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Customer Billing System for Excavator Workshop

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Abstract

The project developed a web-based customer billing system for Yau Jin Chong (YJC), which specialises in excavator repair. Currently, YJC company uses manual procedures, paperwork, and Excel files to manage customer information and business operations, leading to inefficiencies and error-prone processes. By automating these tasks, the system aims to eliminate the duplication of efforts and minimize the opportunities for human error, thus enhancing the accuracy and reliability of business operations. The project employs the prototyping model, which involves creating several preliminary versions of the system for evaluation and feedback from the customer to ensure the system meets the customer's requirements. The technologies used include web development frameworks and tools. The project's significance is transforming manual processes of data management into efficient and automated systems. By implementing this web-based billing system, YJC company can achieve long-term financial stability, gain customer trust, and maintain a competitive edge in the market.

1. Introduction

Excavator repair is fixing or replacing broken or worn parts on an excavator. The most common repairs performed on excavators are engine, hydraulic system, transmission, and electrical system repairs [1], [2]. In business, it is essential to keep all invoices properly [3], [4]. An invoice is a document that lists the goods or services provided to a customer, as well as the price and terms of payment. Companies should keep and manage their invoices to track sales and expenses and to manage cash flow [5], [6]. They offer a list of all the products and services the business has sold, as well as all the costs raised. Informal judgments about pricing, budgeting, and other business areas can be made using this information [7] - [9]. All invoices must be properly filed for the workshop business to operate efficiently and maintain good customer relations, legal protection, and solid financial management. Workshops can achieve long-term economic sustainability, client trust, and confidence by keeping precise and well-organized invoicing records. A billing system is essential for any business to keep track of customer information and invoices and automate the billing process [10], [11]. It also ensures that bills are accurate and timely. Additionally, the system can help to prevent fraud and errors and provide valuable insights into customer spending habits and trends.

Currently, a company named YJC Company still uses manual procedures, paperwork, and Excel files to keep its business operations data as part of its current customer management process. The owner manages all business-related duties, such as repair, maintenance, inspection, and data record-keeping. The company operates and records all pertinent information or records manually in a notebook and then enters in the Excel file, including customer information, service descriptions, and company invoices. This is a laborious and error- prone process because of the owner's inability to immediately input the data digitally, which results in

duplication of effort and more opportunities for human error. Additionally, it is challenging to efficiently obtain and analyze data without an organized database or software solution.

Data entry and transfer problems currently make manual customer administration and billing operations prone to error. Therefore, a billing system was built into this project to solve this issue where the new system makes billing-related work easier and eliminates the possibility of errors. The system's primary functions include tracking payments, generating invoices, tracking customer accounts, and managing customer data effectively. Three different user types are included in the newly developed system: managers, accountants, and administrators. The new system holds significant importance in managing customer data and billing within the industry. As businesses increasingly rely on streamlined processes and technology-driven solutions, implementing an efficient and comprehensive system becomes imperative for staying competitive.

This document is divided into six sections, each focusing on a significant project component. The project's background is explained in the first part. The relevant works are shown in Section 2. Section 3 describes the project methodology and analysis and design of the system. The system's implementation and testing are explained in Section 4, and the conclusion is provided in Section 5.

2. Related Work

Excavators are heavy construction machines widely used in construction, mining, agriculture, and forestry industries. These vehicles are used mainly for excavation lifting and handling tasks [12]. Due to their heavy workload and frequent use in harsh environments, excavators require regular maintenance and repair to ensure their durability, reliability, and safety [13]. Excavator crews are vital in keeping these essential machines in working order. Excavator repair shops are specialized businesses with the personnel, tools, and equipment needed to diagnose, service, and repair excavators. They carry out a range of tasks, such as upkeep, restoration, overhaul, rebuilding, refurbishing, and reassembly. To prolong the life of the excavator, avoid breakdowns, and identify and fix problems with the engine, hydraulic system, electrical system, and structural components, the primary emphasis is on maintenance and repair.

One such workshop that is the subject of this case study is Yau Jin Chong (YJC), located in Segamat, a Johor-based business specialising in excavator repairs. Inquiries from customers, technical guidance on necessary repairs, excavator diagnostics and inspections, repair and maintenance services, negotiation with suppliers for parts, and record-keeping are all part of YJC's everyday responsibilities. As part of existing customer management methods, the organization still maintains its business operations data using manual processes, paper, and excel files. The owner is solely responsible for managing all business-related tasks, including data record-keeping, inspections, repairs, and maintenance. Customer information, descriptions of services, and business bills are all managed and recorded manually by the company in a notebook before being entered into an Excel file. To enhance the efficiency of its business operations, YJC must change its approach to storing and maintaining data. A new web-based system that allows for real-time data access should be implemented.

