

Streamlining Inventory Management with QR Technology: Introducing the Supply and Equipment Tracking System

^[1]Noe Jhon N. Sionillo, ^[2]Dr. Renante A. Diamante*

^[1] Professor, West Visayas State University, Lambunao Campus, Lambunao, Iloilo, Philippines

^[2] Iloilo State University of Fisheries Science and Technology, Poblacion, Barotac Nuevo, Iloilo, Philippines
Corresponding Author Email: ^[1] noejohn.sionillo@wvsu.edu.ph, ^[2] rdiamantetip@gmail.com

Abstract— This abstract explores the critical role of inventory management and the transformative impact of information technology on optimizing operations across various industries. As we delve into the digital age, the integration of modern technologies, such as computerized Inventory Systems, has revolutionized the way organization's function, delivering cost reductions, real-time reporting, and fortified data security. In this context, our study introduces an innovative automated system designed to revolutionize how to manages its supplies and equipment, ultimately leading to enhanced efficiency, accuracy, and process streamlining. One of the noteworthy aspects of this system's design is the incorporation of QR code technology into the inventory process. QR codes offer a powerful solution to the inventory tracking dilemma. These two-dimensional barcodes provide an efficient and reliable means to store, retrieve, and transmit a wealth of information regarding inventory items. Embracing automation and the advanced capabilities offered by QR code technology. This integration resulted a more reliable, accurate, and secure information system for their daily operations, aligning the institution with the forefront of technological advancements.

Keywords— QR Code, Tracking System, Supply, Inventory Management.

I. INTRODUCTION

Inventory management is very helpful for various industries as it reduces the manual work, time required, and it handles various data that include serial number, cost of products, quantity of products and helps to keep track of these data throughout the process [1]. The positive impact of information technology is to provide convenience and speed in obtaining information, delivering information, and making it easier to complete tasks or work [2]. One of the more popular computerized technologies most used in offices and institutions nowadays are Inventory Systems.

Look around the world we live in today. It's filled with different technologically convoluted devices. In the rapid development of technology in the 4.0 era, it makes us to continue to innovate in technological progress [3]. Most of the organizations have a separate department or job function called inventory planners who continuously monitor, control and review inventory and interface with production, procurement, and finance departments [4].

The symbol known as a Quick Response (QR) code is a two dimensional (matrix) that was introduced in 1994, initially to track parts used in automobile manufacturing in Denso Wave - one of Japan's Toyota group of companies [5]. The use of QR code technology in inventory management allows for the digitalization and automation of asset tracking processes. In additions, QR code inventory management software helps avoid overstocking, understocking, and duplication errors [6]. Many items grouped into a PP&E class are assigned the same useful life for depreciation purposes

[7].

It is this paradoxical situation that makes inventory management a challenging problem area in materials management. It also makes a high inventory turnover ratio as a desirable performance indicator [8]. Likewise, the computerized inventory system improves accuracy through an inventory database. We can conclude that "A QR Code Technology for Centralized Inventory management system" will contribute towards digital and go green movements.

This study aimed to develop a system that automate the transactions inside the supply office. The proposed system was utilized specific technology and developed software intended to address the needs for proper recording of PPEs under the custody of the property custodian or the supply officer. The new system reduced, if not eliminate, the redundancy of recording the acquired assets. It will aid the supply officer to monitor the property in the least possible time. The study also minimizes the time consumed by the personnel involved in the conduct of physical counting of the said properties.

II. METHODOLOGY

The output of the system study is the Supply and Equipment Tracking System for enhancing inventory management. The system is designed to address the deficiencies of the current system for monitoring the supply and equipment.

