PRINTING SERVICE SYSTEM FOR PRINT CUBE SHOP

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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
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School 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.

ACKNOWLEDGEMENT

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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. 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 also was plan to be 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. The Print Cube shop system also will be developed using a cloud database which is MySQL to store and retrieve the client's data when it is requested.

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 ke dalam sistem 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. 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 juga dirancang untuk 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. Sistem untuk kedai Print Cube juga akan dibangunkan menggunakan pangkalan data awan iaitu MySQL untuk menyimpan dan mendapatkan semula data pelanggan apabila ia diminta.

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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
SMS	-	Short Message Service
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. I discovered that the majority of his customers were Universiti Sains Malaysia (USM) Kubang Kerian students in Kelantan. This is due to 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 will record 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 the appropriate denomination 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 for this system are admin, staff, owner and customers of Print Cube.

(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) Instead of involving an online payment gateway, the system will use the simulator for online transfer payments only.

1.6 Project Importance

The proposed idea of this project 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 Short Message Service (SMS) 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 five chapters that cover everything from the project's beginning to its conclusion. The project's surface will be introduced in Chapter 1, which will explain the project's introduction, problem background, project goal, project objective, scope, and project importance. The literature review will next 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. This chapter

will look at the differences between existing systems and the technology that is being used.

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 summary will be correctly described in accordance with the previous chapters in Chapter 5. This chapter also serves as the report's conclusion, listing all of the accomplishments made throughout the document.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will examine existing manual operation, as well as review and analyse 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 details and information also covered in this chapter will exemplify why it was well qualified to use 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.

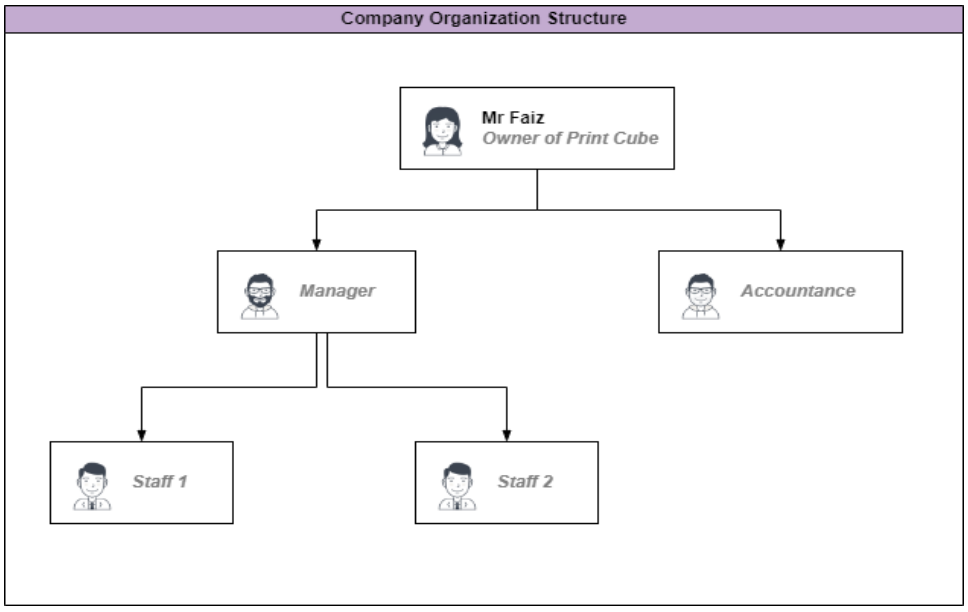

Figure 2.1 Company organization structure for Print Cube shop

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, such as 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.

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. 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.

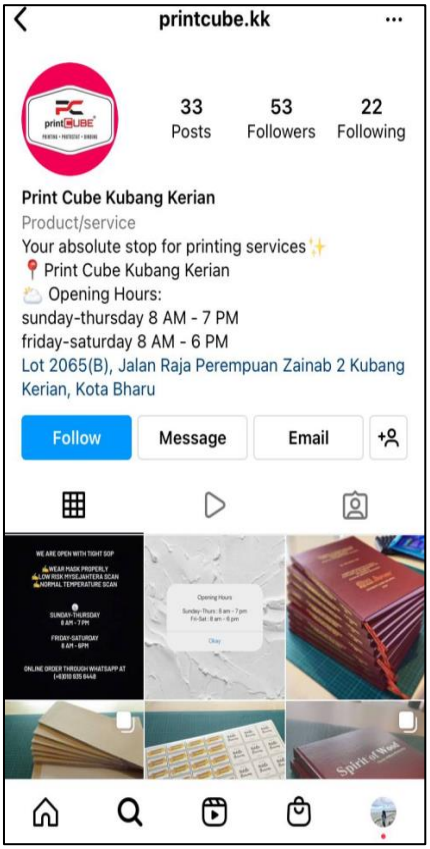

Figure 2.2 Advertising via Instagram

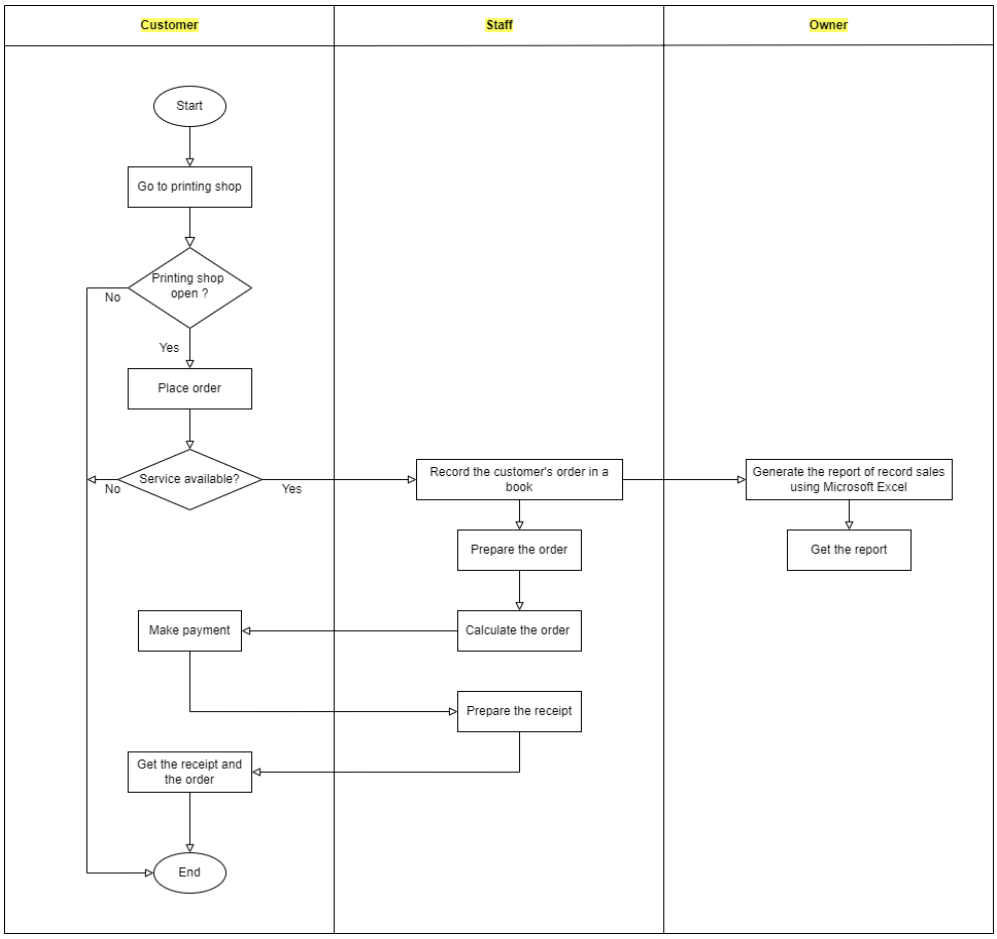

Figure 2.3 Current working flow of Print Cube shop

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 adapted to 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.

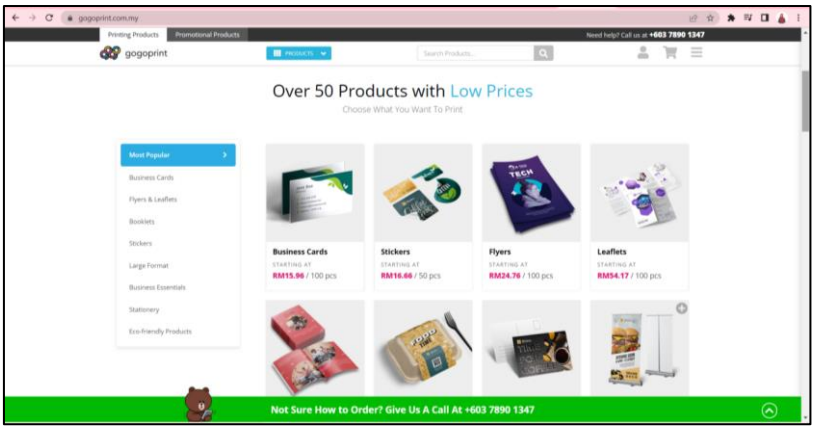

Figure 2.4 User interface at Gogoprint website

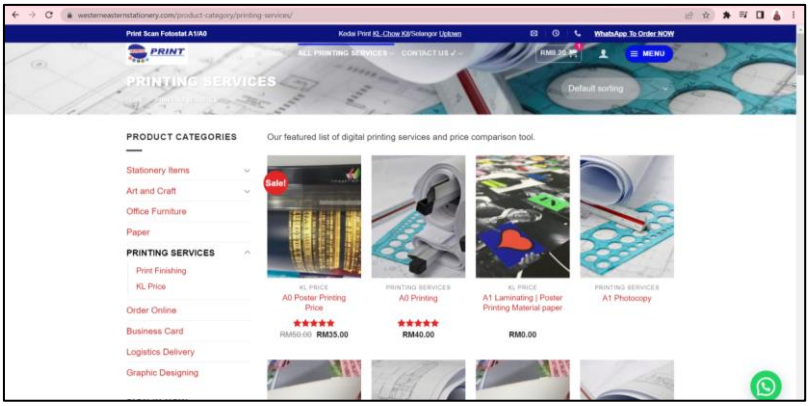

Figure 2.5 User interface at Western Eastern Printing website

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 or delivery status via SMS where this function is not implemented by two other systems.

Additionally, the proposed system is also allowed to give ratings and share their feedback to each order made. This tactic will be beneficial to keep their customers continuing to use the Print Cube services. Furthermore, all of 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. However, feedback is very crucial for an owner in order to provide the best customer service and maintain their market position. Thus, we can see there are reviews from customer feedback who share their experience and satisfaction regarding the service provided by Gogoprint and Western Eastern Printing from their website. Same to the proposed system, the customer is free to provide feedback on the service or quality order from the Print Cube shop.

In terms of sales management, the owner of existing systems and proposed systems are able to generate the weekly or monthly 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.

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	✓	✓	✓
SMS push automated notification	×	×	✓
Able to make payment via online	✓	✓	✓
Customer feedback	✓	✓	✓
Owner able to generate online sales report	✓	✓	✓
Staff able to insert or delete or modify the printing services	✓	✓	✓

Online printing services have transformed the way people think about printing, opening up new horizons and opportunities for businesses and people from all walks of life. However, the weakness found on these existing systems in the market is they do not provide the SMS push notification to the customers. For instance, the customer of Gogoprint is able to check the progress of their order through the system only. This flaw could cause problems for customers because they will have to check multiple times to see if their order has 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.

