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AN INVENTORY MANAGEMENT SYSTEM FOR SMALL BUSINESSES

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ABSTRACT

Effective inventory management is crucial for the success and profitability of small businesses, yet many struggle with outdated manual processes or overly complex systems that are not tailored to their needs. This study addressed this gap by developing a web-based inventory management system called "EzStock" specifically for small businesses. The system provides real-time visibility into inventory levels, automates key processes, and offers cross-platform accessibility. An Agile methodology guided the development process, with requirements gathered through surveys of 30 participants and a comprehensive literature review. The system was developed using web technologies, including HTML, CSS, JavaScript, and PHP, with a Mysql database backend. Key findings revealed high user satisfaction rates, with 93.3% of users expressing overall satisfaction with the system, 96.7% likelihood of recommendation, and 90% finding the user interface intuitive. The system significantly improved inventory management processes, data accuracy, and time savings. This study contributes an affordable, user-friendly solution that streamlines inventory management for small businesses, with identified areas for future development, including enhanced search functionality, improved reporting features, and product bundling capabilities.

Keywords: Inventory management, small business, web application, agile methodology, usability testing

INTRODUCTION

Inventory management is critical to supply chain management and overall business performance, especially for small businesses operating in increasingly complex global supply chains (Koh et al., 2006). Effectively integrating inventory systems with broader business processes can strengthen coordination and competitiveness. However, many small firms still fail to leverage technology in managing inventory flows, leading to inefficiencies and lost profits (Shah & Shin, 2007). Manual processes or basic spreadsheets leave gaps in visibility and accuracy.

While integrated ERP software provides broad functionality, it can be prohibitively expensive and complex for small businesses to implement (Svensson & Thoss, 2021). There is a clear need for purpose-built inventory management systems to help small businesses optimise stock levels, costs, and customer service (Esmail Mohamed, 2024). The approach taken in this project aligns with the contemporary understanding of inventory management concepts as outlined by Munyaka and Yadavalli (2022), who identified key implementation factors for successful inventory management systems in small business contexts.

Small businesses face several key challenges when it comes to inventory management. These include limited resources to implement and maintain complex systems, managing inventory across multiple sales channels, dealing with demand fluctuations, cash flow constraints, limited storage space, lack of real-time visibility into stock levels, and reliance on time-consuming and error-prone manual processes (Orobia et al., 2020; Tuan Mat et al., 2023). These challenges can significantly impact a small business's ability to operate efficiently and remain competitive in today's fast-paced market (Penelitian et al., 2023).

To address these challenges, this project aims to develop a web-based inventory management system tailored to small businesses. The system leverages modern web technologies to provide an affordable, user-friendly solution that can be accessed across devices. Key objectives include defining functional and non-functional requirements based on a comprehensive analysis of small business inventory management needs, developing a prototype web-based system that addresses core requirements, and evaluating usability and effectiveness through user testing and feedback from small business owners.

Using a cost-effective web-based model, the proposed system focused on essential inventory management capabilities. Key features are expected to include real-time inventory tracking across multiple sales channels, automated low stock alerts and reorder recommendations, essential demand forecasting and inventory optimisation, integration with common e-commerce platforms, mobile accessibility for on-the-go inventory management, customisable reporting and analytics, and a user-friendly interface designed for non-technical users. The system's capability to provide early alerts regarding low stock levels directly addresses one of the critical challenges Hasbullah et al. (2021) identified regarding material shortage management in small and medium enterprises.

The project followed an Agile development methodology, with iterative requirements gathering, prototyping, and user testing cycles. This approach allows for continuous refinement based on small business user feedback. Usability testing with actual small business owners will be a key component to ensure the final system effectively meets real-world needs.

By providing small businesses with an affordable, user-friendly inventory management system, this project aims to address a critical gap in the market. The potential impact includes helping small businesses reduce costs, improve cash flow, enhance customer satisfaction through better stock management, and ultimately drive growth and competitiveness in an increasingly complex business landscape. This system empowers

small firms to gain better control over inventory tracking, purchasing, warehousing and reporting - ultimately boosting their operational efficiency and profitability.

RELATED WORK

Several recent studies have explored various technological approaches to improve inventory management systems for small businesses. These works can be broadly categorised into mobile-based solutions, Iot-based systems, and cloud-integrated applications.

