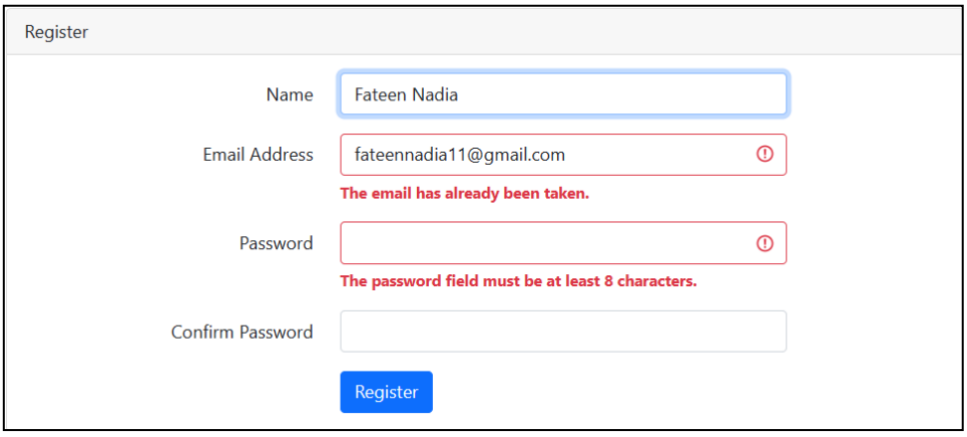

Figure 5.5 Error validation message

5.2.2 Admin

The administrator is the one who responsible of managing the printing service products. The code for implementing the admin's main function, which are manage the available items and the users enrolled in the system, is shown in the subtopics below.

5.2.2.1 Manage Product

Figure 5.6 shows the controller that used by admin to store the product of Print Cube Shop. The information includes the name, description, paper size, color, print sided and price of each product will be validated by rules() function in "ProductFormRequest" before it can be stored successfully in the products database as can be seen in Figure 5.7. Besides, a condition statement for uploading multiple product images also was created. Create function was used in order to add new product, while update function is used for update the any data in products table.

```
public function store(ProductFormRequest $request)
{
    $validatedData = $request->validated();

    $category = Category::findOrFail($validatedData['category_id']);

    $product = $category->products()->create([
        'category_id' => $validatedData['category_id'],
        'name' => $validatedData['name'],
        'description' => $validatedData['description'],
        'size' => $validatedData['size'],
        'color' => $validatedData['color'],
        'print_sided' => $validatedData['print_sided'],
        'price' => $validatedData['price'],
    ]);

    if($request->hasFile('image')){

        $uploadPath = 'uploads/products/';

        $i = 1;
        foreach($request->file('image') as $imageFile){
            $ext =$imageFile->getClientOriginalExtension();
            $filename = time().$i++.'.'.$ext;

            $imageFile->move($uploadPath,$filename);
            $finalImagePathName = $uploadPath.$filename;

            $product->productImages()->create([
                'product_id' => $product->id,
                'image' => $finalImagePathName,
            ]);
        }
    }

    return redirect('/admin/products')->with('message','Product Added Successfully');
}
```

Figure 5.6 Function of store product

```php
public function rules(): array
{
    return [
        'category_id' => ['required','string'],
        'name' => ['required','string'],
        'description' => ['nullable','string'],
        'size' => ['nullable','string'],
        'image' => ['nullable'],
        'color' => ['nullable','string'],
        'print_sided' => ['nullable','string'],
        'price' => ['required','string'],
    ];
}
```

Figure 5.7 Function in “ProductFormRequest”

5.2.2.2 Manage Users

Admin is the one who in charge in managing all the user such as able to add new staff, view the list of registered customers, and delete the unused account. Figure 5.8 is the controller for managing all the users by admin. The cryptography process which is encrypt() function also implemented at user’s password whenever the admin registering the new user. The column level in the "users" database table refers to the user's role, such as owner, staff, or customer. The detailed for user’s level was discussed in section above.

```php
public function AdminListUser(Request $r) {
    $user = \App\Models\Register::all();
    return view('adminViewUser',compact('user'));
}
0 references | 0 overrides
public function AdminAddUser() {
    return view('adminAddUser');
}
0 references | 0 overrides
public function FormAdminAddUser(Request $r) {
    $user = \App\Models\Register::where('email','=',$r->email)->count();
    if ($user != 0){
        return redirect()->back()->with('alert','That email has already been registered!');
    }
    else{
        //newdata is a new variable that hold the data entered
        $newdata = new \App\Models\Register;
        //take the inprut from registration form
        $newdata-> name = $r->name;
        $newdata-> username = $r->username;
        $newdata-> email = $r->email;
        $newdata-> telephone = $r->telephone;
        $newdata-> password =  Crypt::encrypt($r->password);
        $newdata-> confirmpwd = Crypt::encrypt($r->confirmpwd);
        $newdata-> level = $r->level;
            if ($r->password == $r->confirmpwd){
                $newdata->Save();
                return redirect()->back()->with('alert1', 'New user, successfully added!');
            }
            else{
                echo "Sorry. Please make sure your password same to the confirm password";
            }
    }
}
```

Figure 5.8 Admin manage users

5.2.3 Customer

Customers are the people who will utilize this Print Cube Shop system to order any services that match their needs. The code for implementing the customer's main function, which can add the available product to the cart will be shown in the subtopics that follow.

5.2.3.1 Add to Cart

This printing service system is managed by a Laravel Livewire wizard form that allows for a step-by-step process when the user click on add to cart button as shown in Figure 5.9 below. The Livewire approach is actually the traditional MVC model where it divides the code into two components which are one operates as the controller to process all logic and requests, and another one is a blade file to show the dynamic interface. There are two things that will add to cart for each product which are print orientation chosen by customer and a document file that want to be printed also must upload here.

```
{{-- FORM ADD TO CART WITH LIVEWIRE --}}
<form wire:submit.prevent="addToCart({{$product->id}})">
    <label for="">Print Orientation</label>
    <div class="input-group mb-3">
        <label class="input-group-text" for="inputGroupSelect">Orientation</label>
        <select name="orientation" class="form-select" id="inputGroupSelect" data-size="5">
            <option selected>Choose...</option>
            <option value="Horizontal">Horizontal</option>
            <option value="Vertical">Vertical</option>
        </select>
    </div>

    {{-- UPLOAD FILE --}}
    <div class="form-group mb-3">
        <label for="">File Upload</label>
        <input type="file" class="form-control" name="document" wire:model="document">
    </div>

    <!--INCREMENT AND DECREMENT-->
    <div class="mt-2">
        <div class="input-group">
            <span class="btn btn1" wire:click="decrementQuantity"><i class="fa fa-minus"></i></span>
            <input type="number" wire:model="quantityCount" value="{{$this->quantityCount}}" class="input-quantity" />
            <span class="btn btn1" wire:click="incrementQuantity"><i class="fa fa-plus"></i></span>
        </div>
    </div>

    <!--ADD TO CART FUNCTION-->
    <div class="mt-2">
        <button type="submit" class="btn btn1">
            <i class="fa fa-shopping-cart"></i> Add To Cart
        </button>
    </div>
</form>
```

Figure 5.9 Livewire wire:click for addToCart() function

Once customer click at add to cart button, the controller addToCart will take over by checking few conditions as shown in Figure 5.10. This function consists of four (4) condition statements. The first condition is checking for user authentication where the user can add the product into the cart once they are login to the correct account. If the user did not login to his/her account, then the product is unable to be added. Once the first condition is met, then the second condition is taking place by checking if the product is really existing in the database or vice versa. If customer passed for second condition, the third condition is checked to see if the product is already in the cart or not. If the same product already in the cart, then the customer merely needs to change the quantity in the cart list. The last condition is about counting if the product quantity is greater than 0, then the customer is able add the product into the cart respectively. Otherwise, an error message will be prompted.

```php
public function addToCart(int $productId)
{
    // Validate
    $this->validate([
        'document' => 'required|mimes:png,jpg,jpeg,csv,doc,pdf|max:2048',
    ]);

    if(Auth::check())
    {
        //Check if the Product is Exists
        if($this->product->where('id',$productId)->exists()){
            if(Cart::where('user_id', auth()->user()->id)
                    ->where('product_id', $productId)
                    ->exists())
            {
                $this->dispatchBrowserEvent('message', [
                    'text' => 'Product Already Added to Cart',
                    'type' => 'success',
                    'status' => 200
                ]);
            }
            else
            {
                //Insert Product to Cart
                if($this->quantityCount > 0)
                {
                    $filename = $this->document->getClientOriginalName();
                    $this->document->storePubliclyAs('fileUpload', $filename);

                    Cart::create([
                        'user_id' => auth()->user()->id,
                        'product_id' => $productId,
                        'quantity' => $this->quantityCount,
                        'document' =>$filename
                    ]);
```

Figure 5.10 Controller for addToCart()

5.2.3.2 Checkout Page

Checkout page is where the steps that customer must enter the information like full name, email, phone number, and address as displayed in Figure 5.11 below. However, this information will be retrieved from "user_details" table in the database if the customer already updated on their profile page. But then, the customer can change their information on the checkout page. All the data will undergo the validation through validate() function presented in Figure 5.12 before they can check out the item ordered. If they did not enter any of the information or entered invalid input, then the error message will be displayed by the system.

```
2 references | 0 overrides
public function placeOrder()
{
    $this->validate();
    $order = Order::create([
        'user_id' => auth()->user()->id,
        'order_no' => 'PCS:'.Str::random(5),
        'fullname'=> $this->fullname,
        'email' => $this->email,
        'phone' => $this->phone,
        'postcode' => $this->postcode,
        'address' => $this->address,
        'status_message' => 'In Progress',
        'payment_mode' => $this->payment_mode,
        'payment_id' => $this->payment_id
    ]);
    foreach($this->carts as $cartItem)
    {
        $orderItems = OrderItem::create([
            'order_id' => $order->id,
            'product_id' => $cartItem->product_id,
            'quantity' => $cartItem->quantity,
            'document'=> $cartItem->document,
            'price' => $cartItem->product->price
        ]);
    }
    return $order;
}
```

Figure 5.11 Controller for checkout function

```
0 references | 0 overrides
public function validationForAll()
{
    $this->validate();
}

0 references | 0 overrides
public function rules()
{
    return[
        'fullname' => 'required|string|max:121',
        'email' => 'required|email|max:121',
        'phone' => 'required|string|max:11|min:10',
        'postcode' => 'required|string|max:5|min:5',
        'address' => 'required|string|max:500',
    ];
}
```

Figure 5.12 Input validation for checkout page

5.2.3.3 Payment Method

There are two types of payment method in Print Cube shop web application, that are cash or online payment using PayPal gateway. Rather than cash, internet payment solutions have substantially improved financial transactions and give better ease for customers. However, the cash technique is still used because it is a traditional approach and few customers require it in certain situation. Figure 5.13 shows the codOrder() function in controller will be executed when customer choose for cash payment method. It is a simple function only because once the user clicked on cash button and checkout successfully, then they will be directed to “thank you” page.

```
0 references | 0 overrides
public function codOrder()
{
    $this->payment_mode = 'Cash on Delivery';
    $codOrder = $this->placeOrder();

    if($codOrder)
    {
        Cart::where('user_id', auth()->user()->id)->delete();

        try{
            $order = Order::findOrFail($codOrder->id);
            Mail::to("$order->email")->send(new PlaceOrderMailable($order));
            //Mail Sent Successfully
        }catch(\Exception $e){
            //Something Went Wrong
        }

        session()->flash('message','Order Placed Successfully!!');

        $this->dispatchBrowserEvent('message',[
            'text' => 'Order Placed Successfully',
            'type' => 'success',
            'status' => 200
        ]);

        return redirect()->to('thank-you');
    }
    else{
        $this->dispatchBrowserEvent('message',[
            'text' => 'Something Went Wrong',
            'type' => 'error',
            'status' => 500
        ]);
    }
}
```

Figure 5.13 Controller for COD payment method

The chosen of payment gateway is based on popular online payment systems. Figure 5.14 shows the code execution when customer choose PayPal to pay their order. PayPal gateway is user friendly interfaces that allow users or customers to enter payment information securely. An account must be created in order to set up this payment gateway because the information like Sandbox client ID and password used during the integration. Anyhow, PayPal is implemented as an online payment simulator only for this project.

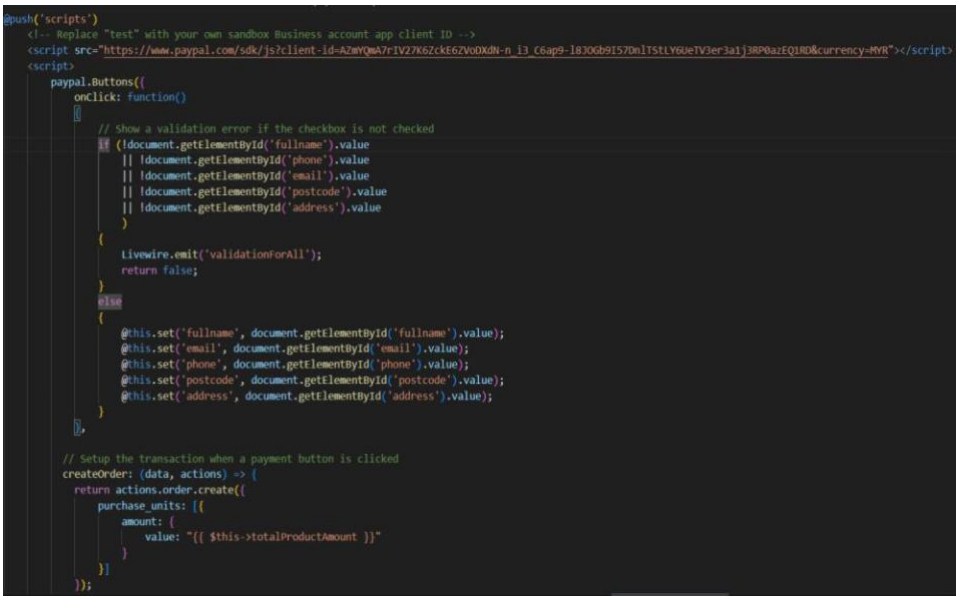

Figure 5.14 Integration of PayPal simulator

5.2.4 Staff

The main function for staff is managing the customer order where they are able to view the details of customer order, download the document file to be printed, update order status together with sending an invoice receipt via email if the order is completed.

5.2.4.1 Update Order Status via Mail

The system includes an email notification for two purposes which are the first is to send an invoice or order receipt once a client order is completed, and the second is to provide the URL of the password reset page requested by the user. Every coding statement that calls this method must include the email subject, email body, and recipient's email address as shown in Figure 5.15. This method includes logic for configuring SMTP with Gmail as the email client, secure socket layer (SSL), and port 587. This method also saves the parameters supplied into it as an object, which is subsequently transmitted via the SMTP that has been configured. This approach also includes a try and catch block to handle any errors that occur. A Gmail account for the developing system was generated to serve as the user credential since SMTP requires a user credential.

```php
public function __construct($order)
{
    $this->order = $order;
}

0 references | 0 overrides
public function build()
{
    $subject = "Your Order Invoice";
    return $this->subject($subject)
                ->view('staff.invoice.generate-invoice');
}
```

Figure 5.15 Method that set the information for email notification

5.2.5 Owner

The main function for owner is observing the current sales for his/her shop through graphs on the dashboard and generating the sales report effectively. An e-commerce dashboard is a real-time visual interface that monitors an e-commerce business's most significant metrics and KPIs. Based on sales data, e-commerce dashboards provide the owner with instant insights into the business's performance (Hannon, 2022).

