FOOD MANAGEMENT SYSTEM

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Abstract

Projek ini membangunkan Sistem Pengurusan Makanan Terpadu untuk meningkatkan kecekapan operasi perniagaan katering dengan menangani isu-isu utama seperti pengurusan inventori yang tidak teratur, pemprosesan pesanan yang tidak efisien, dan pembaziran makanan. Perniagaan katering sering menghadapi kesukaran dalam menguruskan tahap stok yang tepat, pemprosesan pesanan tepat pada masa, dan perancangan menu yang ideal, yang mengakibatkan lebihan stok, pembaziran, dan aduan pelanggan. Penyelesaian yang dicadangkan ialah sistem digital yang pelbagai fungsi yang membolehkan pengurusan inventori masa nyata, pengurusan pesanan, pengurangan pembaziran, dan pengoptimuman menu. FMS ini mengemas kini stok secara automatik, memberikan amaran stok rendah kepada pengurus, dan mengautomasikan sepenuhnya proses dari pesanan hingga penghantaran dengan penghantaran tepat pada masa dan pemenuhan pesanan yang tepat. Pendekatan pembangunan berperingkat telah digunakan, membolehkan peningkatan sistem secara bertahap, memastikan fleksibiliti dan maklum balas berterusan dari pengguna akhir. Spring Boot, Vue.js, dan MySQL adalah antara alat dan teknologi yang digunakan, dengan tumpuan khusus pada reka bentuk antara muka pengguna yang mudah digunakan dan seni bina backend yang stabil. Sistem ini merangkumi fungsi teras seperti pengurusan inventori, pemprosesan pesanan, dan laporan analitik, yang membantu dalam membuat keputusan berasaskan data dan penambahbaikan proses perniagaan. Dengan penggunaan teknologi berasaskan web moden, FMS menawarkan penyelesaian yang boleh diskalakan dan direka khusus untuk perniagaan katering kecil dan sederhana. Hasilnya adalah sistem pengurusan makanan yang fleksibel dan kohesif dengan tujuan mengautomasikan aktiviti perniagaan utama, mengurangkan pembaziran, meningkatkan kecekapan operasi, dan memaksimumkan kepuasan pelanggan. Sistem ini mudah digunakan, cukup fleksibel untuk menyokong pelbagai keperluan perniagaan, dan mampu menawarkan maklumat masa nyata, dengan itu membolehkan perniagaan katering membuat keputusan yang lebih baik dan memanfaatkan sepenuhnya sumber yang ada. Penggunaan sistem ini yang berjaya dijangka akan memberi sumbangan besar kepada kemampanan dan keuntungan perniagaan katering.

Kata kunci : Sistem Pengurusan Makanan Terpadu, Kecekapan Operasi Katering, Penyelesaian Digital.

Abstract

This project is developing an Integrated Food Management System to improve the operational efficiency of catering businesses by addressing significant issues of inventory mismanagement, inefficient order processing, and wastage of food. Catering businesses are generally bogged down in managing proper stock levels, timely processing of orders, and ideal menu planning, resulting in overstocking, wastage, and customer complaints. The solution proposed is a multi-faceted digital system that allows real-time inventory management, order management, wastage minimization, and menu optimization. The FMS automatically updates the stock, provides low-stock alerts to managers, and fully automates the order-to-delivery process with on-time delivery and accurate order fulfilment. The incremental development approach has been adopted, enabling system improvement in a sequential manner, thus guaranteeing flexibility and continuous feedback from end users. Spring Boot, Vue.js, and MySQL are among the tools and technologies utilized, with specific focuses on designing an easy-to-use user interface and a stable backend architecture. The system includes core functionalities like inventory management, order processing, and analytical reporting, which aid in data-driven decision making and business process improvement. With the utilization of modern web-based technologies, the FMS offers scalable solutions engineered specifically for small and medium-sized catering businesses. The result is a flexible and cohesive food management system with the aim of automating key business activities, reducing wastage, improving operational efficiency, and maximizing customer satisfaction. The system is easy to use, flexible enough to support a wide range of business needs, and able to offer real-time information, hence allowing catering businesses to make better decisions and fully utilize available resources. The successful application of the system is expected to greatly contribute to the sustainability and profitability of catering businesses.