Web-based information systems have become crucial for corporations, groups, and people to dramatically improve their business models and change internal structures. As a result, numerous organizations worldwide have made significant financial investments to put up these systems [14]. These systems use the internet's capabilities to store, organize, process, and distribute information effectively and securely. A software program known as a "web-based information system" uses web technologies like browsers and web servers to make it easier to store, retrieve, analyze, and share information over the internet or an intranet.

This project aims to design a customer billing system based on a structured approach and develop a web-based customer billing system. After finishing development, the user should test the usability and functionality and debug the defect by user review of the proposed system. The advantage of the system is users can access information and perform tasks from anywhere with an internet connection and can easily accommodate growing data and user loads. Additionally, the system can allow multiple users to work concurrently and share information seamlessly, restructures processes, reduces paperwork, and minimizes manual data entry.

Table 1 *System Comparison*

System / Features	Zoho	FreshBooks	QuickBooks Online	Customer Billing System
Log in by entering the user ID and password.	√	√	√	√
Customer Relationship Management	√	√	√	√
Invoicing	√	√	√	√
Late Payment Reminder	X	√	X	√
Report	√	√	√	√

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An essential first step in the development process is thoroughly analysing current web billing systems. This will provide valuable information about the market, help identify potential problems and their solutions in advance, make performance benchmarking easier, and help build a solid foundation. Three additional billing systems were considered for comparison. Zoho Invoice (https://www.zoho.com/invoice/), FreshBooks (https://www.freshbooks.com/), and QuickBooks Online (https://quickbooks.intuit.com/) are some of the existing available systems. Thorough observation was carried out on similar systems, and some differences and similarities were identified. **Table 1** compares similar systems and systems that will be developed.

Based on **Table 1**, the existing and proposed systems have login features by entering user ID and password, customer relationship management, invoicing, and reports. Only then does FreshBooks have the late payment reminder feature. Therefore, this functionality might be included in the suggested system to guarantee that clients fully clear their debts. The following section describes the methodology and the findings from the analysis and design.

3. Methodology

The prototyping model is a software development model consisting of several prototypes presented to the customer for evaluation. A prototype is a preliminary version that requires review and assessment by the customer to determine whether the requirements are achieved. Once a prototype fulfils the requirements, it is upgraded with additional features until it reaches its final product form [15]. This model has been chosen for the current project because prototypes are needed to satisfy the customer's needs. Some requirements might not be articulated, making prototyping essential to confirm their expectations. The prototype model is divided into six phases, each with specific tasks and results that must be achieved throughout the project's development. The specifics of each phase and the days allotted for finishing the outputs are shown in **Table 2.**

Table 2 *Software development activities*

Phase	Task	Output
Analysis	Determine the system requirements and modules as the problem solution.	Proposal, Gantt Chart, System requirements, DFD diagrams, ERD Diagram, and Flowchart
Design	Design the user interfaces and implement each function according to the customer's latest requirements.	System architecture, Database schema, and User interface design
Prototyping	Construct prototypes according to the latest quick design of each module and interface.	Prototype I Prototype II
Customer Evaluation	Determine whether the prototype satisfies the requirements or not.	Customer Evaluation
Review and refine	Any modification is needed to add on or remove requirements.	Reviews and modification record.
Implementation	Develop the final system and the modules based on the prototypes.	System program with functions.
Testing	Use case testing and record the use case testing result, analyse the result and finalize the report.	Test case results, final project report.

3.1 System Requirements

The functional requirement defines the system's functionalities, which convert the input obtained into output. Non-functional requirements specify the criteria for evaluating its operational performance rather than the system's specific behaviour or functions. **Tables 3** and **4** show the functional and non-functional requirements for the proposed system.

