



**An Independent Project Report
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of the regulations governing
the award of the
B.Sc. (Hons) in Computing, Year 3**

**Development of a Web-Based Smart Store Management
System for Retail Store**

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Authorship Declaration

Except where reference is made in the references, this report contains no material published elsewhere or extracted in whole or in part from a dissertation or report presented by me for another degree or diploma.

No other person's work has been used without due acknowledgement in the content of the report.

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ABSTRACT

This project aims to design and develop a web-based smart store management system application. With the help of this application, it helps retail store managers to improve management efficiency and performance.

The research methodology of the project was conducted by using Literature Review, which summarizes several published journal papers and gives an opinion on the problems that exist in the current system. A random questionnaire survey method was also conducted, which included a sample of retail store managers or store owners and store customers in various regions of Kuala Lumpur to determine the current status of the application or system to be developed. This project adopts the SDLC model as the software development method. The SDLC defines and outlines a detailed plan that includes stages, each stage contains its own process and deliverables. It mainly consists of six main stages, namely Requirements Analysis, System Design, Implementation, Testing, Deployment, Maintenance. This approach helps us to produce the highest quality product at the lowest cost when we are pressed for time.

In addition, the main feature of this Web-based store management system is that it solves the operational management problems of traditional retail stores and develops a combined online and offline store management system, which makes the store operations more efficient and accomplishes the most streamlined and effective store management, thus helping traditional retail stores to increase profits and reduce retail operation costs.

In addition, the system develops store delivery, express delivery and other functions, so that consumers can shop through the website at any time, any place, in any way. After the development of the System web application project is completed, the system will be tested to avoid any errors in the application and to ensure that the goals of the project match the needs of the system. Once the testing is complete, the product will be deployed in a customer environment or launched into the marketplace and feedback will be obtained from customers on their experience with the application. The results of the user experience will then be summarized and suggestions will be gathered on how to better enhance this smart store management system as part of a future system improvement program.

Keywords: Store Management, SDLC Model, New Retail

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1.0 Project Title

Development of a Web-Based Smart Store Management System for Retail Store

2.0 Introduction

Today, our lives are more and more inseparable from the store, and the store has become a part of our life. Stores are now all over everyone's surroundings. It is a traditional retail business organization that is open 24 hours a day. It not only has the convenience of supply in alleys and small retail stores on the street, but also has the open-shelf sales method and chain management. It has developed very rapidly in the world, especially after using the chain operation method, it has become one of the most organized major formats in the retail industry. Some large chain retail store brands are of considerable magnitude and are well received by consumers like. Among them, there are many retails commercial enterprises operating convenience stores with huge market space and strong market competitiveness, such as 7-Eleven convenience store, Family Mart convenience store, etc. [1].

New retail can maximize the efficiency of the retail industry in the context of the whole society. It is a business model derived from the new era, based on the core of consumers and the form of retailing using data and information technology. In practice, new retail combines the OMO business model (Online-Merge-Offline), integrating offline E-Commerce, Shared E-commerce, and Mobile E-commerce into one, meeting the needs of business survival and development and consumer consumption in the context of the new era [2]. The physical access channel is thus optimized, and consumers can enjoy the consumption experience of online, mobile and offline channels, promoting communication between enterprises and users. When enterprises build this complete business platform, they can allocate their resources according to their own product and service characteristics, and develop marketing strategies that can maximize their effects, thus achieving the enhancement of corporate brand image and the expansion of product sales [3].

In this article, I will develop an intelligent store management system, which is based on the OMO business model and provides solutions for the management of retail enterprises, so that retail enterprises can effectively improve their ability to adapt to the online and offline retail business environment, and help retail Enterprises realize the integration of

online and offline business of store and online store, including online store inventory management and online Web application mall, etc., connecting people, goods, and fields, and building a new retail closed loop for chain enterprises. These will be the main points of this article. Questions for research and exploration [2].

3.0 Background

3.1 Revolution in Retail

The retail industry has a long history of development. Products produced by any industry need to be delivered to consumers through retailing, such as agriculture, industry, etc. At this stage, the definition of retailing is not clearly defined. There are two mainstream definitions of retail industry, one is from the perspective of marketing, and the other where the U.S. Department of Commerce has given its own interpretation of the retail industry. They consider the industry in which businesses and individuals sell products they buy from distributors to consumers by means of marketing activities. This definition is often seen in the marketing literature, and the definition given by the U.S. Department of Commerce is that any entity responsible for selling only a small number of goods to the masses is retail trade. They only sell but do not produce, and even the services they provide take place in the process of selling goods. The retail trade industry exists in both brick-and-mortar and virtual store models. The retail trade industry is characterized by its direct communication transactions with consumers and the delivery of products and services to them compared to other industries. The number of sales in the retail industry is sporadic and frequent, and the average sales are low. To increase profit margins, the retail industry must control costs and can increase profitability by increasing the variety of products and improving the speed of product turnover. The retail industry faces customers with temporary purchase characteristics, which requires retailers to combine many factors to maximize the attraction of consumers, such as product display, store location, advertising, etc [3].

By studying the evolution process of the global retail industry, it can be found that: the goal of retail enterprises is to obtain more customer traffic, higher purchase rate and higher customer loyalty at lower cost, and loyalty can lead to higher customer unit price and repeat purchases Rate. People enter the Internet from brick-and-mortar stores, and from the

Internet to the mobile Internet [4]. Only with corresponding changes can the business format obtain the most efficient customer traffic.

When the market is in a period when the supply is less than the demand and the communication and logistics infrastructure is not well developed, the retail industry aims to acquire customer traffic at low cost. At the end of the 19th century, productivity was not yet developed, and the retail consumption field pursued a production-driven demand model, because consumer demand grew faster than supply growth, consumers were the receivers of prices, and there were not many choices of goods, and manufacturers did not need to pay attention to consumers, to do too much research. The retail channel is in its infancy, and good retailers have a core principle—find a place where people gather to sell their products [5].

At the beginning of the 20th century, department stores gathered more people at a lower cost. In the process of urbanization, department stores became the places where the growing urban population gathered. Compared with mail order catalogs, the cost and time to obtain customer traffic were shorter, and the efficiency was greatly improved. Gradually replaced mail order catalogs [6]. The way to obtain consumers by mail-order catalogs is to send mail-order catalogs to consumers' homes by horses. After consumers select them, they will bring back the consumer demand information. The turnaround time is longer and the transportation cost is also higher. Department stores, on the other hand, can gather a large number of people and obtain more timely information on consumer demand. The increase in demand for information on mail-order catalogs comes at the expense of increased horses, while the increase in foot traffic in a department store is within a range of almost zero marginal cost [7].

With the rapid development of network information technology, the emerging form of online retailing has appeared in people's lives, which not only brings convenience to people's lives, but also has a direct impact on the business activities of physical retailing. For example, in China in 2015, the total amount of e-commerce transactions reached 18.3 trillion yuan, a year-on-year increase of 36.5%, an increase of 5.1 percentage points, of which the online retail market transaction scale reached 3.8 trillion yuan, a year-on-year increase of 35.7%, accounting for the total retail sales of consumer goods. 12.7%, an

increase of 2.1% over 2014. In the face of the impact of the online retail industry, the brick-and-mortar retail industry has entered a bottleneck period of development from the golden age of extensive growth. Its traditional single store operation and large-scale grid layout operation model urgently needs to be transformed. In 1999, due to the establishment of China's Alibaba, the online retail model continued to influence and change the shopping behavior of consumers, and won the favor of consumers. The company has established an online retail platform, settled in an e-commerce platform and other methods, and tried to conduct an online and offline business model of physical retail and online retail synergy [8].