2.5 Literature Review of Technology Used

This section describes all the technology that was used to create the Print Cube System. In this context, technology is defined as any framework and network and security elements that will support this system development.

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. 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 that will save time even though the website will be developed from scratch since this framework is 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 Synohost Web Hosting. MySQL is an open-source software that is ideal for building data-driven applications because it includes a free database feature. The software's limitation is that a database cannot contain more than a thousand tables. Synohost will be used as a web-hosting provider, providing the technologies and services required for the website to be viewed on the Internet. The websites are then

hosted on special computers known as servers. The only restriction to using it is a yearly payment on any selected packages.

2.5.4 Push Notification

SMS 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. SMS notification only requires a customer to give an active phone number for the system to be able to send the notification. SMS 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 since all smartphones come with an SMS reader built in. When messages are broadcast, text messages reach your customers instantly, and they are instantly notified. This novel idea of SMS notification actually benefits both customers and staff. 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.

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). In this project, MD5 algorithm will be implemented since it is most widely used currently. 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. 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 username, password and PIN as the unique ID and 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. The plan to verify the user for the proposed system is by entering the user phone number during account registration. Then, the user had to key in the PIN number that is sent via their respective phone number to ensure any third parties cannot perform malicious action.

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.

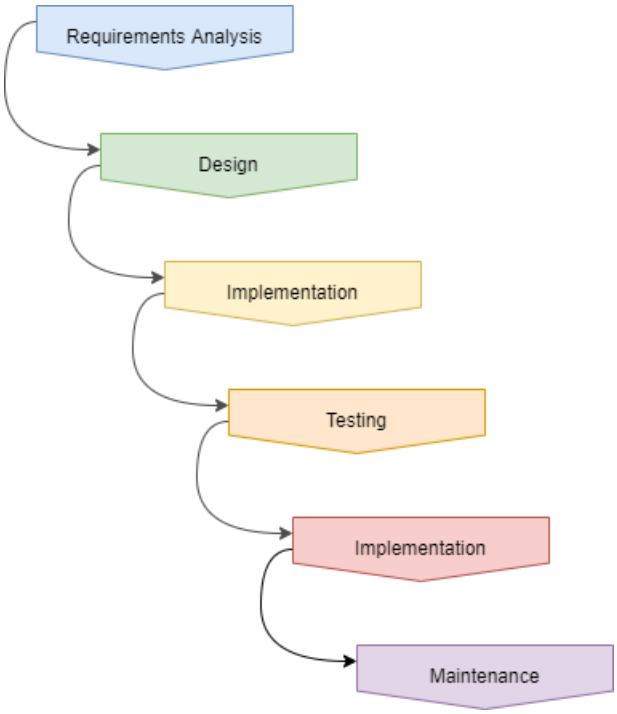

Figure 3.1 Waterfall methodology (SDLC – Waterfall Model, n.d.)

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 below. 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, while Canva is used to create user interfaces wireframing.

3.3.3 Implementation Phase

Starting from this phase, it will be conducted in Final Year Project 2. In implementation phase, the technical execution begins by writing project source code

for the proposed system. The coding is developed based on the user requirements. 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. Meanwhile, Microsoft Visual Studio Code is chosen as the IDE tool for writing and editing programme code.

3.3.4 Testing Phase

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. 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 will undergo a checking by the lecturer and the client. Any failures found during the testing activities will be fixed 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 out client. Following the deployment of the system, check in the environment will be performed to ensure that the system does not fail. 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.

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 will be implemented to ensure the

system is updated. However, due to the scope of FYP 2, the project will end after the defects discovered during the system deployment phase have been fixed.

3.4 Technology Used Description

This subtopic will define all the technology that will be used to develop the Print Cube System. The technologies used in terms of framework, network elements and security elements have been discussed in Section 2.5 above. Table 3.1 will focus 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
Input/Output Devices	Mouse, Keyboard / Printer
Smartphone	iPhone 8 iOS 15.4.1
Software	
Operating System (OS)	Window 10
Browser	Google Chrome, Microsoft Edge, Safari
Integrated Development Environment (IDE)	Visual Studio Code
Cloud Server	Firestore, Firebase
Cloud Storage	Google Drive
Documentation	Microsoft Word, Draw.io, Canva

3.5 System Requirement Analysis

The system requirements analysis's goal is to construct the system independent of any implementation environment. This phase can influence the system's behaviour and limitations. Similarly, 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 and above
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	Mouse, Keyboard / Computer, 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 will be used throughout this project. To ensure that the study runs smoothly, the study is planned as thoroughly and methodically as possible. This 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 will discuss the details of requirement analysis and design for the Print Cube system. The requirement analysis will be discussed again and the system design includes the use case diagram, sequence diagram, activity diagram and 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 are capable of overcoming 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 below.

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	System will send SMS push notification
Only provide cash payment method	Add on online transaction
Miscalculate of the order	Automatically calculate the customer's order
Report sales need to generate manually	Owner can directly view the sales report either for weekly or monthly
Customer need to walk in to send their printing material	Can upload the printing material via website
Manual receipt process	Paperless environment since the system can generate e-receipt

4.3 Use Case Diagram

Use case diagram is a representation of interaction between the actors and the system's functionality. It is a general view only without going deep into the inner workings of the system with four elements which are use cases, actors, subsystems and its relationship between the actors and use cases. The importance of use case diagrams represents the goals of the system and its actors, then describe what the system does and how the actors use it, but not how the system operates internally.

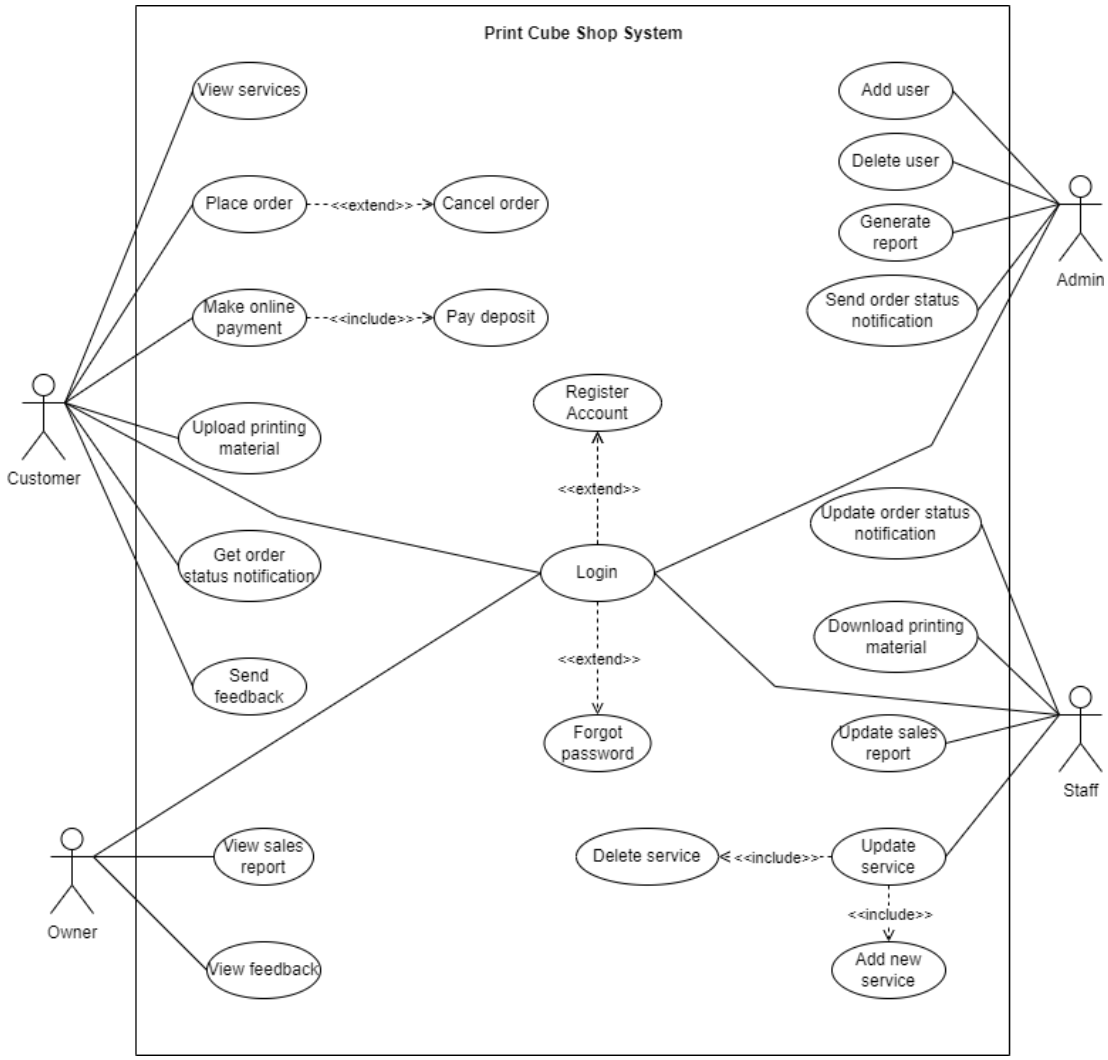

Figure 4.1 Use case diagram for overall system

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 printing 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
Send feedback	Customer also allow to share their feedback in this system
View sales report	Owner's Print Cube shop is able to view the sales report either for weekly or monthly
Generate report	Applicable for staff only to update and generate the report
View feedback	The owner can view the feedback that shared by his customer for future improvement
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 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. 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.

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 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. After that, when the user wants to login, the system will validate the user by comparing the keyed-in email address and password with the database data. If the entered email address and password are found and same in the database, then the user is able to access and will be redirected to the main page. Otherwise, the user will be unable to access the Print Cube system.

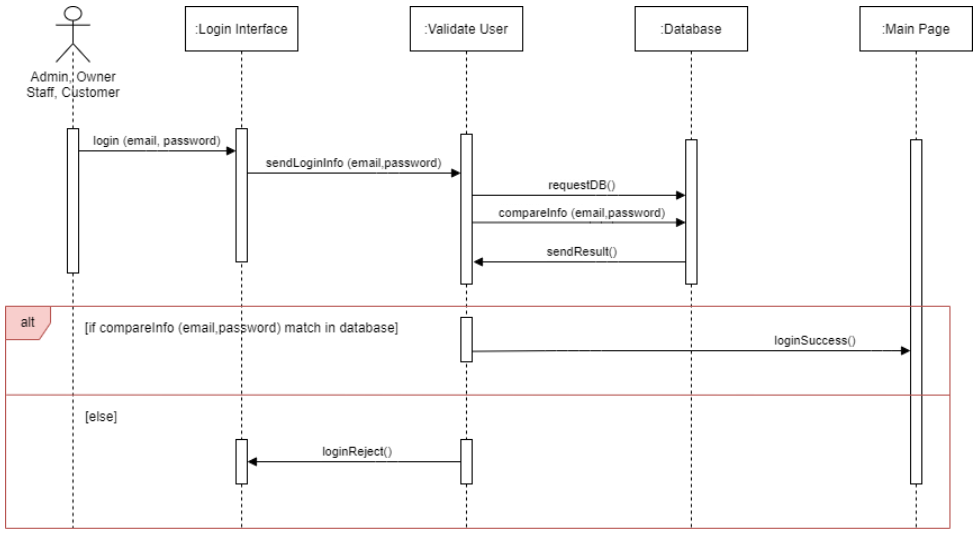

Figure 4.2 Sequence diagram for login feature

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. Then, they can view the list of available services and its prices based on a few options which are the quantity, types of paper chosen and whether they want to print in colour or not. Next, the customer can add the order item into a cart and proceed to payment. Once the order is completed and ready for them to pick-up, they will be notified through Short Message Service (SMS) by the system admin.