Table 3 *Functional requirements*

Modules	Function
1.User Registration and Login Module	● The system should allow users to log in using their ID and password. ● The system should direct valid users to the main page. ● The system should show error messages to invalid users. ● The system should allow only administrators to create and register new users. ● The system should allow administrators to approve the usage of new users. ● The system should allow administrators to change the privileges of users.
2.Customer Relationship Management (CRM) Module	● The system should allow users to create and edit customer information like company name, contact number and address. ● The system should allow users to list the customer's sales. ● The system should allow users to list the customer's invoice number. ● The system should allow users to list the customer's statement.
3.Sales and Invoices Module	● The system should allow users to record services for the customer on the dater. ● The system should allow users to record the excavator the customer uses. ● The system should allow users to record the description of the products on the invoice. ● The system should allow users to print or save the invoices as PDF files.
4.Product Management Module	● The system should allow users to manage information about the products provided in this co. ● The system should allow users to change the price of the products provided to the customer.
5.Report and Notification Module	● The system should allow users to generate the report of total invoices monthly. ● The system should allow users to generate yearly reports of total invoices. ● The system should allow users to print or save the invoices as PDF files.

Table 4 *Non-functional requirements*

Requirements	Description
1.Operational	● The system should be user-friendly. ● The system should be easily maintained and updated. ● The system should be able to work on most web browser
2.Performance	● The system should be available 24 hours per day. ● The system should get access to the Internet quickly.
3.Security	● Users can only access their account with a user ID and password

User requirement defines what the users of the system expect from the system. **Table 5** shows the user requirement for the developed system.

Table 5 *User requirements*

No.	User Requirements
1.	The user should be able to input the user's ID and password to log into the system.
2.	The user should be able to create and edit the customer information.
3.	The user should be able to list the customer's sales.
4.	The user should be able to list the customer's invoice number and statement.
5.	The user should be able to create customer invoices.
6.	The user should be able to generate the report of total invoices monthly and yearly.
7.	Users should be able to print or save the invoices as PDF files.
8.	The user should be able to generate the report of the customer's invoice number and payment record.
9.	The user should be able to print or save the statement as a pdf file.
10.	Users should be able to manage information about the services provided in this co.
11.	The administrator should be able to input the admin's ID and password to log into the system.
12.	The administrator should be able to log out of the system.

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3.2 System Analysis

Context diagrams present an overview of the interaction between the system and its user. **Figure 1** shows the external entities of the developed system: Accountants are responsible for creating invoices, managing customer information and services, and producing analytical reports. Administrators oversee user management and system monitoring. Managers monitor the status of invoices and reports. Each entity can develop in its domain, and separating responsibilities guarantees effective system operation. **Figure 2** shows the Level 0 Data Flow Diagram (DFD 0) of the Customer Billing System for the Excavator Workshop.