Keywords： *Integrated Food Management System, Catering Operational Efficiency, Digital Solution.*

1.0 INTRODUCTION

This project aims to develop an Integrated Food Management System to address core challenges faced by catering businesses, including disorganized inventory management, inefficient order processing, and significant food wastage. As a critical support for events, corporate functions, and private gatherings, the catering industry has a high demand for real-time resource management (Lahdenranta-Jakobsson, 2021). However, traditional manual management often leads to issues such as overstocking or stockouts, delayed orders, and irrational menu planning, which in turn result in customer complaints and profit losses (Watanabe et al., 2022). Studies have shown that effective food management systems can reduce waste by up to 25% and

enhance profitability by improving order accuracy, highlighting the practical value of this project.

The core objective of the system is to improve operational efficiency through digital solutions. Specifically, it will integrate real-time inventory tracking, full-process order automation, waste minimization, and menu optimization functions to enable data-driven decision-making for small and medium-sized catering businesses. An incremental development model is adopted to ensure the system can be improved and continuously receive user feedback. Technically, Spring Boot, Vue.js, and MySQL are used to build a stable front-end and back-end architecture, balancing usability and scalability (Osman & Sulieman, 2023).

By addressing the practical pain points of catering enterprises, this system ultimately aims to automate business activities, reduce resource waste, improve operational efficiency, and maximize customer satisfaction. As emphasized by Wang et al. (2019), digital tools are crucial for the sustainable development of the catering industry, and the successful application of this project is expected to strongly support enterprises' profitability and long-term growth.

2.0 LITERATURE REVIE

In recent years, catering enterprises have faced increasing complexity in managing real-time inventory, orders, and customer demands, making efficient food management systems a key to enhancing competitiveness. Existing research has confirmed the significant effects of automation technologies in reducing waste and improving order accuracy: Lahdenranta-Jakobsson (2021) demonstrated that real-time inventory systems can significantly reduce operational costs for catering businesses; Wang et al. (2019) proposed an AI-driven demand forecasting system that optimizes food production planning and alleviates order processing pressures.

Current related technologies include Inventory Management Systems (IMS), Order Management Systems (OMS), and Point-of-Sale (POS) systems, while cloud technology has further improved the efficiency of multi-store collaboration (Jayasingh et al., 2023). Among emerging trends, the Internet of Things (IoT) enables real-time inventory monitoring through smart sensors, and blockchain technology enhances transparency in the food supply chain (Kaur et al., 2023). However, existing studies mostly focus on single functional modules or large enterprises, with insufficient attention to technology integration for small and medium-sized catering businesses, and a lack of comprehensive solutions integrating AI, IoT, and cloud technology (Youssef et al., 2024).

Existing methodologies have limitations: some studies have small sample sizes, making it difficult to generalize to the entire industry; simulation models often fail to fully replicate the complexity of real operational scenarios (Knani et al., 2022). This research aims to fill this gap

by integrating multiple technologies and designing for the needs of small and medium-sized enterprises, providing a more applicable comprehensive management solution for the industry.

