Web-based Inventory Management System

Maredel T. Tanaman[1], Jhon Lloyd A. Baylosis[2], Bhrnt Joshua A. Abiles[3], Mark Lester P. Catungal[4],
Dr. Philipcris C. Encarnacion[5]
[1]Saint Columban College, Philippines, mttanaman.ccs@sccpag.edu.ph
[2]Saint Columban College, Philippines, jabaylosis.ccs@sccpag.edu.ph
[3]Saint Columban College, Philippines, baabiles.ccs@sccpag.edu.ph
[4]Saint Columban College, Philippines, marklestercatungal@sccpag.edu.ph
[5]Saint Columban College, Philippines, philcrisen@sccpag.edu.ph

ABSTRACT

This software project is a web-based inventory management system for a small business enterprise established in Pagadian City, Zamboanga del Sur, Philippines. It primarily supports the business owner of the said business enterprise to perform regular inventory management online through a web platform. This mechanism did not only improve the overall business process but also enabled the business owner to manage inventories with efficiency and convenience. The enterprise comprises four branches and a mobile store that strolls around the city to cater to customer needs. In addition, the current mechanism of conducting inventory management is purely manual through the use of paper files, which overwhelmed the business owner with several challenges, including data inaccuracy due to the reliance on using papers where data are recorded and process inefficiency due to the manual recording and distribution of inventory and sales reports. This software project addressed these challenges by eliminating these manual approaches through an automated computing solution using a web platform where data are electronically recorded and processed, and reports are electronically produced.

Key words: Web-based inventory management system, online inventory management system, inventory management system, inventory management

1. INTRODUCTION

The integration of information technology has become a crucial component in the daily operations of business establishments. Above all the many reasons, information technology has undeniably brought ease in conducting business processes or operations such as recruitment, marketing, and managing inventory by digitizing it. Inventory management involves supervising stock items and their flow from the manufacturers to the warehouse and the customer at the point of sale. Inventory management is vital because it keeps a detailed record of products from when they enter or leave a warehouse or at the point of sale [1]. Effective inventory management provides a tangible benefit to business owners as it leads to higher revenue and profits [2]. A business establishment in the locality of Pagadian City in the province of Zamboanga del Sur, Philippines, is currently managing its inventory through a manual system using paper forms. The establishment sells industrial, medicinal, and liquefied petroleum gas or LPG. Currently, it has four branches to cater to customer needs, with a mobile store that strolls around the city to sell the products and a warehouse where each store requests stocks.

The said paper forms are used to serve as inventory requests, and indicated therein are the items requested by the store branches, including its mobile store. The forms will be submitted by the staff to the warehouse for processing. The business owner is regularly confronted with data inaccuracy issues concerning inventory requests because paper forms are sometimes lost, torn, or contain inaccurate information due to the rotating work schedules of the employees, which means that several employees record data on the same paper form daily which is prone to recording incorrect or inaccurate data. In addition, the business owner also needs more efficient processing of producing an accurate sales report due to the manual system that the business owner uses when tracking and calculating sales data, primarily through a pen, paper, and spreadsheet application. Lastly, the business owner needs a more convenient experience and a real-time view of the entire inventory management status, including information about daily sales, because of the manual design of the process. This situation led to designing and developing a web-based inventory management system for the said business establishment.

Most establishments have always practiced a manual inventory management system and always have inefficiency issues. Due to this, a digitized inventory management system is ideal as it transforms the manual method into a convenient and more efficient system [3]. Digitalization is the integration of digital technology into an establishment's operations, such as inventory management, to significantly change the way of doing the process [4]. Manually managing the inventory results in issues like unrecorded items sold, mismanagement, overstocks, and even understocks [5]. The wide array of technological innovations useful in recording inventories is necessary, mainly if the process is manually performed to

ensure accuracy in recording incoming and outgoing goods, which often happens [6]. After all, inventory management nowadays is integrated with an information system to quickly and accurately assist in managing inventory [7].