Through the application of the Internet platform, it will promote the integration of online and offline, realize the innovative development of "Internet + circulation", optimize the allocation of resources, develop a new model of sharing, collaboration and experience economy, and stimulate the vitality of the physical retail industry. The physical retail industry has been developed to realize the combination of online and offline mode, which can integrate and utilize enterprise resources, improve the efficiency of the industrial chain structure, enhance the competitive advantage of enterprises, and meet the development and survival needs of enterprises in today's context. Due to the lack of relevant experience, the physical retail industry still has many problems in the development process, such as unreasonable allocation of resources and high costs [9]. Therefore, retail enterprises should have a full understanding of the online and offline retail environment and develop a reasonable marketing model on this basis, which is the main problem faced by the development of retail enterprises at present.

3.2 Observation on existing System

3.2.1 iQmetrix

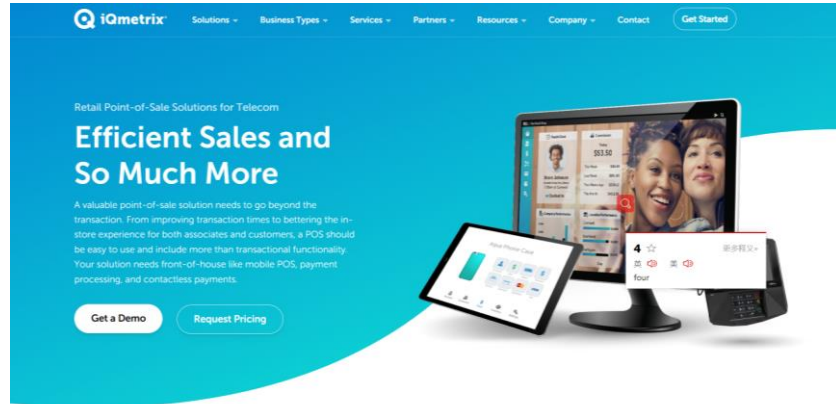


Figure 1 - iQmetrix's Official Website Home Page

iQmetrix's main business lies in providing IT and services for retail solutions for other enterprises. iQmetrix provides solutions for multi-location retailers with a cloud-based point-of-sale and sales management core. Functions include mobile POS, maintenance and in-depth reporting and analytics, CRM, marketing and loyalty, advanced inventory management, and more. In addition, RQ involves front-end and back-end succession, including biometric security, marketing automation, payment processing, vendor managed inventory, etc. Retailers can meet users' multi-channel consumption needs with the channel direct marketing and e-commerce integration capabilities it offers, and get the consumption experience in multiple channels. Centralized internal communication using Intranet enables information sharing and communication among employees within the enterprise. Employees can learn the latest product information, corporate business planning, and promotional activities through the Intranet. In the marketing process, e-mail and telephone can be used as promotional channels to meet the promotion needs of many marketing activities. Combined with the characteristics of the campaign to contact the corresponding customers, to achieve precision marketing. iQmetrix can meet the service needs of more than 2,000 retail points, retailers can get the same service in all channels and contact points [10].



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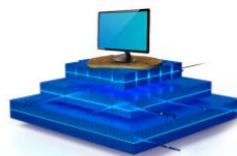
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Figure 2- Solutions provided by IQmetrix

iQmetrix is a suite of interactive retail and remarketing management solutions presented in the medium of a centralized commerce platform. Based on this concept, iQmetrix is integrated with third-party API to provide a communication platform for customers to develop partners. When the metrics library covers all of these, retailers can use it as a driving force for their own development, improving business efficiency and profitability, and no longer perceiving and understanding customers based on a single point of view. iQmetrix solutions can circumvent the gap between physical and virtual retailing, and thus better integrate the two to meet the development needs of the retail industry and provide consumers with an omnichannel consumer experience [10].

3.2.2 Retail Pro

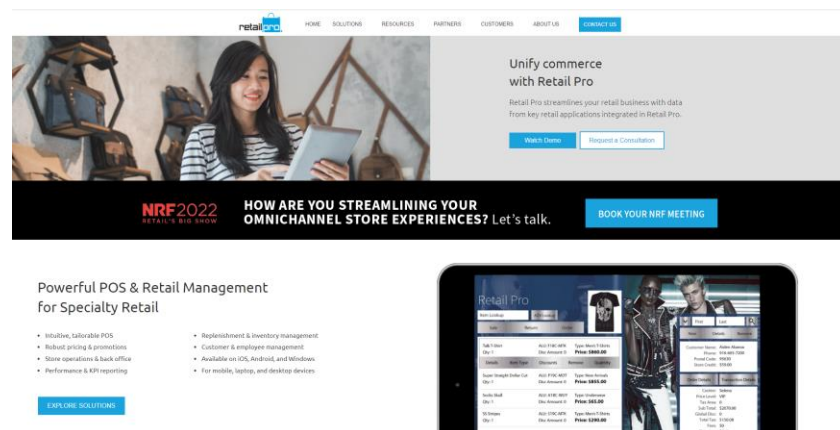


Figure 3 - Retail Pro's Official Website Home Page

Retail Pro is a retail management software platform that provides many retail management functions, such as KPI reporting, inventory management, customer management, back office, and performance statistics. Retailers can use the platform to collect retail data, arrange specific workflows with data analysis, and develop business development plans that fit with the advantages Retail Pro offers. Retailers can extend the functionality of the platform by introducing third-party solutions such as marketing, ERP, loyalty, and HR systems through the APIs provided by the platform, and Retail Pro has an adaptive user interface that allows retailers to tailor their business activities, develop workflows that are tailored to their business characteristics, and deliver brands to customers with precision. The solution leverages over 150 pre-built functional reporting templates to provide ad-hoc reporting. Functions such as gift cards, store credit, and gift certificates are issued throughout the chain as an effective means to expand product sales and increase user loyalty. Also, specific products and franchised items can enjoy discounts for reaching a certain purchase size at the time of purchase. Automatic purchase orders can meet the needs of stores and warehouses for minimum inventory products and achieve effective control of product quantities. Accounting, marketing, and e-commerce applications are referenced to meet users' needs for managing their own information. Companies can design and decorate their online stores with built-in E-Commerce functions to display and promote their

products online, while providing online payment capabilities, user loyalty rewards and product information tracking. This solution meets the needs of many retailers, such as multi-subsidary retailers, franchises, outlets, etc [11].