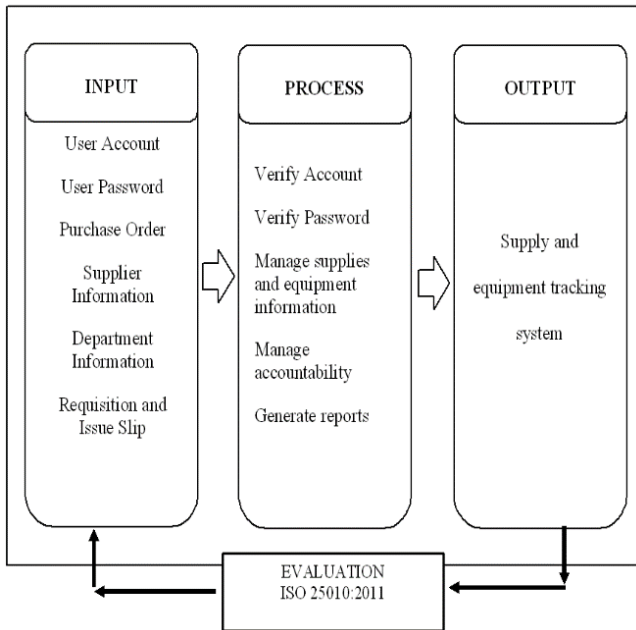


Figure 1. The conceptual framework of Supply and Equipment Tracking System.

The concept of the study shows in Figure 1 focuses on how users interact with the proposed system to manage the inventory of supply and equipment. With the Purchase Order (PO) and supplier's information as inputs, the system is expected to execute automated processes such as a) manage user accounts, b) manage information on equipment and supplies, c) manage accountability of supplies and equipment, and d) generate reports. The system uses the Input-Process-Output framework for its development. Input items are data sets on supplies and equipment and suppliers' information. After the input and processing stages are in place, the system is expected to function as designed.

Development Process

This research is anchored on System Development Life Cycle, which supports system development methodologies such as the Waterfall Approach, Prototyping Approach, Incremental Approach, Spiral Approach and Rapid Application Development (RAD) Approach. This research used the Agile Approach.

Meet

The researchers met with the end-user, the Supply Officer, to discuss the perspective of the proposed system and its underlying functions. During these meetings, the researchers diligently took notes, focusing on gathering information about the necessity of the system, the encountered problems, and the end-user's suggestions to enhance the system's efficiency and effectiveness.

Plan

The researchers carefully planned and consolidated the gathered data to produce an output that provides relevant and

valuable information tailored to meet the needs of the end users within the institution. The primary objective was to create a system that would significantly enhance the efficiency and effectiveness of the supply officer's tasks, particularly in recording and managing inventory items. To achieve this goal, the researchers began by mapping out the initial steps of the system design, which involved identifying the tasks performed by the user.

Design

During this phase, the researchers initiate the analysis and design process for the proposed system. The focus shifts towards crafting the potential outputs and functionalities of the system. Meanwhile, the programmers take charge of designing and developing a web application, leveraging the capabilities of React.JS and Node.JS for software development. In addition, PostgreSQL is chosen as the database management system to efficiently store and manage project data.

Develop

In this phase, the programmer continues to make progress on the tasks using Visual Studio Code as the software development environment. The development process for this project was carefully structured, commencing with the creation of the database. Following this foundational step, the focus shifted towards front-end development, using React.js for crafting user interfaces and Bootstrap to ensure responsive and visually appealing designs across various devices.

Test

In this phase, the researcher/programmer conducted preliminary testing to assess the system's capability in delivering the desired results based on the specified design and provided data. Multiple iterations of testing were performed to ensure the system's smooth operation and error-free performance. The White Box Testing method is a software testing method in which the internal structure/design/implementation of the item being tested is known/to the tester (*softwaretestingfundamentals.com*). The tests were done a considerable number of times to ensure that the system will run smoothly and free of errors.

Evaluate

The system underwent a performance assessment to gauge its readiness for implementation. Sixteen (16) identified users served as evaluators, including three (3) Staff of the Supply Office, ten (10) Faculty, and three (3) IT experts. The evaluators' feedback and insights were collected to comprehensively assess the system's functionality, usability, and overall performance.

III. RESULTS AND DISCUSSION

Develop a comprehensive database structure to efficiently store and organize supply and equipment information.

