DESIGN AND IMPLEMENTATION OF AN INVENTORY MANAGEMENT SYSTEM: A CASE STUDY OF JTMK KIOSK, POLITEKNIK UNGKU OMAR

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ABSTRACT

Effective inventory management is vital to ensure smooth operations and business sustainability, especially for small and medium sized enterprises (SMEs). However, many SMEs often rely on manual tools like Microsoft Excel, as these methods tend to be error prone, inefficient and lack data driven insights. This study aims to develop a web-based inventory management system using the Agile methodology, allowing for iterative design, continuous feedback, and flexible adaptation to user requirements throughout the development cycle. MySQL was used for structured data storage, and Visual Studio for system development featuring real-time stock tracking, price monitoring, automated commission calculations, and report generation. Results showed after the implementation of this system at JTMK Kiosk, Politeknik Ungku Omar, which demonstrated significant improvements in operational efficiency, including reducing manual errors, faster data updates, improved stock visibility, and an intuitive user interface, while also enabling remote data access. In conclusion, the system successfully meets its objective of delivering a simplified, cost effective inventory solution for SMEs seeking to transition from manual processes to more efficient digital management, with opportunities for future improvision to tackle its current limitations

1. Introduction

Efficient inventory management is a key success for small and medium enterprises (SMEs) because of its limited resource(Panigrahi et al., 2024). There are still many SMEs that use manual operations or simple tools such as Excel in tracking inventory and it becomes trouble in terms of time and may lead to complications (Tripathi et al., 2024). In addressing the above challenges, web-based inventory management systems for SMEs have been developed with the agile approach that enables the system to be improved iteratively and receives feedback from the users (Minasa et al., 2024; (Minasa et al., 2024; Setiawan et al., 2024). Recent study highlights the increasing importance of web based inventory systems for digitally enhancing

small businesses. Web based inventory systems provide real-time information access, computerized maintenance of records, and easier management of stocks, leading to higher efficiency and comprehensive outcomes (Aan Setiawan et al., 2024; Maredel T. Tanaman et al., 2023). The implementation of web-based inventory programs was found to validate significant improvements in inventory control, such as real-time tracking and reduced manual recording errors (Supriatna & Mardira Indoneisa, 2023).

Previous studies have shown that web based inventory systems can enhance efficiency and minimize manual errors (Minasa et al., 2024; Supriatna & Mardira, 2023). However, these systems are designed for larger retail and do not meet the requirements of SMEs. At the same time, commercial tools like Zoho Inventory and QuickBooks Commerce are complex and expensive for SMEs (Ltd., n.d.; Yakal, n.d.).This finding points out a research gap for affordable, simplified, and user-tested inventory systems specifically for small scale businesses.

Therefore, this study focus on the design and implementation of a web-based inventory management system for the JTMK Kiosk at Politeknik Ungku Omar. The system was constructed using Agile principles, supporting iterative progression informed by user feedback and adaptable to shifting requirements. MySQL was using for structured data storage, while Visual Studio functioned as the primary development platform.

The main features of the system include real time inventory tracking, price monitoring, automatic commission calculations, and customizable reporting. The system was successfully implemented and tested in the JTMK Kiosk, resulting in improved stock visibility, data accuracy, and operational efficiency. However, there were some challenges, including internet dependency, potential security vulnerabilities, lack of mobile compatibility, and limited multi user support. This research paper demonstrates the feasibility of tailor made inventory solution to enable SMEs to move from paper based inventory management to a digital one. There is also a scope for future work to make the system more scalable, secure, and accessible..