3.2.3 ChainDrive

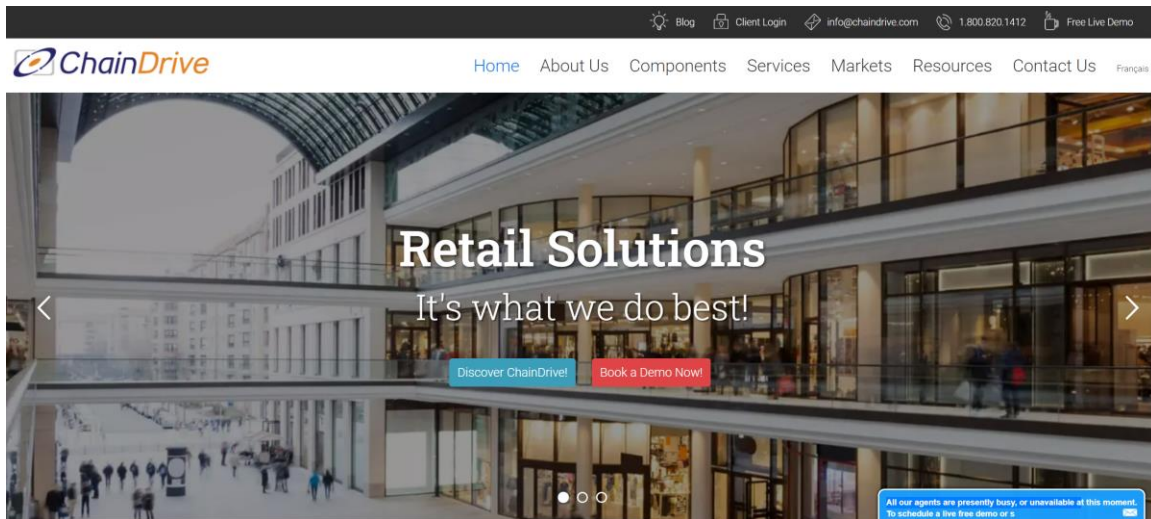


Figure 4 - ChainDrive's Official Website Home Page

ChainDrive's omnichannel retail management solution serves retailers, wholesalers and e-tailers. Specific industry sectors include department stores, apparel, specialty retailers, footwear, home furnishings, and more. ChainDrive enables retailers to capture customer data, manage customer relationships, develop effective offers based on customer characteristics, and improve customer retention. Analysis and reporting functions can meet users' promotion options for products.

ChainDrive's store budgeting capabilities meet the needs of retailers for performance monitoring, store ranking, evaluating store performance levels, and charting data. ChainDrive integrates operations in both physical and digital sales environments to achieve integrated operations and form a complete and unified system. ChainDrive provides services in point-of-sale, merchandising, and financial management, and performs statistical operations under the whole system, which makes the solution suitable for the current retail environment and provides many functions to facilitate retailers' business development. ChainDrive also provides email and online forms services for users [12].

3.2.4 Springboard

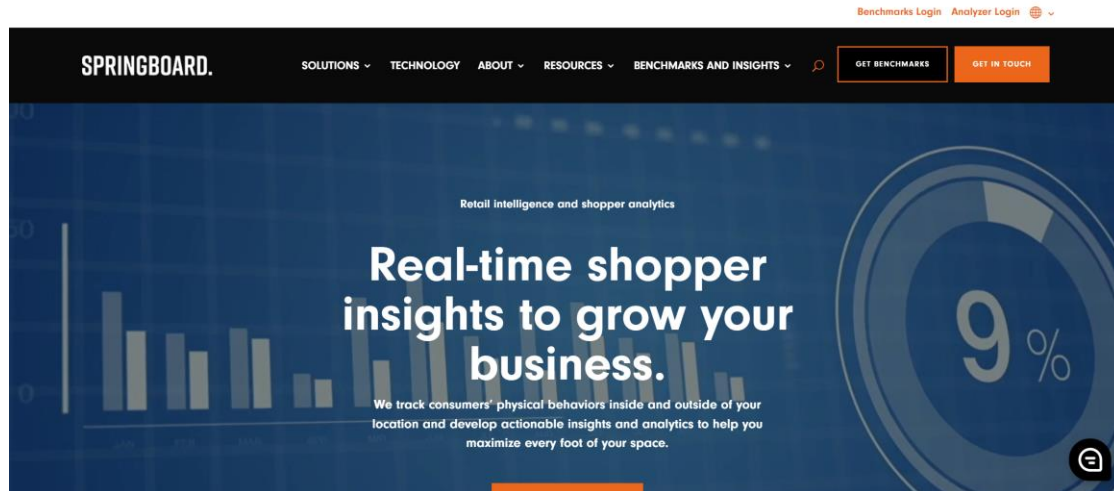


Figure 5 - Springboard's Official Website Home Page

The Springboard Retail platform is all about retail management and cloud-hosted point of sale. The software provides the business and tools that retailers need in a variety of areas and was designed by retailers based on their own development experience and brand development needs. ChainDrive's mobile POS and retail management system was developed with retailers in mind, thus helping them to maximize their resources and efficiency. Springboard Retail's intuitive mobile POS provides retailers with more functionality for their sales because of its connection to the Internet. The cloud-based software provides real-time visibility into customer location and shopping behavior, and retailers can collect and analyze this data to develop appropriate sales campaigns to maximize sales. Springboard Retail also offers comprehensive inventory management capabilities that allow retailers to monitor and understand inventory across all sales channels. The software runs on the cloud, so users can achieve the requirement of monitoring inventory through the club basket network. Retailers can also gain insight into sales performance, while extracting the details they need to know to form extensive reports [11]. All of these features help retailers with sales, enabling rapid collection and analysis of information to make scientific and rational decisions.

3.3 Comparison on existing System

The table below compares the existing systems mentioned above:

Table 1 - Comparison Table of existing Systems

No	System Title	Advantage Features	Bottom Line	User Evaluation (out of 10 points)
1	IQmetrix	<p>1. Scalable The inventory management, CRM, reporting and analytics provided by iQmetrix are all designed to better serve retailers, meet retail management needs, and help retailers achieve online and offline integration to serve consumers' needs in multiple channels [10].</p> <p>2. Easy to use It enables specialty retail teams to serve customers faster, more efficiently, and with more confidence than ever before, creating a superior experience for customers.</p> <p>3. Advanced Security An advanced combination of encryption, tokenization, PCI compliance and EMV protection.</p>	<p>iQmetrix provides integrated POS, retail management and software solutions that help wireless, repair and specialty retailers create an outstanding customer experience [10].</p>	6.4 points

		<p>4. API</p> <p>No more outdated systems or technologies that don't communicate with each other [10].</p>		
2	Springboard	<p>1. Data driven</p> <p>Improve refinement, delve into the data and use it to make the right decisions</p> <p>2. Built-in flexibility</p> <p>Seamlessly scale up or down, it also ensures that your software version is always in sync with the latest version</p> <p>3. Export</p> <p>Easily export to CSV, PDF or shared URL</p>	<p>Springboard</p> <p>Retail's point-of-sale and retail management software is integrated with the needs of retailers, providing them with data to support a more rational sales strategy and improve profitability [11].</p>	9.0 points
3	Retail Pro	<p>1. Internationalization</p> <p>The system supports up to 18 different languages and multi-currency interface</p> <p>2. Mining complex data</p> <p>Slicing, dicing and sorting of data independent of the original data layout-</p> <p>3. Inventory management</p> <p>The inventory management system automatically updates inventory data when purchases</p>	<p>Retail Pro is the global leader in retail management software and is known worldwide for its rich functionality, multinational capabilities and unmatched flexibility [12].</p>	7.2 points

		or returns are made, allowing for easy monitoring of inventory status [12].		
4	ChainDrive	<p>1. Mobile Friendly: Interact and communicate with employees anywhere across the enterprise.</p> <p>2. Loss Prevention: Take action on any discrepancies or policy violations.</p> <p>3. Employee Productivity: Understand the data and metrics related to employee productivity, detect, track and maintain.</p> <p>4. Store Performance: Data involved in tracking and monitoring store status, sales history and management.</p> <p>5. System is capable of querying, linking, listing, pivoting, drilling down and charting data using sophisticated data mining techniques [11].</p>	ChainDrive is composed entirely of retail process components and is a single-source omnichannel software on which users can base their management activities and implement many operations [11].	6.4 points

3.4 Related work

G Divya Jyothi, K Navya from Department of Computer Science and Engineering, MLR Institute of Technology, Hyderabad, Telangana. The system proposed by the author is a Store Management System Web Application developed based on a web server. In order to overcome the problem of out-of-stock in stores, the author proposes Store management

framework. The store management framework is very beneficial to both the customer's shopping background and the knowledge provided by the retailer. Store management framework means that inventory can be authorized and replenished by store administrators in case of stock shortage [13].