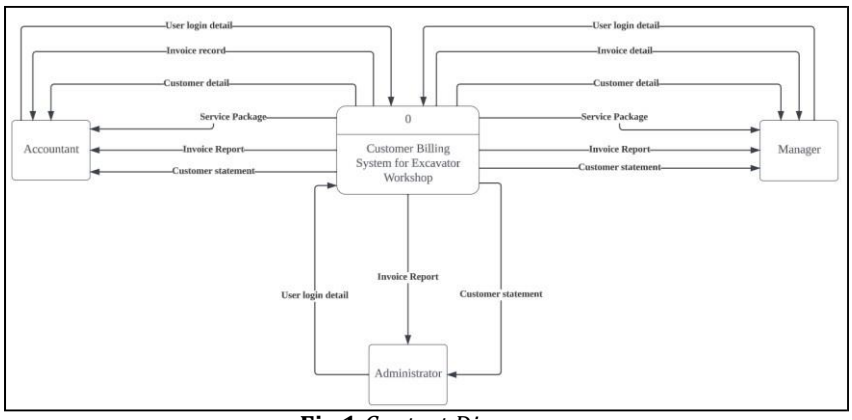

Fig 1 *Context Diagram*

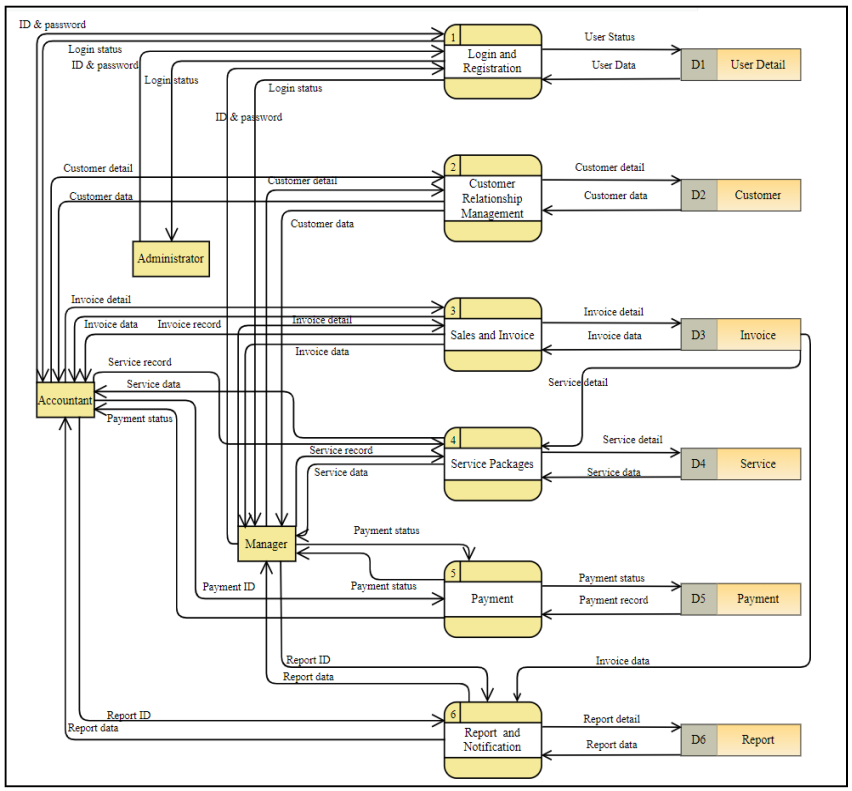

Fig 2 *Data Flow Diagram Level 0*

Figure 3 shows the entity relationship diagram for this system with ten tables: `Customer`, `Excavator`, `Invoice`, `Product`, `Manager`, `Accountant`, `Payment`, `Report` and `Receipt`.

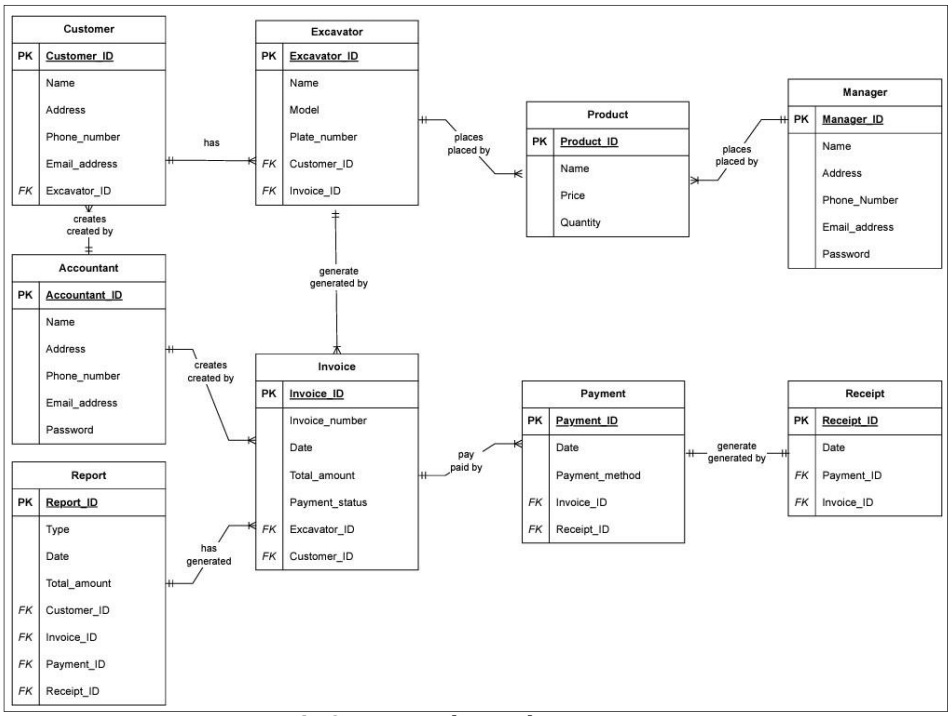

Fig 3 *Entity Relationship Diagram*

Figure 4 outlines the role of users in the system in the flowchart. Administrators handle user management and system oversight, Managers manage invoice/package workflows, and Accountants handle customer finances and data, generating reports and statements.