Patil et al. (2022) developed a mobile-based inventory management system using QR codes explicitly designed for small businesses. The system comprised an Android application capable of scanning QR codes attached to inventory items, providing instant access to product details, serial numbers, and service history stored in a centralised database. This approach successfully digitised inventory records, reducing paper waste and workforce requirements. However, the system faced challenges related to native app development, including cross-platform support issues and difficulties in scaling across multiple device types and operating systems. Additionally, the centralised database required manual updates, limiting its real-time capabilities.

Similarly, Gelogo and Kim (2014) presented a mobile application for enterprise inventory management using component-based development (CBD). Their system integrated, reused interface, database, and reporting components into a cohesive solution. The CBD methodology enabled efficient mobile software development, aiming to enhance workforce productivity through real-time inventory data access and transactions via mobile devices. Despite these advantages, the system encountered mobility and application management challenges across different devices.

Sampath Kumar et al. (2021) also focused on mobile solutions, developing an inventory management system tailored for small-scale businesses. Using a mobile phone, their application allowed inventory tracking and report generation, leveraging cloud computing for real-time data access and backup. The system offered additional features such as automatic profit/loss calculations and multi-user access. While this approach facilitated the digitisation of inventory records and improved accessibility for small businesses, it faced potential security and weak connectivity issues.

Mulay et al. (2020) demonstrated an IoT-based real-time food inventory tracking system. Their solution utilised load cells and sensors connected to a microcontroller and cloud platform to monitor weight and quantity data, generate reports, and analyse usage patterns. The system aimed to automate kitchen inventory management, providing low stock alerts and optimising procurement processes. Although it offered an affordable IoT solution for inventory visibility, the system faced sensor calibration and connectivity challenges.

Expanding on this concept, Choi et al. (2017) developed an IoT-based automatic inventory management system using Raspberry Pi and Arduino boards and various colour and ultrasonic sensors. This work aligned with Mulay et al.'s findings, further demonstrating the potential of IoT devices in automating inventory management tasks such as product identification, inventory level assessment, and storage allocation. The use of colour sensors for product classification provided additional evidence for the capabilities of IoT and sensor technologies in enabling automated inventory tracking.

The reviewed works highlight the diverse approaches to inventory management systems for small businesses, each with strengths and limitations. Mobile-based solutions offer accessibility and ease of use but may face challenges in cross-platform compatibility and real-time data updates. IoT-based systems provide automation and real-time tracking capabilities. However, they may encounter sensor calibration and connectivity issues and require specialised hardware knowledge, which is often unavailable in small business settings.

Furthermore, a critical literature analysis reveals several significant gaps that justify developing the proposed web-based inventory management system. First, most mobile solutions are platform-dependent, creating barriers for businesses utilising diverse devices. Second, while IoT solutions offer automation benefits, they typically require technical expertise for maintenance and troubleshooting—a resource often scarce in small business environments. Third, existing cloud-based solutions frequently lack comprehensive reporting and analytics features necessary for informed decision-making in inventory management.

Additionally, the literature indicates insufficient attention to user experience design specifically tailored to small business operators who may lack technical expertise. Svensson and Thoss (2021) noted that small businesses face unique implementation challenges with enterprise systems, including limited IT resources and training capabilities. This highlights the need for systems with intuitive interfaces and streamlined workflows explicitly designed for small business contexts.

The analysis also revealed that existing solutions rarely address the full spectrum of small business inventory needs within a single, accessible platform. Most systems excel in specific areas (e.g., tracking, ordering, or reporting) but fail to provide a holistic solution that integrates all essential inventory management functions. As Orobia et al. (2020) demonstrated, small businesses require comprehensive yet straightforward systems that support managerial competence across all inventory processes.

These findings underscore the need for a comprehensive solution that addresses the limitations of existing systems while leveraging the strengths of web-based technologies to provide an accessible, scalable, and real-time inventory management system specifically designed for small businesses. The proposed EzStock system aims to fill these gaps by providing a platform-agnostic, user-friendly solution that integrates essential inventory management functions without requiring specialised hardware or technical expertise, thereby meeting the unique needs of small business operators in today's competitive market environment.

METHODOLOGY

Figure 1

Agile Methodology

The methodology for this project followed an Agile approach with iterative cycles and continuous user collaboration (Omonije, 2024). This framework was well-suited for developing the Inventory Management System for Small Businesses called "EzStock", allowing for adaptive development based on user feedback. The Agile methodology was chosen for its flexibility and ability to respond quickly to changing requirements, which is particularly important in the dynamic field of small business inventory management. By breaking the project into smaller, manageable sprints, we delivered functional increments of the system regularly, allowing for frequent reassessment and adjustment. This iterative approach also facilitated the early detection of potential issues. It enabled us to incorporate user feedback throughout the development process, ensuring that the final product would closely align with the needs of small businesses. The Agile framework also promoted transparency and collaboration among team members, stakeholders, and end-users, fostering a shared understanding of project goals and progress, as illustrated in Figure 1.

