SUGISAKA MASANORI

Journal of Robotics, Networking and Artificial Life
Vol. 10(2); September (2023), pp. 115–126
ISSN (Online): 2352-6386; ISSN (Print): 2405-9021
https://alife-robotics.org/jrnal.html

Research Article

Driving SDG Impact: Web-Based Stocktaking Systems for Sustainable Business Operations

Cheah Dei Xuan[1], Heshalini Rajagopal[1], Shayla Islam[1], Neesha Jothi[1], Sook Fern Yeo[2,3], Kay Hooi Keoy[4]
[1]*Institute of Computer Science and Digital Innovation, UCSI University, 56000 Kuala Lumpur, Malaysia*
[2]*Faculty of Business, Multimedia University, Jalan Ayer Keroh Lama,75450 Melaka, Malaysia*
[3]*Department of Business Administration, Daffodil International University, Dhaka 1207, Bangladesh*
[4]*Graduate Business School, UCSI University, 56000 Kuala Lumpur, Malaysia*

ARTICLE INFO

Article History

Received 14 December 2022
Accepted 24 September 2023

Keywords

Stocktaking
Web-based application
Sustainable business

ABSTRACT

As businesses increasingly embrace digitalization, the transformative impact of technology becomes evident, making various aspects more streamlined and manageable. This, in turn, has the potential to alleviate workloads and contribute to Sustainable Development Goals (SDGs) and Environmental, Social, and Governance (ESG) principles. The primary objective of this study was to conduct research and develop a web-based application for efficient business stock management, aligning with SDG 9 (Industry, Innovation, and Infrastructure) and SDG 12 (Responsible Consumption and Production). This application empowers employees to monitor their stock levels, helping to prevent stockouts and improve business performance, thereby addressing SDG 8 (Decent Work and Economic Growth). The development process adhered to the Software Development Life Cycle (SDLC) model and utilized technologies such as the Vue 2 framework, JavaScript, HTML5, and Tailwind CSS to code the web-based application, contributing to SDG 9 by promoting technological innovation. In addition, a cloud-based database was established to store shop-related data securely, reducing the risk of data loss due to disasters or human errors, aligning with SDG 11 (Sustainable Cities and Communities). Furthermore, the web-based system was designed to conduct stock checks and monitoring, providing valuable insights into product statistics and notifying shopkeepers when stock levels are low, which supports SDG 12 by promoting responsible consumption and production. As part of the sustainability efforts, a digital receipt system was implemented as the default option for customers instead of traditional hardcopy receipts. This initiative aligns with SDG 13 (Climate Action) by reducing paper consumption and waste, as hardcopy receipts often contain non-recyclable chemical substances. In summary, the web-based application's contributions encompass promoting business efficiency, preventing stock shortages, and reducing paper usage, all of which align with various SDGs and ESG principles, ultimately fostering sustainable and responsible business practices.

1. Introduction

Technology has transformed the way we approach tasks, significantly improving their efficiency and effectiveness. As the world transitions towards Industry 4.0 technology, many sectors rely on these innovations [1]. This transformation is facilitated by the increasing wave of innovation from diverse platforms and providers. Whether it's a large corporation or a startup, businesses require technology to function effectively.

In this research, we delved into the development of a web-based stock checking system, introducing an innovative approach for shopkeepers and store owners to manage their inventory. The significance of stock checking lies in its ability to align product supply with customer demand. Here, "supply" refers to the quantity of products or services producers are willing and able to provide to the market, given limited resources [2]. Conversely, "demand" represents the quantity of those products or services that buyers desire to acquire from the market [2]. Another crucial aspect of stock checking is its

Corresponding author's E-mail: yeo.sook.fern@mmu.edu.my URL: www.ucsiuniversity.edu.my

role in preventing losses and theft, safeguarding business assets, and curbing issues such as overstocking.
In simpler terms, stocktaking, also known as stock counting, involves meticulously tallying all purchased items and reconciling them with goods sold and the revenue generated [3]. Businesses that neglect regular stocktaking face a plethora of issues, including stock losses and financial discrepancies. Thus, stocktaking plays a pivotal role in business growth by preventing problems like overstocking, identifying damaged goods, and deterring theft.