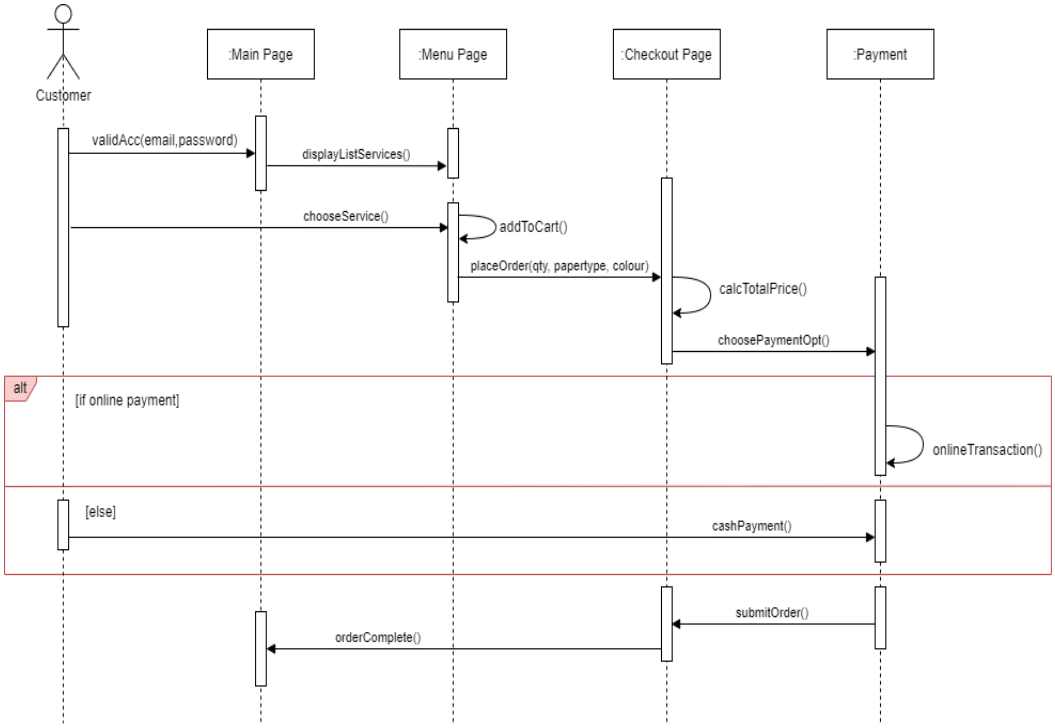

Figure 4.3 Sequence diagram for place an order

4.4.3 Sequence Diagram for Reporting

The step on how to generate and view the sales report is shown in the Figure 4.4. Basically, the sales of online data are already stored in the system but the staff need to key-in the sales for customers who walk-in to their shop. Then, the staff need to submit it, so that the system can generate the report. The sales report either for

weekly or monthly can only be viewed by the owner at the dashboard section in the proposed website. An Application Programming Interface (API) will be integrated in order to create this dashboard. Google Analytics API will be chosen to create customized dashboards of report sales for this website's backend.

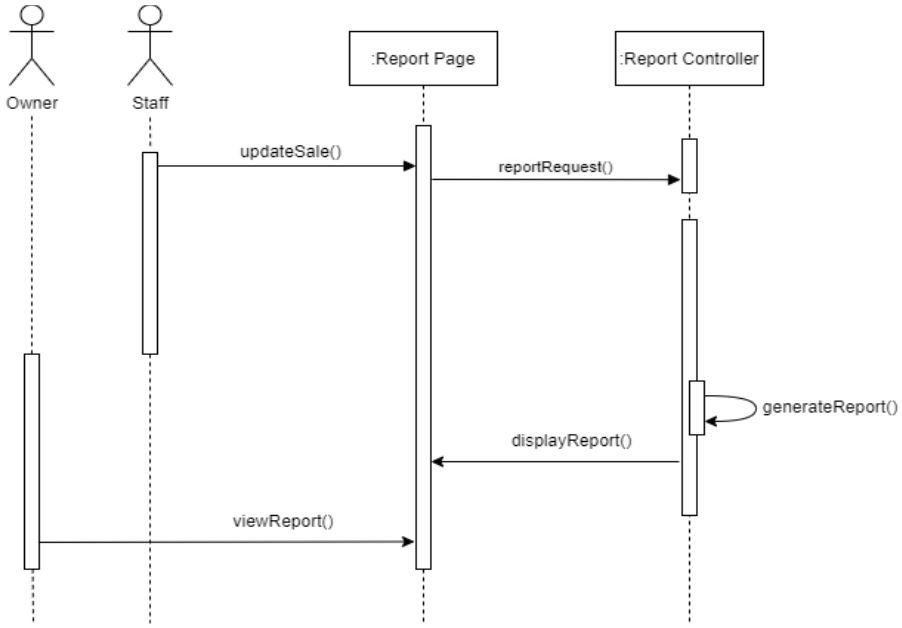

Figure 4.4 Sequence diagram for reporting

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.). Each user's activity diagram for this proposed system is shown in the Appendix C.

4.5.1 Activity Diagram for Customer

The activity diagram for customer users is discussed in this section. Figure C.1 in Appendix C 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 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.

4.5.2 Activity Diagram for Staff

This section shows and describes the activity diagram for staff refers to Figure C.2 in Appendix C. 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”. Besides that, the staff also are allowed to update the services like add new service into the system or delete unavailable service from the system. All changes and additions will be saved and updated in the database.

4.5.3 Activity Diagram for Owner

The activity diagram for the owner is discussed in this section as represented in Figure C.3. The activity flow for the owner also begins with the login process and then he is taken to the main page after successfully logging in. Basically, the owner was only able to see the sales report in the dashboard once the staff had generated the report.

4.5.4 Activity Diagram for Admin

This section illustrates and describes the activity diagram as can see in Figure C.4 for the admin. 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 has the ability to add and delete user accounts. Adding an account means adding a new user to the system, whereas deleting an account means removing the account from the system. When creating a new account, the administrator must first choose a user role, such as student, faculty coordinator, or programme coordinator. Admins can also view a list of users and update user information. On the other hand, the information roles, user IDs, and passwords, are fixed and cannot be changed. Moreover, once the staff update on the order status is completed, the admin must also send a notification to the customer to make sure they alert that their order is already completed. To send a notification, the administrator must first select the “Notification” menu, where he or she must enter the contents of the notification to be sent to the customers. All registered customers will receive this notification via SMS.

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 below. 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.

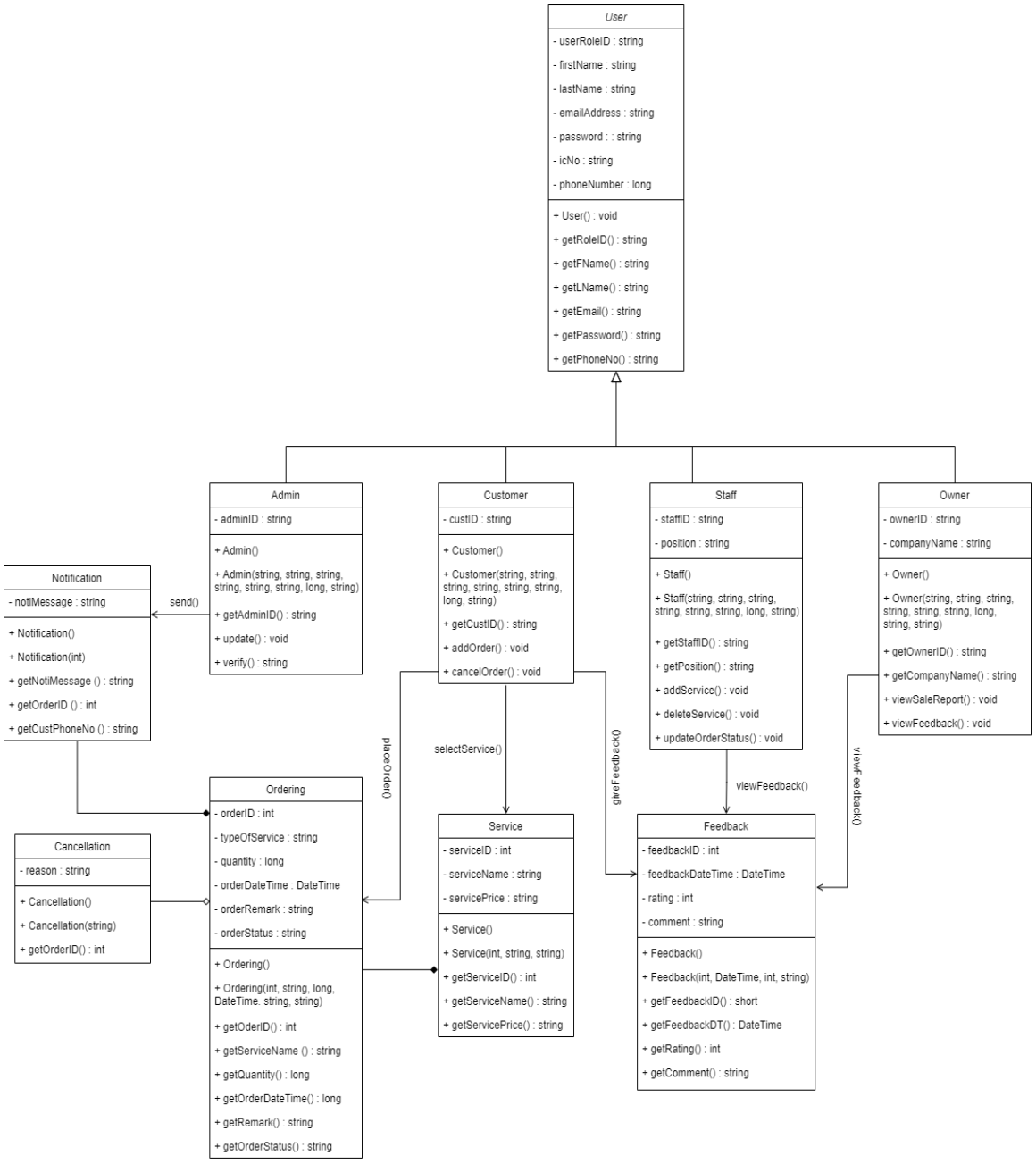

Figure 4.5 Class diagram for overall system

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 SMS. 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 SMS, so that customer can just come to the shop and pick up the printed material.