Requirements Phase

The process began with the Requirements phase, where we gathered requirements through online surveys about small businesses and inventory management and a literature review of research publications and industry best practices. These requirements were formulated into user stories capturing the necessary features and functionality of the system. This phase also involved creating the project proposal and low-fidelity prototypes.

Design Phase

Following the gathering of requirements, we moved into the design phase. Here, we created high-fidelity user interface prototypes to create an intuitive and user-friendly design. The system architecture and database schema were also planned during this phase.

Development Phase

The Development phase involved constructing the front-end using HTML, CSS, and JavaScript to create a responsive and interactive user interface. The backend utilised a MySQL database to store inventory information, with PHP used to manipulate data and create APIs connecting the front and backend components. The system was developed as a web-based platform to provide greater accessibility and ease

of use without requiring specialised hardware or extensive IT infrastructure (Agboola et al., 2022). This approach aligns with contemporary inventory management system development trends prioritising cross-platform functionality and cloud-based data storage. Version control was implemented using Git and GitHub.

Testing Phase

Testing was ongoing throughout development, with unit testing at the code level to detect bugs early. More extensive system testing evaluated the full functionality and UI experience. The project timeline consisted of 2-week sprints, with user feedback on prototypes incorporated into subsequent sprints.

Field testing was conducted near the end of development. This involved a usability test with 30 participants, primarily small business owners and individuals involved in inventory management. Participants interacted with EzStock and completed a questionnaire assessing its usefulness, ease of use, and user satisfaction. This evaluation provided both quantitative and qualitative feedback to identify areas for improvement.

Deployment Phase

The Deployment phase marked the transition of EzStock from development to production. This critical stage involved completing all features, conducting final testing, and preparing comprehensive documentation. The deployment process was carefully managed to ensure a smooth transition for end-users. User training materials were developed to facilitate the adoption of the system. The actual deployment was controlled, likely starting with a small group of users before proceeding to a full rollout. Throughout this process, monitoring tools were implemented to track system performance and user interactions in the live environment. Support channels were established to address user queries and report unforeseen issues, ensuring a smooth transition for all stakeholders.

Review Phase

The Review phase commenced immediately after deployment and was designed as an ongoing process to ensure the continual improvement and relevance of EzStock. A multi-faceted approach to gathering user feedback was implemented, similar to the methods used in the field-testing phase. This included surveys, interviews, and analysis of system usage data. The feedback collected focused on the system's usefulness, ease of use, and user satisfaction, as well as identifying any areas for improvement.

Based on the insights gained from user feedback and emerging business needs, new features and improvements were prioritised for future iterations. This phase also involved long-term strategic planning, including developing a roadmap for future versions of EzStock and considering evolving business requirements. Through this continuous improvement cycle, EzStock remained adaptable and responsive to the changing needs of small businesses.

If users expressed dissatisfaction with any aspect of EzStock, they were encouraged to provide detailed feedback using the 'thumbs down' button feature. While not retaining information from the current conversation, this feedback mechanism allowed users to communicate their concerns directly to Anthropic for future improvements.

This approach ensured adequate time for detailed requirements analysis, proposal development, and system design, followed by iterative development incorporating user feedback. The result was a high-quality inventory management system tailored to the needs of small businesses.

ANALYSIS AND RESULTS

Analysis

The analysis phase for EzStock focused on evaluating the system's usefulness, ease of use, and overall user satisfaction. This process was critical in understanding how well the application meets the inventory management needs of small businesses and identifying areas for improvement.

Data Collection Methodology

Data was collected through various methods to ensure a comprehensive understanding of user interactions and experiences with the EzStock application:

1. Online Questionnaire: A Google Forms questionnaire was distributed to gather demographic information, user experience ratings, and feedback on the application's usefulness and usability. The questionnaire utilised a five-point Likert scale adapted from Davis' (1989) Technology Acceptance Model and Nielsen's (1993) usability metrics, with modifications to suit the specific context of inventory management systems.
2. Hands-on System Interaction Participants were allowed to use and interact with EzStock, completing tasks to experience its functionality firsthand.
3. Open-ended Feedback Qualitative feedback was collected through open-ended questions to identify positive aspects, areas for improvement, and suggestions for additional features.