5.2.5.1 Generate Report

There are times when the owner had to analyze the data on the data in database stored as hardcopy or in more user-friendly formats, such as an Excel worksheet. The owner of Print Cube shop, Mr Faiz can extract the details of customers order information stored in “order_items” table by generating the report as excel file. Figure 5.16 shows a method in which functions to load the blade file and data from the database can be written. The data for the report is retrieved from the database using the join function, which allows data from several tables to be accessed simultaneously.

```php
function exportData(){
    $data = DB::table('order_items')->orderBy('created_at', 'DESC')->get();
    $data_array [] = array("cust_id","product_id","items","quantity","price","created_at");
    foreach($data as $data_item)
    {
        $data_array[] = array(
            'cust_id' =>$data_item->cust_id,
            'product_id' => $data_item->product_id,
            'items' => $data_item->items,
            'quantity' => $data_item->quantity,
            'price' => $data_item->price,
            'created_at' =>$data_item->created_at
        );
    }
    $this->ExportExcel($data_array);
}
```

Figure 5.16 Generate report function

5.3 Interfaces of System Main Functions

This sub-chapter reveals many interfaces for the system's primary features in Print Cube Shop. All users must provide their login credentials for password authentication in order to access the system's major capabilities. If the user is authenticated, then the user will be redirected to the respective landing page based on their role. This subtopic will provide a full description of the interfaces for the system's main functions in order to acquire a better knowledge of the built system depending on the user's preferences.

5.3.1 Admin

Figure 5.17 shows the interface for admin to manage new product. Admin able to perform edit and delete function for each of the product together with creating a new product too. Meanwhile, Figure 5.18 is illustrated the interface when the admin views the list of users. In the role column, multiple colors are used to differentiate each of user’s role. Admin also has the permission to edit the user’s information and delete any unrelated user.

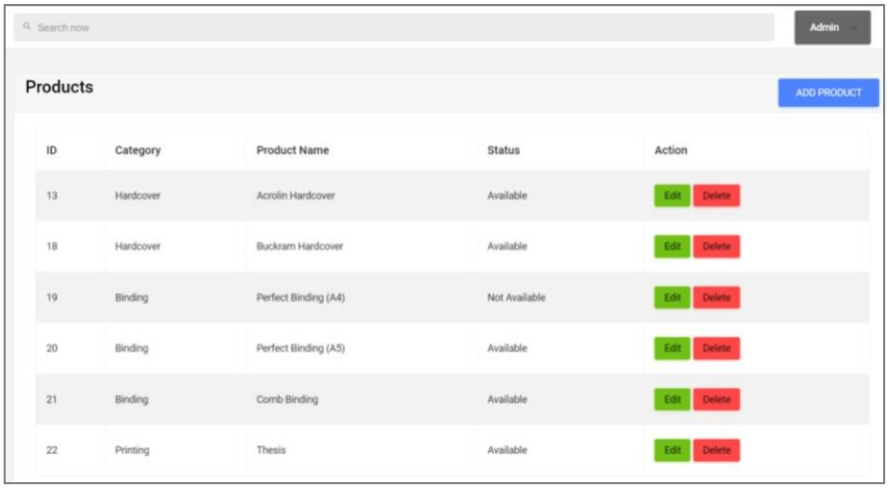

Figure 5.17 Interface of admin to manage the product

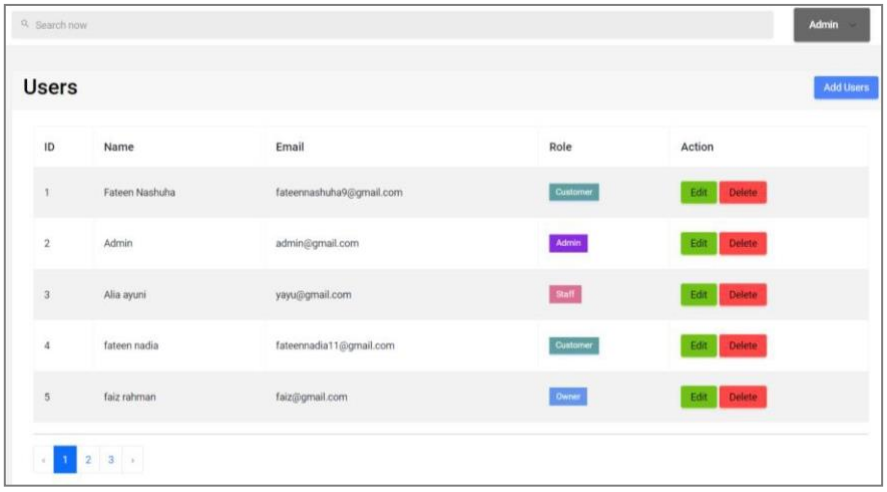

Figure 5.18 Interface of admin view the list of user

5.3.2 Owner

Figure 5.19 illustrated the design of owner's sales dashboard. It consists of dashboard card that presents the current total order, total category and total products running for his/her shop. Next, there are two types of graphs can be viewed by the owner which are a pie chart for total number of products sold and a bar chart represents the total number of orders by month. This visualization of every part of the Print cube store sales portfolio provides a unique opportunity for the owner to take a full picture of current sales operations quickly and easily without losing any valuable information.

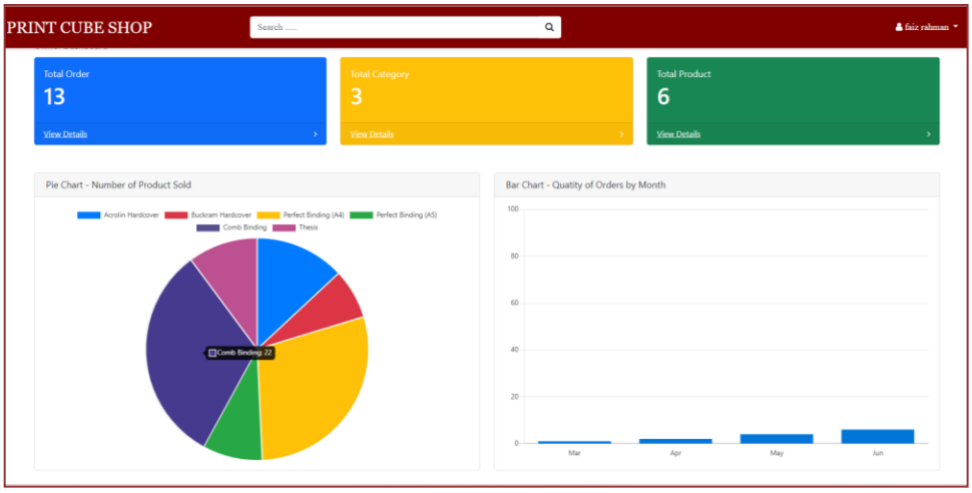

Figure 5.19 Interface for sale dashboard

5.3.3 Staff

As mentioned before, staff is only able to manage the customer's order as shown in Figure 5.20. So, one staff login into the system, then the list of customer's order will be presented on his/her page. Staff can view the status of the order and able to view the details of the order. After that, staff can update the order status by choose the current status on dropdown button created on view page. The pagination function also included for splitting the section of customer's order from a website, into discrete pages in order to create clean and neat web design.

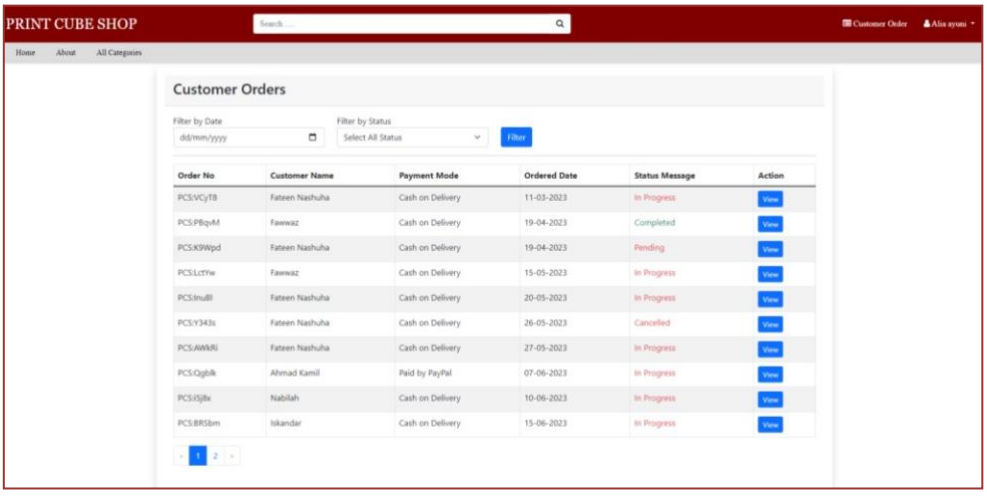

Figure 5.20 Interface for staff viewing the customer's order

5.3.4 Customer

Figure 5.21 illustrates the interface of customer's cart. The data saved in the cart table in database was displayed includes the number of quantity as well as the document file uploaded by the customer on previous page. Meanwhile, Figure 5.15 represents the interface of the customer's cart. Customer also able to review the total price too before proceeding to the checkout procedure. Next, Figure 5.22 depicts the interface of checkout page which asks the customer to provide some basic information. If the input field is left blank, an error message will appear describing the problem.

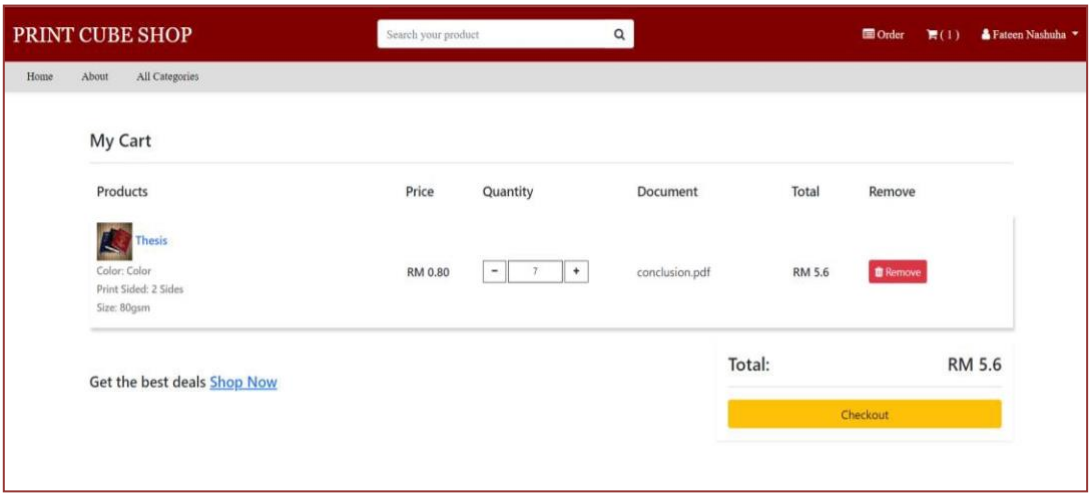

Figure 5.21 Interface of customer's cart

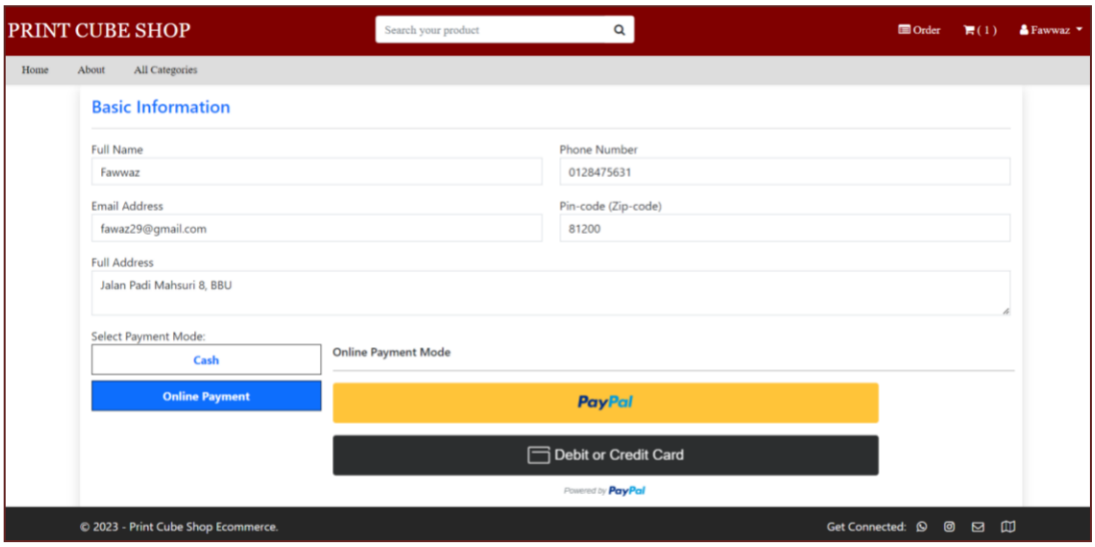

Figure 5.22 Interface of checkout page

5.3.5 Other Interfaces

All additional interfaces, such as interface of customer view the product details, payment interface for PayPal, staff view the details of customer's order, and others may be found in Appendix G which is involved in stage interface design.

5.4 System Testing

Alongside application development and implementation, a testing phase is required to test the application in several aspects such as performance, application functionality, application security, and user interface. The system testing is separated into three categories: black box testing, white box testing, and UAT. To examine each of the Print Cube system functionalities, the developer personally did the white-box and black-box tests. However, UAT was performed with the targeted users to construct or develop the system or application that meets the needs of stakeholders and users.

5.4.1 Black-Box Testing

Black-box testing validates the application flow without considered the internal structure of the system. It means that this testing focuses on application functioning without examining the code. The outcomes are dependent on the input and execution circumstances that were evaluated. Tables 5.1 show the results of Print Cube shop system black-box testing, including steps taken, expected outputs, and actual outputs for each action. Table 5.2 shows the results of the system input and output of verification tests. The testing is carried out in accordance with the system flow depicted in Table 5.1.

Table 5.1 Black-box testing of system flow

Flow	Test	Expected Outcome	Results
Admin using Print Cube Shop system			
1	Login as admin	Able to login and access the system	✓
2	Admin view the dashboard	Can see the current statistics of orders, users, category and products	✓
3	Admin manage the category of product	Able to add, update and delete the category of product	✓
4	Admin manage the product	Able to add, update and delete the product provided by the shop	✓
5	Admin manage all the users	Able to add, update and delete the users of this system	✓
Staff using Print Cube Shop system			
1	Login as staff	Able to login and access the system	✓
2	Staff edit profile	Can add the information of staff's contact number and address	✓
3	Staff view list of customer's order	Able to view all customer's orders and able using the filter function	✓
4	Staff update the status order	Status of order is updated and the changes in customer view too	✓
5	Staff send mail notification	Customer will receive the order notification once it completed together with the invoice receipt of order	✓
Owner using Print Cube Shop system			
1	Login as owner	Able to login and access the system	✓
2	View the dashboard	Analyze the sales based on the graphs	✓
3	Generate report	Generate an excel report successfully	✓
Customer using Print Cube Shop system			
1	Register as customer by fill in the form	User successfully register and redirect to the main page	✓
2	Login as customer	User successfully login into system and redirect to the menu page	✓
3	Customer add any the interested product into the cart	Product selected with information entered such as quantity and uploaded document was added to the cart	✓
4	Proceed for payment process	Payment is success based on customer's preferred payment method	✓
5	Checkout customer's order	Able to fill in personal information, then checkout the product	✓
6	View the placed order	Able to view all of his/her order includes the order status	✓

Table 5.2 Input and output verification testing

Item	Test	Expected Outcome	Result
1	Customer register function: - Name is a string with max 255 characters - Email is unique - Email is not empty - Email address must be valid (Satisfy the ^[a-zA-Z09+.] +@[a-zA-Z0-9.-]+condition) - Password must not empty and not less than 8 - Confirm password must be match with password	If the input is of the does not satisfy the validation, an error message will occur.	Name √ Email √ Password √
2	Login function: - Email already registered - Password is not emp - Password must same to value stored in database	If the input is of the does not satisfy the validation, an error message will occur.	Email √ Password √
3	Checkout function: - Name is a string with max 255 characters - Email address must be valid (Satisfy the ^[a-zA-Z09+.] +@[a-zA-Z0-9.-]+condition) - Length of phone number within 10 to 11 characters only and must be a string - Postcode is stored as string with 5 characters of length - Address is a string with maximum 500 length of characters	If the input is of the does not satisfy the validation or input is empty, then an error message will occur.	Email √ Password √ Name √ Phone No √ Address √
4	Add to cart function: - Quantity is not equal to 0 - Upload a document file and size of file less than 2.048GB	If one of them is empty, then user unable add the product into the cart	√

	- Accept file upload in few formats only includes png, jpg, jpeg, csv, doc, and pdf - Choose the print orientation		
6	Function of manage category: - Name is a string and required - Description is long string and is not empty - Image uploads in format jpg, jpeg, png only is accepted	If the input is of the does not satisfy the validation or input is empty, then the category is failed to add or update.	√
7	Function of manage product: - Name is a string and required - Description is long string and it is an optional - Only image's formats in jpg, jpeg, png is accepted - Size is a string and required - Color is a string and optional - Print side to print is a string and optional - Price is a string and required - Status of the products is not required	If the input does not satisfy one of the conditions, then an error message will be displayed.	√

Figure 5.23 shows the example of the error message being displayed on the register function on web system during the testing. For example, the customer attempts to register a new user using an existing email address in database and the input for password also less than 8 characters. Figure 5.24 depicts a message error of on login form when customer email entered to login is not matched with the password. Figure 5.25 illustrated error messages that occurs when the customer left the phone number field and postcode field empty during checkout process. Last but not least, an error message on Figure 5.26 appeared when the admin did not input the price when trying to add new product.