3.0 METHODOLOGY

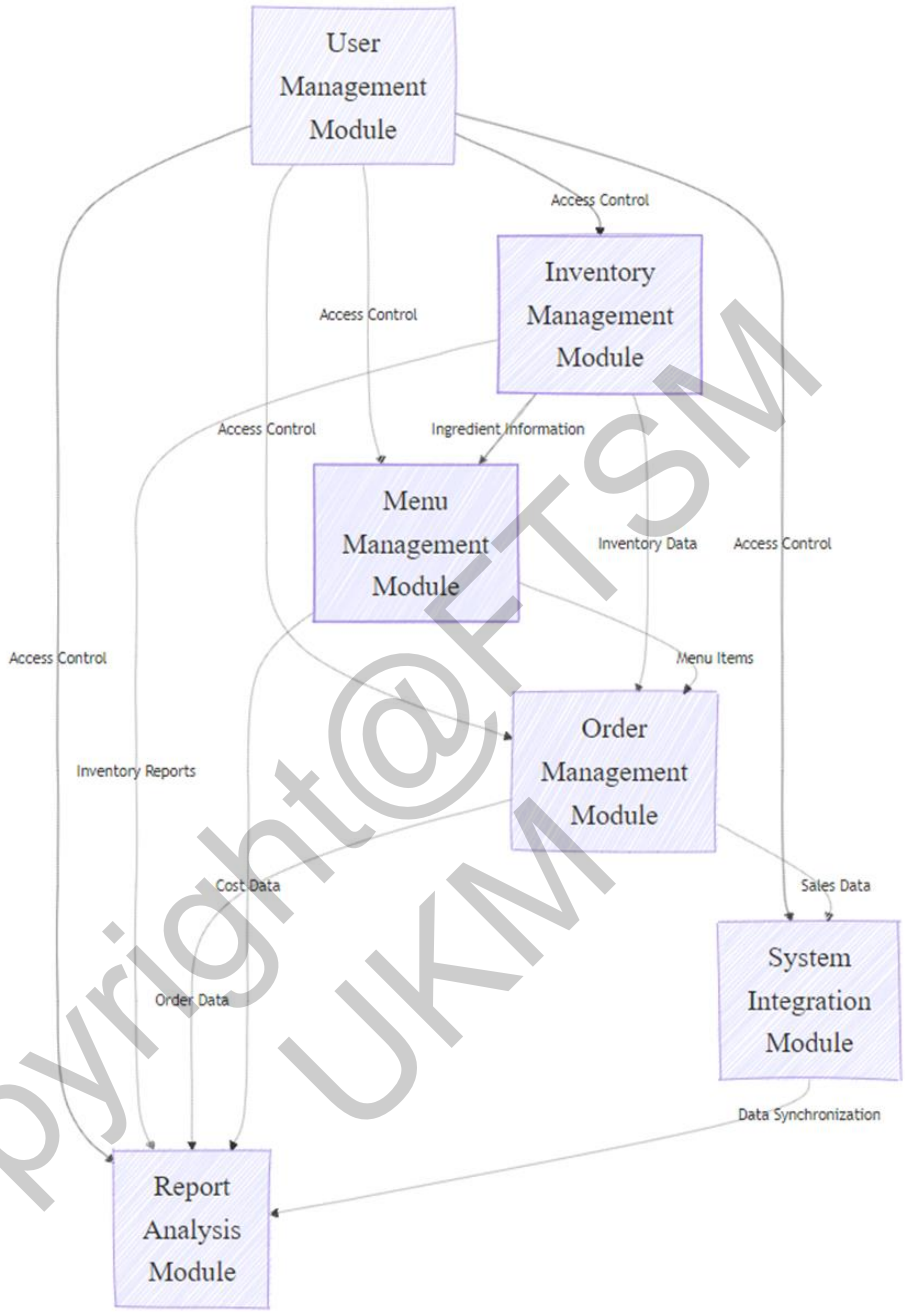
This project adopts the Incremental Development Model, implementing system functions in phases, with each iteration cycle including requirements analysis, design, development, testing, and integration. This approach offers high flexibility, allowing continuous optimization based on user feedback while reducing overall risks (Pandey, 2023). Technically, the back-end uses Spring Boot to build a stable service architecture, the front-end employs Vue.js to create user-friendly interfaces, and MySQL is selected as the database to store structured data, ensuring system scalability and security.

System development is centered on user needs. Target users include catering managers (requiring inventory monitoring and report generation), kitchen staff (needing real-time access to inventory and order information), service personnel (needing to process orders quickly), and customers (benefiting from accurate order fulfillment) (Jayasingh et al., 2023). Functional requirements include real-time inventory tracking (with low-stock alerts), full-process order management (creation, modification, status updates), report analysis (sales, inventory usage), and menu management (linking inventory and pricing). Non-functional requirements include supporting 100 concurrent users, data updates within 2 seconds, 99.5% system availability, and role-based access control (Knani et al., 2022).