Fan Wei and Qian Zhang of Xi'an Shiyou University, China, designed the system for the online store. The system is developed on the Web side, using JSP language, Spring framework, and B/S Model to integrate the system to complete the control layer management, including processing data access, etc. The author describes in detail how the system will implement these functions, how to design the relationship between various entities, the attributes of each table and the relationship between them. And a detailed database design is carried out. The visual modeling tool of the system is composed of use case diagram diagrams, which are created using the Unified Modeling Language [14].

Md. Abdur Rahim and Rafat Ara from Department of Computer Science & Engineering, German University Bangladesh, Bangladesh. They propose implementing point-of-sale software, which is widely used in retail operations. The app generates all necessary reports for buying and selling, reducing human errors and paperwork. The software is designed using an incremental model, developed using technologies such as HTML, CSS, JavaScript, Ajax and PHP, and MySQL server is used as the database to store data. Authorized users can use the app anywhere in the world, and business owners can also monitor their business from home. The system was trialled at Farhan Traders (Bangladesh mobile showroom) and researchers provided positive feedback on the software. In the research, the author uses Unified Modeling Language to construct the visual modeling of the system, and uses the activity diagram to construct the basic architecture of the system [15].

4.0 Problem Statement

4.1 High operation and management costs of traditional retail stores

In the rapid growth of the Internet retail channel today, the speed of the update of goods, and in traditional retail stores, the shelves and shelves of goods, as well as various data reports of the record query through manual statistics are very time-consuming, which makes the store's operation and management costs are high. In addition, the store itself has high comprehensive operating costs, such as employment, management, resources and other issues, and can only carry out high-cost investment and compressed earnings [5]. Therefore, the solution I provide is to make the store operation more efficient by developing a combined online and offline store management system to accomplish the simplest and most effective store management, thus helping traditional retail stores to increase profits and reduce retail operation costs.

4.2 The limited amount of customers that can be reached in traditional offline retail stores

Nowadays, due to the development of the new coronavirus epidemic, more and more people have changed their shopping habits. Changing the original offline activity shopping to online shopping. In traditional retail stores, consumers can only buy the goods that exist in the store at a defined time and place. This leaves traditional offline retail stores with a limited amount of customers to reach [16]. Therefore, the solution I provide is to develop store delivery, express delivery and other functions through the system, so that stores allow consumers to shop at any time, any place, in any way, which is more convenient than traditional retail stores, which not only gives consumers great convenience, but also helps offline retail sellers to increase sales and profits.

4.3 Traditional retail stores are difficult to aggregate merchandise statistics

For traditional retail stores, since most of their operations are labor-based and the purchase volume of goods is large, calculation errors are prone to occur in commodity statistics [17]. The problem is because traditional calculation methods do not have excellent statistical

aggregation capabilities [18]. Therefore, the solution I provide is to develop the function of online real-time entry and update of inventory information through the system, which can make it easier for merchants to manage the store and operate more easily, which is important for improving the management efficiency of the store.

4.4 Traditional retail stores are difficult to manage inventory

Retail stores generally invest more in the inventory of goods, which also generates a lot of inventory management costs and a lot of working capital. The traditional inventory management model is often fragmented goods management, information resources can not be shared, the general management of goods is difficult to implement, the need for high inventory funds, the search for goods need to waste a long time [18]. Therefore, I provide a solution to develop a system to transfer, replenishment, return, inventory functions, strict control of each link to prevent unexpected inventory situations. This also makes it easier for merchants to manage store inventory and gives them a clearer picture of the store's condition.

5.0 Aim

The aim of this project is to design and develop a web-based smart store management system application. With the help of this application, it helps retail store managers to improve management efficiency and performance.

6.0 Objectives

1. To study the current existing store management system and determine the strengths and weaknesses of the current system.
2. To develop a web-based smart store management system application:
 - To design a store management system that combines online and offline to solve the high operating cost of retail stores.
 - To develop store distribution, express distribution, and other functions for retail stores

to solve the limited number of customers in offline retail stores.

- To develop the function of online real-time entry and update of inventory information for the system to solve the statistical problem of commodity information in traditional retail stores.
 - To develop the functions of allocation, replenishment, return, and inventory for the system to solve the difficult problem of inventory management in traditional retail stores.
3. To evaluate the performance of the developed web-based smart store management system and compare it with existing systems.

7.0 Justification

The aim of this project is to design and develop a web based intelligent store management system application with the help of which to help retail store managers to improve their management efficiency and performance and solve the problem mentioned in the problem statement section. After observing and comparing the existing systems IQmetrix, Springboard, Retail Pro, ChainDrive, reviewing the articles of various researches under related topics, namely Jyothi, G. and Navya, K., 2017 [13], Wei, F. and Zhang, Q., 2018 [14], Rahim, M. A., & Ara, R. 2019 [15], I feel that there are many aspects that are closely related to my project idea. These existing systems help retail teams manage and control all aspects of their business to serve their customers faster and more efficiently than ever before, thus creating the most exceptional experience for the end user.

These research articles also identified a significant contribution to my research by summarizing the problems and limitations in the existing systems in order to get some ideas in this context that will be used to develop new projects and determine the current state of the systems that will be developed in this research [19].

In addition, going to design an integrated online and offline store management system and solving the existing retail store inventory management difficulties are the biggest reasons that attracted my attention to this topic the most, by introducing these features, I believe it

will bring more convenience and good experience for the retail team. Make it easier for merchants to manage store inventory and get a clearer picture of the store's status.

By developing this project, it will allow me to apply the knowledge and skills I learned in my lectures to my future work. It will improve my professional skills and boost my self-confidence. Therefore, as this Final Year Project develops, it provides a new experience for me to gain more knowledge.

8.0 Scope

The scope of the project focuses on helping retailers and retail store managers improve the management efficiency and performance of their retail stores, thereby developing a web-based store management system. This application will work in Malaysia. There will be three users in the store management system, namely store admin user, customer user, and supplier user. Among them, the store admin user and the customer user are the main users of the system. All users must first log in to the system to operate the store.

To better understand the system, a use case diagram is used to explain the scope of this project in the following figure. A use case diagram is a diagram used to show a set of use cases, actors, and the relationships between them. It describes how the user wants to use the system. Through use case diagrams, we can know who the relevant users of the system or what services the system are provides to them.