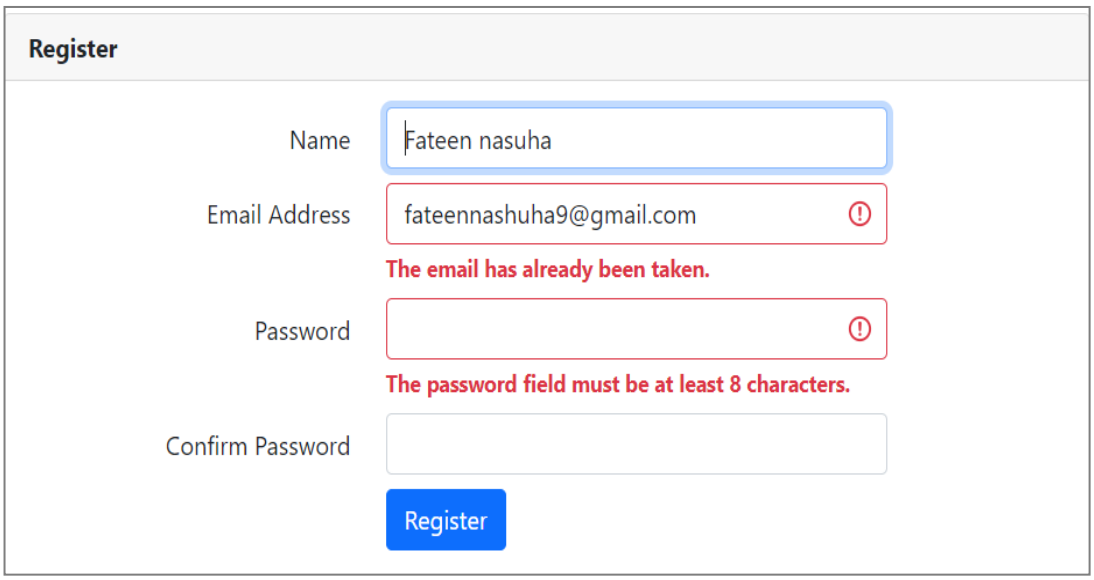

Figure 5.23 Error message on registration form

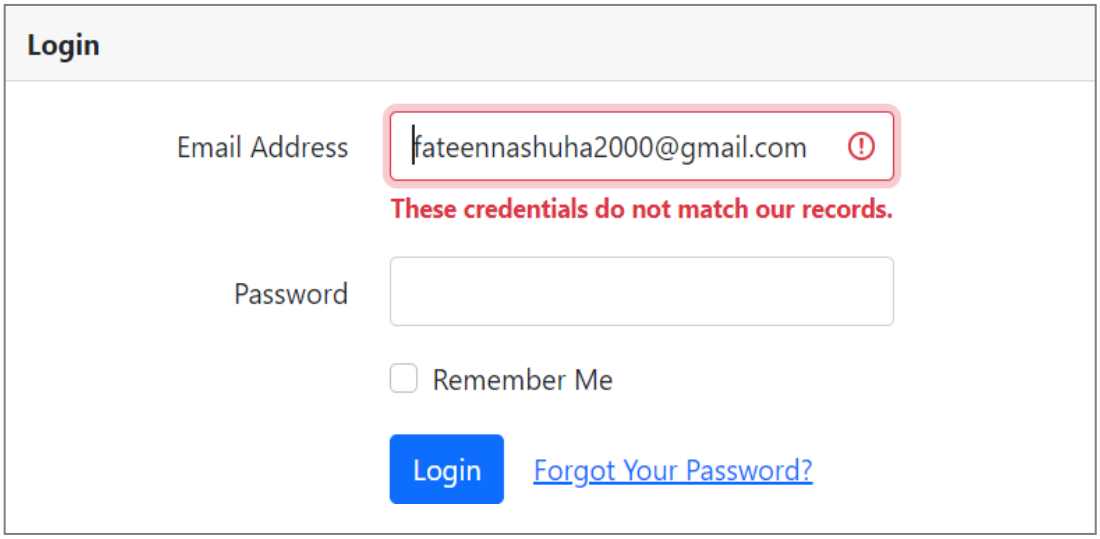

Figure 5.24 Error message on login form

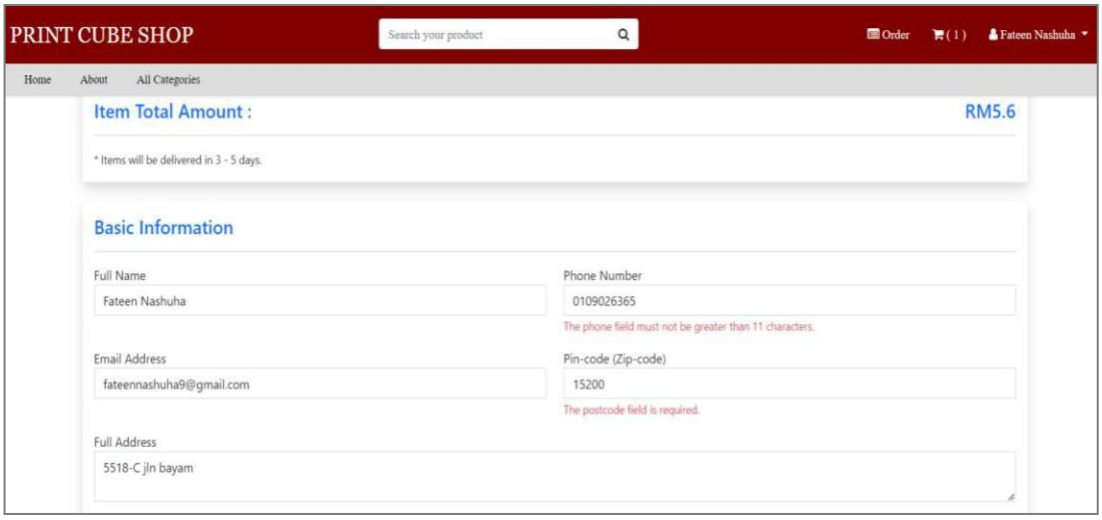

Figure 5.25 Error message during check out page

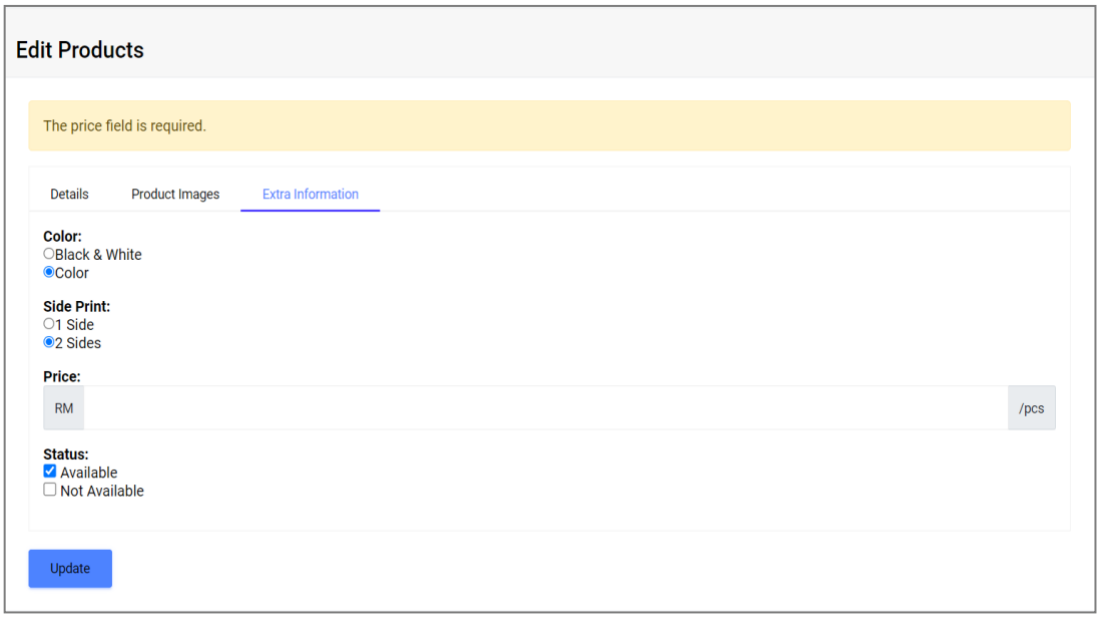

Figure 5.26 Error message on add product page

5.4.2 White-Box Testing

The white box test is a method used by software developers to test software while taking into its internal workings including coding statement and methods. (Black Box Vs White Box Testing, n.d.). The testing was carried out according to the system flow specified in Table 5.1 and the input and output verification described in Table 5.2. Table 5.3 shows the outcomes of the tests.

Table 5.3 White-box testing results

Item	Test	Expected Outcome	Result
1	Register function: 1. Click “Register” icon. 2. Enter name, valid and unique email address, matched confirm password with password. 3. Click the “Register” button.	1. Successfully create a new user account in the database.	Pass
2	Login function: 1. Enter valid and registered email address, and correct password. 2. Click “Login” button.	1. Login successfully. 2. Redirect to user’s dashboard page	Pass
3	Forget password function: 1. Click “Forgot Password”. 2. Enter current password. 3. Enter a match new password and the new confirm password. 4. Click “Update Password” button.	1. A new password is updated	Pass
Admin functionalities			
1	Function of add new category: 1. Click “Add” button on category page 2. Enter valid information for name, description and image	1. A new category is added successfully	Pass
2	Function of add new product: 1. Click “Add” button on product page 2. Choose the category for the product using dropdown button 3. Enter valid information for the attributes of name, description size, print sided, and color 4. Upload the product’s image 5. Tick the product is available or not for the current time	1. A new product is added successfully	Pass
3	Function of edit user info: 1.Click “Edit” button for respective user	1. The user’s information saved with the updated data	Pass

	2. Change the information based on requirement 3. Click "Update" button to save new information of users		
Customer functionalities			
1	Add to cart function: 1. Choose any category by clicking at the images in menu page 2. Click at the image of chosen product to see the details 3. Input the quantity to print 4. Upload the valid file document 5. Click "Add to Cart" button	1. Item is successfully added into the customer cart	Pass
2	Place order function: 1. Click "Checkout" button at cart page 2. Fill in the valid personal information such as name, email, phone number, postcode and address 3. Choose type of payment by clicking the "Cash" or "PayPal" button 4. Redirect to thank you page once payment is completed	1. Order is placed successfully 2. View the order in "My Order" page	Pass
Staff functionalities			
1	Manage customer's order: 1. Click the "View" button to view the details of order's information 2. Click the link in document row to download the customer's file to print 3. Update the status of customer order by choose the status in dropdown button 4. Send the notification to customer once their order is completed	1. Able to view all customer's order 2. Able to download customer's document 3. Mail notification received by customer once the status order is completed	Pass
Owner functionalities			
1.	Generate sales report: 1. Click "Generate Report" button at the right-top of the page to download the excel files contains the data of all order	1. Report sales is downloaded	Pass

5.4.3 User Acceptance Test (UAT)

The user acceptability test (UAT) ensures that every function incorporated into the Print Cube Shop system functions properly. The goals of UAT are to gain user satisfaction, suggestions, and feedback on the developed website application, which can then be used to improve the system in the future. Following the testing of this designed system, a Google Form survey form was created to collect user input which can be referred in Appendix H.

The survey is then separated into three sections: the first contains general questions, the second has questions about the system's functionalities available to each user, and the third contains questions regarding the system's overall feedback. The statistics of general question are presented in Figure 5.27. Ten users participated in this testing consisted of eight females and two males, including five of them are customers, two staff members, two administrators, and an owner.

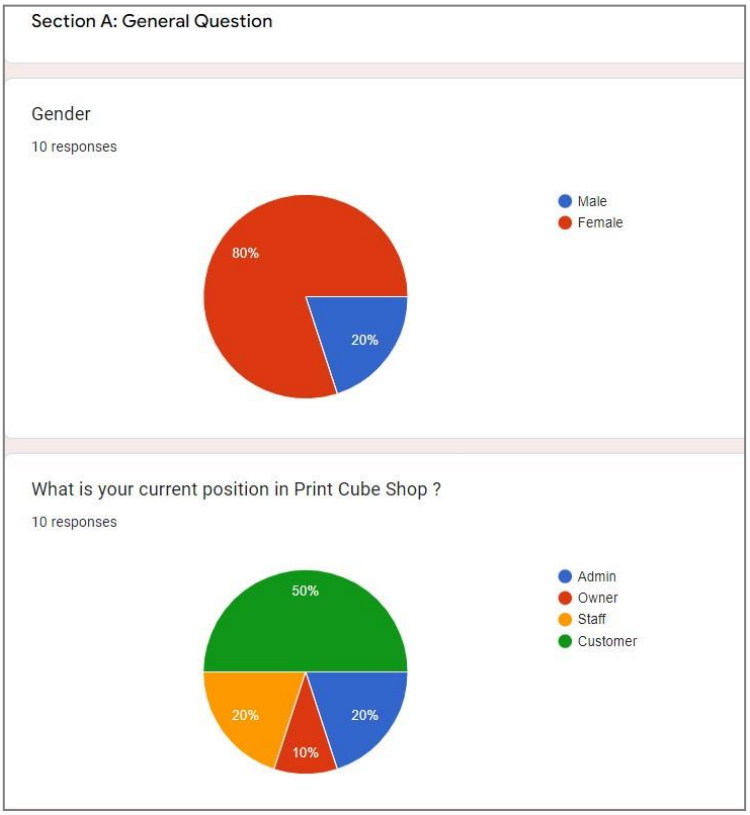

Figure 5.27 Statistics for general questions

According to the statistics results, both the owner and the administrator are extremely satisfied with the most of functionality. Figure 5.28 depicts the admin feedback chart, while Figure 5.29 shows the owner feedback chart. Both users voted for strongly agree that they can login to the system successfully and very interested to their sales dashboard view. The dashboard is very simple but attractive for them. Administrators are extremely satisfied with the process of managing the category, and product. But then, one of the administrators give a little bit low rating for the manage users function. Besides, the owner also satisfied that he can easily downloading and viewing the generated report in excel format.