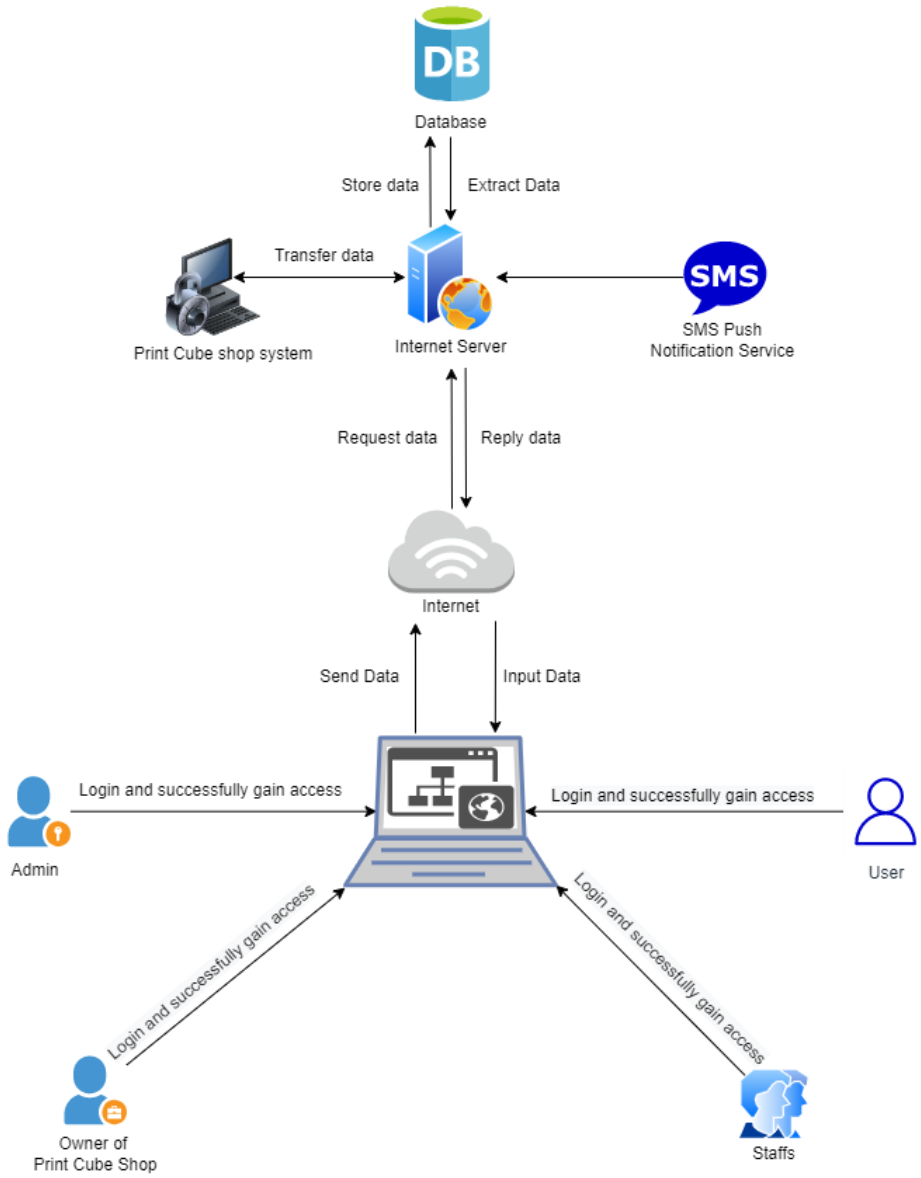

Figure 4.6 System architecture for Print Cube shop system

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 D, an ERD was created for this proposed system with 8 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. Some of user interfaces for the customers, staff, and owner are shown on below of this section.