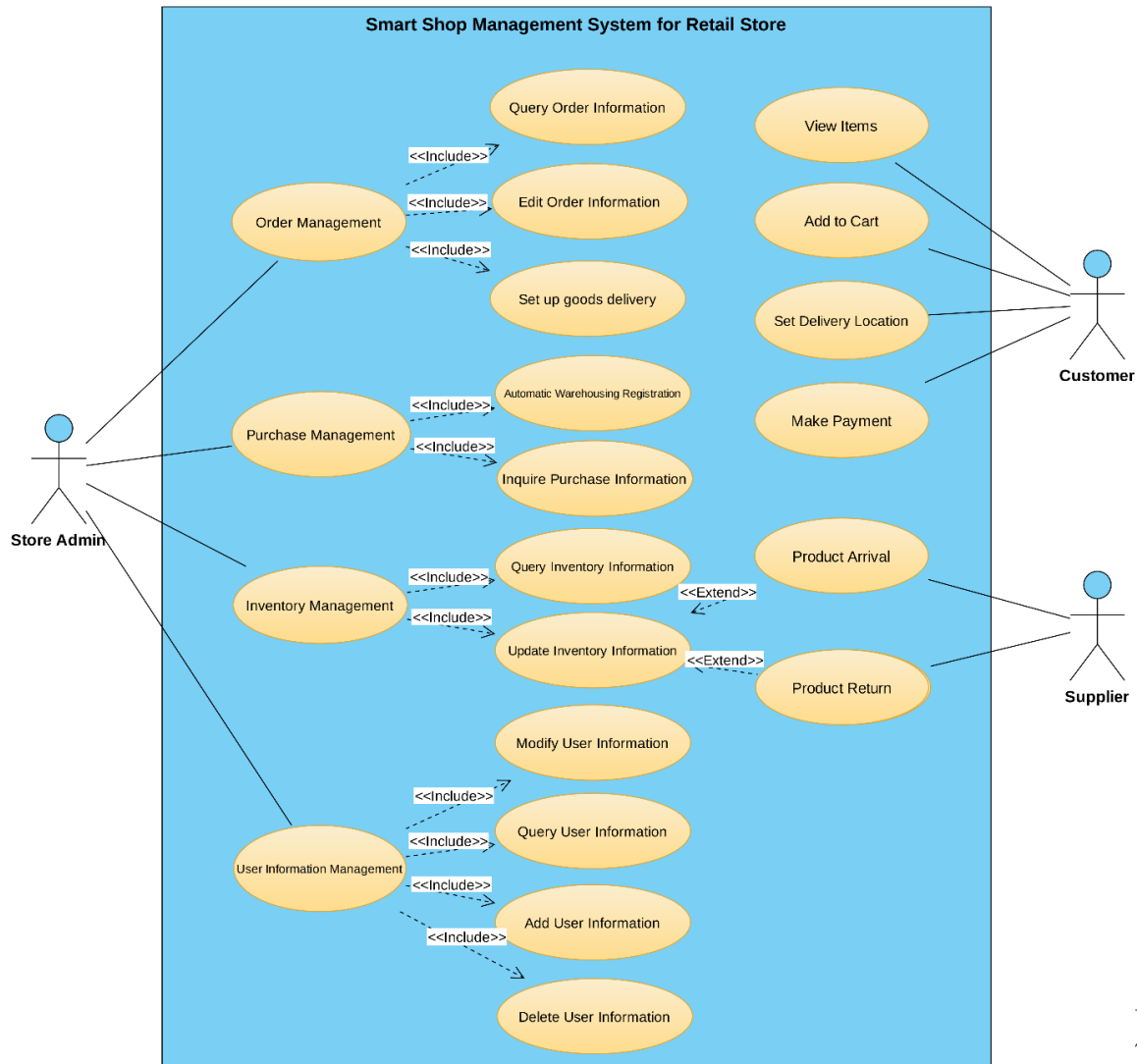


Figure 6 User Case Diagram for Smart Shop Management System

In this use case diagram, the three actors represent the store admin user, the customer user, and the supplier. The store admin user represents the relevant person in charge of the store, such as the store owner or the core management personnel of the store. The customer users refer to people who come to the store to buy goods or request services, while suppliers are enterprises that provide goods or services to retail organizations.

8.1 Store Admin User

For store admin users, its permissions include order management, purchase management, inventory management, and user information management.

8.1.1 Order Management

For order management, its functions include the following:

1) Query Order Information

Store admin can query the order information submitted by customers.

2) Edit Order Information

The store admin can modify the order information according to the actual situation of the current order.

3) Set up Goods Delivery

If a customer buys a product online, after the store has an order submitted by the customer in the system, the store admin can arrange the delivery of the product.

8.1.2 Purchase Management

For purchase management, its functions include the following:

1) Automatic Warehousing Registration

Store admin can register purchased items.

2) Inquire Purchasing Information

Store admin can query the purchase information of products.

8.1.3 Inventory Management

For inventory management, its functions include the following:

1) Query Inventory Information

Store admin can query product inventory information

2) Update Inventory Information

Store admin can modify the information of in-stock items

8.1.4 User Information Management

For user information management, its functions include the following:

1) Modify User Information

The store admin= can modify the user's information, it can be the user's type, the user's permissions, etc.

2) Query User Information

Store admin can query the information of existing users

3) Add User Information

Store admin can enter information for new users

4) Delete User Information

Store admin can delete an existing user's information

8.2 Customer User

For customer users, its permissions include the following:

1) View Items

Customers can view the products through the system's product list, which includes the corresponding thumbnails, prices and numerous attributes of each product.

2) Add To Cart

Customers can add multiple items to the shopping cart at the same time and buy in bulk at one time

3) Set Delivery Location

If the customer buys the product online, he needs to set the mailing address of the product, so that the merchant can arrange the delivery of the product

4) Make Payment

After the customer submits the order, they need to pay for the order

8.3 Supplier User

For suppliers, it may supply the goods directly to retailers. In addition, retailers may return merchandise purchased from suppliers in the event of a return or exchange.

9.0 Approach and Deliverables

9.1 Research Approaches

9.1.1 Literature Review

In this research, several published journal papers, books, etc. will be studied through Literature Review to get some ideas in this context and then summarize the problems and limitations in the current system [20].

9.1.2 Online Survey

In this study, a random questionnaire survey will be used. The sample will include retail store managers or store owners and store customers in each region of Kuala Lumpur to collect a large amount of information such as personal perceptions of store owners on the management of existing business management, analysis of user satisfaction, etc. to determine the current status of the application or system to be developed. 120 respondents were invited to fill in the questionnaire and the results were analyzed and summarized. For accurate survey results, some abnormal data will be removed from it, which may affect the accuracy of the results. In addition, the survey will also be published on social media platforms such as Facebook, twitter, etc., and the questionnaire will be distributed and data analyzed through google forms.

9.2 Development Process and Methodology

This research will use the SDLC (Software Development Life Cycle) waterfall model as a software development methodology. The Software Development Life Cycle (SDLC) is a structured process that helps developers quickly produce quality software that is properly tested and ready for use [21]. The SDLC defines and outlines a detailed plan of phases, each containing its own process and deliverables. Adherence to the SDLC increases development speed and minimizes project risks and costs associated with alternative production methods. The SDLC model is a linear sequence model, which consists of six main stages, namely Requirements Analysis, System Design, Implementation, Testing, Deployment, Maintenance [22].

The SDLC waterfall model was chosen because SDLC allows developers to analyze requirements and helps developers to produce the highest quality software product in the shortest possible time and at the lowest possible cost [23]. SDLC is suitable for time-critical projects, and the following are the main phases of the selected SDLC waterfall model and the sequence shown in Figure 1.

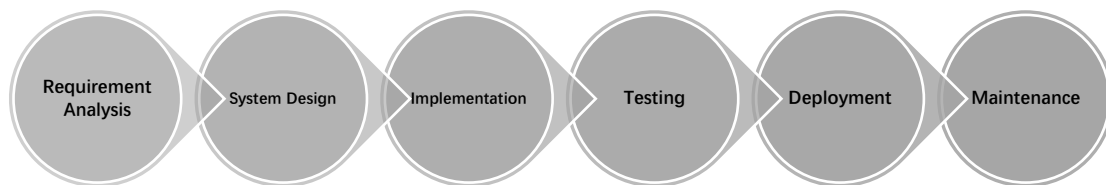


Figure 7 Main Phases of Software Development Life Cycle Model

9.2.1 Requirement Analysis

This phase focuses on what the system needs. We need to collect all system requirements from the target customer through discussions and write them in a requirements specification document. This document is the basis of the project and must include the purpose of the system, a brief description and the specific requirements identified [24].