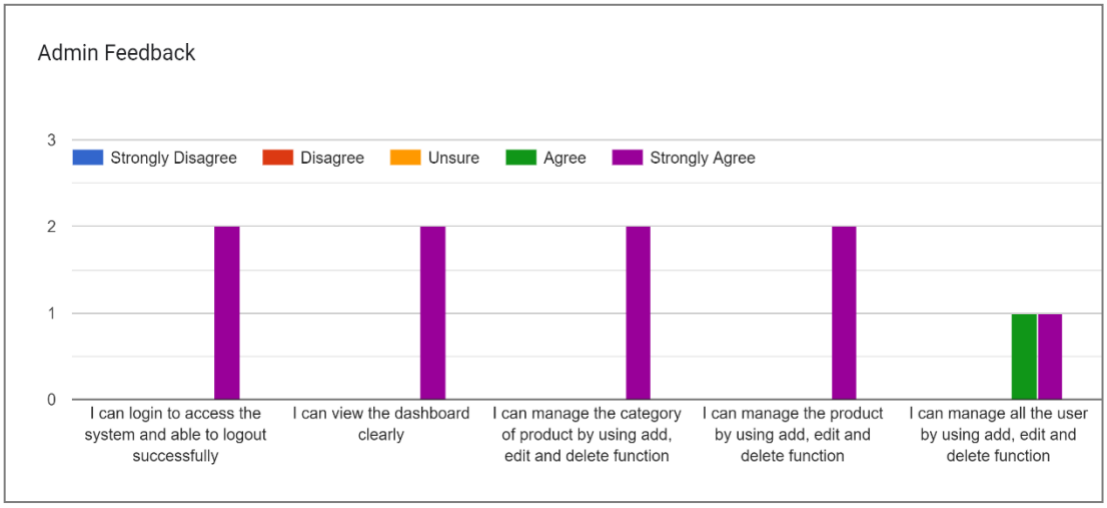

Figure 5.28 Statistics for admin feedback

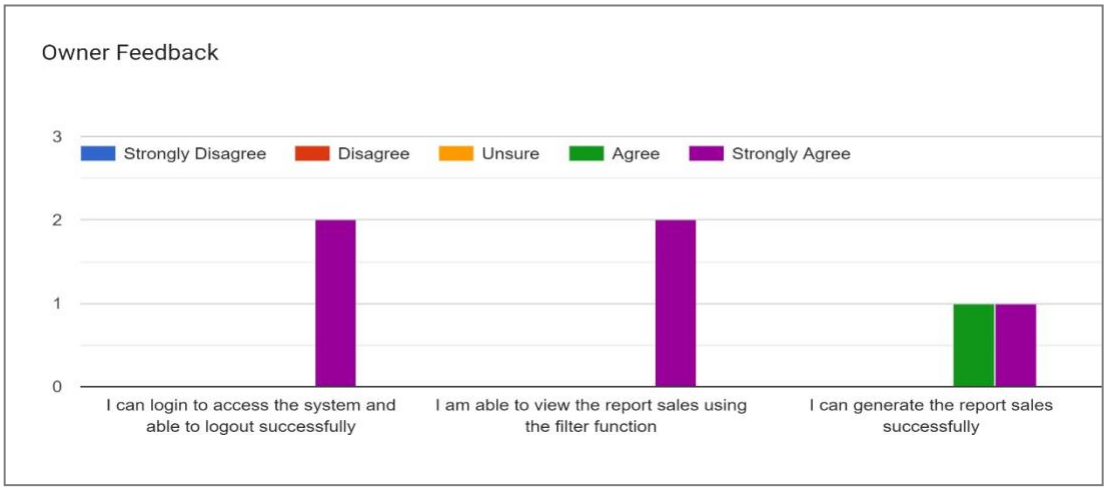

Figure 5.29 Statistics for owner feedback

Figure 5.30 represents the statistics for staff feedback, the two participants provide favourable comments on overall satisfaction in several domains. Able to login, update their profile, able to view the list of customer's order and the order's detail information, can update the order status and generate the invoice receipt are among the aspects. Nevertheless, few of the staffs are unsure about how they can notify the customer regarding their order through mail notification.

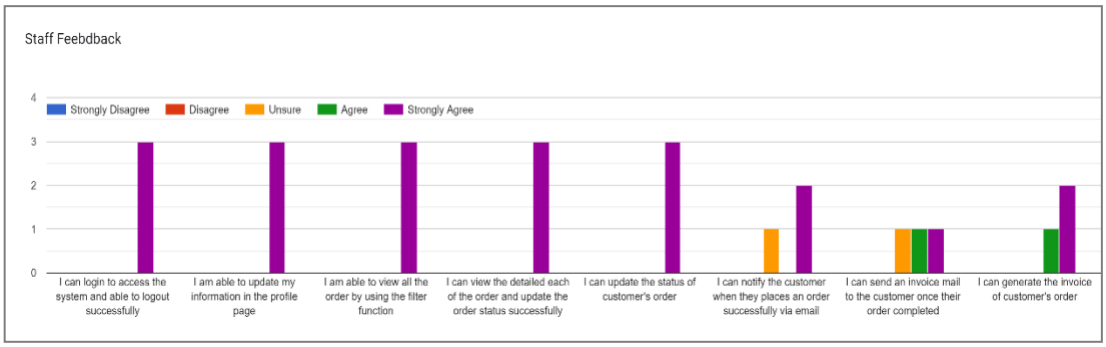

Figure 5.30 Statistics for staff feedback

Figure 5.31 describes the statistics of feedback from customers. All users can successfully login to the system, but only five out of six people firmly agree that they can easily register an account. Next, most of the customers strongly agreed that they may examine products with complete information, upload document files, and conveniently add products to the cart. Unfortunately, average of customers having some issues with the payment and checkout processes, as well as the email notification function. Email notifications may cause problems because they will be sent once the staff updates their order is complete.

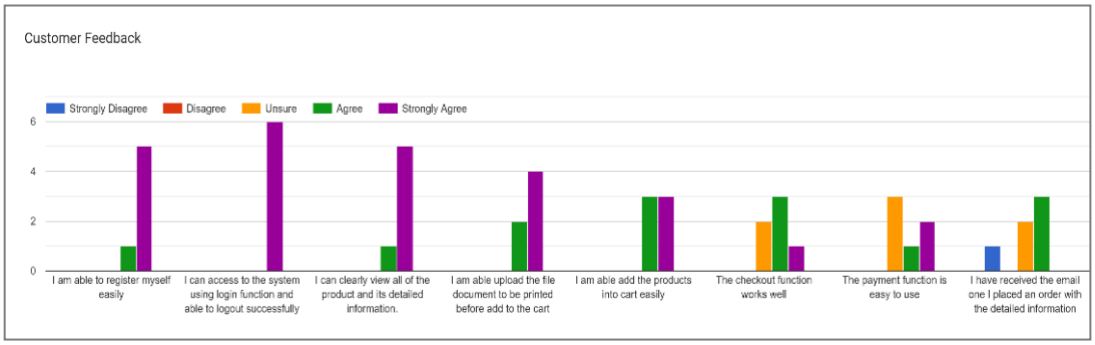

Figure 5.31 Statistics for customer feedback

Figure 5.32 shows the majority of participants are extremely satisfied, and others are quite satisfied with these features. Regardless, the ranking for security aspects is ordinary, and they stated that they had no knowledge of security features in a system other than password. However, none of them are totally satisfied with all of them, which could be caused by lack of understanding or guidelines for testing this system development. Anyhow, the average user rating for the produced system is 8.5 out of 10.0 based on the result shown in Figure 5.33. This signifies that based on the criteria in the questions they were given, those users are satisfied with the built system.

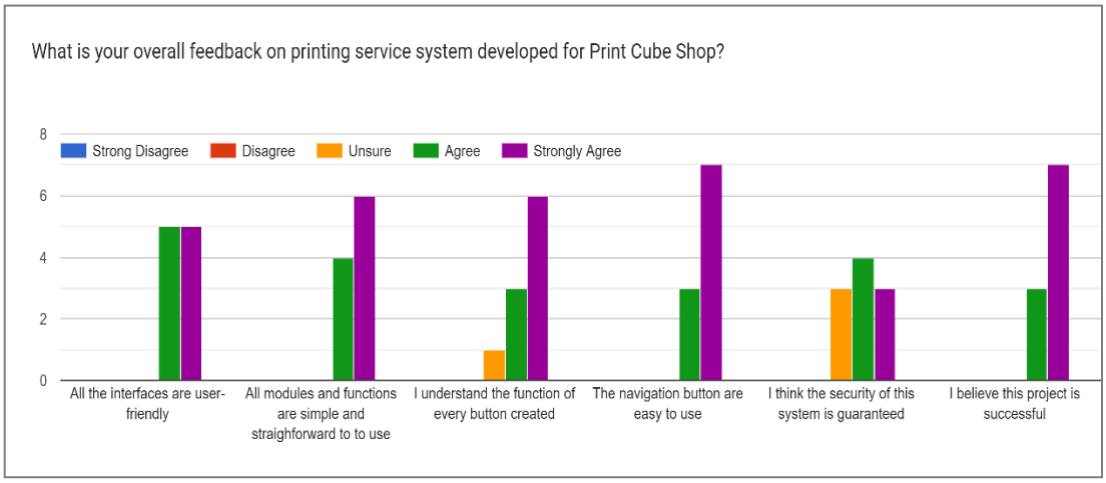

Figure 5.32 Statistics for overall feedback

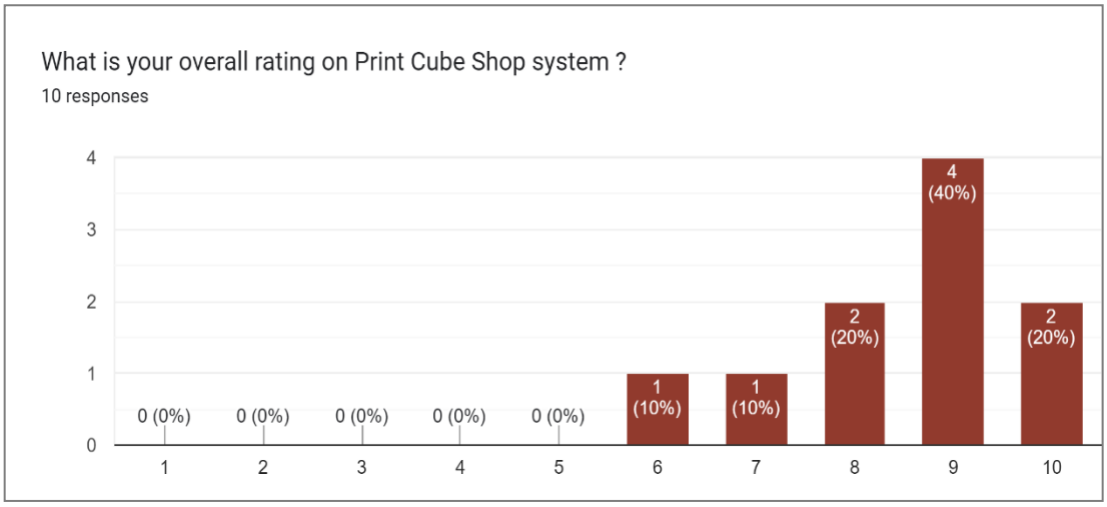

Figure 5.33 Statistics for overall rating

5.5 Chapter Summary

To summarize this chapter, all the system's main functions, including the user interfaces and coding execution are described. The user interface (UI) and code of the developed system, particularly those linked to the Print cube shop system, have been thoroughly described. Last but not least, this chapter has covered the system testing, which includes black-box testing, white-box testing, and user acceptance testing.

CHAPTER 6

CONCLUSION

6.1 Introduction

Chapter 6 is the final chapter in PSM 2 report documentation. This chapter summarises the project outcomes and indicates the accomplishments of project objectives as the project progresses. Future enhancement suggestions are also offered so that this project can improve in the future to maintain system functionality, stabilise the system, meet project objectives, and achieve success.

6.2 Achievement of Project

The developed website application, Print Cube system is the solution to this shop's current system of advertising printing services. The Print Cube system was developed to address current issues while also meeting the needs and expectations of the users. The key accomplishment of the project is that all its objectives were met. The Print Cube shop's requirements were established by interviewing the owner about the current printing process implemented in his shop. A questionnaire and project stakeholder interviews were also conducted to obtain user needs. Other similar existing systems were also gathered and analysed in order to uncover any characteristics of those systems that could be compared to the built system. The main drawback is that all current systems that have been gathered cannot be accessible for detailed analysis. Then, this web-based system was developed to the shop to overcome all those problems found and this contributes to meet the user's expectations and requirements.

This project implements the waterfall model as the selected system development technique. This system was developed using all of the technology and software stated during PSM1, as well as the hardware specifications that meet the

system requirements. Next, the flow of the system and features also approximately same to what have been proposed in the all the designed system diagrams during PSM1. The implementation and testing of Print Cube shop system was achieving the last objective of this project. The code implementation has been discussed in detailed for the main functions. Furthermore, the developed system has been tested by three testing methods which are black-box, white-box and user acceptance testing. System's functionalities have been determined to be successful based on the feedback collected from the UAT questionnaire. The system was also designed in accordance with the requirements gathered and was successfully developed within the time frame allotted to accomplish this project.

6.3 Suggestions for Future Improvement

In order to upgrade the system that has been built, some proposals have been made to improve and enhance the printing service for Print Cube shop. Firstly, the system can be improved in terms of payment method by providing clients with a more comprehensive list of payment options that they prefer or are familiar to. The payment options that can be included standard online banking and e-wallet payments. E-wallets are increasingly popular because they allow customers to complete purchases by just entering their password only. Aside from that, the system can add the live chat function to increase the engagement between the customer and seller. It is a user-friendly, convenient, and cost-effective for providing excellent customer service and even increasing revenue.

Next, the system should be more attractive if added product review and rating function. Product review and rating provide ecommerce firms by increasing conversions is one of the key advantages. Positive product reviews can enhance conversion rates since prospective buyers are more likely to make a purchase when they receive positive feedback from prior customers. Besides, the system was suggested to add a "Note" field before customer add product into the cart. Order notes which allow the customer to provide special instructions if they have to the staff on how they can prepare the order. Moreover, the developed system would be more

convenient if there are more option for delivery methods such as cash on delivery and shipping will attract the customer to use this online printing service too.

In terms of security elements, the system should provide more verification using email since it is a unique key for each user. For example, the customer should receive the PIN code by email notification to ensure that they are registering with a valid mail account. An email notification can be sent to the customer when they request for a password reset. This is essential in order to avoid any security risks. If these suggestions are put into practise in the future, it is likely that leveraging this approach will make printing more convenient and organised.

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Appendix A Interview Session

Interview 1

Date: 2/4/2022

Time: 10.00 AM - 11.00 AM

Venue: Direct-Dial

Interviewer: Fateen Nashuha

Interviewee: Mr Faiz (Owner of Print Cube Shop)

Question and Answer

Q1: Who is your regular customer?

Ans: Our regular customers consist of students and teachers because our shop is located close to the school grounds in Kubang Kerian.

Q2: What type of services are provided by your shop?

Ans: We provided many types of services such as photocopy, printing, binding and lamination at cheaper prices.

Q3: Can you please explain in detail the current service workflow from your shop?

Ans: The current service is a manual operation where the customer needs to walk-in to our shop first. Then, they can place their order if we offer the service that they want. However, some customers got frustrated because they had a long waiting time to complete their order. Sometimes they need to place an order or leave any material if necessary and come again to the shop a few times until the order is completed. Unfortunately, if the service that they want is not available at our shop, they have to find another shop.

Q4: In your opinion, what is the biggest problem that you have faced regarding this existing operation?

Ans: The biggest problem that we have faced is that we have potential to lose our customers too because the majority of the processes are performed manually, and customers must wait for a considerable period of time before we can provide a precise response to our customer. This is due to the large number of orders that we must handle and process on a daily basis. For example, if a customer wants to print and then they need to visit our shop to send their material first and come again to pick-up because there are other orders that need to be settled first. This is actually another serious issue since some of our customers, especially students, have difficulties coming to our shop many times due to lack of transportation.