In 2, the database showcases comprehensive information about the supply and equipment. It includes details such as the item's Name, Category, Quantity Received, the Department or Employee who requested it, Price, Supplier Name, and the Fund utilized for the procurement.

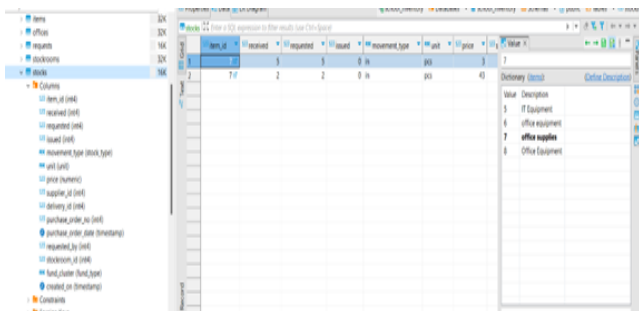


Figure 2. Shows the information of the supply and equipment on the database.

In Figure 3, the QR codes are generated using Node.JS and React.JS, providing a powerful tool for scanning and tracking equipment. These QR codes enable easy monitoring of equipment locations, significantly reducing the time and effort required for manual recording during inventory management. The system's ability to generate and scan QR codes streamlines the process of recording and updating equipment information, enhancing accuracy and efficiency in maintaining the inventory database.

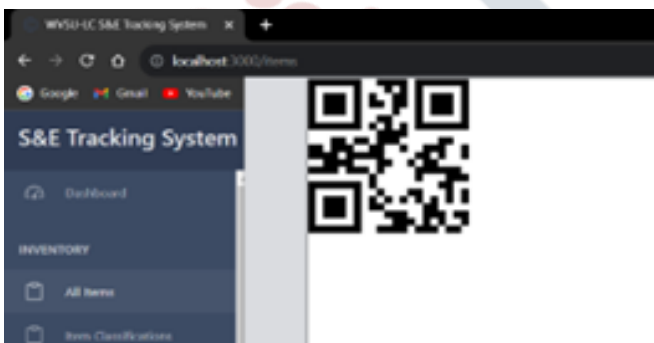


Figure 3. Shows the generation and scanning of QR codes on the equipment.

In Figure 4, the system demonstrates its versatile reporting capabilities, allowing the generation of various essential reports. These reports include the Report of Supplies and Materials Issued, Report on the Physical Count of Inventories, and the Report of Semi-Expendable Property Issued. Additionally, the system can generate Inspection and Acceptance Reports, Property Cards, Inventory Custodian Slips, and Inventory Count Forms that are designed in compliance with the Commission on Audit (COA) Government Accounting Manual (GAM) Forms. With this

extensive range of report options, the system provides comprehensive insights into supply and equipment management, facilitating better decision-making and resource allocation. The ability to export these reports in Excel format ensures convenient access and seamless sharing of information, empowering users to effectively utilize the data for analysis and planning purposes.