9.2.2 System Design

System design is the process of defining the system architecture, components, modules, interfaces, and data using the requirements specification document, which describes how the system functionality is implemented [25].

9.2.3 Implementation

In this phase, the system design is used to develop the system, which is first developed in small programs called units, where programmers begin to develop the system by writing code in a programming language [26].

9.2.4 Testing

Each completed program code needs testing methods to avoid any errors in the application. At this stage, we need to run the system and check if it gives the results we want to determine if the project's goals match the system's requirements [27].

9.2.5 Deployment

When testing is complete, the product is deployed in the customer environment or released to the market. However, there are many organizations that choose to move the product through a different deployment environment, such as a test or interim environment. This allows any stakeholder to safely use the product before it is released to the market. In addition, this allows any eventual errors to be caught before the product is released [28].

9.2.6 Maintenance

Maintenance is the backbone of successful system development. During the development of the system, modifications are made from time to time in order to keep the system up to date with changes in the environment and user requirements [29].

9.3 The Activities and deliverables for each phase of the SDLC

Table 2 - Phase, Activities and Deliverables

Phase	Activities	Deliverables
Requirements Analysis	<ul style="list-style-type: none">- Conduct a Literature Review to examine existing journal articles and summarize the problems and limitations of the current system.- Conduct an online questionnaire to collect a large amount of information and analyze and summarize the results of the questionnaire to determine the current status of the application or system to be developed.- Analyze the summary of the literature review and survey results to determine the final system requirements	System requirement Specification (SRS)
System Design	System Design, System User Interface Design, Database Design	Use Case Diagram Activity diagram Sequence Diagram System Prototype Entity Relationship Diagram
Implementation	Development of systems using system design	Application
Testing	Conduct Unit Testing, System Integration	Test Cases, User Acceptance Testing

	Testing, and Quality Assurance Testing	
Deployment	Deploy systems in customer environments or to market	Deployment Guidelines
Maintenance	Maintain and update the system to keep it up to date with changes in the environment and user requirements	System Maintenance Checklist

10.0 Major Milestone

Table 3 - Project Major Milestones

No	Milestone/Task	Date
1.	Initiation Completed	21/1/22
2.	Submission of Proposal First Draft	12/2/22
3.	Planning Completed & Proposal Submission	18/2/22
4.	Proposal Presentation	21/2/22
5.	Analysis Completed	22/3/22

6.	Submission of Phase 1 Draft Report	8/4/22
7.	Design Completed	3/5/22
8.	Implementation Completed	21/6/22
9.	Presenting the prototype of the application to supervisor	24/6/22
10.	Testing Completed	11/7/22
11.	Deploy Completed	15/7/22
12.	Monitoring and Controlling Completed	20/7/22
13.	Project Completed & Submission of Phase 2 Draft Report	22/7/22
14.	Final Report Submission	29/7/22
15.	Project Viva session	1/8/22