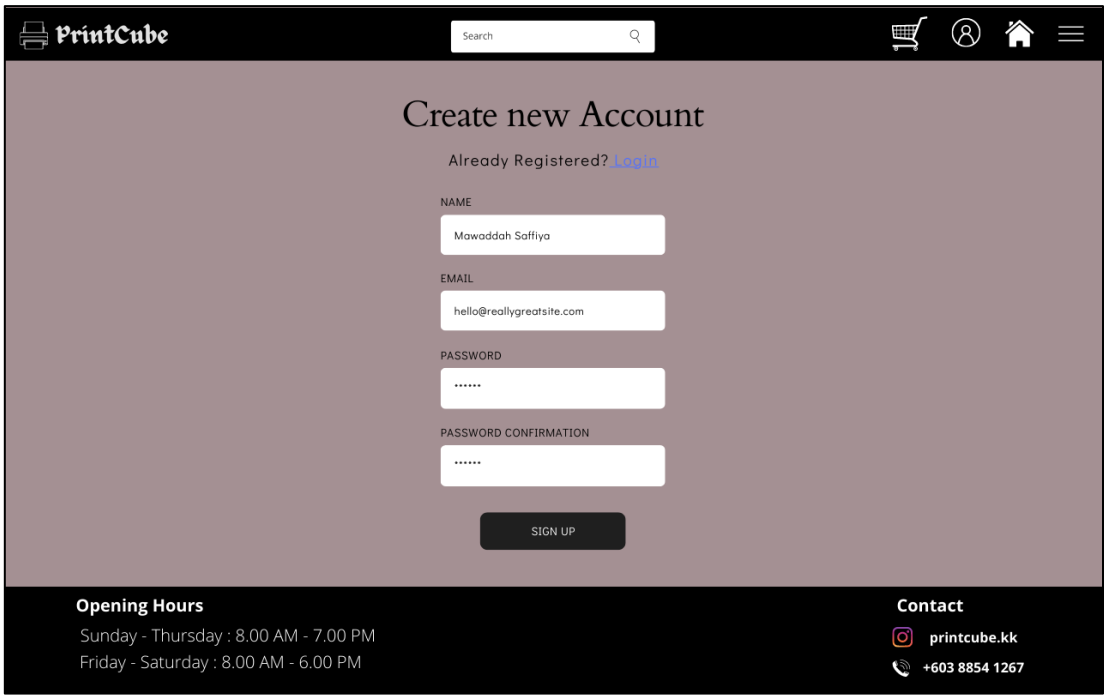

Figure 4.7 User interface for register account

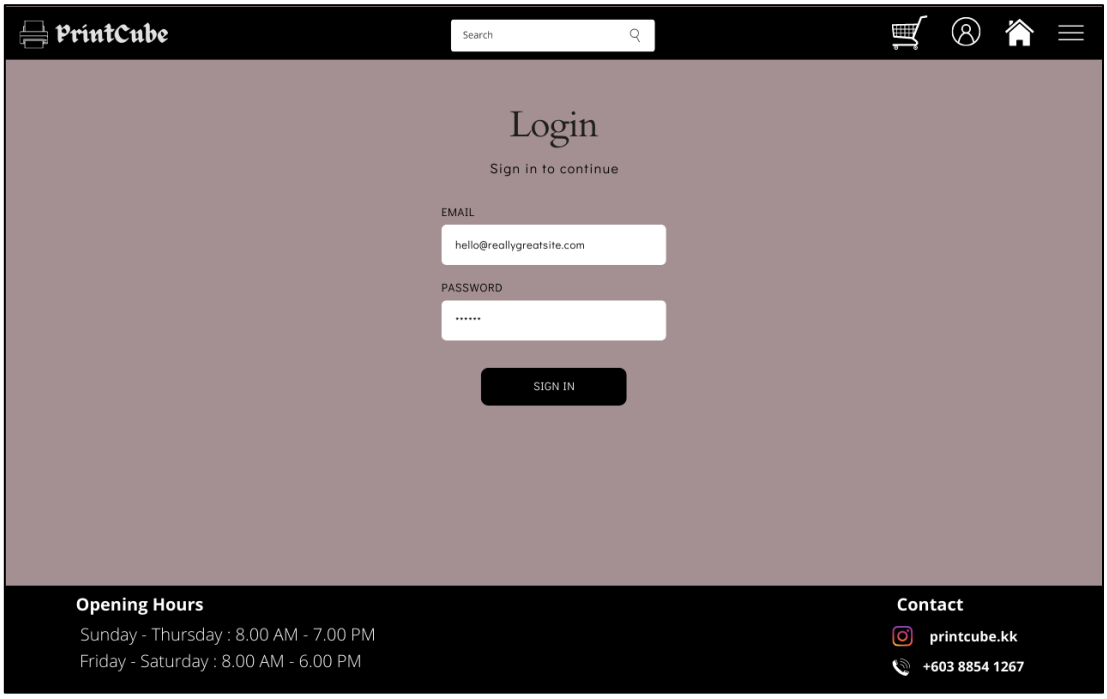

Figure 4.8 User interface for login

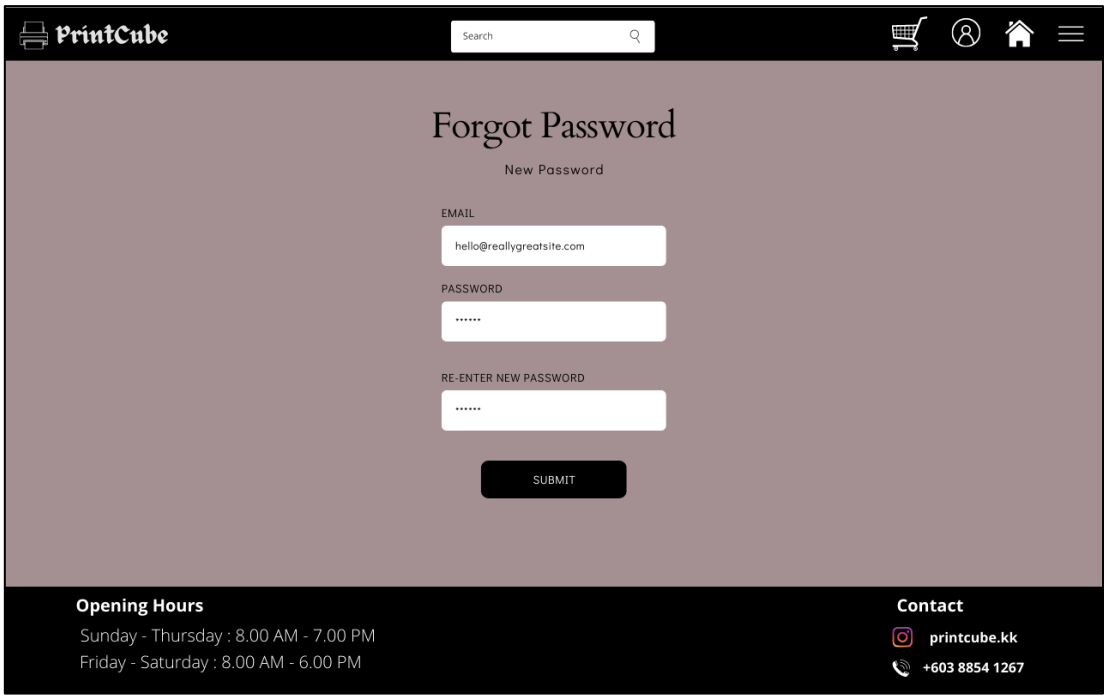

Figure 4.9 User interface for reset password

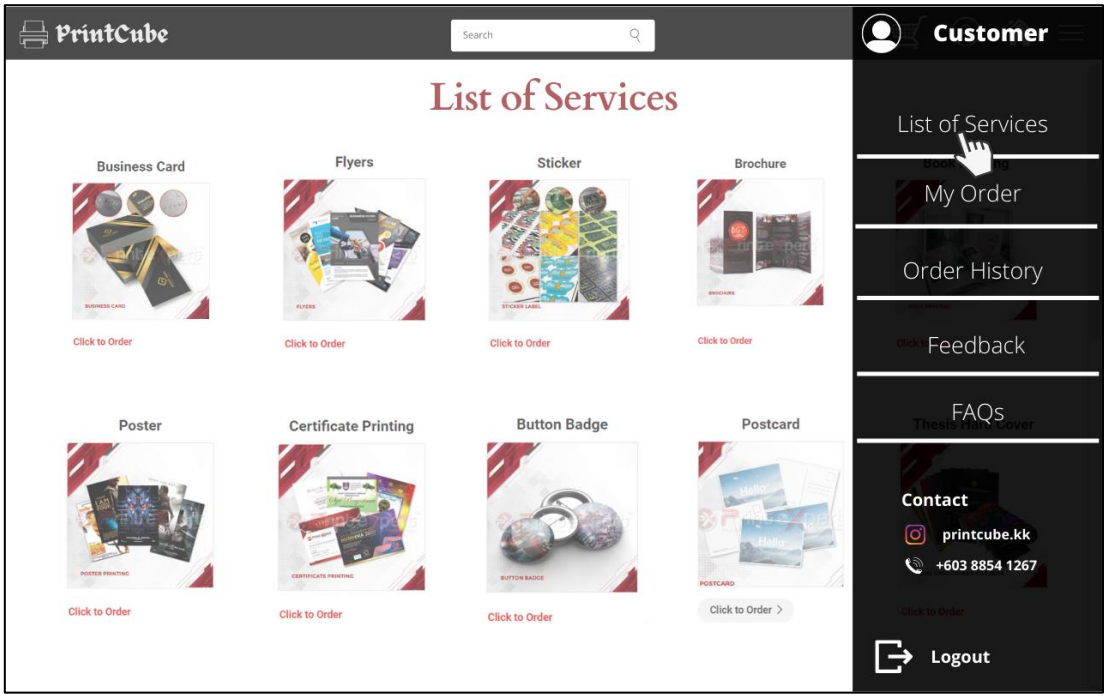

Figure 4.10 User interface for view the List of Services

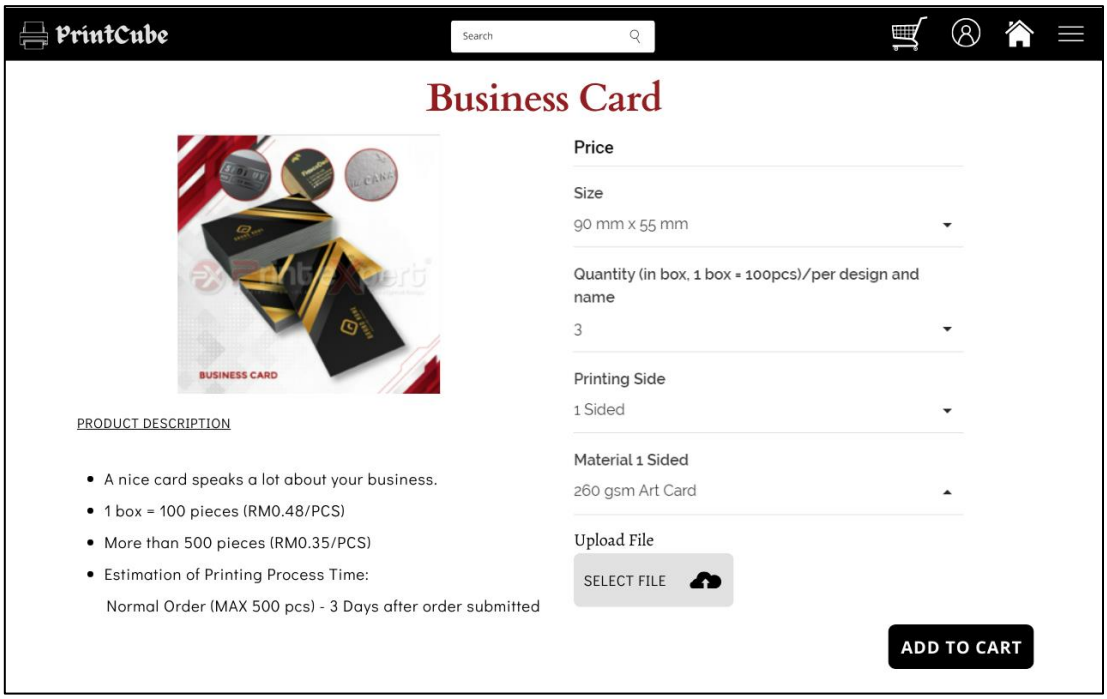

Figure 4.11 Customer interface to select the details of order item

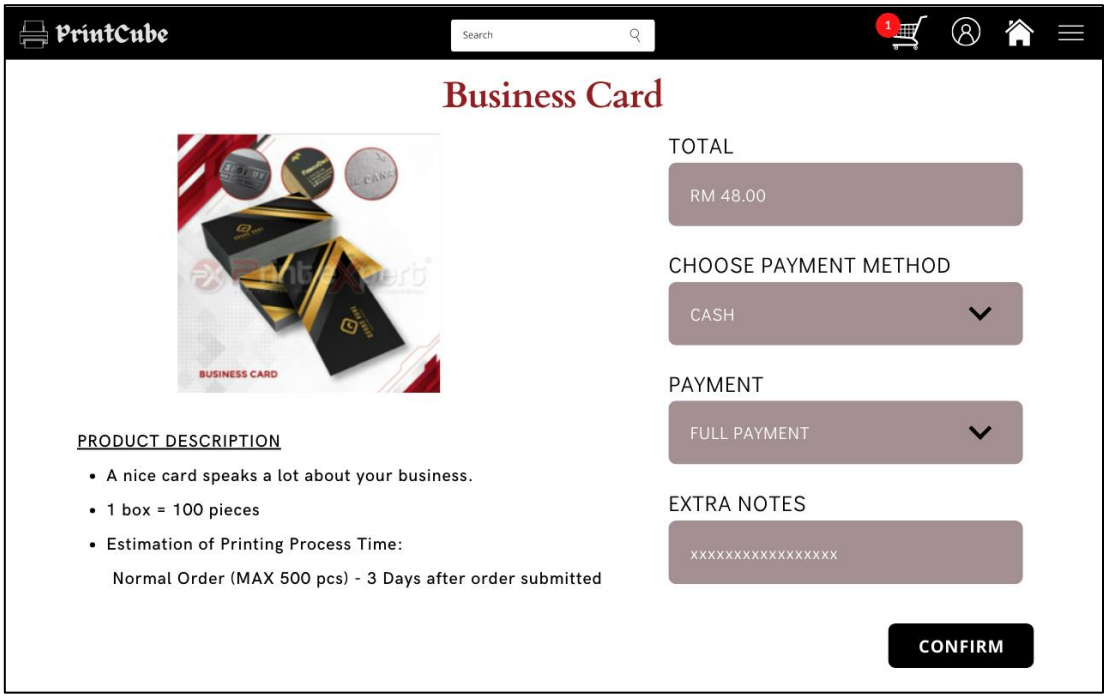

Figure 4.12 Customer interface for payment process

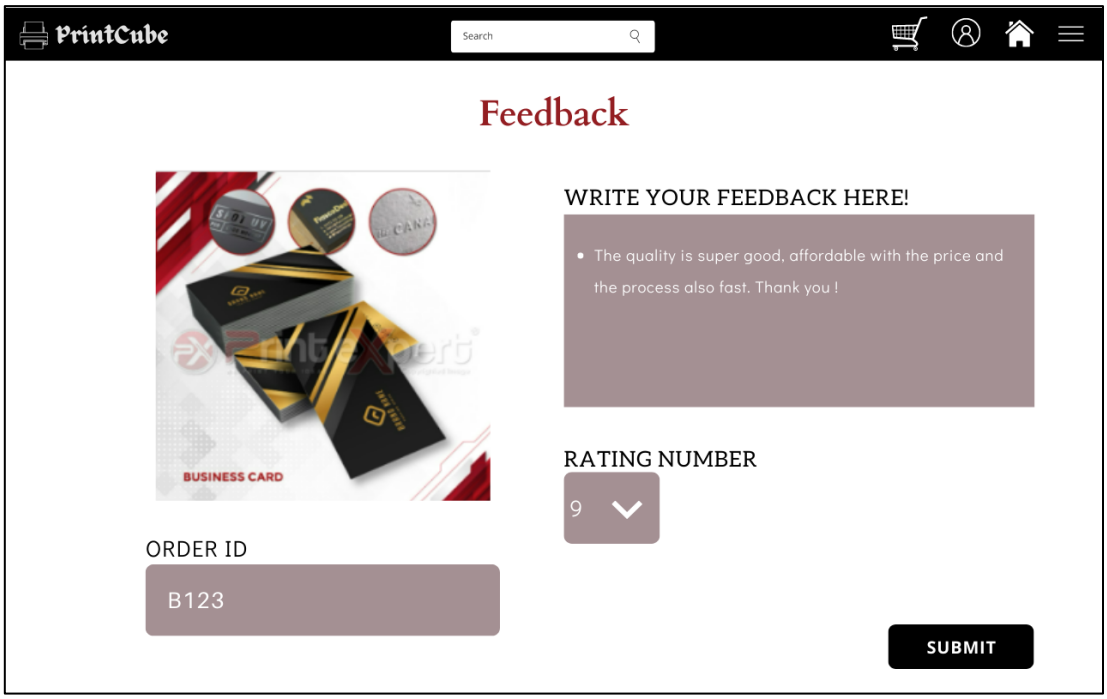

Figure 4.13 Customer interface for feedback

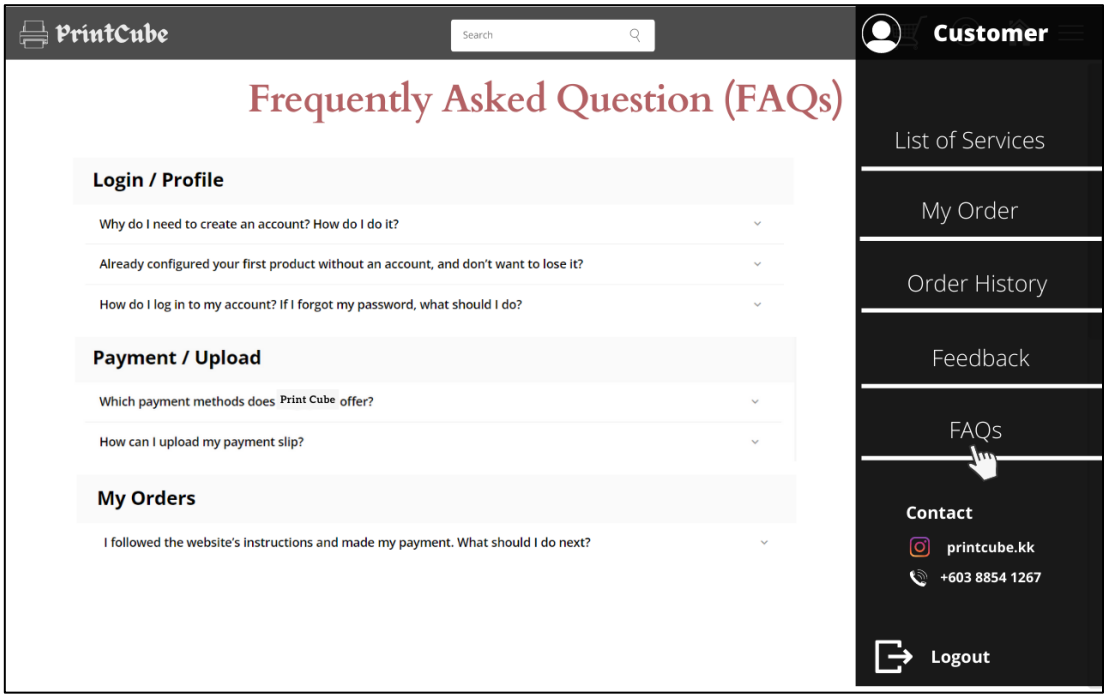

Figure 4.14 Customer interface for FAQs

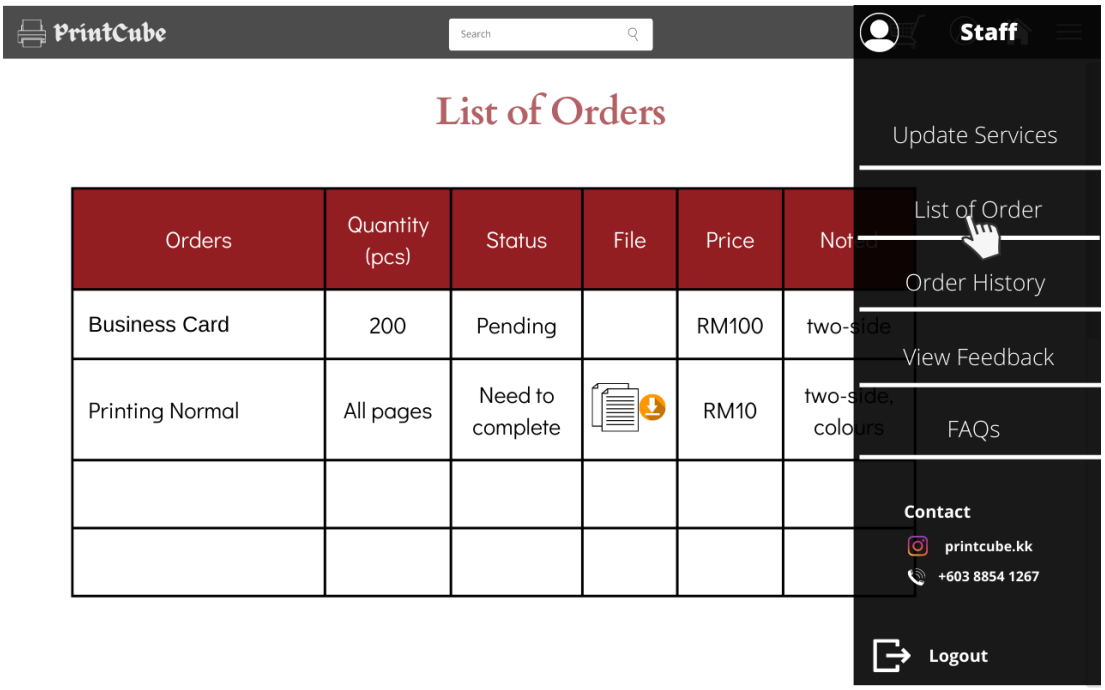

Figure 4.15 Staff interface for view List of Order

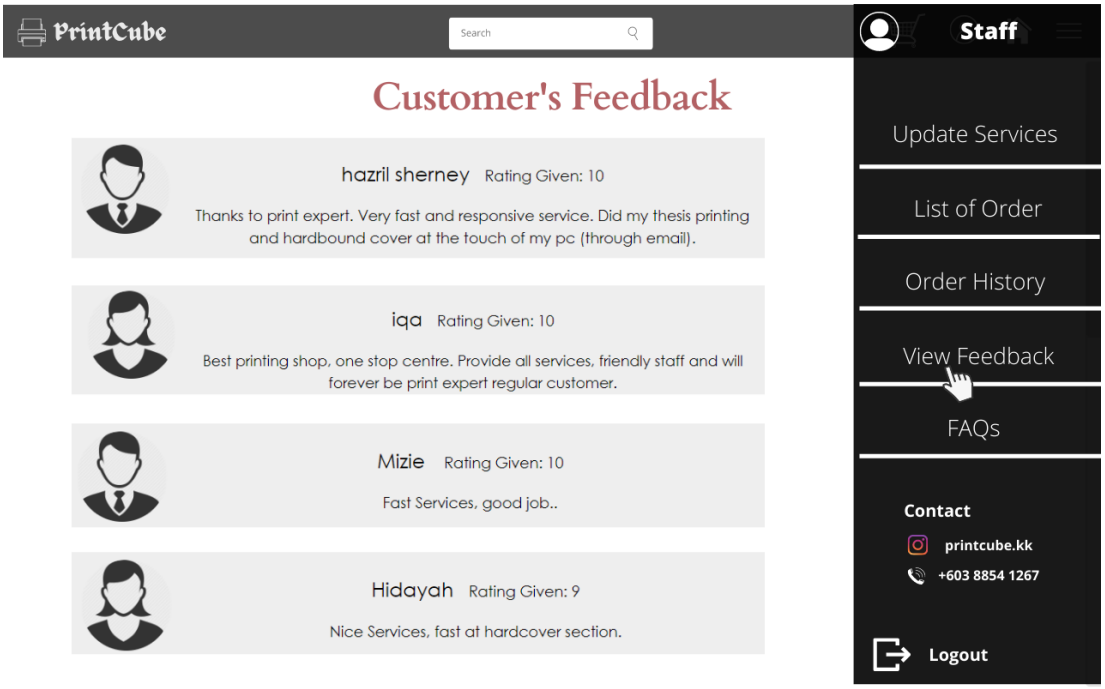

Figure 4.16 Staff interface for view Customer's Feedback

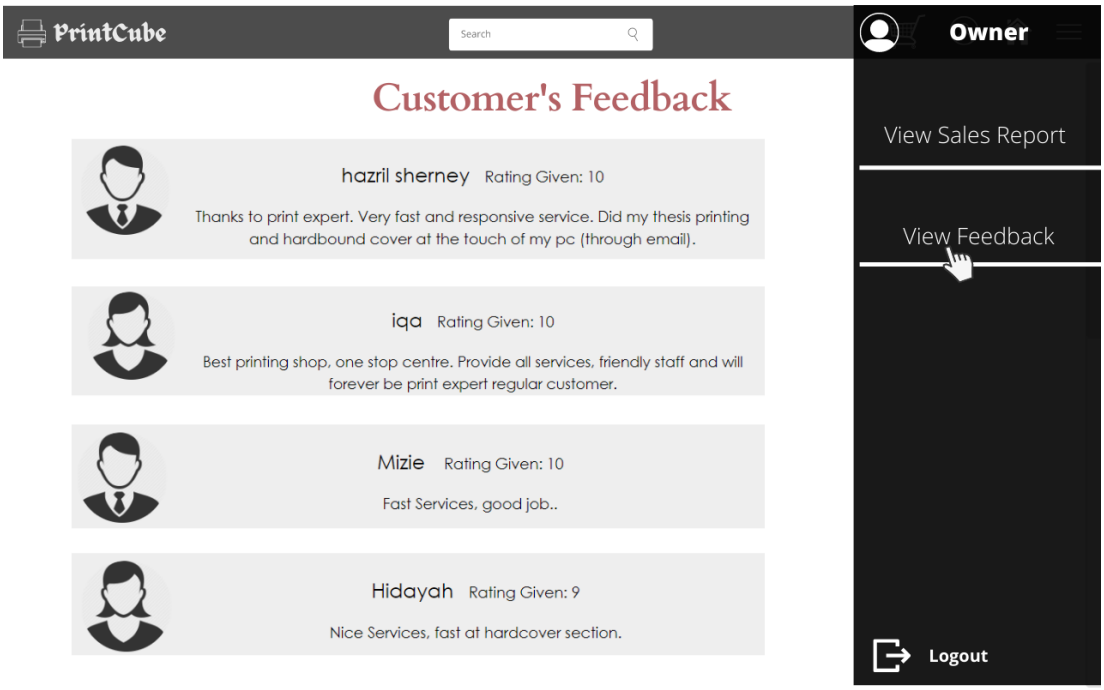

Figure 4.17 Owner interface for view Customer's Feedback

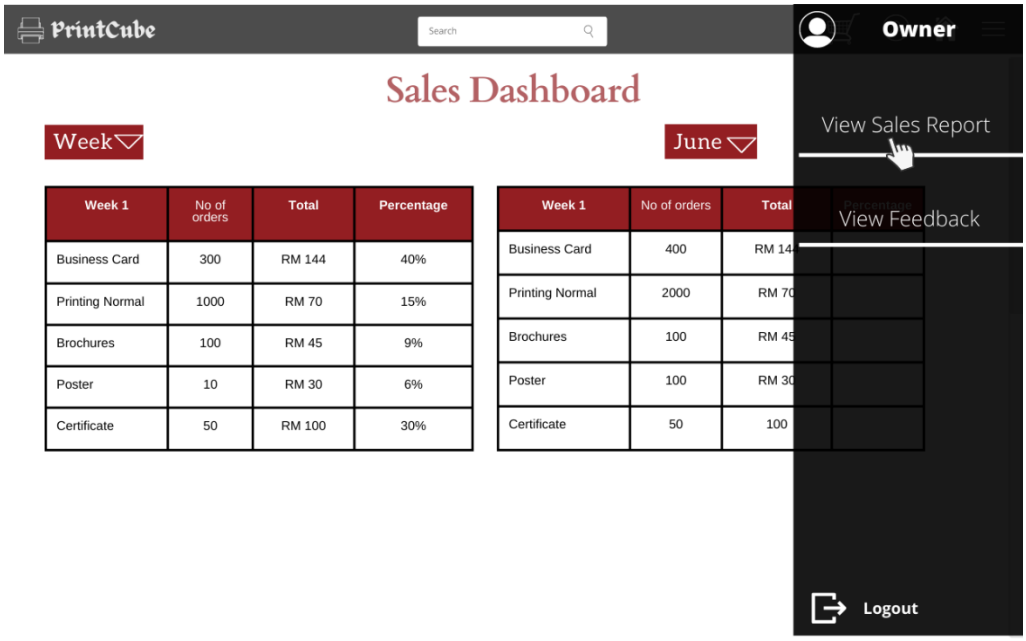

Figure 4.18 Owner interface when view the Dashboard

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

CONCLUSION

5.1 Introduction

This final chapter of the PSM 1 has made a conclusion regarding the system that will be developed, which includes the findings from the literature review, project objectives, and a suggested plan for project implementation that will be used in PSM 2. Based on the outcomes documented in this report, it is easier to determine the suggestions for future improvements to maintain the system's functionalities and achieve project objectives. The proposed web system is a replacement for the Print Cube shop's current system or operation. It will be created to address these issues while also meeting the needs and expectations of the users. Furthermore, a suggestion for future improvement will be presented.

5.2 Achievement of Project Objectives