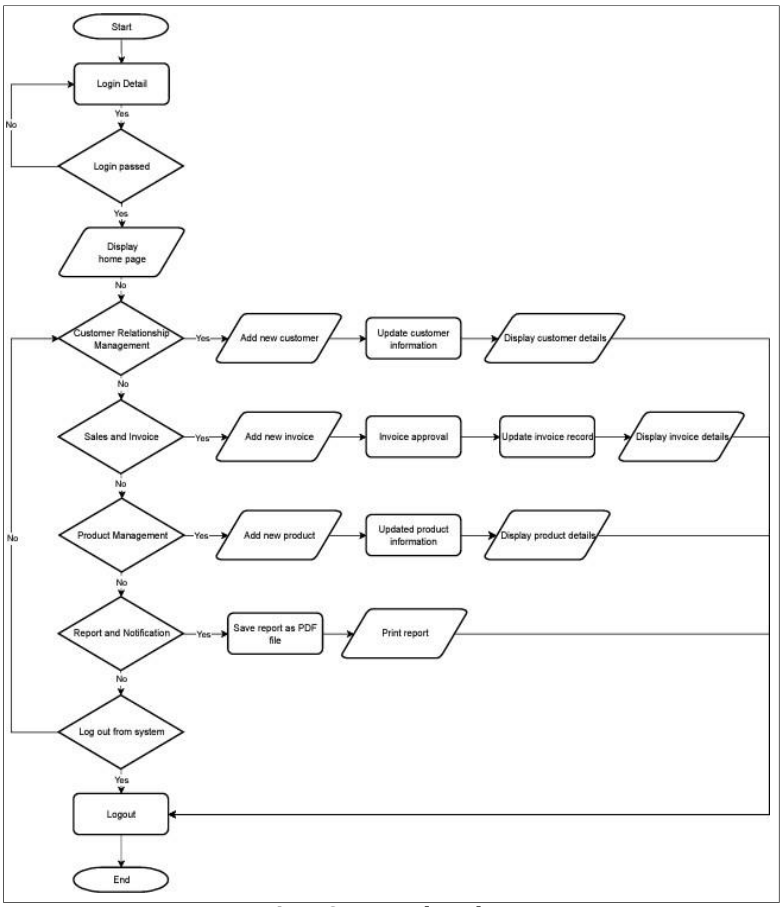

Fig 4 *System Flowchart*

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3.3 System Design

The Excavator Workshop Customer Billing System's architecture is shown in **Figure 5**. The user interface, which may be accessed by any standard web browser, pulls data or information from the Content Billing Unit and other parts of the client billing system with ease. A user-friendly experience is achieved by the simplified architecture, which guarantees efficiency and accuracy when entering invoices and client details.

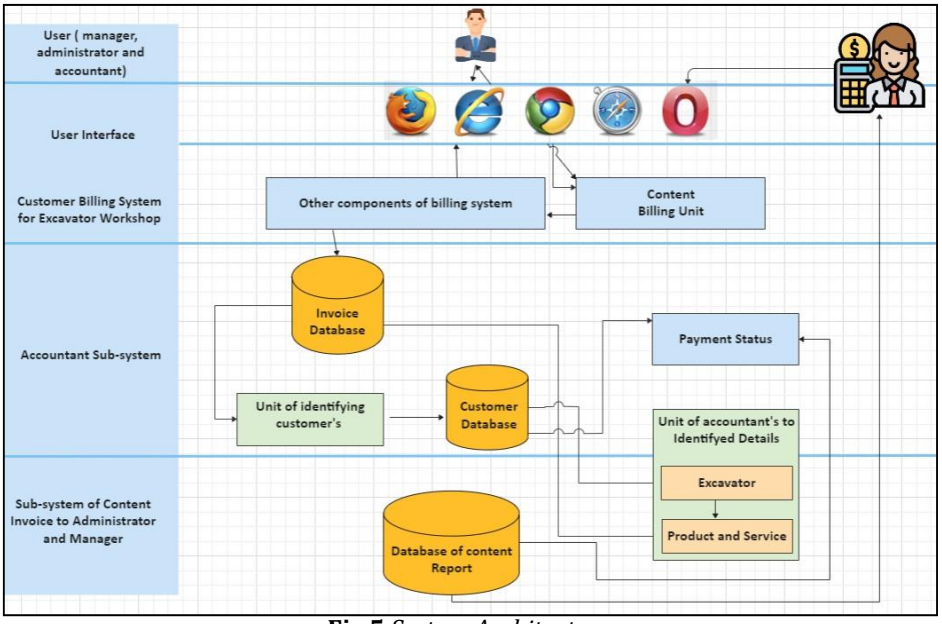

Fig 5 *System Architecture*

The following are the schema tables from the database that have been designed and extracted from the entity relationship diagram.