2. Methodology

The development of JTMK Kiosk inventory management systems was achieved through the application of the Agile model, as depicted in Figure 1. designed for the JTMK Kiosk in Politeknik Ungku Omar.
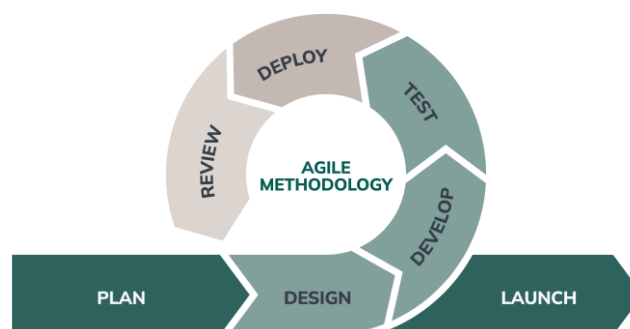

Figure 1: Agile Software Development Model

Agile framework focuses on incremental development, customer collaboration, and adaptability to change requests (Adeboye Popoola et al., 2024). It breaks down development into repeating phases such as planning, design, development, testing, deployment, review, and launch (Hossain, 2023).

In the planning phase, interviews and observations of the kiosk users have been conducted to understand the inefficiencies of the current manual system when it was in the planning stage. Some key factors to point out are the possibility of mistakes by over staffing the input, no visibility of stock, slow to update and manual handling, for example, on commission, etc. Based on those findings, a project road map and a product backlog were established to determine system functions according to users' needs.

During the design process, wireframes and databases were made to visualize how the program would look and how data would be structured. Special attention was given to the friendliness interface which would be friendlier for the non-technical user. The framework was also designed to support the incorporation of pivotal features such as stock management, product pricing and reportability features.

The system was developed in Visual Studio throughout the developmental stage. Backend was developed in PHP, and the frontend interface was developed using HTML, CSS and JavaScript. The database was utilized to store the structured data which concerns inventory items, transactions and financial records.

In the testing phase, the system is subjected to unit testing and user acceptance testing for its functionality and stability check. The modules were also tested at the end of each sprint to identify and remove bugs earlier in the cycle. Also, the implemented functionality was checked against the users' expectations and the system's needs.

During the deployment, the implemented system was put in place and tested in real operating conditions at the JTMK Kiosk. Actual stock data was ported over to the new system and kiosk staff were trained to use the system on a daily basis.

After the deployment, feedback was collected from the users via structured questionnaires and informal discussions as part of the review process. The users judged the usability, efficiency and the reduction of the amount of manual work done by the system.

Finally, the system was launched when it was fully integrated and adopted. The initial mindset was to bring users from analogue to digital, and then to continuously monitor for stability and support. The Agile loop kept development adaptive, user focused, reactive to real world constraints, and user feedback.

3. Results

The result of the design and development for JTMK Kiosk Inventory Management System was the effective implementation of a web based inventory management system which was able to function efficiently as a platform designed to simplify and improve the conventional inventory functions for a small business. The system features secure login, real time stock information, automated reporting and ease of use. It fulfilled all functional and non-functional requirements; increased accuracy, reduced resource consumption and improved decision making through inventory tracking and data management.

3.1 System Interface and Features

A system's interface design refers to the graphical user interface (GUI) that users interact with and has been designed and improved to provide a seamless, consistent user experience.