Based on the problem background studies and the user requirements that were identified, it shows that the online system for Print Cube shop is needed to ease every party involved like customers, staff and owner himself. Thus, the web-based system proposed to this shop to overcome all those problems found and this contributes to meet the user's expectations and requirements.

The first goal of this project has been completed which is to identify the user requirements by interviewing the shop's owner. Moreover, there are some literature reviews on similar existing systems and applications on the market. The identified strengths and weaknesses of the market's similar existing system are used as references and guidance in developing the proposed mobile application and determining system functionalities. Moreover, Chapter 3 focused on the system requirement analysis

including the description of hardware and software requirements for the project development.

Finally, in Chapter 4, the goal was met because some of the requirement analyses were properly explained including the system's flow in this project. The design was correctly created, and understanding the class diagram and system architecture is beneficial. The database design also included displaying all of the data linked within the system. The interface was designed to ensure that the view of the process and the development plan was clear and neat. Making an early design helps the developer avoid losing the idea while developing the system.

5.3 Suggestions for Future Improvement

Although the proposed system can be said to meet the objective outlined, there is still scope for improvement that can be made in order to upgrade the system to a higher level. This is due to the fact that this is the first version of the Print Cube shop proposed system, as the operation was previously done manually. Although the system for this Print Cube store can function as intended, suggestions for improvement are needed to ensure that the system's functionality can be expanded.