The system design phase uses object-oriented methods, clarifying user-system interaction logic through use case diagrams, sequence diagrams, and activity diagrams, and designing the database structure based on an Entity-Relationship (ER) model to ensure data consistency (Tang et al., 2021). Algorithmically, the login module uses password encryption verification, inventory management implements automatic alerts through threshold monitoring, order processing integrates inventory check mechanisms, and sales analysis uses the moving average method to predict demand trends. These designs ensure the system meets current operational needs while reserving space for future expansion.

This is the module structure diagram of the restaurant management system, including six core modules, which reflects the interrelationships between the modules in detail. The User Management Module is designed for privilege control, connecting all kinds of modules so that different functions can be accessed by the owner according to his or her role. The inventory management module will be responsible for the core operation of ingredient inventory management and interacts with Order Management Module and Menu Management Module in providing ingredient information and

inventory data to make sure that dishes on the menu have enough inventory. The menu management module will link inventory and orders to make sure the accuracy of dish information while providing dish cost data to the report analysis module. Order Management Module forms the centerpiece for the placement, modification, payment, and updating of the status of customer orders, interacting with Inventory, Menu, and System Integration Modules for a smooth process of order taking. The report analysis module collects data on inventory, orders, and sales, producing reports that aid management decisions. The System Integration Module interfaces with external systems for data synchronization, such as the POS sales system and CRM customer management system, while it interlinks with the Order and Reporting Module for support of sales data. These work in concert to guarantee that the F&B management system runs effectively, reduces wastage, and enhances efficiency.



FIigure 1 Module Structure Diagram

This diagram illustrates some of the key functional modules that may compose such a system, their major relationships, and summarizes how users might interact with such a system: First, a user needs to log in into the system after which he will be able to conduct three key functions: inventories management, placing orders, and viewing sale data. The status of the inventory or the replenishment operations can be viewed in the inventory management module, and after replenishment, the data of the inventories

will get updated. Order Management Module: Through this module, the user will be able to place the order, and the system will first check the status of the inventories. If it is in stock, it confirms the order and goes to the stage where the order will be fulfilled. The level of inventory is updated, while if it is out of stock, the system should notify a user either to revise the order or add more stock. Report analysis module allows the generation of sales data analysis reports, which will be visual in providing data statistics and charts to assist managers in making business analysis and decisions. This diagram illustrates how users can achieve core business processes within the system and also highlights the close ties between inventory management, order management, and data analysis that make the whole food management system work effectively.