Various software projects to effectively and efficiently manage inventory have already been developed. Although these projects are not necessarily used in the same context, they have the same goal. Oluwapelumi [8] developed an inventory system that will be used to record day-to-day activities in the context of an industry or an institution. This system can also manage supply and sales activities, document inventories, and store the results in a database. Misu [9] also developed a web-based application that manages the stocks of an organization, stores the details of the purchases, adjustments, bookings, and sales, and generates a report based on a criterion. In particular, this software project is a web-based system that runs online and requires that the business owner perform inventory management online by connecting to the Internet. Agboola et al. [10] developed a web-based platform for automating inventory management of a small and medium enterprises to help storekeepers make decisions about their stocks and reduce unnecessary stress brought by a manual system, keep the account current, and simplify the entire inventory management process. Another online inventory management system was developed by Johari & Aziz [11], which is specifically an IoT-based system for a small business to generate stock counts while being accessible online automatically. In addition, it also notifies the system users of stocks running low. Lastly, Andriani & Andry [12] also designed a web-based inventory application for a steel company to improve its inventory management performance, particularly in managing inventory data in the warehouse, the incoming goods, outgoing goods, goods returned, and printing reports.

Specifically, this software development dealt with the following concerns:
1. How may the Web-based Inventory Management System be developed using Waterfall Model and IEEE Recommendation:
    1.1 Requirements Specification;
    1.2 Planning
    1.3 Designing;
    1.4 Development/Implementation;
    1.5 Testing;
    1.6 Deployment;
    1.7 Maintenance;
2. How may the Web-based Inventory Management System be evaluated by the IT Experts and End-Users in Improving a Business through a Web-Based Inventory Management System based on the following attributes or criteria as:
    2.1 Functional Suitability;
    2.2 Performance Efficiency;
    2.3 Compatibility;
    2.4 Usability;
    2.5 Reliability;
    2.6 Security;
    2.7 Maintainability;
    2.8 Portability;

2. METHODOLOGY
2.1 Research Design

The entire software development process follows the IEEE or Institute of Electrical and Electronics Engineers Recommendation in software engineering. The software developers also adopted the Waterfall Model in terms of software development model. The Waterfall Model has been adapted as a research design methodology because of its systematic approach. This model portrays a sequential or linear progression through different phases, making it look like a cascading waterfall, meaning that a phase will begin when a previous one is completed. This further means that the phases do not overlap. Generally, the phases involved in this model are Requirements Specification, Planning, Design, Development or Implementation, Testing, Deployment, and Maintenance.

The IEEE Recommendation, on the other hand, is a set of standards and best practices established by the Institute of Electrical and Electronics Engineers for the development, documentation, and maintenance of software projects. These recommendations cover various aspects of software engineering, including requirements analysis, design, coding, testing, and documentation. By adhering to IEEE guidelines, software developers ensure that their projects are developed with a high level of quality, reliability, and maintainability. These guidelines make it easier for different teams to collaborate and understand each other's work. Additionally, following IEEE recommendations in software engineering enhances software products' credibility and trustworthiness, benefiting developers and end-users alike.

2. RESULTS

1. Design and Development of Web-based Inventory Management System
This Web-based Inventory Management System was successfully developed by adopting the Waterfall Software Development Model and the IEEE Recommendation in Software Engineering. The phases involved in the entire development process are outlined and discussed below.
1.1 *Requirements Specification*
This phase played an essential role in the development of this software project. Requirements Specification defines and documents the functional and non-functional requirements that any system must accomplish to meet the client's needs and expectations. It was during this phase that the developers performed data gathering from the intended end-users, who are composed of the business owner and the employees of a small business establishment in the locality of Pagadian City, Zamboanga del Sur, Philippines, concerning the entire process of inventory management and the issues and challenges that business owner experienced. The gathered data were used as the basis for the succeeding phases.

1.2 Planning

The planning phase has been fundamental in the entire development process. In this phase, project objectives, requirements, resources, and constraints were further defined and organized to ensure the successful execution of the software project. In this phase, the developers prepared a comprehensive plan that served as a guide throughout the project. This plan also served as a blueprint outlining the steps, resources to be used, and potential risks to be managed. Changes have occurred during the development process. Hence, reviews and updates were essential in accommodating new requirements during the software development.