Moreover, our staff also need to calculate the customer's order manually and then write down all the orders in a log book. It is not systematic for our shop because we handle many orders most of the day. For my personal problem, I have difficulties in order to track my business because all the orders are recorded in a log book only. Our accountant needs to do the manual calculation to check the expenses and the gains for each month.

Q5: What are the major causes of the problem, based on your response to the previous question?

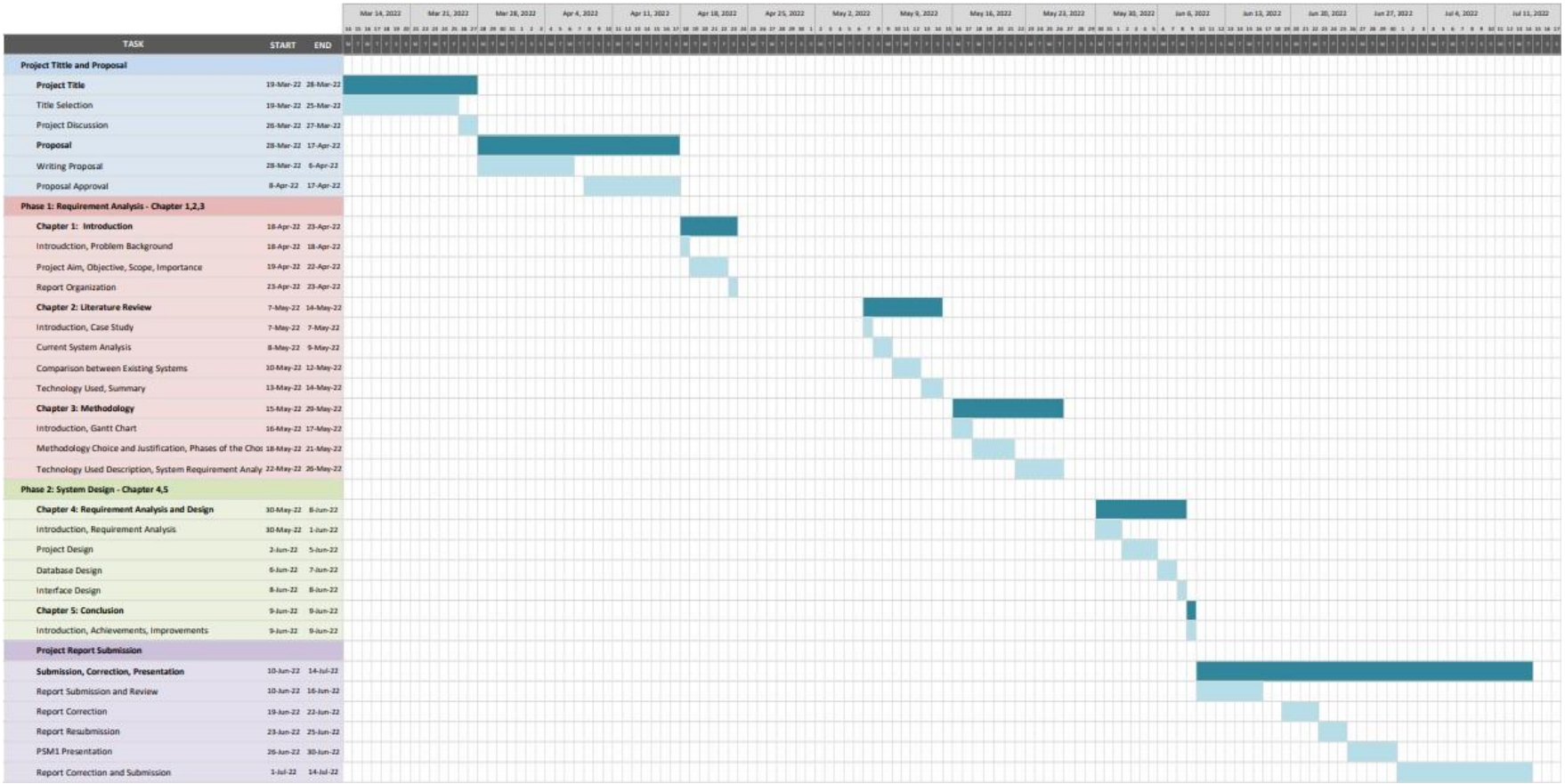
Ans: I believe the major factor that leads to these problems is primarily due to the procedures' slowness. As we can see, the majority of the processes are still performed manually, and we have no choice but to wait.

Q6: Do you get any feedback from the customer regarding the existing operation?

Ans: Sometimes we get complaints from the customers due to the problems that I already mentioned above and we do not collect any feedback from them too. I think we need their feedback now in order to improve our current processes but we do not have a centralized system to record all the feedback data.

Appendix B Gantt Chart

Final Year Project 1: Print Cube System
Supervisor: Madam Lizawati Binti Mi Yusuf
Student's Name: Fateen Nashuha Binti Yusof



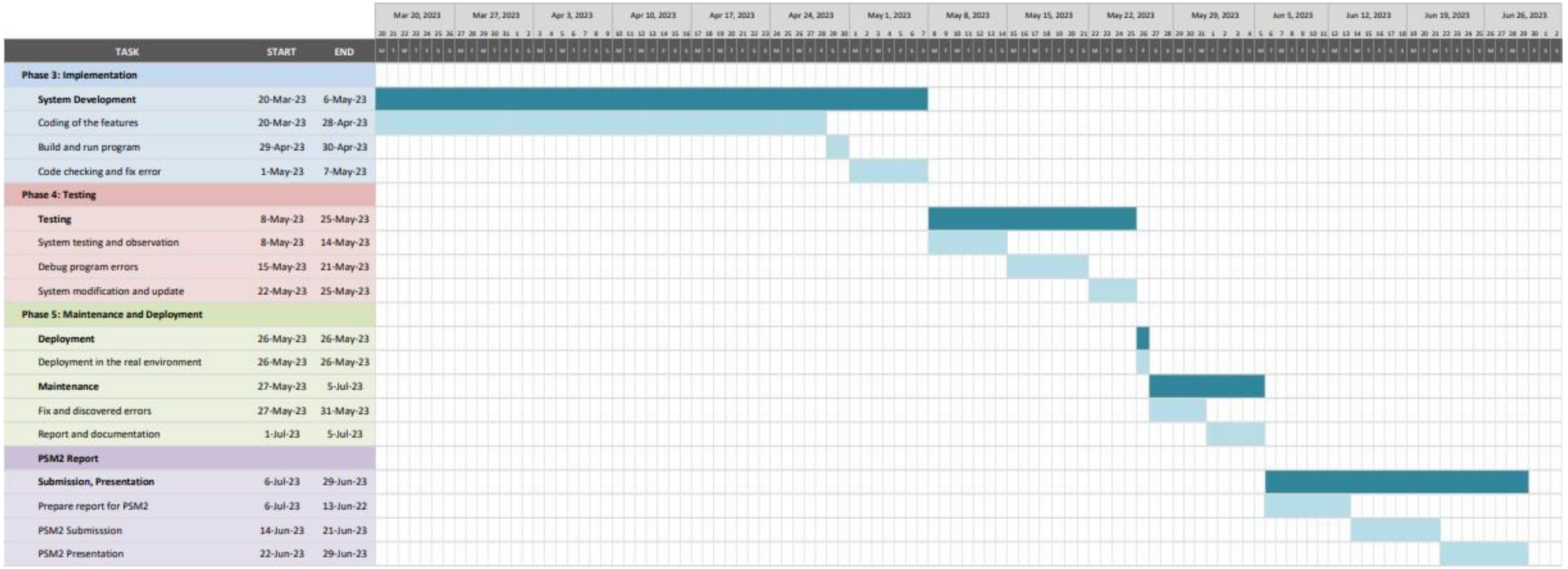
TASK	START	END
Project Tittle and Proposal		
Project Title	19-Mar-22	28-Mar-22
Title Selection	19-Mar-22	25-Mar-22
Project Discussion	26-Mar-22	27-Mar-22
Proposal	28-Mar-22	17-Apr-22
Writing Proposal	28-Mar-22	6-Apr-22
Proposal Approval	8-Apr-22	17-Apr-22
Phase 1: Requirement Analysis - Chapter 1,2,3		
Chapter 1: Introduction	18-Apr-22	23-Apr-22
Introudction, Problem Background	18-Apr-22	18-Apr-22
Project Aim, Objective, Scope, Importance	19-Apr-22	22-Apr-22
Report Organization	23-Apr-22	23-Apr-22
Chapter 2: Literature Review	7-May-22	14-May-22
Introduction, Case Study	7-May-22	7-May-22
Current System Analysis	8-May-22	9-May-22
Comparison between Existing Systems	10-May-22	12-May-22
Technology Used, Summary	13-May-22	14-May-22
Chapter 3: Methodology	15-May-22	29-May-22
Introduction, Gantt Chart	16-May-22	17-May-22
Methodology Choice and Justification, Phases of the Chos	18-May-22	21-May-22
Technology Used Description, System Requirement Analy	22-May-22	26-May-22
Phase 2: System Design - Chapter 4,5		
Chapter 4: Requirement Analysis and Design	30-May-22	8-Jun-22
Introduction, Requirement Analysis	30-May-22	1-Jun-22
Project Design	2-Jun-22	5-Jun-22
Database Design	6-Jun-22	7-Jun-22
Interface Design	8-Jun-22	8-Jun-22
Chapter 5: Conclusion	9-Jun-22	9-Jun-22
Introduction, Achievements, Improvements	9-Jun-22	9-Jun-22
Project Report Submission		
Submission, Correction, Presentation	10-Jun-22	14-Jul-22
Report Submission and Review	10-Jun-22	16-Jun-22
Report Correction	19-Jun-22	22-Jun-22
Report Resubmission	23-Jun-22	25-Jun-22
PSM1 Presentation	26-Jun-22	30-Jun-22
Report Correction and Submission	1-Jul-22	14-Jul-22

Figure B.1 Gantt chart for PSM1

Final Year Project 1: Print Cube System

Supervisor: Madam Lizawati Binti Mi Yusuf

Student's Name: Fateen Nashuha Binti Yusof



TASK	START	END
Phase 3: Implementation		
System Development	20-Mar-23	6-May-23
Coding of the features	20-Mar-23	28-Apr-23
Build and run program	29-Apr-23	30-Apr-23
Code checking and fix error	1-May-23	7-May-23
Phase 4: Testing		
Testing	8-May-23	25-May-23
System testing and observation	8-May-23	14-May-23
Debug program errors	15-May-23	21-May-23
System modification and update	22-May-23	25-May-23
Phase 5: Maintenance and Deployment		
Deployment	26-May-23	26-May-23
Deployment in the real environment	26-May-23	26-May-23
Maintenance	27-May-23	5-Jul-23
Fix and discovered errors	27-May-23	31-May-23
Report and documentation	1-Jul-23	5-Jul-23
PSM2 Report		
Submission, Presentation	6-Jul-23	29-Jun-23
Prepare report for PSM2	6-Jul-23	13-Jun-22
PSM2 Submisssion	14-Jun-23	21-Jun-23
PSM2 Presentation	22-Jun-23	29-Jun-23