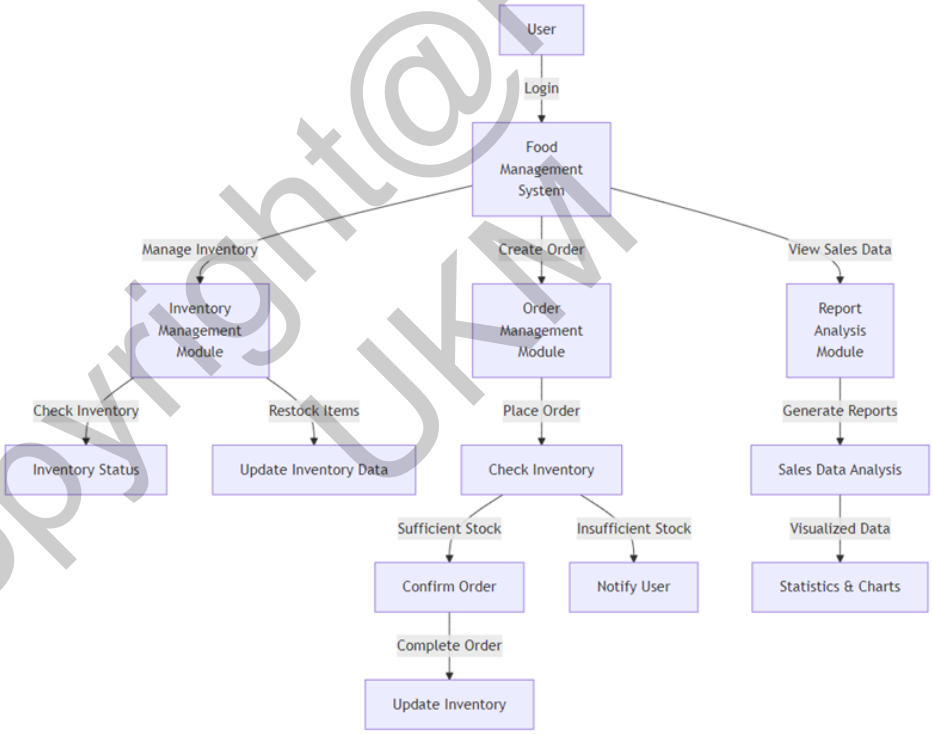
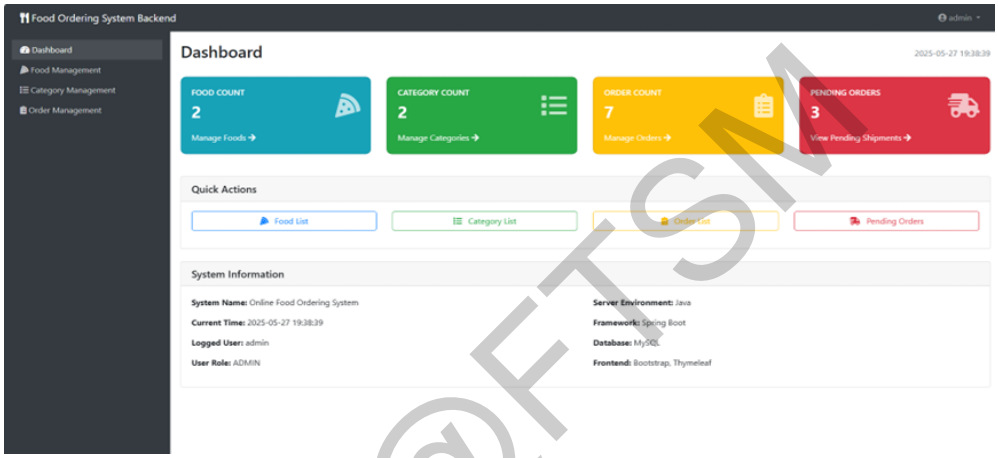


FIgure 2 User Interaction Flowchart

4.0 RESULTS

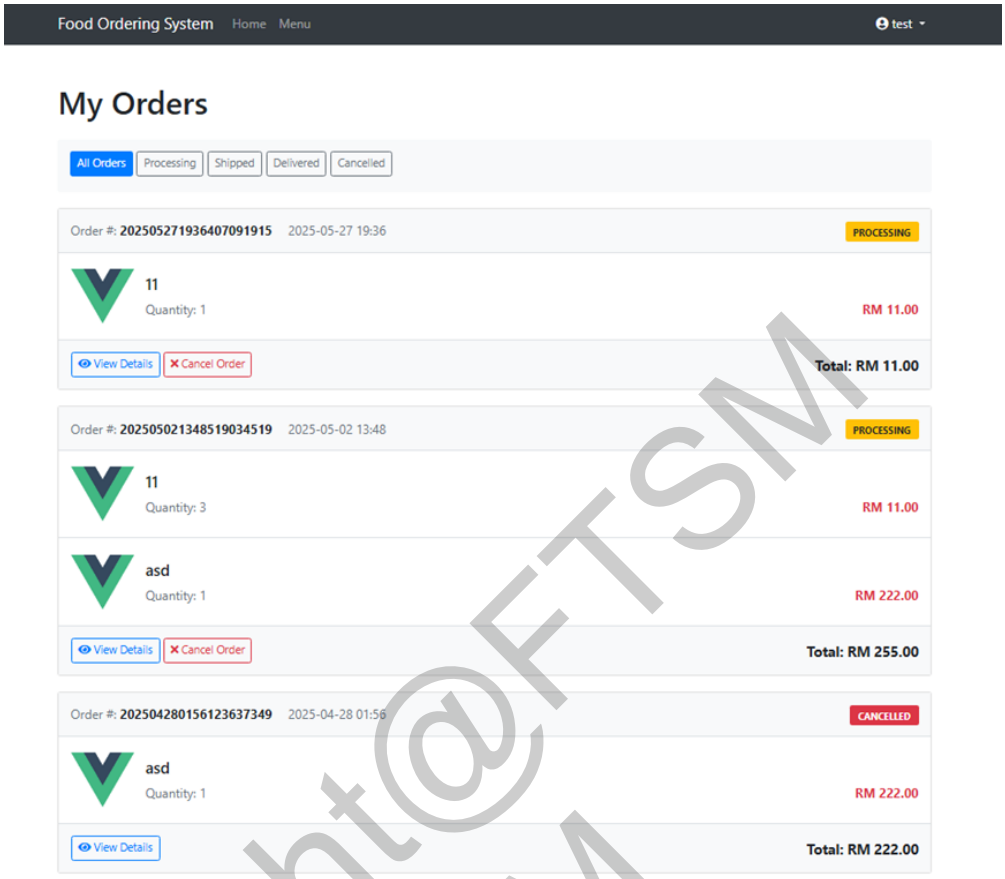
This is the home page of the system's back-end management, and the administrator first enters this interface after logging in. The top of the page shows the core statistics of the system, including the number of food items, the number of categories, the number of orders and the