1.3 Designing

This phase was also another crucial phase in the software development process because it transformed the requirements gathered in the earlier phases into a detailed design that produced a new blueprint as the development of a software system continued. This system is a web-based application that supports the business owner in conducting inventory management online. The system was also designed to produce accurate sales reports.

a. Technical Specification

This web-based online system is mainly a website that allows the business owner to manage inventories and produce a sales report. The required hardware is a PC, and Internet connectivity must be available. The following technologies serve as the building blocks of the web-based online system:

- HTML5
- PHP
- Bootstrap
- JavaScript
- MySQL

b. Use Case Diagram

A use case diagram visually represents the functional requirements and the interactions of a system from the perspective of the end users, which means that it shows what the end users can do while using the system. Its primary purpose is to provide a clear overview of how the end-users interact with the system.
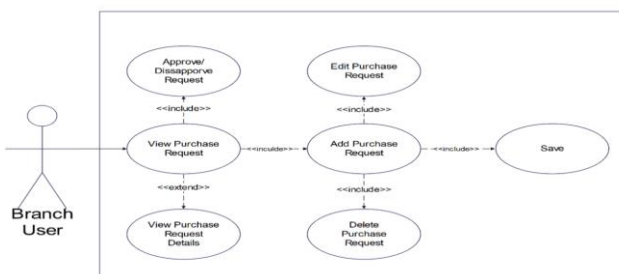

Figure 1: Use Case Diagram of the Web-based System for Ordering per Branch

Figure 1 shows the functional requirement and the interactions between the end-user and the system from the perspective of the end users by showing that an employee from a branch can request new stocks whenever needed as part of inventory management.
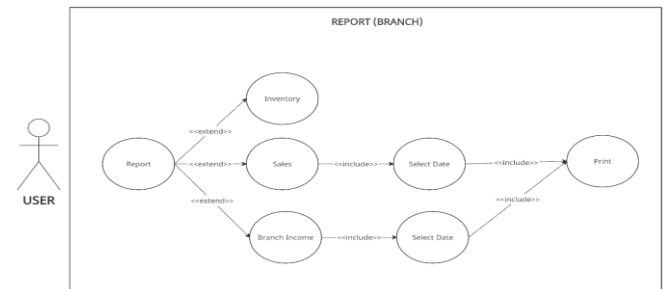

Figure 2. Use Case Diagram of the Web-based System for Viewing Reports

Figure 2 shows the functional requirement and the interactions between the end-user and the system from the perspective of the end users by showing that an employee can produce a report based on a criterion.

c. Interface Design

A system's interface design refers to the graphical user interface (GUI) that users interact with to perform relevant tasks or to access system functionalities. The design provides users a seamless and efficient experience while interacting with the system.
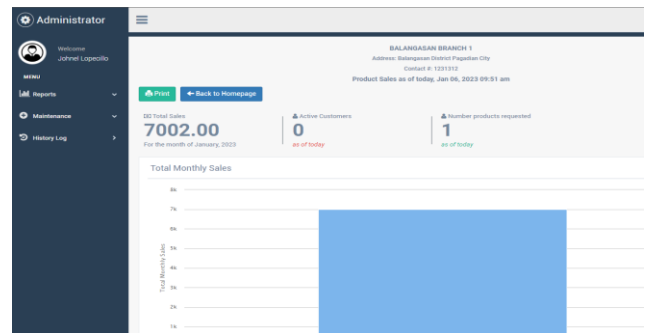

Figure 3: Report Interface per Branch

Figure 3 shows the interface of a sample sales report based on a chosen branch where the business owner can see an update about the report automatically.
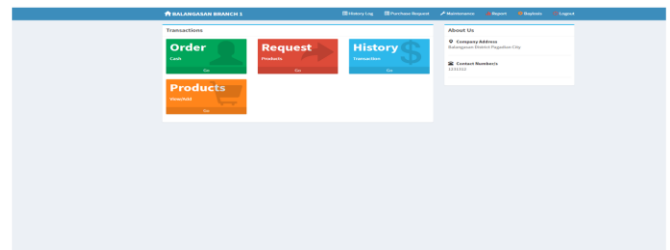

Figure 4: Dashboard Interface of the Web-based System

Figure 4 shows the dashboard interface of the Web-based Inventory Management System. Through this interface, the business owner and the employees can perform processes.
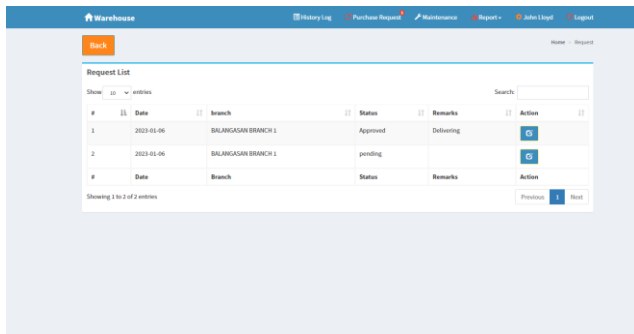

Figure 5: Warehouse Purchase Request Interface

Figure 5 shows the interface of purchasing from the warehouse as part of the inventory management.