In the days before advanced technology, stock checking was a laborious task for business owners and shopkeepers who manually counted and recorded items one by one in physical record books. Gradually, with the advent of computers, shopkeepers could type out goods information and quantities. However, the real game-changer came with the introduction of system applications and barcodes. Barcodes were created to encode product information into bars, providing a unique identifier for each product. This innovation revolutionized inventory management by simplifying the tracking process. Barcodes comprise several essential components, including the quiet zone, number system digit, manufacturer code, product code, and check digit [4].

Barcodes come in two dimensions: one-dimensional (1D) and two-dimensional (2D). 1D barcodes represent data through variations in line width and spacing, including familiar examples like the Universal Product Code (UPC), European Article Number (EAN), Code 39, Code 128, and Codabar [5]. In contrast, 2D barcodes employ symbols and shapes to encode data, exemplified by QR codes and Data Matrix codes [5].

The motivation behind this study arises from the common practice in retail businesses, where shopkeepers or owners often invest in costly software and hardware known as Point of Sale (POS) systems [6]. These systems offer numerous advantages to both shopkeepers and customers. However, the high costs, constant system updates and upgrades, and expensive hardware pose financial challenges, particularly for startups. As a result, many small businesses struggle to monitor their inventory effectively, hindering their ability to respond to supply and demand dynamics and track business statistics.

Studies have shown that the failure of many small businesses can be attributed to factors such as inadequate capital, limited access to technology, and insufficient financial planning [6]. Therefore, this study aims to develop a web-based application that can function across multiple devices, serving as a cost-effective alternative to traditional POS systems. This application is designed to help businesses manage their inventory effectively, address supply and demand, and monitor their business performance. By doing so, it aims to alleviate critical challenges faced by small and startup enterprises.

2. Literature Review

Several studies have been carried out on stock checking systems. K. R. Ravindranath (2017) has focused on the RFID technology hardware needed to implement in the shooing cart once the customer placed any item inside the cart. It will detect the RFID tag that was attached on the goods where this helps to identify the details of the product such as the name of the product and its price. It helps customers financially where customer key in the limit once the total amount in the backet is over the limit the system will notify customer. In this study they used C language to implement the whole system with the required hardware like keypad, LCD screen, motherboard, etc [7]. The drawback of this system is that every good was needed to attach with an RFID tag which eventually increases the workload, and every basket needs an hardware device to scan for the RFID which lead to an extra expenses to implement it.
Ambarish N. Kulkarni and Surabhi G. Lohiya (2017) proposed a framework which used cloud computing technology where they have faced problems like the shortage of goods in the store. Hence a system that provides a platform where vendors were able to manage their shop online and able to deal with customers according to themselves. As this platform provides a multi-tenancy database store at the cloud that will lead to more reliable data accessing in the cloud architecture [8]. The drawback of this proposed system is that data stored in the cloud database needs to constantly update the data by the vendor itself.
Milind Amrutkar et al. (2017) a more in-depth study on the QR code technology and a mobile application been developed for stock management system to store new goods or item into MySQL databases and generate QR code for each of the goods or item. They proposed a more efficiency ways to identify and show all the information of the goods or items [9]. However, the proposed system is that QR code needs to be printed out and attached into each single one of the goods or item, thus it increases the workload and this system only shows the information and identify the goods it did not managing.

R. Padaya et al. (2018) proposed an e-commerce mobile application where machine learning (ML) was also implemented in the application. The proposed system uses ML engine to notify customers for advertisement purpose. The system will keep track of the customer demand on the product and provide statistics to the

shopkeeper [10]. The drawback of this system is that it brings inconvenience towards users who only came once need to download the application to enjoy the services. Shopkeepers are only able to view the statistics of the product but not the quantity of the product.

Jayananda P.K.V et al. (2018) proposed Augmented Reality (AR) that navigates customers to their destination using beacon technology. An android based mobile application was developed where it used the AR direct user to the destination and the beacon technology will transmit the data to the application and shows all the information stored in the beacon device. Where each of the beacon devices stores the information of the product [11]. The drawback of this system is that not all the users' mobile devices are able to support high tech like augmented reality and it is costly in terms of purchasing lot of the beacon device for every single product that sell in the store. This system does not bring any benefits towards shopkeepers in terms of managing the stock, follow-up on the business status, etc.