10.1 Gantt Chart

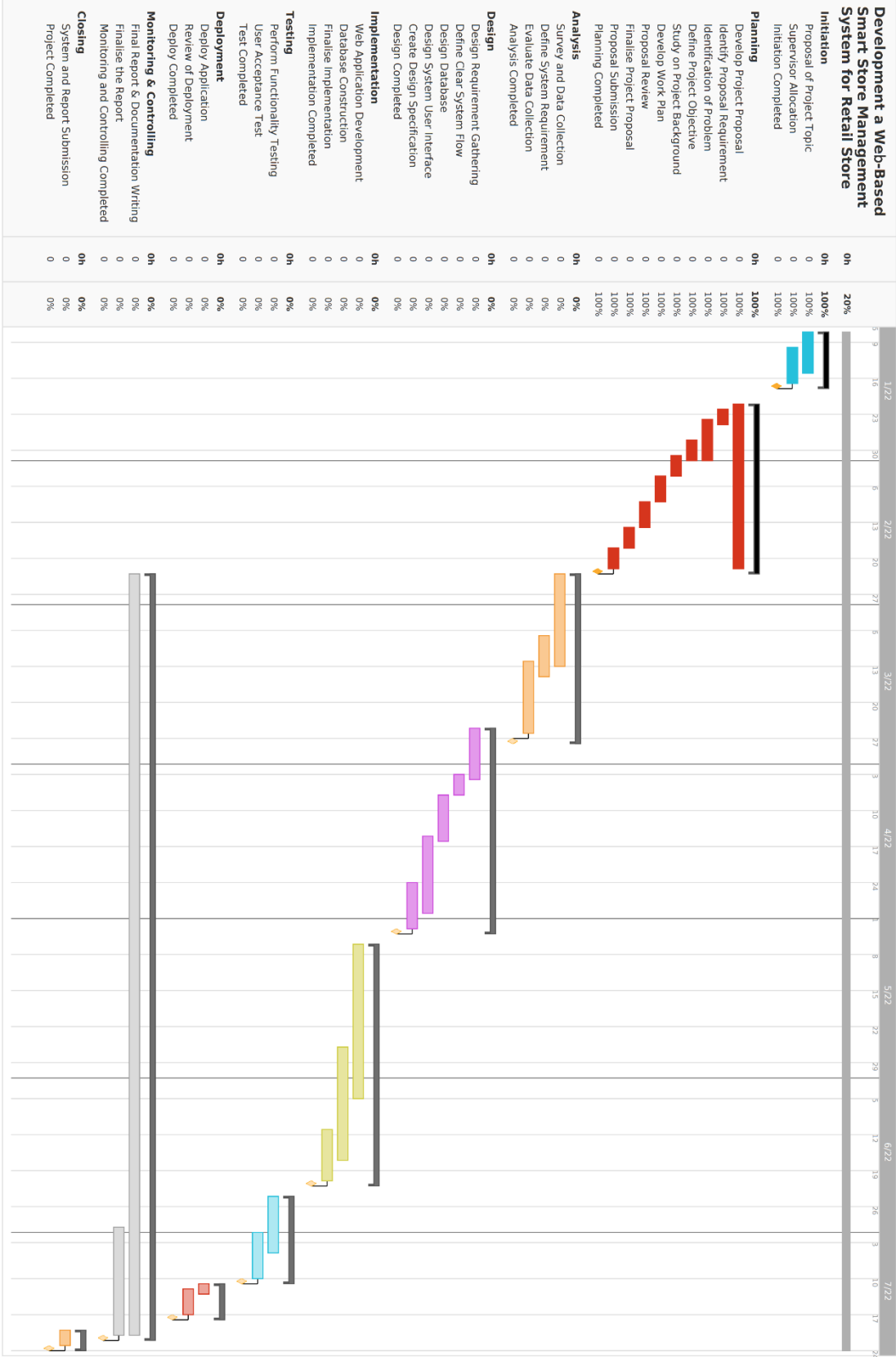


Figure 8 - Gantt Chart for Smart Store Management System

10.2 Work Breakdown Structure (WBS)

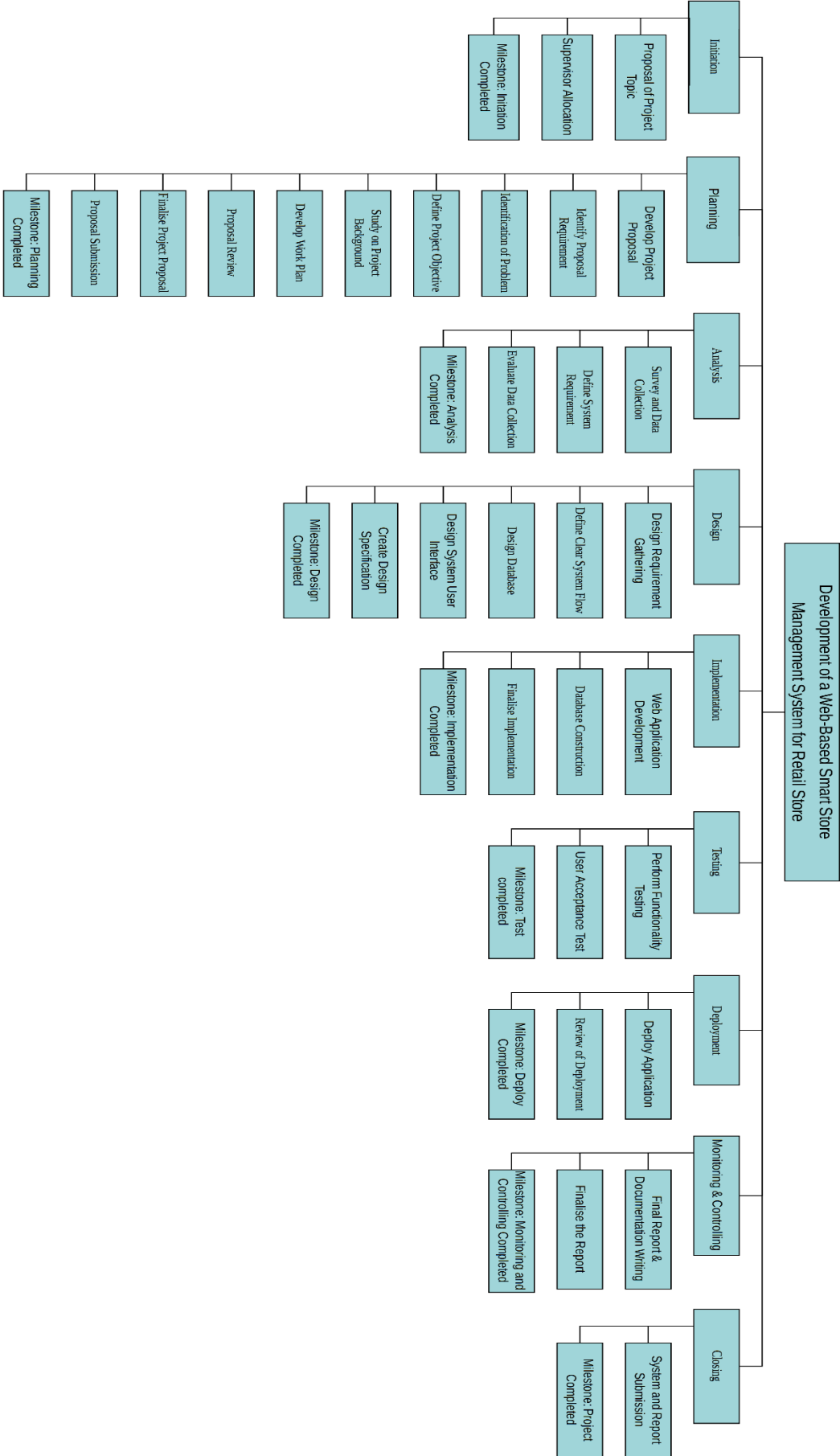


Figure 9 - Work Breakdown Structure for Smart Store Management System

11.0 Constraints and Assumptions

Any proposed system must have an obstacle and a constraint preventing it from being implemented, and the development of this system has some constraints. The following are some constraints and assumptions regarding the development of this project.

11.1 System Constraints

- The system may not support multiple languages and multi-currency interface.
- The system's user account passwords may not be encrypted using any complex algorithms.
- The developed application requires a client device to connect to the Internet for access, and a browser application with the ability to receive data from the server.

11.2 External Constraints

- Due to cost constraints, the project will not be developed on any high specification physical server and the developed web application will only use a regular PC as the base server for the application.
- The articles used in this study may not be in the best journal indexation status.

11.3 Assumptions

- The working hours of this project are 09:00-18:00.
- Some tasks in the project may be worked on non-working days (weekends, holidays).
- The cost of resources such as equipment and software will be provided for the development of the project.

11.4 System Assumptions

- The system will work properly.
- With the system, it will make the store management operation more efficient.

12.0 Resources

This research and work were done using tools to support the implementation of this project, which required prototyping and documentation of the proposed application, as listed below.

12.1 Hardware

The hardware used in the development of this project is 1 laptop with specifications:

Processor: Intel Core i7-11800H @ 2.30GHz

Graphics: NVIDIA GeForce RTX 3070 Laptop GPU

Memory: 16GB

Hard Disk: 1TB

12.2 Software

The software used in this project are as follows:

1) Windows 10 (64-bit operating system)



Windows 10 is a cross-platform operating system released by Microsoft, which is applied to computers and used in the project for system development and runtime environment support.

2) Microsoft Word 2021



Microsoft Word was used as a word processor for writing project reports and research results in this project.

3) Microsoft Project 2021



Microsoft Project is a powerful and flexible project management tool that can be used to develop project plans, track and manage projects, control project progress, and more. In this project it is used to generate the project plan.

4) Google Chrome



Chrome is a web browser developed by Google. It is an application program for retrieving and displaying information resources on the World Wide Web, which can be web pages, pictures, videos or other content. In this project, browsers are used to search relevant journals and research, as well as tools for web page authoring and debugging.

5) Visual Paradigm



Visual Paradigm

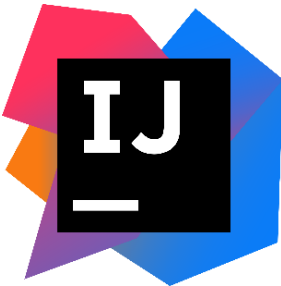
Visual Paradigm is a software application designed for software development to model business information systems and manage development processes. In this project, Visual Paradigm is used as a tool for drawing UML diagrams, WBS diagrams, ERD diagrams, etc.

6) MySQL Community Server 8.0.28



MySQL Community Server is a widely used open source relational database and the primary relational data store used by many common websites, applications, and commercial products. In this project MySQL is used as a database for storing store admin and item details.

7) IntelliJ IDEA Enterprise Edition



IntelliJ IDEA is a Java integrated development environment tool software developed by JetBrains software company. It provides the community version of Apache 2.0 open

license and the enterprise version of proprietary software. Since the community edition does not support configuring web servers, the version I use in this project is the enterprise version, which is the main tool for the development of this project.

8) Apache Tomcat 9.0.58



Apache Tomcat

Apache Tomcat server is a free and open-source Web application server, which is a lightweight application server. It is commonly used in small and medium-sized systems and occasions where there are not many concurrent users. It is used in this project to develop and debug JSP programs.

9) Git 2.35.1



Git is a free and open source distributed version control system. It is used to track changes in any set of files. In this project, it is used as a repository to store management code. It is used to track the code of different versions of the system, in order to check the system with specific version revisions in the future.

13.0 Major Risk

Risks are issues that may or may not arise during our project management process. Although there is no way to control the potential risks of a project, considering them in advance can make the project safer and more secure, and it can have a positive or negative impact on the project [30].