- Figure 2: Main Page Module
  The main page consists of system introduction and menu to access inventory, reporting and other modules.
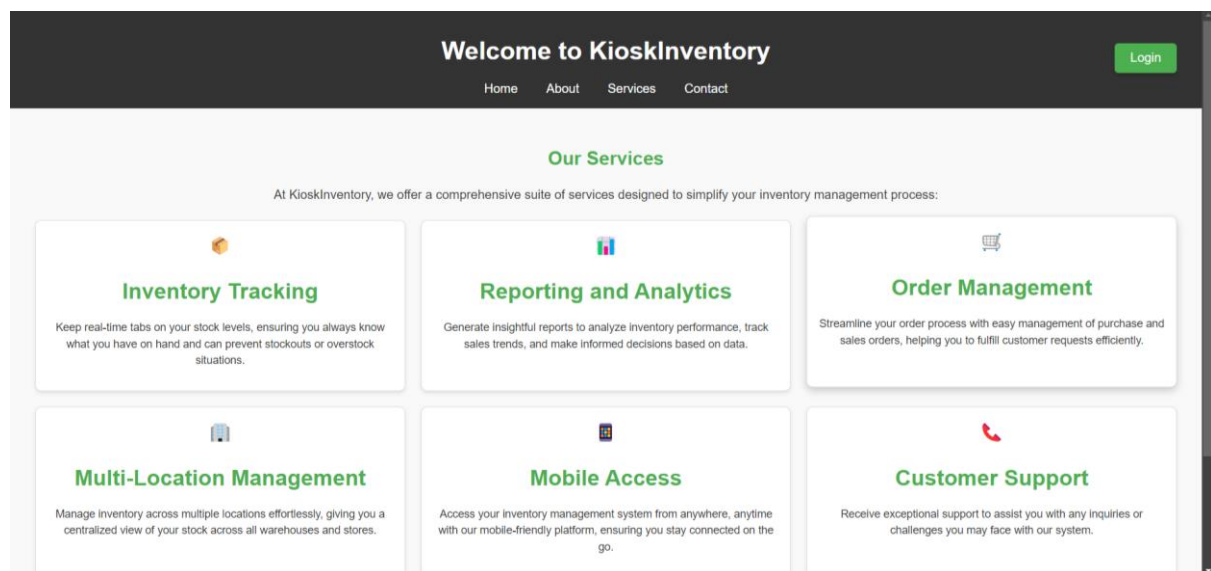

Figure 2: Main page

- Figure 3: Authentication Module
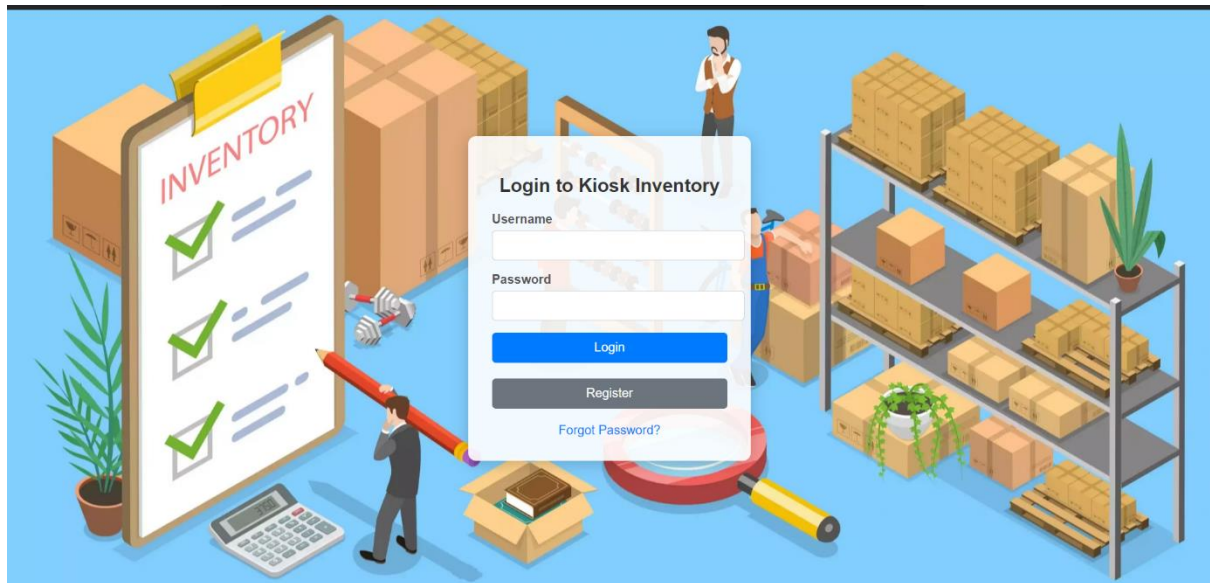 The system includes a login, registration, and password reset for user access control.

Figure 3: Login Page

- Figure 4: Inventory Management Module
  Interface for stocks operations where users can view, add, edit and delete product.