Suggestion for the future use of the proposed system is it will be developed for both web-based and mobile applications. Mobile applications enable users to access this system at anytime and anywhere. Furthermore, this system would be attracting more users if it can add new functions such as cashback or collect points to retain their customers. Finally, the system is advised to send notifications to customers via email as well as WhatsApp messages. This is to ensure that notifications are not missed by customers. If this proposal is implemented in the future, it will make the printing process easier and more systematic.

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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?

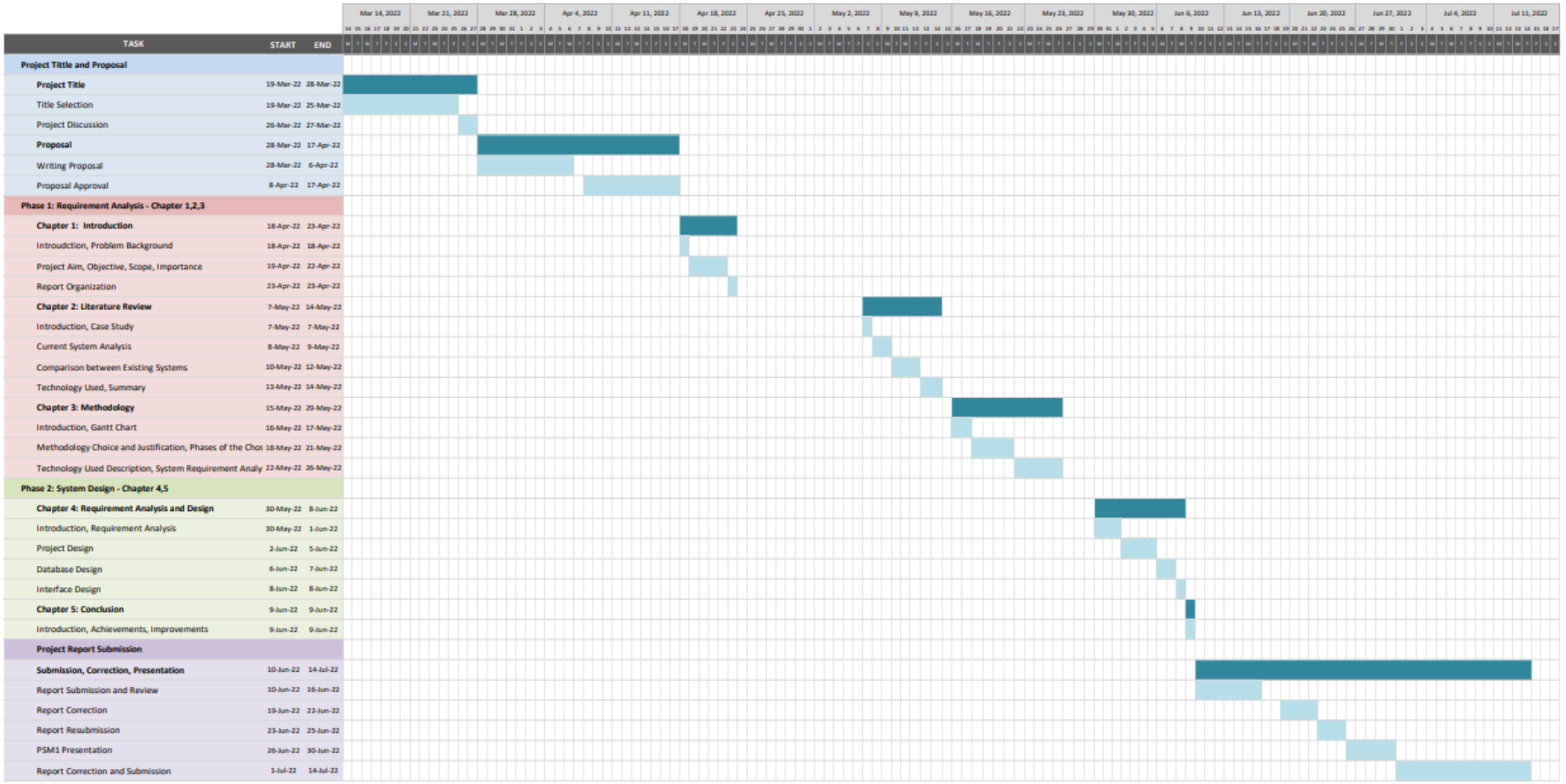
Ans: I believe the major factor that leads to these problems is primarily due to the procedures' slowness. As we can see, the majority of the processes are still performed manually, and we have no choice but to wait.

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



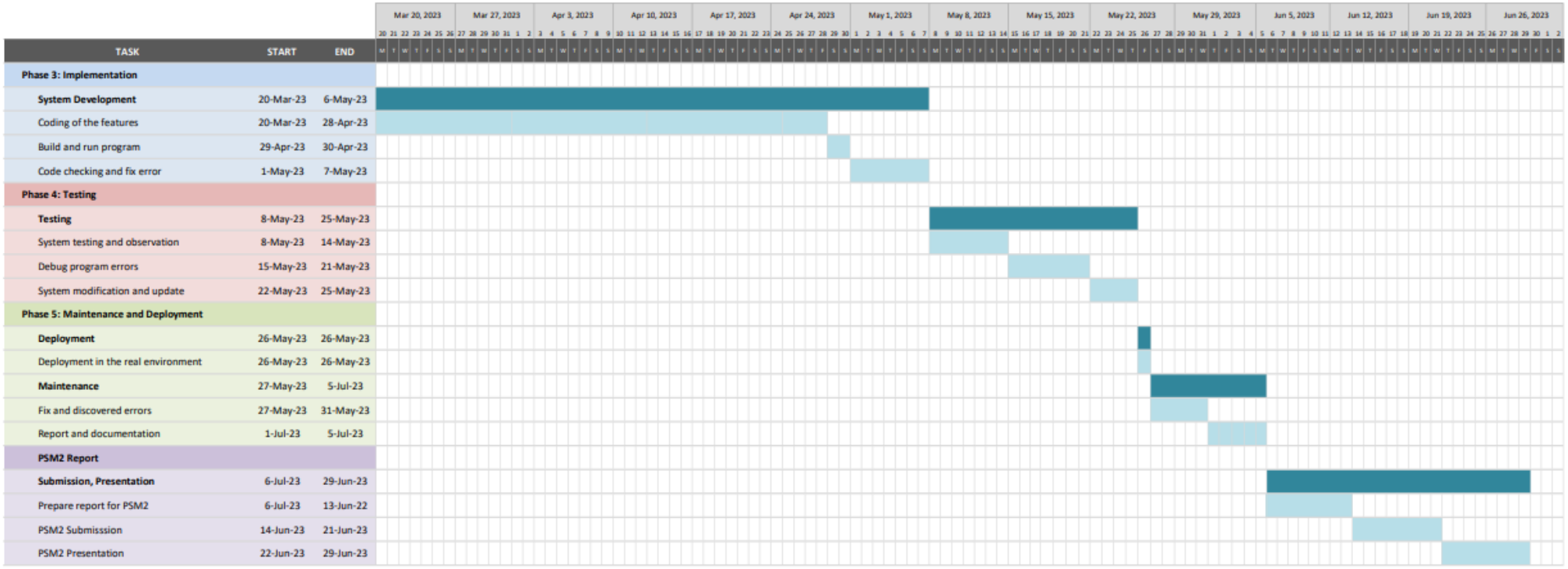
TASK	START	END
Project Tittle and Proposal		
Project Title	19-Mar-22	28-Mar-22
Title Selection	19-Mar-22	25-Mar-22
Project Discussion	26-Mar-22	27-Mar-22
Proposal	28-Mar-22	17-Apr-22
Writing Proposal	28-Mar-22	6-Apr-22
Proposal Approval	8-Apr-22	17-Apr-22
Phase 1: Requirement Analysis - Chapter 1,2,3		
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 Choi	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 Activity Diagram