i. `Customer (customer_ID, name, address, phone_number, email_address, excavator_id)`
ii. `Accountant (accountant_ID, name, address, phone_number, email_address, password)`
iii. `Excavator (excavator_ID, name, model, plate_number, customer_ID)`
iv. `Product (product_ID, name, price, quantity)`
v. `Manager (manager_ID, name, address, phone_number, email_address, password)`
vi. `Invoice (invoice_ID, invoice_number, payment_status, date, total_amount, customer_ID, excavator_ID)`
vii. `Payment (payment_ID, date, payment_method, invoice_ID, receipt_ID)`
viii. `Receipt (receipt_ID, date, payment_ID, invoice_ID)`
ix. `Report (report_ID, type, date, total_amount, customer_ID, invoice_ID, payment_ID, receipt_ID)`

The system user interface has been designed and is shown in **Figures 6 – 11**.

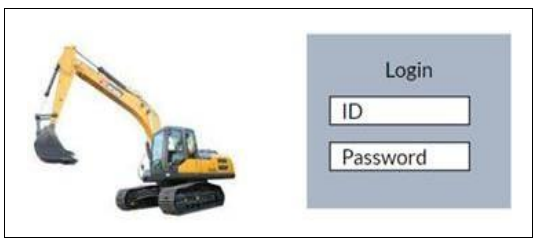

Fig 6 *Login Page Interface*

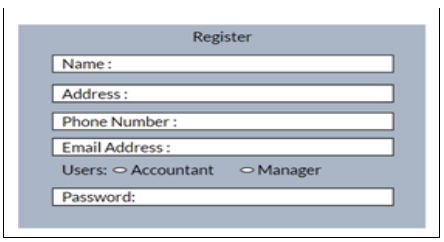

Fig 7 *Registration Page Interface*

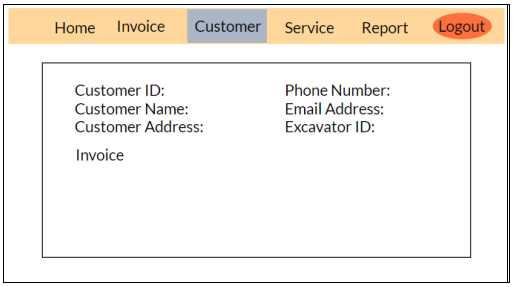

Fig 8 *Customer Page Interface*

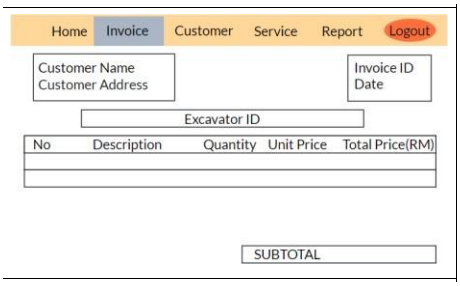

Fig 9 *Invoice Page Interface*

Fig 10 *Product Page Interface*

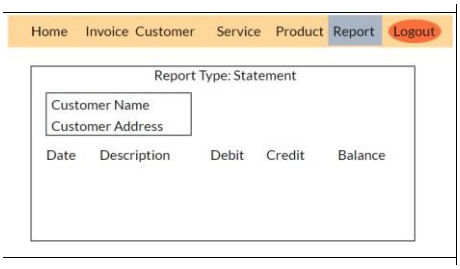

Fig 11 *Report Page Interface*

4. Result and Discussion

Implementation and testing are the final stage in the system development process based on the project methodology. The website component of this project was implemented using HTML, CSS, JavaScript, and PHP programming languages. The program utilized is XAMPP. XAMPP is a distributor of server and database modules. Microsoft Visual Studio is the program code used for the integrated development environment. **Figures 12** through **18** depict the completed system user interface.