number of orders to be shipped, and each of the statistics modules provides a jump link to the corresponding management function. The bottom of the page provides three shortcut buttons: “Food List”, “Categorized List” and “Pending Orders” to enhance the efficiency of administrator's operation. The whole interface has a clear layout and the data is clear at a glance, providing a good entry point for system management.



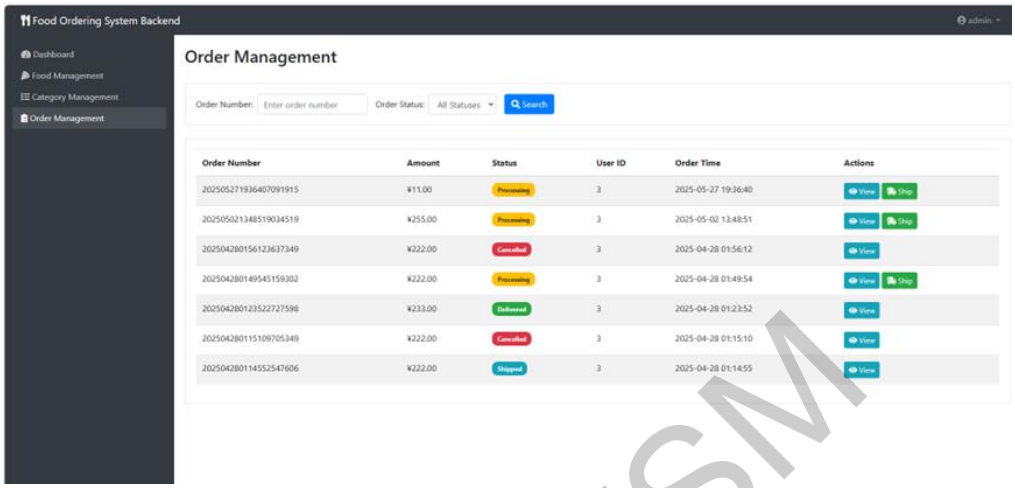
FIigure 3 Administrator Dashboard

This is the interface for ordinary users to view their own order history. “Cancelled” and so on. Each order displays the order number, time, product thumbnail, name, quantity, status and total amount, and provides “View Details” and “Cancel Order” buttons. This interface effectively helps users to manage their personal order records, view the current processing progress, and support canceling unprocessed orders, which enhances the user's sense of control and ease of operation.