Evaluation Criteria

The collected data was evaluated based on several criteria to gauge the application's performance:

1. Usefulness Metrics These metrics assessed how well EzStock met inventory management needs, saved time, provided accurate data, and improved overall inventory management processes.
2. Ease of Use Indicators: System navigation, feature labelling, data input ease, interface intuitiveness, and learning curve were evaluated.
3. User Satisfaction Scores Overall satisfaction, meeting expectations, system performance, feature quality, and likelihood of recommendation were measured.
4. Qualitative Feedback Analysis Open-ended responses were analysed to identify recurring themes in positive aspects, areas for improvement, and desired additional features.

Statistical Analysis

Quantitative data were analysed using descriptive statistics, primarily focusing on the distribution of responses across the five-point Likert scale for each evaluation criterion. Qualitative feedback was categorised and analysed for recurring themes and suggestions, providing a balanced view of user experiences and areas for improvement.

Results

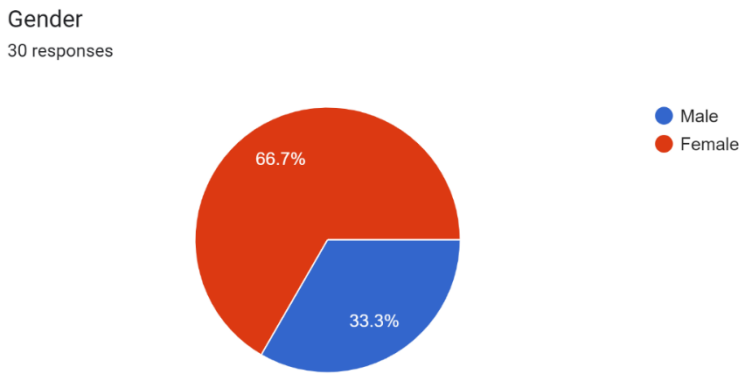
The results are presented objectively, answering the research questions in the project objectives without interpretation.

User Demographics

The demographic distribution of 30 respondents provided insights into EzStock's user base.

Figure 2

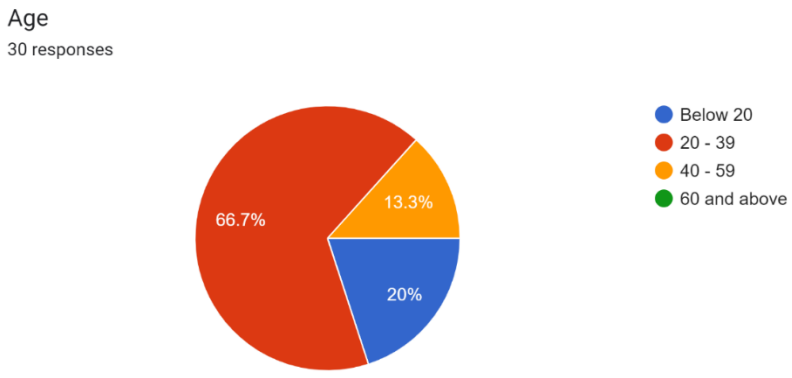
Distribution of Survey Respondents by Gender



Based on the demographic information provided, the evaluation of the EzStock inventory management system involved a diverse group of participants with some notable trends in their characteristics. The gender distribution of respondents, as shown in Figure 2, revealed a significant skew towards female participants, with 66.7% of respondents being women and 33.3% being men. This gender imbalance suggests that the evaluation feedback may represent female users' perspectives and experiences with the system.

Figure 3

Distribution of Survey Respondents by Age.

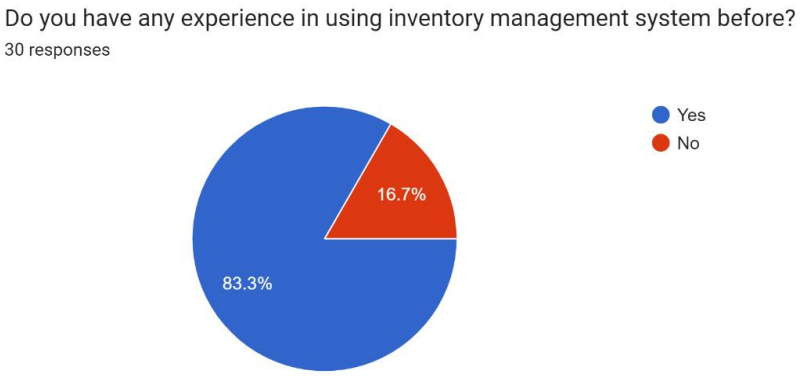


The age distribution of participants, illustrated in Figure 3, revealed that most respondents were young to middle-aged adults. A substantial 66.7% of participants fell within the 20-39 age range, indicating that the system was primarily evaluated by individuals likely to be actively engaged in professional work environments. The evaluation also included a notable proportion of younger users, with 20% of respondents under 20. This suggests that the EzStock system may have relevance or appeal to younger demographics, including students or young entrepreneurs. The remaining 13.3% of participants were

between 40 and 59 years old, providing some representation of more experienced professionals. Notably, there were no participants aged 60 or above, which indicates a potential gap in understanding how older users might interact with or perceive the system.