Figure 4: Inventory management module

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- Figure 5: Dashboard and Report Module
- The dashboard provides a view of total stock, sales, and commissions, while the system automatically generates daily PDF reports.
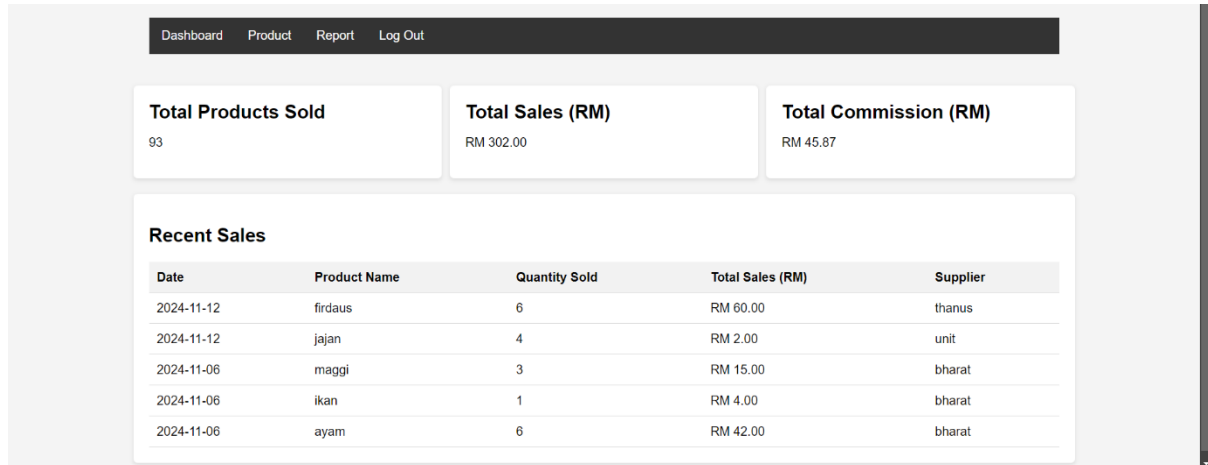

Figure 5: Dashboard and report module

3.2 Testing Outcomes

The testing of the system was completed at the JTMK Kiosk, Politeknik Ungku Omar, where the system was deployed under actual operational situations. 10 kiosk staff members, who are the end users, participated in the evaluation. During the testing, participants were instructed to complete daily inventory tasks such as adding new products, updating stock levels, recording sales, and generating reports. A structured Likert scale questionnaire has been designed to measure user opinions of usability, efficiency, and accuracy.

Three levels of testing were conducted:

- Table 1: Unit Testing
  Each component was tested individually for functionality. This phase was performed by the development team to ensure that every module worked correctly before integration.

Table 1: Unit testing

No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Sign Up	User provides necessary registration details and completes the sign-up process.	User must not be previously registered.	Notification of successful registration is displayed and user is redirected to the login page.	Bharatt	Pass
2	Login	User enters a non registered username, matric number, and password for validation.	User must have successfully registered (sign-up completed).	Page notification displays: "Incorrect username or password."	Bharatt	Pass
3	Forgot Password	User enters the registered username to request a password reset.	User must have completed sign-up and have valid login credentials in the system.	User is redirected to the password reset page and can set a new password for the given username.	Bharatt	Pass
4	About Us	User accesses the About Us page from the homepage.	None	Team details are displayed without glitches.	Bharatt	Pass
5	Contact Page	User accesses the Contact Us page and submits contact details to the support team.	None	User is redirected to Email for contacting the team.	Bharatt	Pass
6	Services Page	User accesses the Services page from the homepage.	None	Services information is displayed correctly without errors.	Bharatt	Pass

• Table 2: Integration Testing
System modules were tested together to ensure correct data flow. This testing was performed by the developers, who verified that the inventory, reporting, and dashboard modules interacted without data loss or inconsistency.