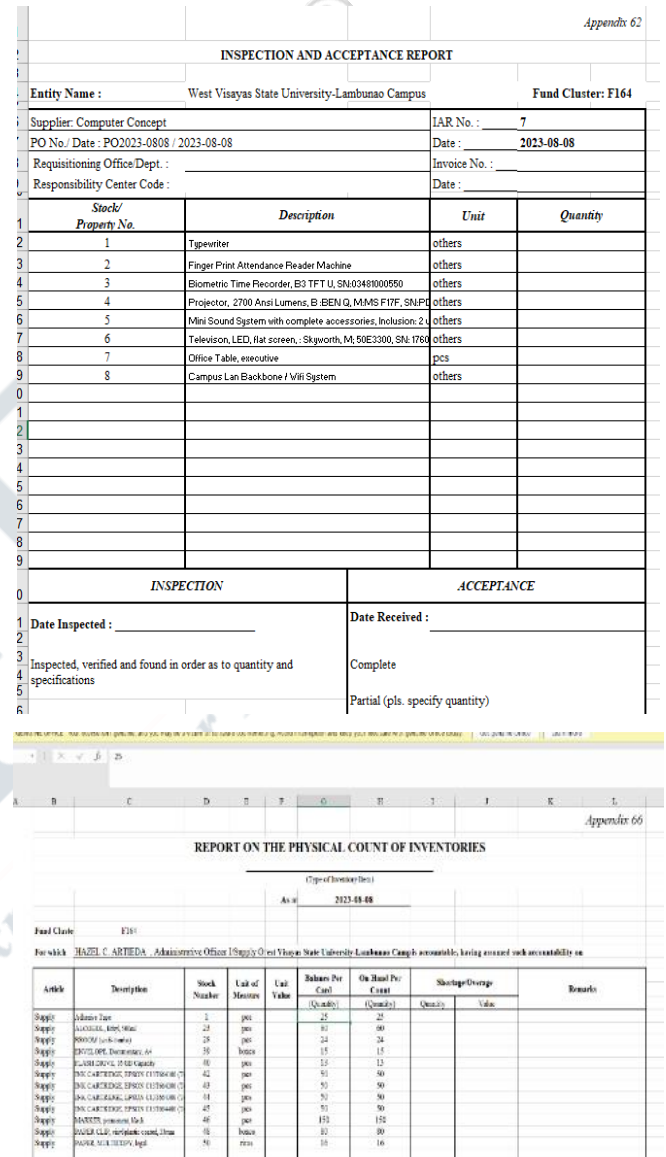


Figure 4. Shows the generation of inventory reports.

In Figure 5, the system utilizes Chart.JS to present graphical representations of data. The graphs depict valuable insights into the most requested supplies or equipment within the institution. Through visualizations, users can easily grasp patterns, trends, and popular items, enabling informed decision-making and resource allocation. The use of Chart.JS enhances the system's reporting capabilities, offering a visually appealing and interactive approach to understanding supply and equipment demand. This feature empowers administrators and stakeholders to efficiently manage

inventory levels and prioritize procurement based on real-time data analysis.

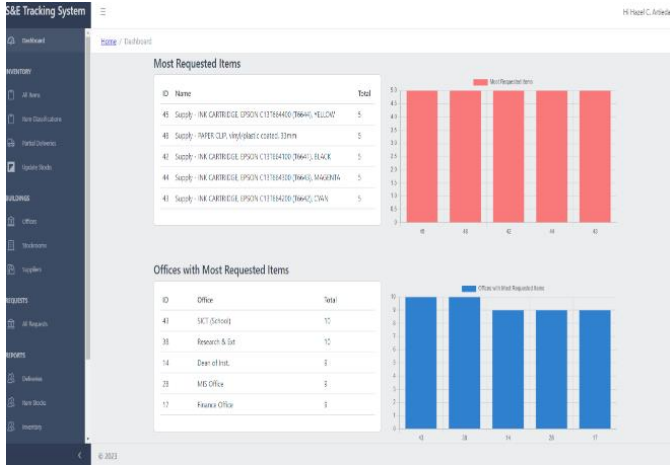


Figure 5 Shows the graphs generated by the Chart.JS that depicts the supplies and equipment mostly requested.

Table 1. Summary of Over-all Evaluation Results.

ISO 25010 Criteria	Mean	Interpretation
Functional Suitability	4.57	Excellent
Performance Efficiency	4.48	Excellent
Compatibility	4.52	Excellent
Usability	4.59	Excellent
Reliability	4.57	Excellent
Security	4.49	Very Good
Maintainability	4.63	Excellent
Over-all Mean	4.55	Excellent

Table 1 shows the results of assessment involved three (3) Supply Officer/Staff, ten (10) faculty members, and three (3) IT experts. As illustrated in Table 1, the findings resoundingly confirm the Supply and Equipment Tracking System's attainment of an "Excellent" quality status based on ISO 25010 standards. Collectively, it secures an "Excellent" ranking in functional suitability (M=4.57), performance efficiency (M=4.48), compatibility (M=4.52), usability (M=4.59), reliability (M=4.57), security (M=4.49), and maintainability (M=4.63).