Figure 4

Distribution of Survey Respondents by Experience.



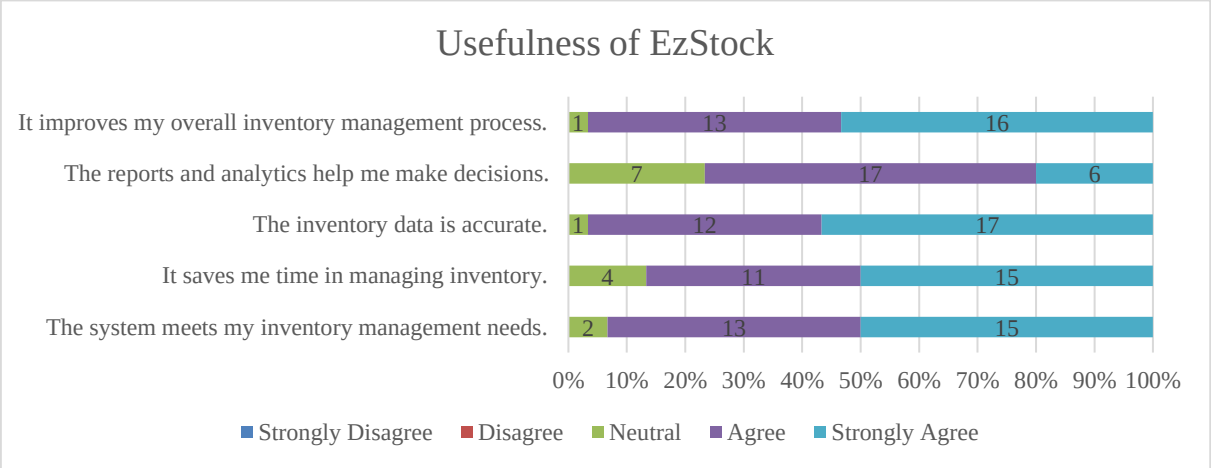
Regarding prior experience with inventory management systems, Figure 4 shows that the vast majority of participants (83.3%) reported having used such systems before. This high familiarity among respondents suggests that the feedback and evaluations were likely based on informed comparisons with other systems and a good understanding of inventory management needs. Including a smaller group (16.7%) of participants without prior experience ensures that the perspective of new users was also considered, albeit to a lesser extent. This experience distribution implies that the evaluation results may be particularly valuable in assessing how EzStock compares to existing solutions in the market but may be less representative of the experiences of complete novices to inventory management systems.

Overall, these demographic findings, as depicted in Figures 2, 3, and 4, provide important context for interpreting the usability and satisfaction results of the EzStock system. The evaluation feedback predominantly reflects the perspectives of young to middle-aged female users with significant prior experience in inventory management. While this aligns well with a likely target demographic for such a system, it also highlights potential areas for further investigation, particularly in understanding the system's appeal and usability for older users, male users, and those entirely new to inventory management software.

Usefulness of EzStock

Figure 5

Usefulness of EzStock.



The survey results in Figure 5 indicate that EzStock is highly regarded by users across multiple dimensions of inventory management usefulness. The system excels in improving overall inventory management processes and providing accurate data, with an overwhelming 96.7% of respondents agreeing or strongly agreeing on both these aspects. This suggests that EzStock is delivering on its core promise of enhancing inventory management efficiency and reliability.

The system also performs strongly in meeting users' inventory management needs, with 93.3% of respondents expressing or strongly agreeing. This high satisfaction rate implies that EzStock is well aligned with the requirements of its user base, offering features and functionality that address its specific inventory management challenges.

Time-saving capabilities are another notable strength of EzStock, as illustrated in Figure 5, with 86.7% of users agreeing or strongly agreeing that the system saves them time in managing inventory. This efficiency gain is crucial for businesses to streamline operations and allocate resources more effectively.