Figure B.2 Gantt chart for PSM2

Appendix C Sequence Diagram

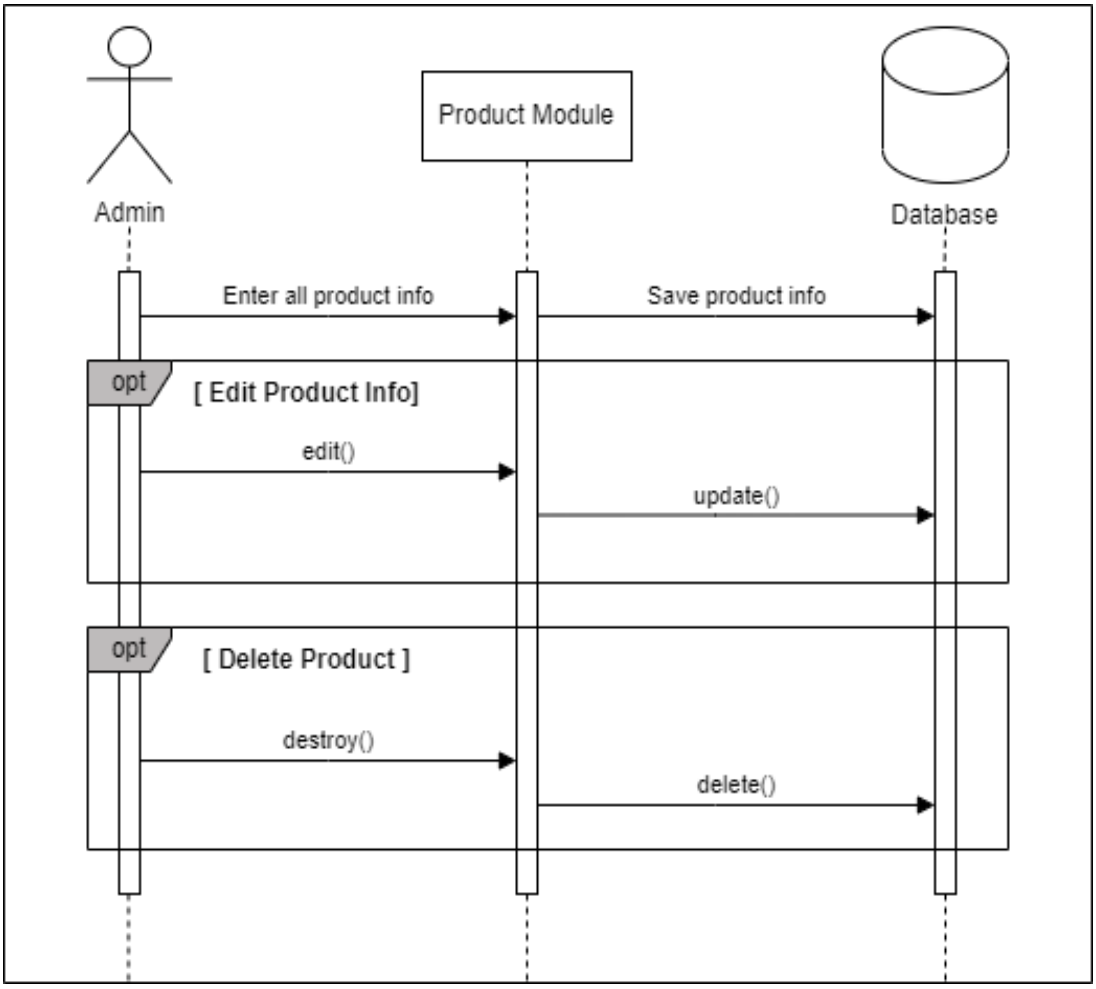


Figure C.1 Admin manage product

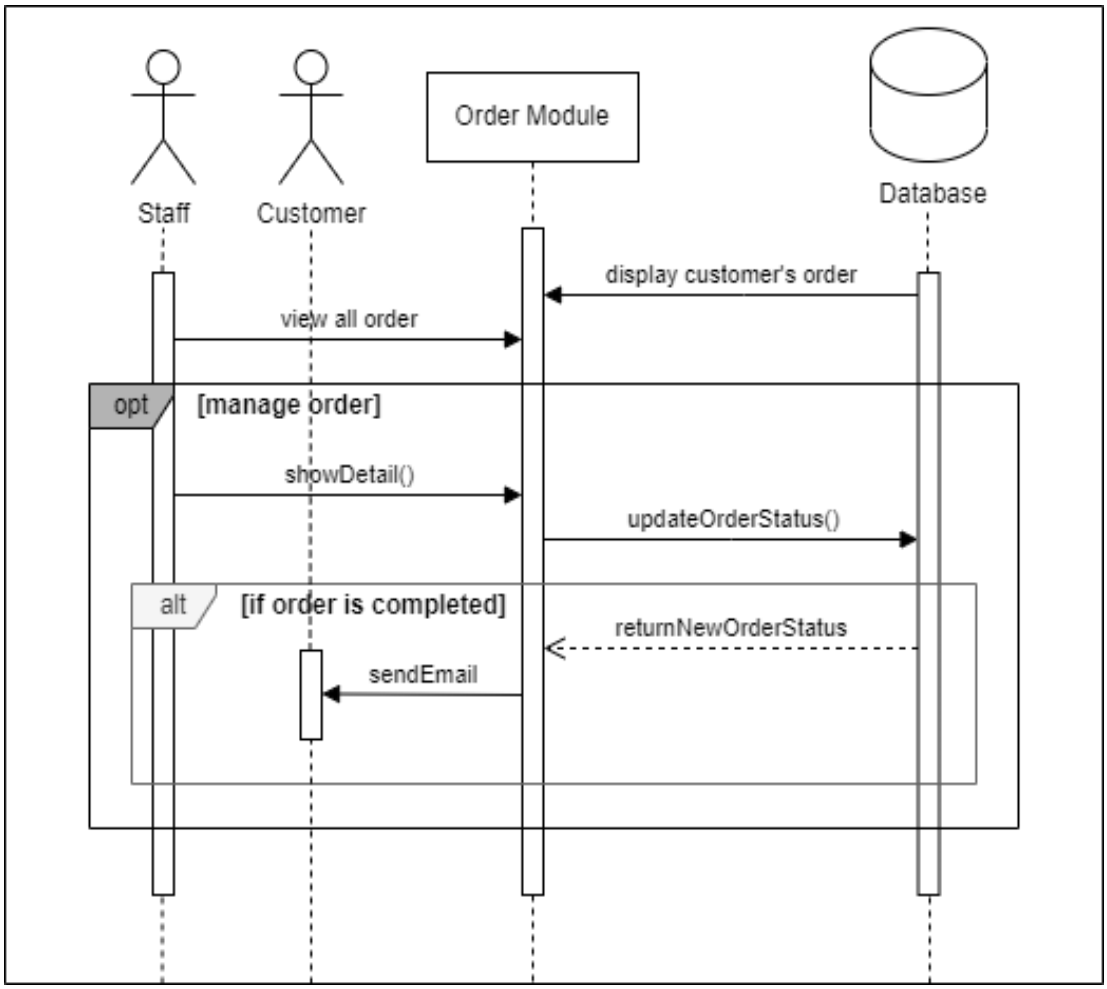


Figure C.2 Staff manage order

Appendix D Activity Diagram

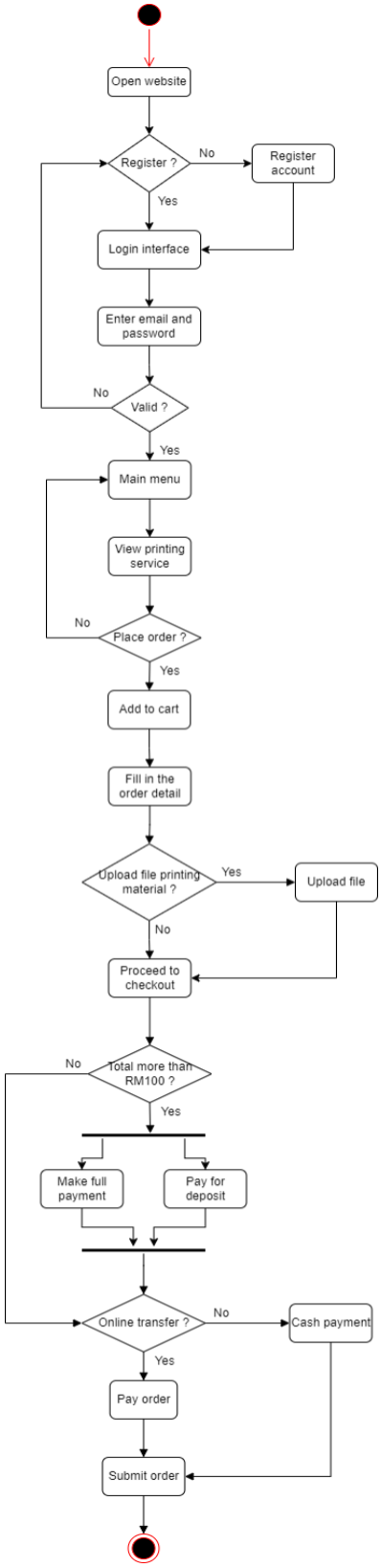


Figure D.1 Activity diagram for customer

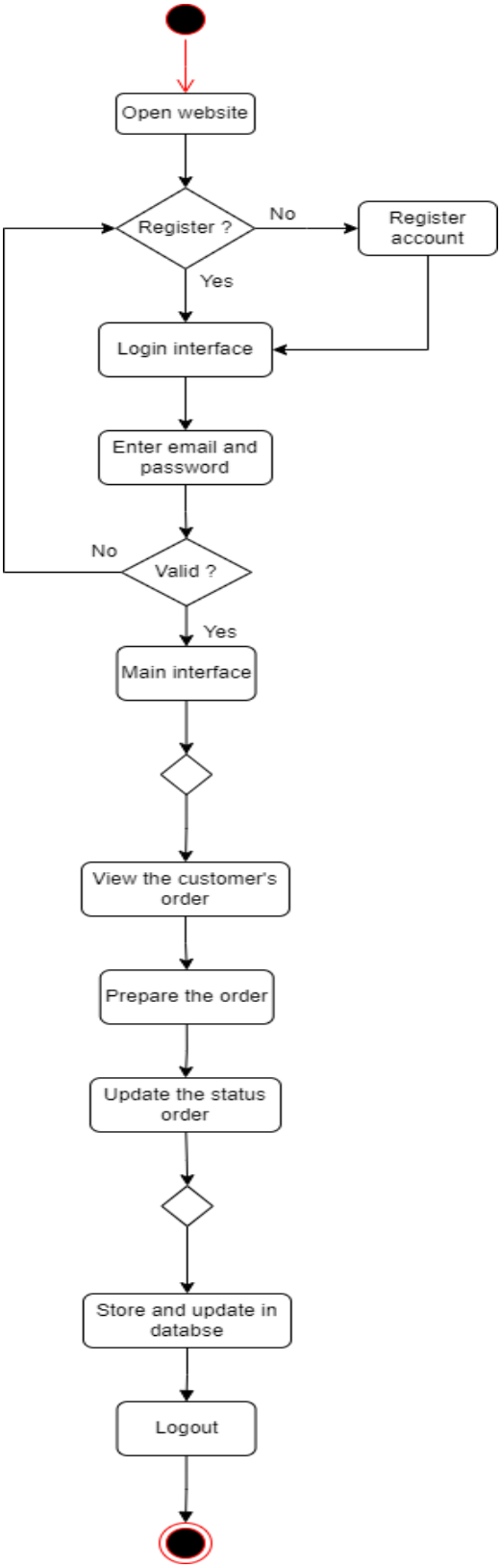


Figure D.2 Activity diagram for staff

Appendix E Entity Relationship Diagram (ERD)