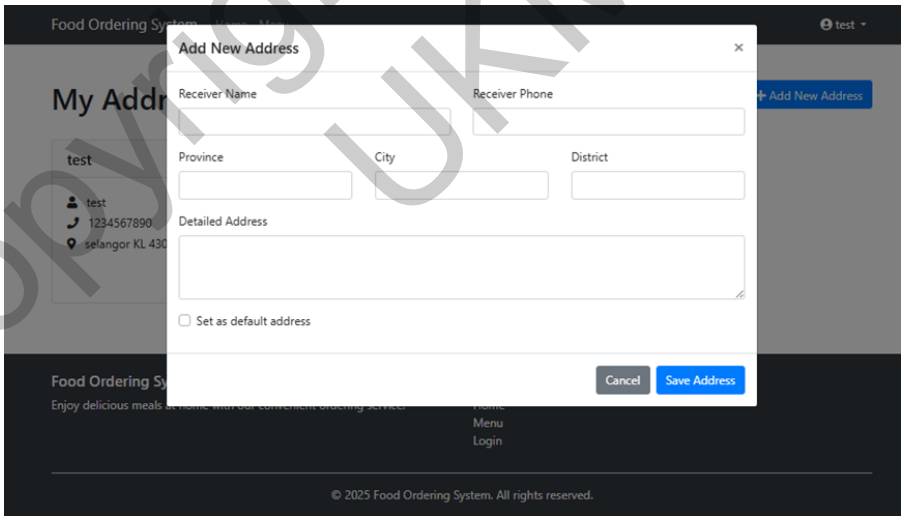
FIigure 4 User Order Record Page

Figure 5 is used for administrators to view and manage all orders in the system in a unified way. The administrator can search and filter by order number and order status. The table displays order information in the form of a list, including order number, total amount, status, user ID and creation time. Each line provides “View” and “Ship” buttons, administrators can click to view order details or shipment operations. Different order statuses are distinguished by color to enhance readability. This interface realizes the centralized management of the whole system order flow and is one of the important core modules of the background operation.



FIigure 5 Order Management Page

Figure 6 is the core part of the user address management module. Users can view their saved address information and add a new address through the “Add New Address” button to open the pop-up window. The pop-up window includes input boxes for name, phone number, province, city, region and address details, and supports setting as default address. This feature supports the saving and management of multiple addresses and provides a convenient delivery address selection for the ordering process, which is a key supporting module in the order process.



FIigure 6 Address Management Page

5.0 CONCLUSION

The project will create an integrated Food Management System for catering companies to prevent inefficiency and resource wastage associated with traditional manual management in inventory management, order processing, menu planning, supply chain management, and sales analysis. The system assists the catering companies in reducing wastage by enabling real-time

inventory tracking and smart replenishment reminders and also easy order management and menu optimization. It utilizes front-end and back-end separation structure, which is implemented with the assistance of Spring Boot and Vue.js and communicates with a MySQL database and also offers great scalability and maintainability. Besides that, utilizing the analysis of sales data and generation of reports features, businesses can make more rational data-based decisions in an attempt to enhance business efficiency. The entire development process follows an incremental model of development, incrementally releasing each functional module one at a time, continually expanding the system architecture, and finally arriving at a successful, smart, and digitalized management solution for small and medium-sized catering companies.

The most significant advantage of the system is its extremely wide range of functions that covers all of the key catering business operations, ranging from stock and order management to menu setup and sales volume analysis. The function modules are properly isolated and organically interconnected, which enhances the efficiency of operations significantly.

From the point of view of user interface, the system interface is simple and easy to use, responsive and multi-device compatible and therefore user-friendly. Besides, the system automatically executes tasks to reduce manual touch automatically, and real-time updating stock and order status enables the operations to be more accurate and efficient. Technically, the system is designed on the newest development stacks, (Spring Boot + Vue), front-end and back-end separated architecture, facilitating development flexibility and ease of maintenance. Despite these advantages, the system does have some shortcomings. First of all, there was an error in the initial database schema design in that some fields lacked default values and validation rules, and this resulted in bugs right from the early stages of testing very frequently. Secondly, front-end styling management was a problem because there was nested complexity of the components, and this resulted in styling problems as well as made debugging harder. Lastly, the system is yet to include AI-prediction and big data analysis features, limiting its level of intelligence for processing data. Lastly, the system has yet to consider large chain companies' intricate management requirements, i.e., multi-branch management and intricate permission controls.

To make the system even leaner, the database design can be more advanced with the inclusion of field constraints and data consistency checks to eliminate errors created because of incorrect data format. Updates in the future would also include integrating artificial intelligence technology to include sales forecasting and intelligent menu recommendations, enhancing the level of intelligence of the system even further and allowing companies to make improved operational decisions. Apart from that, supporting the convenience of creating mobile apps or

WeChat mini programs would enhance the simplicity and friendliness of the system, enabling more cases to fit.

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