Fig 12 *Login Page*

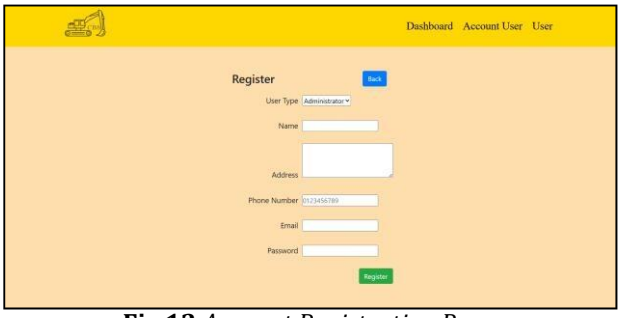

Fig 13 *Account Registration Page*

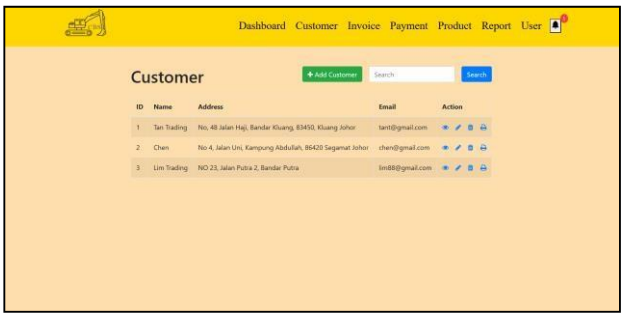

Fig 14 *Customer Page*

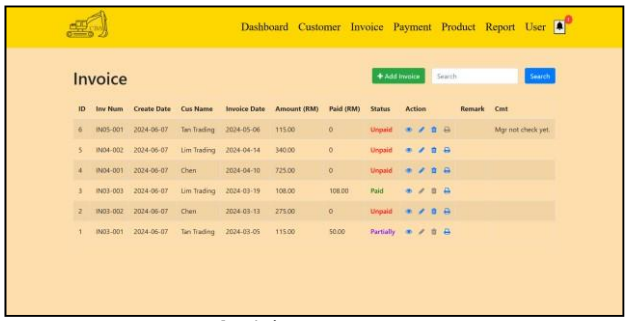

Fig 15 *Invoice Page*

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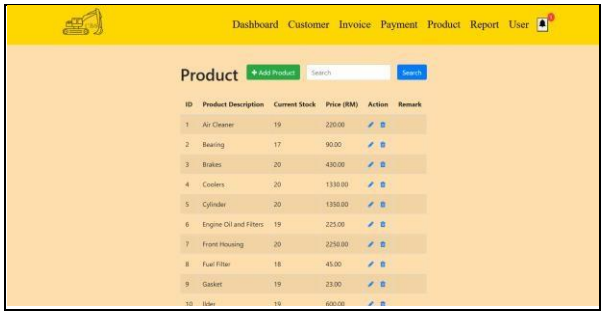

Fig 16 *Product Page*

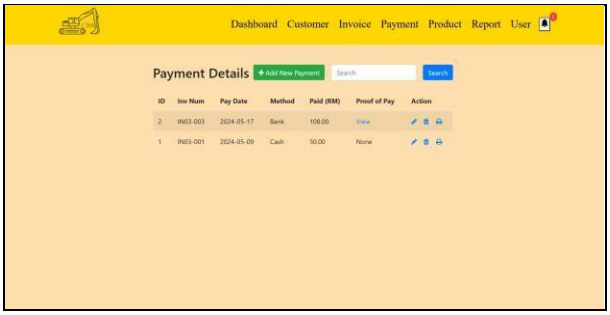

Fig 17 *Payment Page*

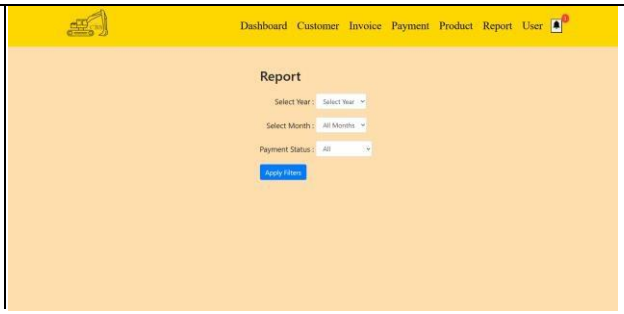

Fig 18 *Report Page*

Figure 12 represents the Login Page to handle the login functionality which includes user authentication by entering their username and password, user type validation to check whether the user is an administrator, manager, or accountant then redirecting the user to their respective home page based on their user type. Figure **13** represents the Account Registration Page to handle the registered user including user type, name, address, phone number, email, and password. Next, **Figures 14** to **17** represent the modules which are Customer Relationship Management, Sales and Invoice, Product Management, and Payment Page which include CRUD, create, read, edit, and delete functions for these three modules. Additionally, it also includes search and print functions. Last, **Figure 18** represents the Report Page to filter year, month, and payment status for invoices within the system.