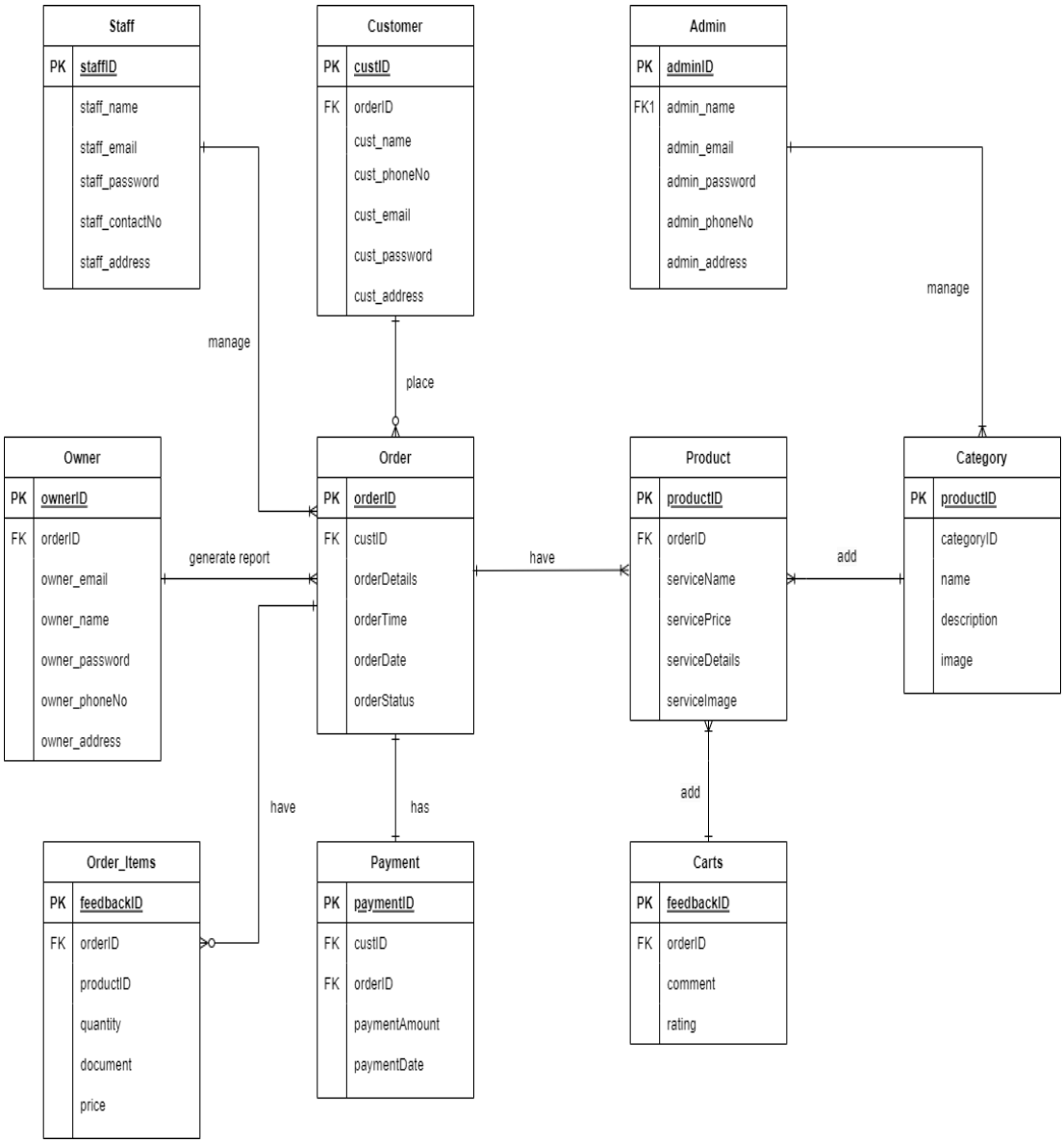


Figure E.1 Entity relationship diagram for overall system

Appendix F Prototype User Interfaces

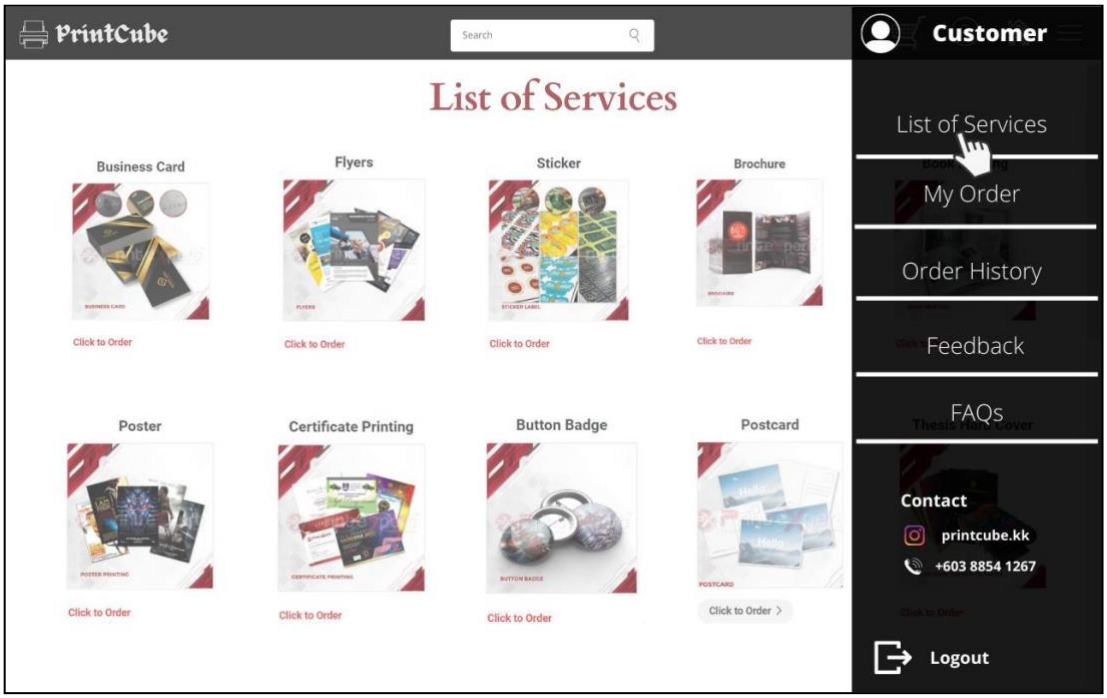


Figure F.1 User interface for view the list of products

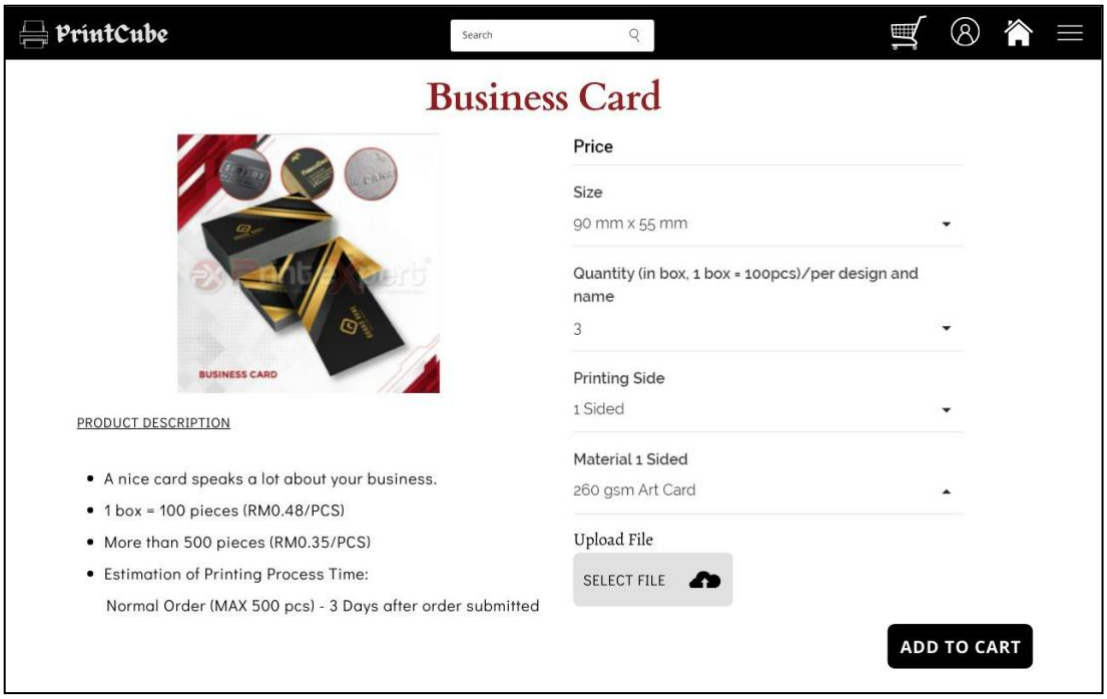


Figure F.2 Customer interface to select the details of order item

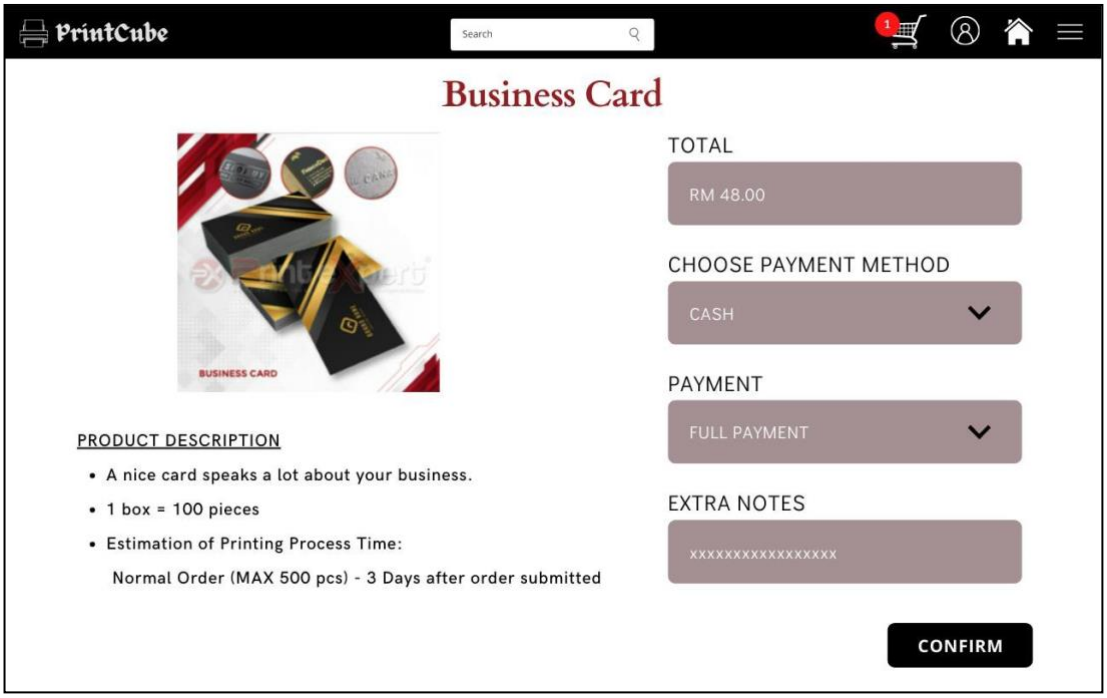


Figure F.3 Customer interface for payment process

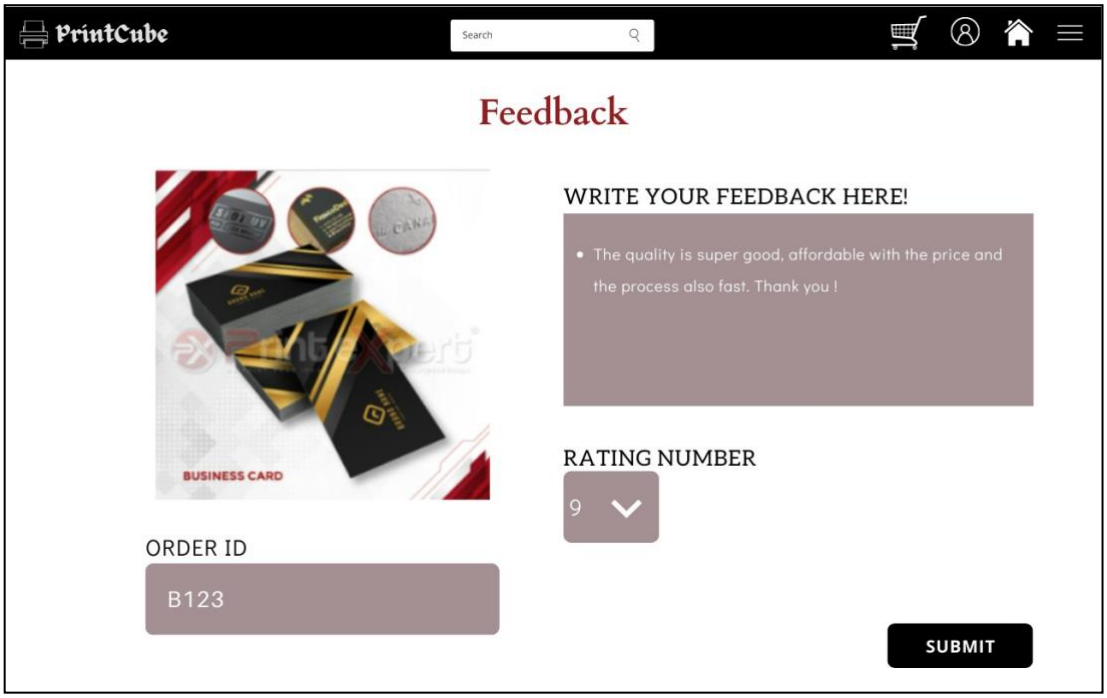


Figure F.4 Customer interface for feedback

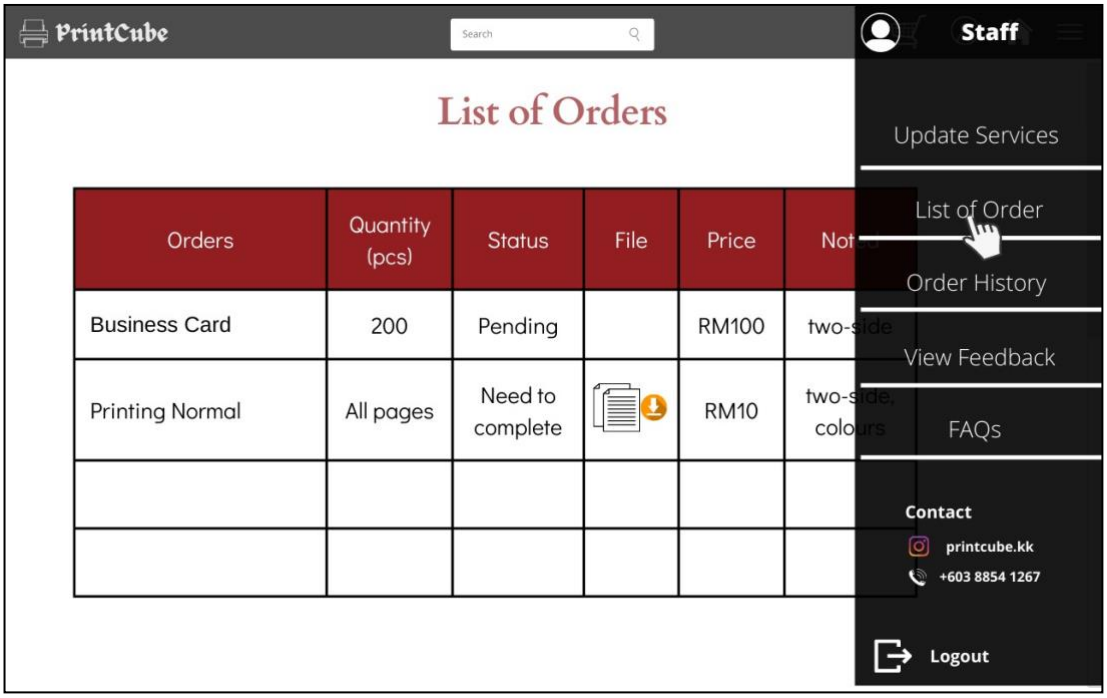


Figure F.5 Staff interface for view list of order

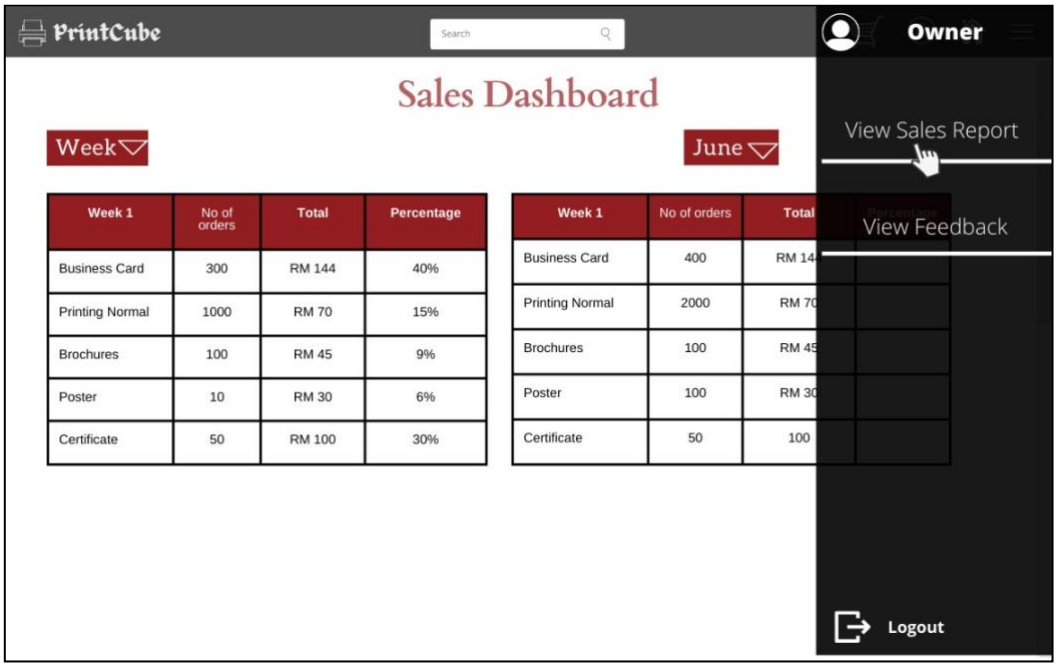
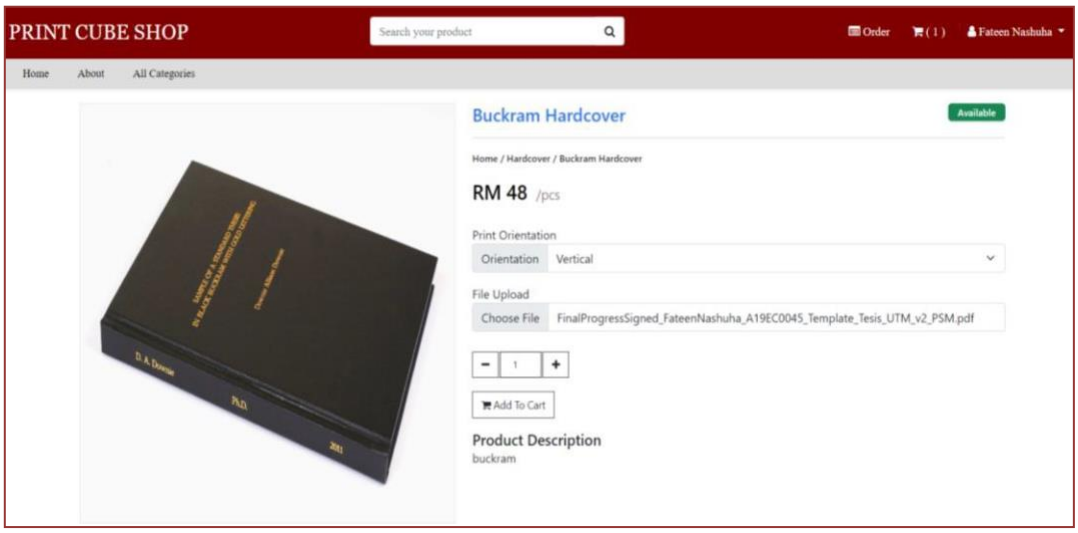
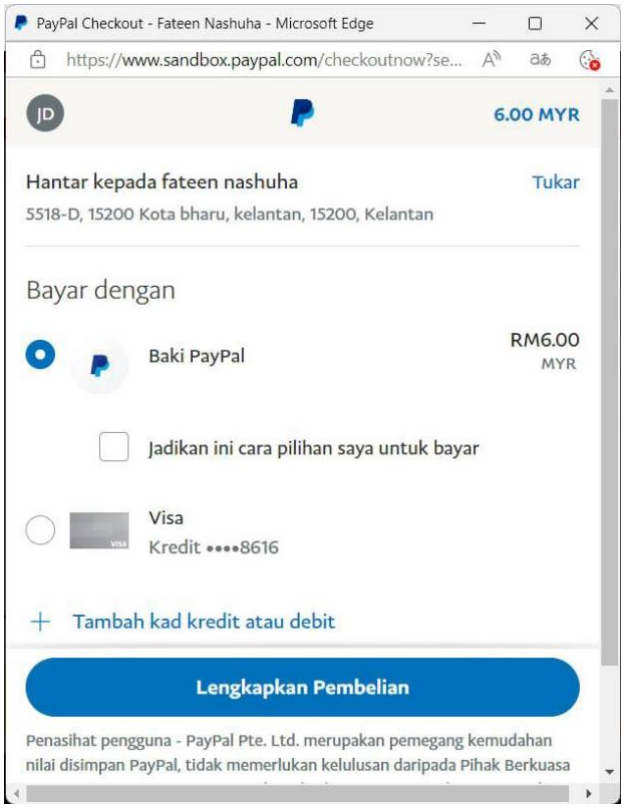


Figure F.6 Owner interface when view the dashboard

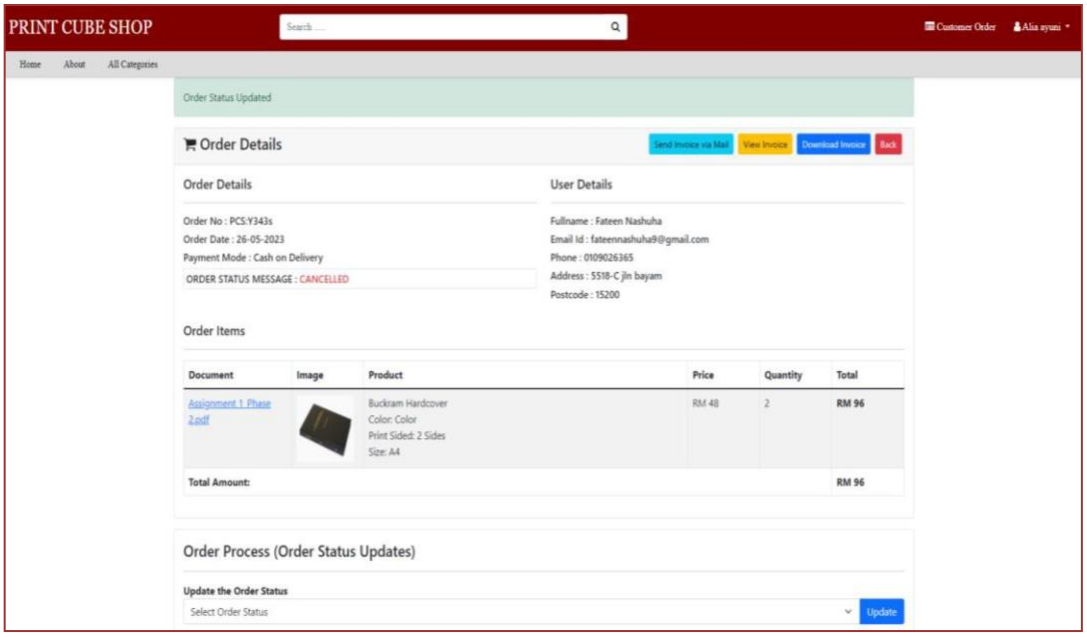
Appendix G Other System's User Interfaces