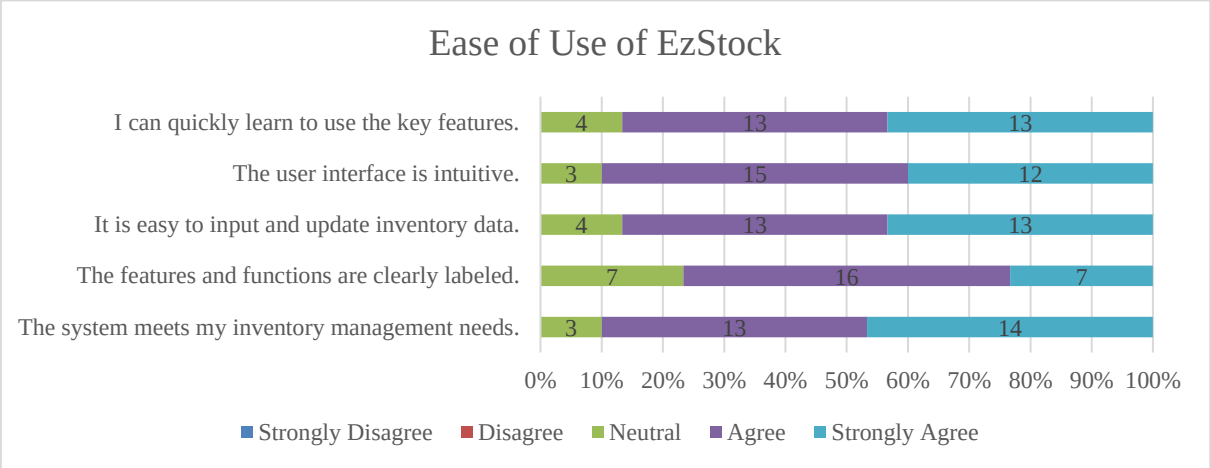
While still positive, the area with relatively lower enthusiasm was the helpfulness of reports and analytics for decision-making. Although 76.7% of respondents agreed or strongly agreed on this point, it represents the lowest agreement rate among the surveyed aspects. This suggests that while most find the reporting and analytics features useful, there might be room for improvement or expansion to support user decision-making processes better.

The results presented in Figure 5 paint a picture of EzStock as a beneficial and effective inventory management system. The consistently high agreement rates across all surveyed aspects indicate that users find significant value in the system's core functionalities, from data accuracy to process improvement. The strong positive feedback illustrated in Figure 5 suggests that EzStock is successfully meeting the needs of its users and delivering tangible benefits in inventory management efficiency and effectiveness.

Ease of Use of EzStock

Figure 6

Ease of Use of EzStock.



The survey results indicate that EzStock excels in user-friendliness and ease of operation. Notably, the system's navigability and interface intuitiveness received the highest marks, with 90% of respondents agreeing or strongly agreeing that the user interface is intuitive and that the system meets their inventory management needs. This suggests that EzStock has successfully created a design that aligns well with users' expectations and mental models of inventory management processes.

The ability to quickly learn key features is another strong point for EzStock, with 86.7% of users agreeing or strongly agreeing that they can rapidly familiarise themselves with the system's essential functions. This high percentage indicates that the learning curve for new users is relatively gentle, which can lead to faster adoption and implementation within organisations.

The ease of inputting and updating inventory data is equally impressive, garnering agreement from 86.7% of respondents. This suggests that EzStock has streamlined one of the most frequent and crucial tasks in inventory management, potentially saving users significant time and reducing errors in data entry.
While still positive, the clear labelling of features and functions received a slightly lower but substantial agreement rate of 76.7%. This indicates that while most users find the system's layout and nomenclature clear, certain features are more immediately identifiable or self-explanatory.

Overall, Figure 6 shows EzStock as a highly user-friendly inventory management system. The consistently high agreement rates across all surveyed aspects of ease of use indicate that users find the system intuitive, easy to learn, and efficient for key tasks. These results suggest that EzStock has successfully prioritised user experience in its design, which is crucial for ensuring widespread adoption and user satisfaction in inventory management software.

User Satisfaction with EzStock

Figure 7

User Satisfaction of EzStock.