There are also many possible major risks in this project, which are mainly in terms of time, cost, project scope, etc. Due to the lack of effective planning for the estimated implementation time and cost of the project, it means that the actual completion of the project may not be able to achieve expected, or there may be inaccurate estimates of the project cost, the following table shows the risks that need to be identified in developing this project.

Table 4 - Major Risk

Phase of the Project Life Cycle	Possible Risk Factors
All phases	<p>This phase encompasses all phases of the project lifecycle, and the risks to be identified during this phase are:</p> <ol style="list-style-type: none"> 1. Insufficient time cycle in some phases of the project. 2. The project may not include all information. 3. The transition between each SDLC phase may not occur according to the project plan.
Plan	<p>This phase is the project planning phase, which involves the planning of project development time and development cost, as well as validation and risk mitigation, etc. The risks to be identified in this phase are:</p> <ol style="list-style-type: none"> 1. Unwritten information and plans. 2. Inadequate cost-benefit analysis. 3. Lack of knowledge of resource availability. 4. Inadequate system risk analysis. 5. Lack of documentation.
Defining	<p>This phase is the stage of defining the system, which involves the requirements and scope documents related to system development, and the risks to be identified in this phase are:</p> <ol style="list-style-type: none"> 1. non-written form of the plan. 2. Lack of planning documentation for the scope of the system development.

	3. Incomplete execution of the plan.
Start	<p>This is the start phase of the project, where the risks to be identified are:</p> <ol style="list-style-type: none"> 1. Lack of relevant information to maintain the system. 2. The terms are being changed.
Carrying out	<p>This is the stage where the project executes and the risks to be identified in this stage are:</p> <ol style="list-style-type: none"> 1. Changes in customer needs and market conditions. 2. Incomplete or incorrect information related to the implementation plan. 3. change management without consistent analysis of the consequences that may affect the entire project. 4. Lack of reliable project progress reports. 5. Software and equipment failures. 6. Academic boundaries
End	<p>This is the end phase of the project, where the risks to be identified are:</p> <ol style="list-style-type: none"> 1. The final product may not be completed according to the expected schedule. 2. The final product may not meet the user's needs or achieve the expected results.

14.0 External Bodies Involved

China Beijing Zhongke Zhuoxin Software Testing Technology Center was established on December 24, 2010. It is a national research institution directly under the Ministry of Industry and Information Technology. The company's business scope includes: software product testing, technology development, technical testing, technical consulting, computer system services, etc. In the field of testing, China Science and Technology Zhuoxin

Assessment has obtained the qualification of laboratory accreditation from China National Accreditation Committee for Laboratories and has so far completed the testing of more than 10,000 software and hardware products and thousands of information system engineering projects, it is an authoritative software and hardware product and information system testing laboratory in China. In the field of testing, the unit has also formulated the index system for government website performance evaluation and carried out the performance evaluation of Chinese government websites for many years [31].



Figure 10 Company Logo

In the testing phase of the system development life cycle, when the development of the smart store management system project is completed, it will cooperate with Zhongke Zhuoxin Software Testing Technology Center, which will run the system to conduct comprehensive user acceptance testing UAT, Quality Assurance Testing (QAT) to verify whether the project's objectives meet the requirements, and issue user acceptance testing reports, quality assurance testing reports, etc. to provide a basis for system acceptance. This allows any eventual bugs to be caught before the application is deployed, by making changes to the system to make it finally fit the environment and user requirements. In addition, when testing is complete, the product will be deployed in partnership with new offline retail stores.

15.0 Project Plan

Table 5 – Project Plan

Phase and Task Name	Duration	Start Date	Finish Date
Development of a Web-Based Smart Store Management System for Retail Store	202 days	Fri 7/1/22	Fri 28/7/22
Initiation	11 days	Fri 7/1/22	Fri 21/1/22
Proposal of Project Topic	4 days	Fri 7/1/22	Tue 10/1/22
Supervisor Allocation	1 day	Tue 10/1/22	Tue 10/1/22
Initiation Completed	0 day	Fri 21/1/22	Fri 21/1/22
Planning	28 days	Fri 21/1/22	Tue 18/2/22
Develop Project Proposal	28 days	Fri 21/1/22	Tue 18/2/22
Identify Proposal Requirement	2 days	Sat 22/1/22	Sun 23/1/22
Identification of Problem	4 days	Sat 22/1/22	Tue 25/1/22
Define Project Objective	4 days	Sat 22/1/22	Tue 25/1/22
Study on Project Background	5 days	Fri 28/1/22	Tue 1/2/22
Develop Work Plan	5 days	Fri 4/2/22	Tue 8/2/22
Proposal Review	2 days	Sat 12/2/22	Sat 13/2/22
Finalise Project Proposal	6 days	Sun 13/2/22	Fri 18/2/22
Proposal Submission	1 day	Fri 18/2/22	Fri 18/2/22
Planning Completed	0 day	Fri 18/2/22	Fri 18/2/22
Analysis	30 days	Fri 22/2/22	Tue 22/3/22
Survey and Data Collection	14 days	Fri 25/2/22	Tue 8/3/22
Define System Requirement	5 days	Mon 7/3/22	Fri 11/3/22

Evaluate Data Collection	15 days	Tue 8/3/22	Tue 22/3/22
Analysis Completed	0 day	Tue 22/3/22	Tue 22/3/22
Design	39 days	Fri 25/3/22	Tue 3/5/22
Design Requirement Gathering	7 days	Fri 25/3/22	Fri 1/4/22
Define Clear System Flow	4 days	Sat 2/4/22	Wed 6/4/22
Design Database	7 days	Thu 7/4/22	Thu 14/4/22
Design System User Interface	12 days	Fri 15/4/22	Tue 26/4/22
Create Design Specification	7 days	Wed 27/4/22	Tue 3/5/22
Design Completed	0 day	Tue 3/5/22	Tue 3/5/22
Implementation	45 days	Fri 6/5/22	Tue 21/6/22
Web Application Development	20 days	Fri 6/5/22	Thu 26/5/22
Database Construction	18 days	Thu 26/5/22	Mon 13/6/22
Finalise Implementation	7 days	Tue 14/6/22	Tue 21/6/22
Implementation Completed	0 day	Tue 21/6/22	Tue 21/6/22
Testing	17 days	Fri 24/6/22	Mon 11/7/22
Perform functionality testing	7 days	Fri 24/6/22	Fri 1/7/22
User Acceptance Test	10 days	Fri 1/7/22	Mon 11/7/22
Testing Completed	0 day	Mon 11/7/22	Mon 11/7/22
Deployment	5 days	Mon 11/7/22	Thu 15/7/22
Deploy Application	1 day	Mon 11/7/22	Mon 11/7/22
Review of Deployment	5 days	Mon 11/7/22	Fri 15/7/22
Deploy Completed	0 day	Fri 15/7/22	Fri 15/7/22
Monitoring & Controlling	150 days	Sun 22/2/22	Mon 20/7/22
Final Report & Documentation Writing	138 days	Sun 20/2/22	Fri 10/7/22
Finalize the Report	12 days	Fri 10/7/22	Mon 20/7/22
Monitoring and Controlling Completed	0 days	Mon 20/7/22	Mon 20/7/22

Closing	1 day	Tue 21/7/22	Tue 22/7/22
System and Report Submission	1 day	Fri 21/7/22	Fri 22/7/22
Project Completed	0 day	Fri 22/7/22	Fri 22/7/22

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