With a comprehensive grand mean of 4.55, these results substantiate the system's adherence to the International Standard specified by ISO.

IV. CONCLUSION AND RECOMMENDATIONS

Conclusions

1. The finalized program, known as the Supply and Equipment Tracking System, successfully established a comprehensive database structure to efficiently store and organize information related to supplies and equipment.

2. The completed Supply and Equipment Tracking System demonstrated an efficient capability to generate QR codes.
3. The developed Supply and Equipment Tracking System was equipped to generate inventory reports that adhered to the standards set by the Commission on Audit (COA).
4. The completed Supply and Equipment Tracking System featured the capability to present dynamic and interactive data visualization.
5. By leveraging the AGILE methodology and utilizing the ISO 25010:2011 Software Quality Model as a foundation for development and evaluation, the system achieved its objectives, as evidenced by the results of testing and evaluation conducted by both users and IT experts.
6. The developed Supply and Equipment Tracking System is secure and user-friendly, enabling efficient and effective management of Supply Office transactions, regardless of internet connectivity.

Recommendations

1. It is essential to provide training to the actual users of the Supply and Equipment Tracking System, including the Supply Office, Faculty, and Staff, to ensure they can operate and utilize the system safely and effectively.
2. To ensure seamless operation and maximum benefit for employees and the institution, the Campus management and administration should commit to regular support and maintenance of the Supply and Equipment Tracking System.
3. For future researchers exploring similar areas, there is an opportunity to develop innovative software programs focused on school record management or to enhance projects by creating mobile applications.
4. Developers can consider enhancing the system by introducing an upgraded version that allows for electronic document submission with electronic signatures, streamlining administrative processes.
5. Other tertiary educational institutions are strongly encouraged to consider implementing the developed Supply and Equipment Tracking System, as it offers valuable features that can enable their supply officers, staff, and faculty to manage supply and equipment monitoring with greater efficiency and effectiveness.

V. ACKNOWLEDGEMENT

The researchers extends profound appreciation to the Office of the President at Iloilo State University of Fisheries Science and Technology and the Office of the Campus Administrator at West Visayas State University-Lambunao Campus for their invaluable authorization to embark on this research endeavor. Equally, the researcher acknowledges the crucial participation and cooperation of the end-users of the proposed system, the Supply Office of WVSU-Lambunao Campus, as vital contributors to the project's ultimate fruition.

REFERENCES

- [1] Harika, B., Maduri, P. & Dr. Mehta, R. V. K.,(2021). *Automatic Smart Inventory Asset Management System (IRJET)*, 1, 2413-2416.
- [2] Mudiar, W., & Hidayat, U. (2019). *Sistem Informasi Manajemen Asset Berbasis Web Pada Perbanas Institute. Information Management For Educators And Professionals*, Vol. 4(1), 41 - 50.
- [3] Ariawan, M. D., Triayudi, A., & Sholihati, I. D. (2020, January). *Perancangan User Interface Design dan User Experience Mobile*. *Jurnal Media Informatika Budidarma*, 4(1), 160-166.
- [4] Samanta, P. (2015). *Introduction To Inventory Management*. 10.13140/RG.2.2.14914.99522.
- [5] Brindha, G. & Gopikaarani, N. (2014). *Secure banking using QR code*.
- [6] Rose. (2022, April 15). *QR Code Inventory Management Software*. Tool Tracking Software. <https://gocodes.com/qr-code-inventory-management-software/>
- [7] Bragg, S. (2023). Property, plant, and equipment definition — AccountingTools. *AccountingTools*. <https://www.accountingtools.com/articles/property-plant-and-equipment>
- [8] Vrat, P. (2014). *Materials Management: An Integrated Systems Approach (1st Ed)*. Springer New Delhi.