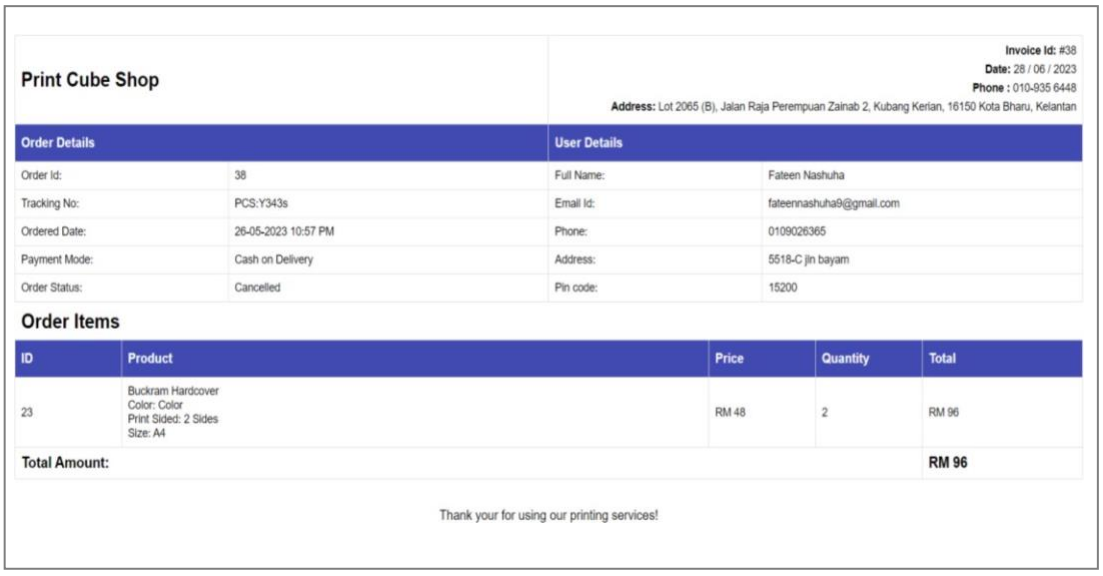
Appendix G.1 Interface of customer view the product details



Appendix G.2 Interface of PayPal simulator



Appendix G.3 Interface for staff views the customer's order



Appendix G.4 Interface of invoice receipt

Appendix H Questionnaires of UAT

User Acceptance Test Questionnaire on Printing Service System at Print Cube Shop

This survey is conducted to collect your feedback while testing the developed system for Print Cube Shop. Your feedback will be recorded in my thesis report and your suggestions will be used to improve the system.

fateennashuha@graduate.utm.my Switch account

Not shared

* Indicates required question

Section A: General Question
Please choose one (1) answer for each question

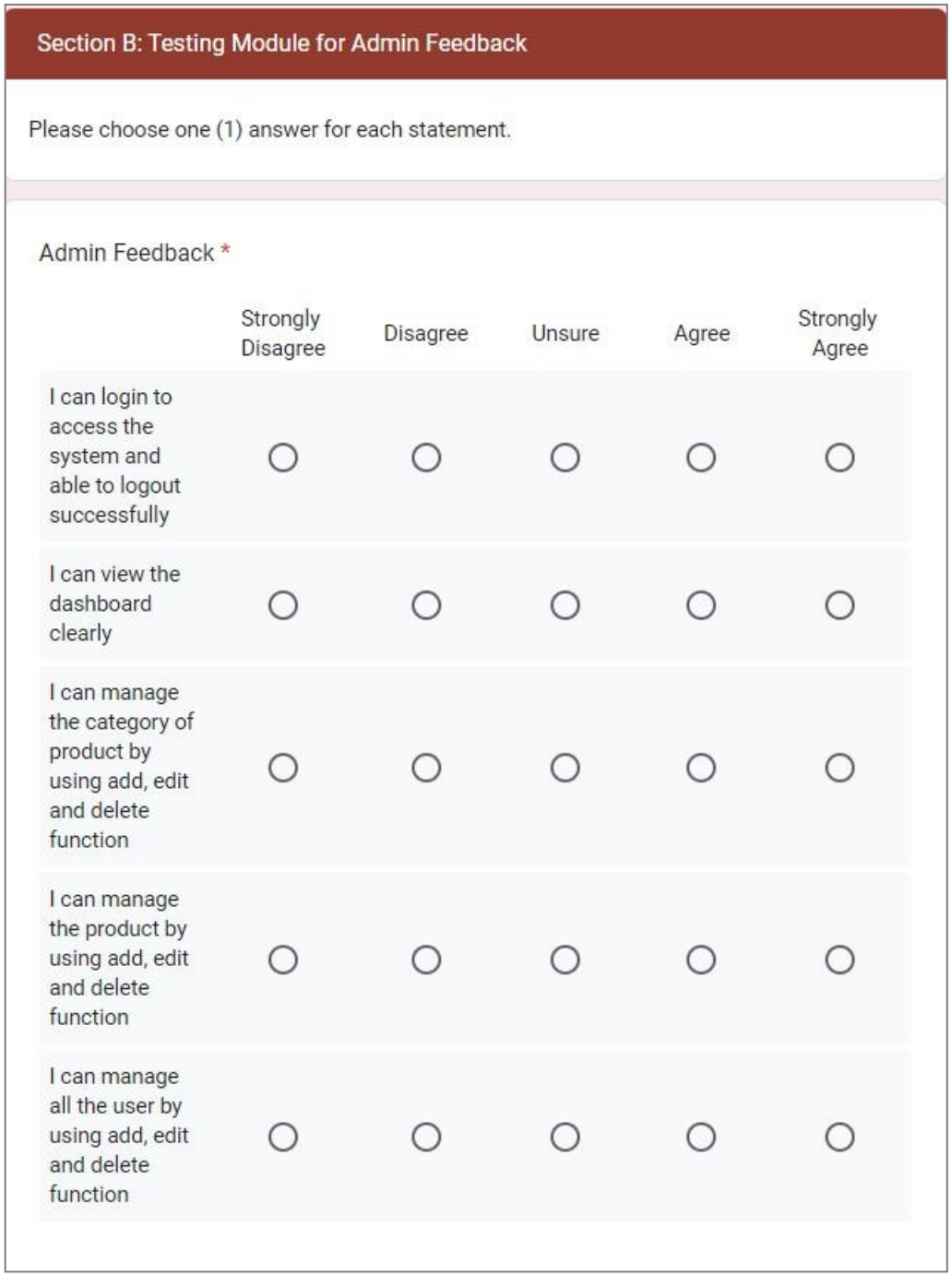
Gender *

- ○ Male
- ◉ Female

What is your current position in Print Cube Shop ? *

- ○ Admin
- ○ Owner

Figure H.1 Form of general question



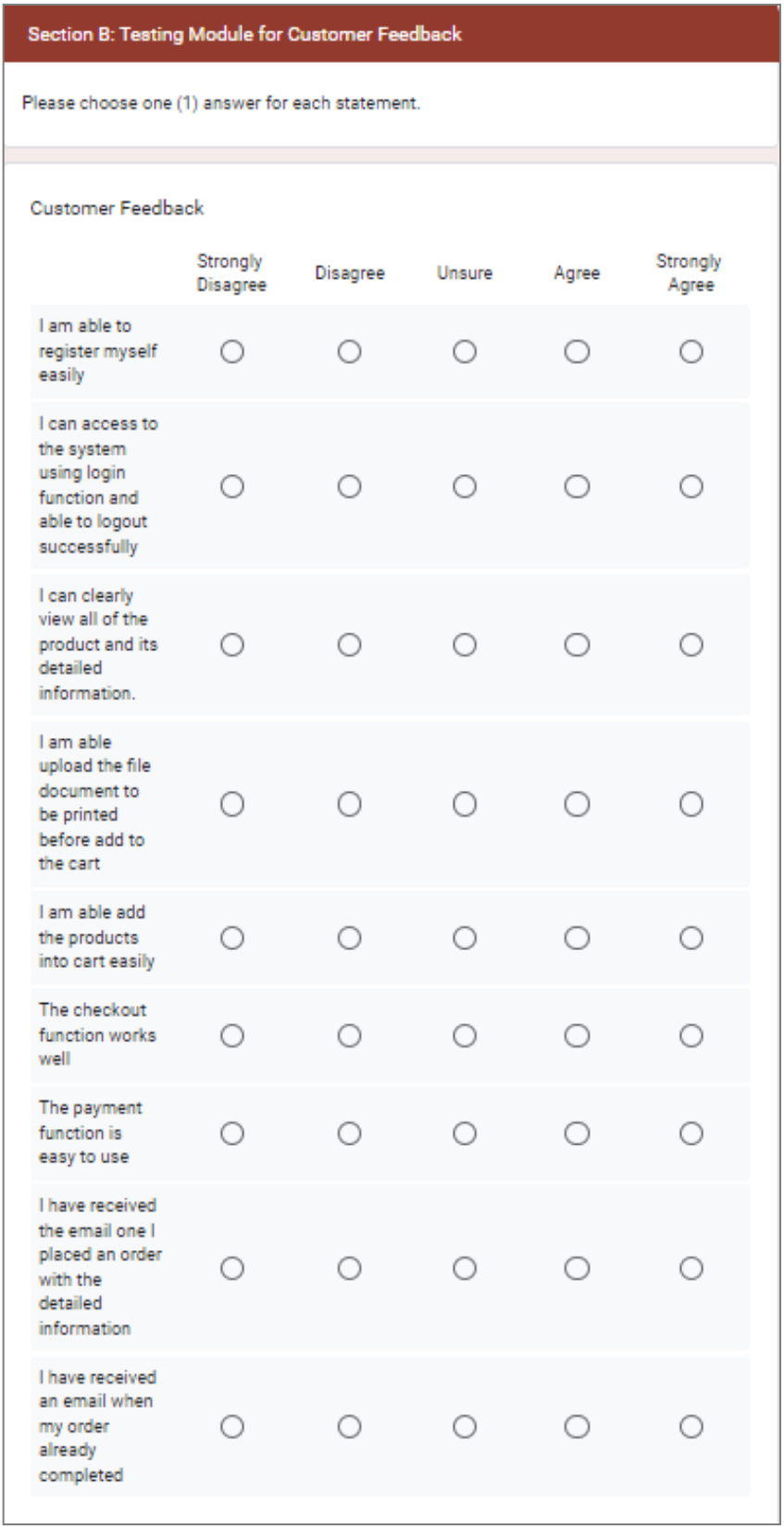
Section B: Testing Module for Admin Feedback

Please choose one (1) answer for each statement.

Admin Feedback *

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
I can login to access the system and able to logout successfully	○	○	○	○	○
I can view the dashboard clearly	○	○	○	○	○
I can manage the category of product by using add, edit and delete function	○	○	○	○	○
I can manage the product by using add, edit and delete function	○	○	○	○	○
I can manage all the user by using add, edit and delete function	○	○	○	○	○

Figure H.2 Admin feedback form



Section B: Testing Module for Customer Feedback

Please choose one (1) answer for each statement.

Customer Feedback

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
I am able to register myself easily	○	○	○	○	○
I can access to the system using login function and able to logout successfully	○	○	○	○	○
I can clearly view all of the product and its detailed information.	○	○	○	○	○
I am able upload the file document to be printed before add to the cart	○	○	○	○	○
I am able add the products into cart easily	○	○	○	○	○
The checkout function works well	○	○	○	○	○
The payment function is easy to use	○	○	○	○	○
I have received the email one I placed an order with the detailed information	○	○	○	○	○
I have received an email when my order already completed	○	○	○	○	○

Figure H.3 Customer feedback form

Section B: Testing Module for Staff Feedback

Please choose one (1) answer for each statement.

Staff Feebdback *

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
I can login to access the system and able to logout successfully	○	○	○	○	○
I am able to update my information in the profile page	○	○	○	○	○
I am able to view all the order by using the filter function	○	○	○	○	○
I can view the detailed each of the order and update the order status successfully	○	○	○	○	○
I can update the status of customer's order	○	○	○	○	○
I can notify the customer when they places an order successfully via email	○	○	○	○	○
I can send an invoice mail to the customer once their order completed	○	○	○	○	○
I can generate the invoice of customer's order	○	○	○	○	○

Figure H.4 Staff feedback form

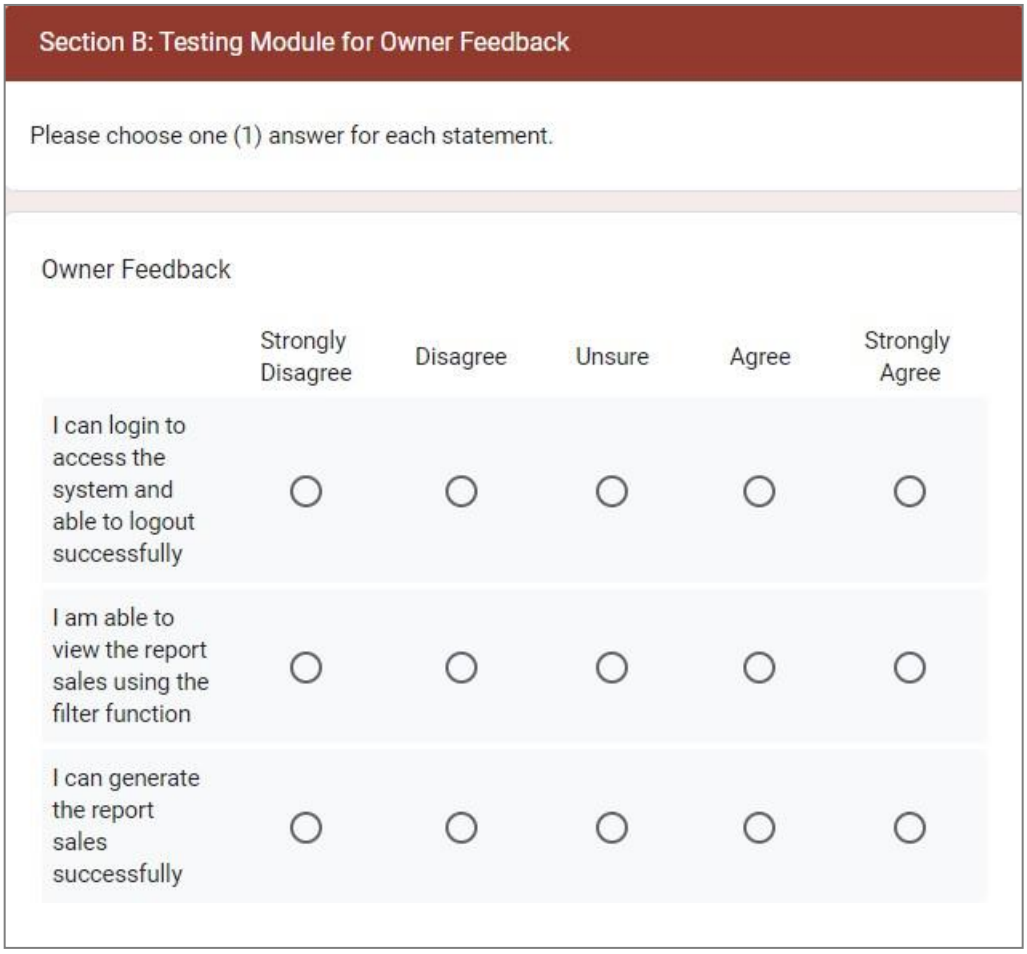


Figure H.5 Owner feedback form

Section C: Overall Feedback

Please choose one (1) answer for each statement.

What is your overall feedback on printing service system developed for Print Cube Shop? *

	Strong Disagree	Disagree	Unsure	Agree	Strongly Agree
All the interfaces are user-friendly	◯	◯	◯	◯	◯
All modules and functions are simple and straighforward to to use	◯	◯	◯	◯	◯
I understand the function of every button created	◯	◯	◯	◯	◯
The navigation button are easy to use	◯	◯	◯	◯	◯
I think the security of this system is guaranteed	◯	◯	◯	◯	◯
I believe this project is successful	◯	◯	◯	◯	◯

What is your overall rating on Print Cube Shop system ? *

	1	2	3	4	5	6	7	8	9	10	
Poor	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	Excellent

Figure H.6 Overall feedback form