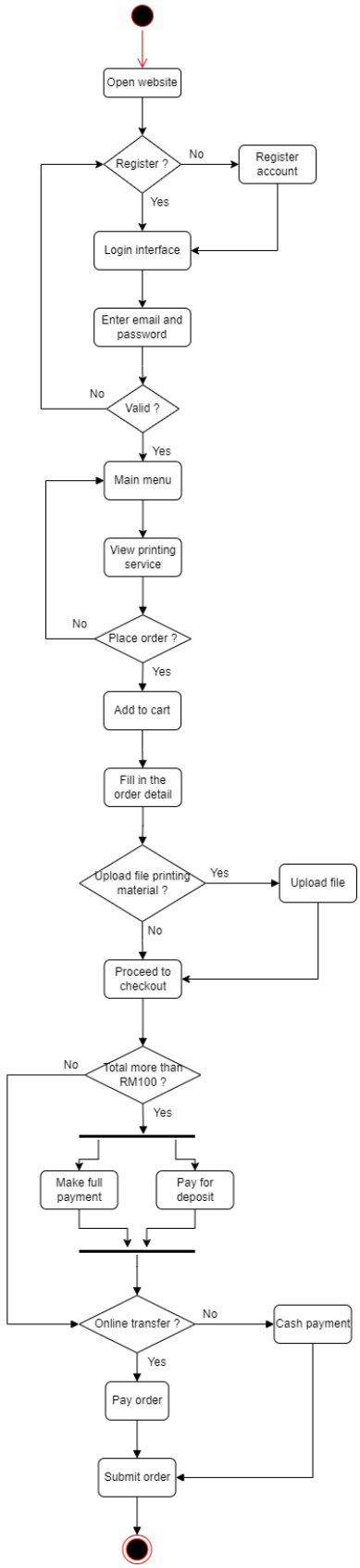


Figure C.1 Activity diagram for customer

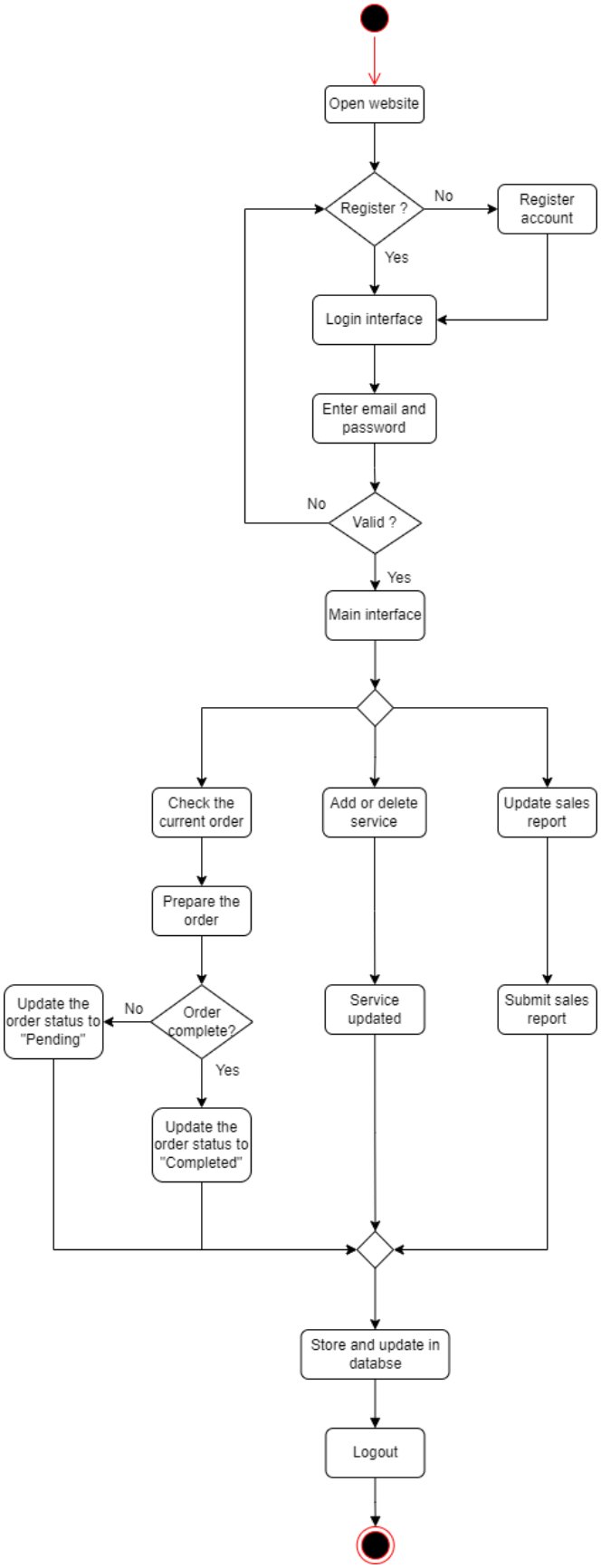


Figure C.2 Activity diagram for staff

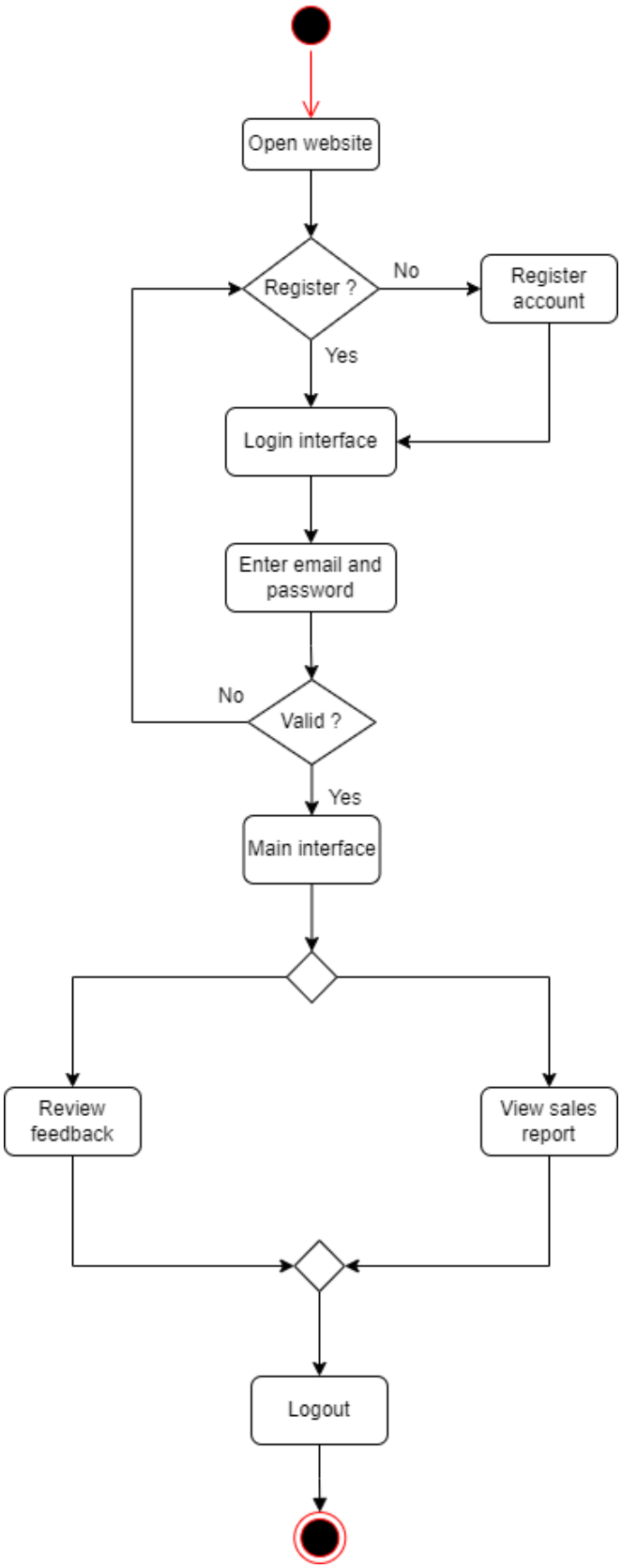


Figure C.3 Activity diagram for owner

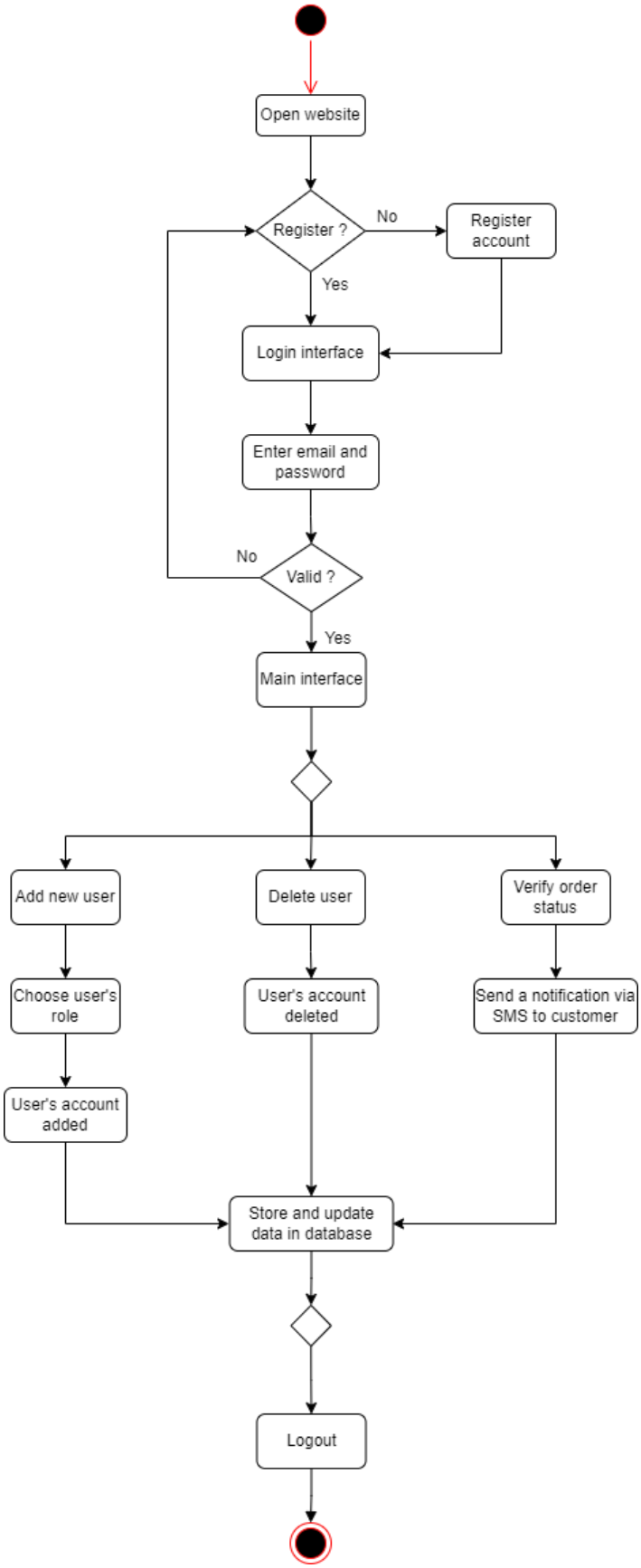


Figure C.4 Activity diagram for admin

Appendix D Entity Relationship Diagram (ERD)

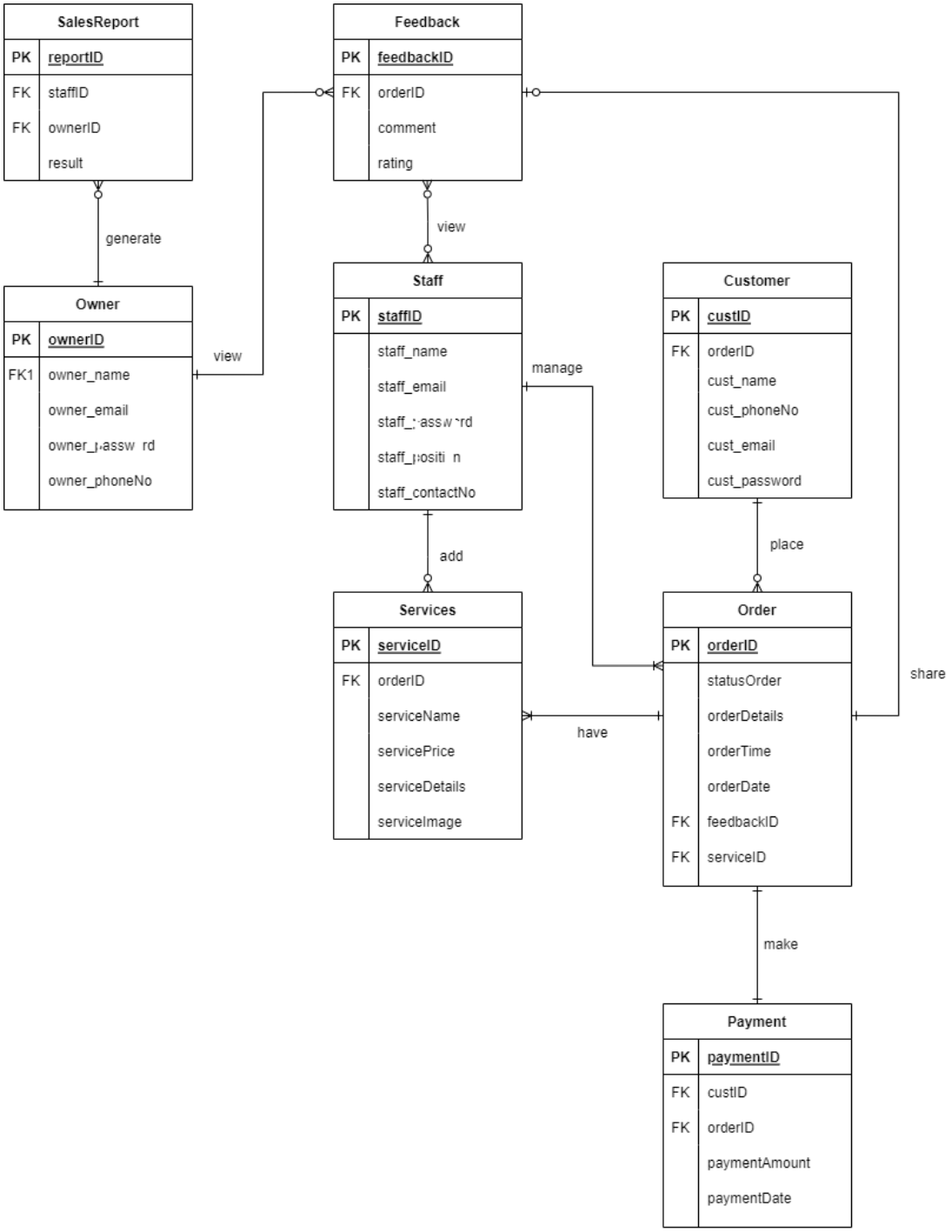


Figure D.1 Entity relationship diagram for overall system