Table 2: Integration testing

No	Test Case Name	Test Procedure	Pre-Condition	Expected Result	Tester	Result (Pass/Fail)
1	Sign Up → Login Integration	User registers with valid details, then attempts to log in.	User is not previously registered.	User can successfully log in with the new credentials and is redirected to the dashboard.	Bharatt	Pass
2	Login → Dashboard Access	User logs in with valid credentials and attempts to access the dashboard.	User account exists with valid credentials.	Dashboard loads correctly, displaying user-specific interface and options.	Bharatt	Pass
3	Dashboard → Inventory Module	From the dashboard, user navigates to Inventory and adds product and sales data.	User is logged in and has dashboard access.	Inventory data is saved successfully and displayed correctly within the system.	Bharatt	Pass
4	Inventory → Report Module	User generates a report based on data entered in the Inventory (e.g., by product, date, dealer).	Inventory contains valid data.	Report is generated accurately, showing sales summary, commission, and product breakdown.	Bharatt	Pass
5	End-to-End Flow (Full System)	User signs up → logs in → accesses dashboard → enters sales in Inventory → generates report.	System is running with all modules enabled.	End-to-end process completes without errors, and reports reflect the entered sales correctly.	Bharatt	Pass

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- User Acceptance Testing

    User Acceptance Testing (UAT) was conducted to assess the system's functionality and usability from the perspective of actual end users. A total of ten respondents participated in the survey, representing users of the system. The collected data were analysed using descriptive statistical methods, including mean (average score), standard deviation (variability of responses), and the observed minimum and maximum scores for each statement.

Table 3: User Acceptance Testing (UAT) Survey Results

No	Survey Statement	Average	SD	Min	Max
1	The system is easy to learn and use.	4.3	0.95	3	5
2	I can complete inventory tasks faster with this system.	4.1	0.74	3	5
3	The system's layout and buttons are clearly organized.	3.8	0.92	3	5
4	I feel confident that the data shown is accurate.	4.4	0.70	3	5
5	I experience fewer errors compared to using Excel.	3.9	0.88	3	5
6	I am satisfied with the overall performance of the system.	4.2	0.67	3	5
7	The system helps reduce my workload.	4.1	0.83	3	5
8	I would recommend this system to other departments.	4.3	0.75	3	5

The results of the questionnaire are shown in Table 3. Overall, the responses are from very satisfied users. The component most highly rated was confidence in data accuracy (average score 4.4), followed by ease of use (4.3) and probability to recommend the information to someone else (4.3). Task efficiency (4.1) and workload reduction (4.1) were also rated high. The lowest average score (3.8) was in the category of visual layout, which suggested the need to optimize interface design. According to the UAT results, the system is considered functional by the target users. The feedback shows that the system fulfilled all the objectives.

4. Discussion

The successful development of the JTMK Kiosk Inventory Management System proved that a web-based system can be cost effective for tracking a small inventory. It solved the problem of manual inventory management, including data inaccuracy and inefficient data, which were raised by other studies, like Zoho Inventory (Ltd., n.d.) and QuickBooks Commerce (Yakal, n.d.). Though these commercial systems provide a variety of functionalities, their systems are complex and costly for small institutions. The JTMK Kiosk Inventory System is an efficient, user-friendly, affordable alternative that meets basic requirements.

The results show that a customizable inventory system would contribute to the improvement of operating performance, accuracy, and decision making for small businesses. Furthermore,

user acceptance testing has confirmed the importance of system usability as a determinant of overall success.

For future research and development, there is potential to expand the system with features such as:

- Mobile application integration.
- Predictive analytics for inventory forecasting
- Integration with barcode scanners or QR code systems

The improvements might extend the system value and application to a wide range of industries. Furthermore, future research may explore the long term effects of computerised inventory systems on business performance, such as cost reduction, customer satisfaction, and environmental sustainability.

5. Conclusion

The JTMK Kiosk Inventory Management System successfully achieved its objectives by providing a simple, cost effective, and user friendly solution to replace manual inventory tracking. It improved data accuracy, operational efficiency, and decision making, while user acceptance testing confirmed its usability and effectiveness over Excel based methods.

The main contributions of this study are: (i) the design and implementation of a low cost web based system tailored for small institutions, (ii) the application of Agile methodology to ensure adaptability and user-centered development, and (iii) the validation of system usability and efficiency through user acceptance testing.

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