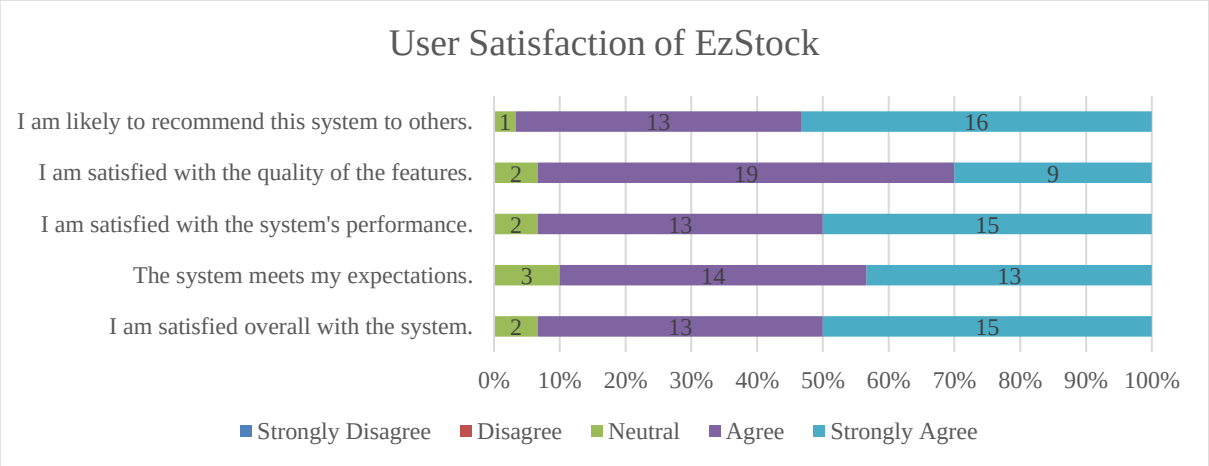


Figure 7 illustrates the User Satisfaction of EzStock, revealing consistently high satisfaction levels across multiple dimensions of the system's performance and features. The most striking result is the exceptionally high likelihood of users recommending EzStock to others, with 96.7% of respondents agreeing or strongly agreeing. This strong endorsement suggests that users find value in the system and perceive it as beneficial enough to advocate for its use among their peers or other businesses.

User satisfaction with the system's performance and overall satisfaction received positive responses, with 93.3% of users agreeing or strongly agreeing on these aspects. This indicates that EzStock is meeting or exceeding the operational needs of its users and providing a positive experience overall.

The quality of features also garnered high approval, with 93.3% of respondents expressing satisfaction. This suggests that the functionalities offered by EzStock are well-designed and effectively serve their intended purposes in inventory management. Slightly lower, but still impressively high, 90% of users agreed or strongly agreed that the system meets their expectations. This indicates that EzStock mainly delivers on its promises and aligns well with user anticipations of what an inventory management system should offer.

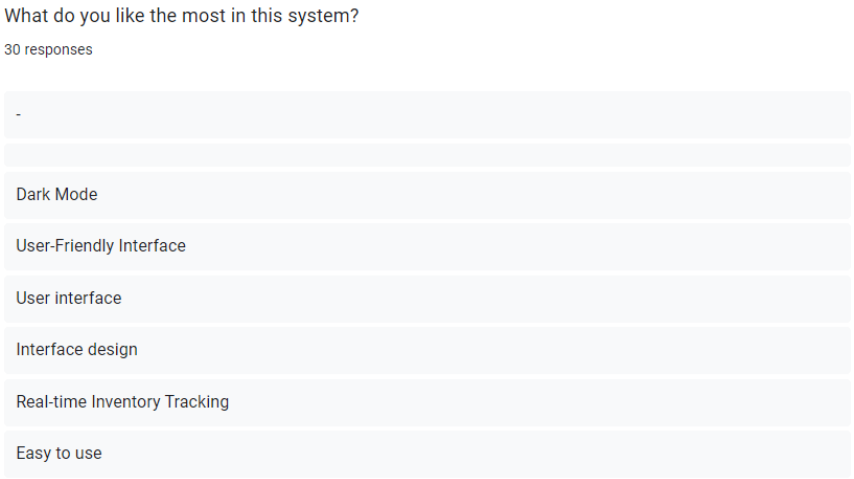
These results from Figure 7 paint a picture of a highly satisfying user experience with EzStock. The consistently high agreement rates across all surveyed aspects of user satisfaction indicate that the system is successfully meeting the needs and preferences of its user base. The extreme likelihood of recommendation suggests that EzStock has satisfied its current users and positioned itself for potential growth through positive word-of-mouth and user advocacy.

Qualitative Feedback

The qualitative feedback from open-ended responses provides valuable insights into users' experiences with EzStock, highlighting its strengths and potential improvement areas.