1.4 Development/Implementation

The actual development, which requires software coding, occurs in this phase. The planning and design phases were critical steps because this phase used it as the primary basis. The developers wrote the code based on the detailed design specifications defined in the previous phase. Hence, this is the actual implementation of the outlined functionalities and features of the system. As already specified, this system is a web-based application, and technologies like HTML5, PHP, MySQL, JavaScript, and Bootstrap as the underlying building blocks of the system are involved.

1.5 Testing

This phase ensures that the system adheres to the requirements specified in the planning phase. Software testing is performed in other phases to regularly identify and manage issues to ensure the software meets the desired quality standards. The testing for the functional requirements yielded an overall positive and acceptable result. The system has improved business operations by providing real-time visibility into inventory levels, reducing stockouts, and optimizing supply chain management. The software developers conducted user acceptance and system testing with the business owner, the client of this software project, to evaluate the usability and functionality of the system.

1.6 Deployment

Deployment is the development phase that prepares the system to be integrated into the client's environment or the end-users to become ready and available. Deployment is also a critical step in the system development life cycle as it requires planning, constant coordination with the client, and further testing to ensure its successful use. After the testing phase, specific considerations had already been considered so the system would be successfully integrated into business operations. The client has already accepted the system and is already integrating it into the establishment's operations.

1.7 Maintenance

This phase refers to continuously managing the system's performance and functionality throughout its operation. It is also a crucial aspect of the system because it ensures it will continuously perform. The software developers of this project had implemented a maintenance plan to ensure the continued performance and availability of the system.

3. IT Experts Evaluation of Web-based Inventory Management System

- *The system was given an evaluation score of 4.61 based on the functionality suitability of its features (Highly Functional).*
- *According to its performance efficiency, the system has received an evaluation score of 4.60 (Highly Efficient).*
- *The system's evaluation score, as measured by its compatibility, is 4.57 (Highly Compatible).*
- *According to its usability, the system has received an evaluation score of 4.73 (Highly Usable).*
- *The system achieved an evaluation score of 4.63 regarding its reliability (Highly Reliable).*
- *The security aspect of the system has received an evaluation score of 4.63 (Secure).*
- *According to its maintainability, the system has achieved an evaluation score of 4.58 (Highly Maintainable).*
- *The system has received an evaluation score of 4.57 based on its portability (Highly Portable).*

End-Users Evaluation of Web-based Inventory Management System

- *According to the user evaluation, the system attained an evaluation score of 4.44 based on the functionality suitability of its features (Highly Functional).*
- *According to the evaluation conducted by the users, the system has received an evaluation score of 4.34 in terms of its performance efficiency (Highly Efficient).*
- *The system's compatibility evaluation score was 4.35 based on user evaluations (Highly Compatible).*
- *The system has been evaluated with a score of 4.43 based on its usability (Highly Usable).*

4. CONCLUSION

The results led to the following conclusions:

1. The web-based inventory management system was evaluated by both IT experts and end-users for system testing.
2. The user evaluation found the system to be highly functional (4.44), efficient (4.34), compatible (4.35), and usable (4.43).

3. The IT expert evaluation found the system to be highly functional (4.61), efficient (4.60), compatible (4.57), usable (4.73), reliable (4.63), secure (4.63), maintainable (4.58), and portable (4.57).

4. Overall, the system received high evaluation scores from users and IT experts, indicating it is a highly functional, efficient, compatible, usable, reliable, secure, maintainable, and portable system that has passed system testing.

5. The system has the potential to significantly improve business operations by providing users with a powerful tool for managing and monitoring inventory and making data-driven decisions.

6. Future work could focus on addressing the feedback related to UI and security and further improving the system's performance.

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