Results from the user acceptance test will be reported in this section. **Table 6** to **Table 10** shows a User Acceptance Test (UAT) method is utilized to perform testing for all modules.

Table 6 *Test Case for Login and Registration Module*

Test Case ID	Description	Expected Result	Actual	Result
M1-1	To check whether administrator can register for an account	The user should be able to create for an account	The user has successfully created for an account	Pass
M1-2	To check whether a administrator can login into the system	The user should be able to login into the system	The user has successfully logged into the system	Pass
M1-3	To check whether the system will restrict login whenever a wrong credential is entered	The system should restrict login when an incorrect credentials has been entered	The system restricted the login when an incorrect or no credentials has been entered	Pass

Table 7 *Test Case for Customer Relationship Management Module*

Test Case ID	Description	Expected Result	Actual	Result
M2-1	To check whether an accountant can create new a customer	The user should be able to create for a customer	The user has successfully created for a customer	Pass
M2-2	To check whether an accountant can view a customer	The user should be able to view a customer	The user has successfully viewed a customer	Pass
M2-3	To check whether an accountant can edit a	The user should be able to edit for a customer	The user has successfully edited a customer	Pass

	customer			
M2-4	To check whether an accountant can delete a customer who doesn't have invoices	The user should be able to delete for a customer	The user has successfully deleted a customer	Pass

Table 8 *Test Case for Sales and Invoice Module*

Test Case ID	Description	Expected Result	Actual	Result
M3-1	To check whether an accountant can create new an invoice	The user should be able to create for an invoice	The user has successfully created for an invoice	Pass
M3-2	To check whether an accountant can view an invoice	The user should be able to view a customer	The user has successfully viewed an invoice	Pass
M3-3	To check whether an accountant can edit an invoice	The user should be able to edit for a customer	The user has successfully edited an invoice	Pass
M3-4	To check whether an accountant can delete an invoice	The user should be able to delete for an invoice	The user has successfully deleted an invoice	Pass

Table 9 *Test Case for Product Management Module*

Test Case ID	Description	Expected Result	Actual	Result
M4-1	To check whether an accountant can create new a product	The user should be able to create for a product	The user has successfully created for a product	Pass
M4-2	To check whether an accountant can view a product	The user should be able to view a product	The user has successfully viewed a product	Pass
M4-3	To check whether an accountant can edit a product	The user should be able to edit for a product	The user has successfully edited a product	Pass
M4-4	To check whether an accountant can delete a product	The user should be able to delete for a product	The user has successfully deleted a product	Pass

Table 10 *Test Case for Report Module*

Test Case ID	Description	Expected Result	Actual	Result
M5-1	To check whether an accountant allow to generate a report	The user should be able to generate for a report	The user has successfully created for a report	Pass

In summary, the Login and Registration module tested three cases for successful registration, login, and handling of incorrect credentials. The Customer Relationship Management, Sales and Invoice, and Product Management module tested four cases which are create, read, edit, and delete. Last, the Report module tested 1 case to successfully generate the report.

5. Conclusion

In conclusion, a web-based customer billing system for YJY company was developed to provide more efficient services for invoice preparation and billing document management in the system. As stated, the proposed system is for accountants to create, delete, and update their client invoices and track client payment status. For suggestions for future research, this project can gather user feedback to continuously improve the system.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

This journal requires that all authors take public responsibility for the content of the work submitted for review. The contributions of all authors must be described in the following manner:

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Yau Jia Yin, Nureize Arbaiy;* ***data collection:*** *Yau Jia Yin, Nureize Arbaiy;* ***analysis and interpretation of results:*** *Yau Jia Yin, Nureize Arbaiy;* ***draft manuscript preparation*** *Yau Jia Yin, Nureize Arbaiy. All authors reviewed the results and approved the final version of the manuscript.*

An author name can appear multiple times, and each author name must appear at least once. For single authors, use the following wording:

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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