Figure 8

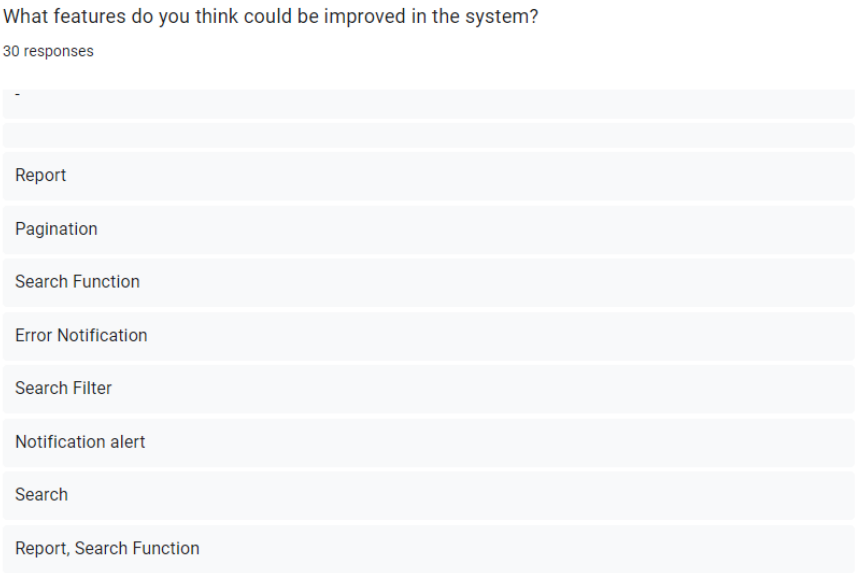
Positive Aspects of EzStock.



Users consistently praised several positive aspects of the system. The user-friendly interface emerged as a standout feature, aligning with the high satisfaction rates in the quantitative data. Real-time inventory tracking was another frequently mentioned benefit, suggesting that EzStock provides up-to-date and accurate inventory information. The overall ease of use was also a recurring theme, further reinforcing the system's strong performance in usability metrics.

Figure 8

Negative Aspects and Areas for Improvement of EzStock.



However, respondents also identified areas where EzStock could be enhanced. The search function was noted as needing improvement, indicating that users may sometimes struggle to locate specific items or information within the system quickly. Reporting features were another aspect highlighted for potential upgrades, corresponding with the slightly lower satisfaction rates for analytics and decision-making support seen in the quantitative data. Users also expressed a desire for consistent pagination across all

functions, suggesting that navigation within the system could be streamlined. Additionally, some respondents pointed out the need for better error handling and notifications, which could help users troubleshoot issues more efficiently and stay informed about system processes.

Figure 9

Suggestions for Additional Features of EzStock.

In terms of future development, users proposed several additional features that could augment EzStock's functionality. Product bundling capabilities were suggested, which could be particularly useful for businesses selling items in sets or packages. Another interesting proposal was the development of client-side components, which could improve system performance and offer more flexibility in how users interact with the software. These qualitative insights provide a nuanced understanding of user experiences with EzStock, complementing the quantitative data and offering clear directions for future improvements and feature additions.

CONCLUSION

The development and evaluation of EzStock, a web-based inventory management system tailored for small businesses, has yielded promising results. Through an Agile methodology approach, the project team created a system that effectively addresses small businesses' unique challenges in managing their inventory.

Analysing user feedback and system performance reveals that EzStock has successfully met its primary objectives. The system demonstrates high levels of usefulness, ease of use, and user satisfaction across various metrics. The system's strengths are particularly noteworthy in improving overall inventory management processes, providing accurate data, and offering an intuitive user interface. These features directly address the core needs of small businesses, enabling them to streamline their inventory operations efficiently.

The overwhelmingly positive response to EzStock, especially the high likelihood of users recommending the system to others, indicates that it has effectively filled a gap in the market for affordable, user-friendly inventory management solutions tailored to small businesses. The system's ability to save time, improve accuracy, and enhance decision-making processes through its reports and analytics features, albeit with room for improvement, demonstrates its potential to significantly impact small businesses' operational efficiency.

However, the evaluation also highlighted areas for future improvement and development. Enhancing the search functionality, refining reporting features, improving error handling, and adding capabilities like product bundling could increase the system's utility and user satisfaction. These insights provide a clear roadmap for future iterations of EzStock.

In conclusion, EzStock represents a significant step forward in providing small businesses with an accessible and effective tool for inventory management. Its success in meeting user needs while maintaining ease of use positions it as an asset for small businesses looking to optimise their inventory processes. As the system continues to evolve based on user feedback and technological advancements, it has the potential to play a crucial role in enhancing the competitiveness and operational efficiency of small businesses in an increasingly complex market environment.

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