Sakorn Mekruksavanich (2020) studies on the RFID technology and the IoT application to develop supermarket shopping system where customer no longer need to wait in line for the shopkeeper to scan each item one by one and straight away make payment. The shopping cart needs to be installed with the RFID reader and the hardware thus all the information able to send request to the mobile application once user click on the checkout button QR code will be generate for shopkeeper to scan on it [12]. Although it was a good approach but once the product was added into the cart it was unable to cancel the product anymore. And to implement this approach it costs a lot in term of every single item need to attach with RFID tag and a large amount of RFID reader together with the hardware.

Sandeep Kumar Yedla et al. (2020) developed a system using python programming language to detect the real-time scene changes for automated stock with the YOLO algorithm. In this study, a few modules such as the Frame extraction, scene change detection, object detection, optical character recognition (OCR) were incorporated. Once the stock has any changes it notifies user [13]. The drawback of this paper is that is hard to identify items with this method where there are a lot of items which have the same colour and same shape but there is different product. As well as the aspect of cost, it will be extremely expensive it needs a lot of cameras to capture the change on the items.

K. Umamaheswari et al. (2020) proposed an IoT based smart cold storage for efficient stock management to identify the quantity and the item present in the cold storage. The system was developed using Arduino and Raspberry Pi 3 and was programmed using Python. Before placing any object in the cold storage, firstly an object detection process will take place where the webcam was trained to capture 50 samples and store them in databases. After identifying the object, it goes for weight identification to get the weight of the object. The system will trigger a notification to the person in charge if the weight is beyond its threshold value [14]. The drawback of this system is that if the hardware has some error not working it will lead to the whole system having error unable to continue the task.

M.Siva Sangari et al. (2021) proposed a system to detect and track all the information of the goods and if the quantity is below the threshold, it notifies the shopkeeper using the GSM or shopkeeper. In addition, the shop owner can check the stock using Wi-Fi. RFID technologies were included to store all the information regarding the product and every product is attached with RFID. Once the customer purchases the product, the RFID reader and the IR sensor will detect and update the data via Arduino microcontroller [15]. However, if the RFID tag is faulty, the system will not be able to detect trace the product.

Y. Jain and U. Maherwal (2021) have studied digitizing the process of trading product where shopkeeper manage their inventory to the end customer purchases the product. A web-based application for shopkeepers was proposed where the product can be added, and the data will be stored in the cloud. QR code will be generated for every product and the code will be printed and pasted on the products. Shopkeepers can manage their inventory as well as track order history. While for customers, a mobile application was developed where customers must scan the QR code and add the product into their virtual shopping cart. Customer may select the delivery options, make payment via preferred payment options. They can also check their order status and order history [16]. The drawback from this study is that each of the products needs a QR code to get the product added into the customer virtual cart. From this study it develops two applications which are time consuming in the developing phases.

AgboolaF. F., MalgwiY. M., MahmudM. A., & OguntoyeJ. P. (2022) have studied the features and functionality of the developed web-based platform. The authors describe how the platform automates various inventory management tasks, including tracking inventory levels, generating reports, and managing stock replenishment. They highlight the platform's user-friendly interface, which enables easy navigation and efficient interaction with the system. The inclusion of screenshots and examples enhances the understanding of the platform's capabilities. However, this study only focused on inventory management [17].

Mursyida Ahmad Tarmizi et al. (2022) have investigated the transition of the information organization module in a library management system from a client-server architecture to a web-based application. The authors aim

to explore the benefits and challenges associated with this shift and evaluate the effectiveness of the web-based implementation. The authors provide a detailed description of the methodology employed in shifting the information organization module from a client-server architecture to a web-based application. They discuss the selection of appropriate technologies, frameworks, and tools for the implementation. The steps taken to ensure data security, accessibility, and user-friendliness are clearly explained. The methodology section demonstrates a systematic approach to implementing the web-based application for the library management system. The evaluation of the web-based application confirms its effectiveness in improving accessibility and user satisfaction [18]. However, it would have been beneficial to include a comparison of the performance and user experience between the client-server and web-based approaches.

Iskandar and Yanuar (2023) investigate the integration of an inventory information system at CV. XYZ, a company that has transitioned to a web-based system. The study emphasizes the importance of integrating various inventory-related functions into a unified system to streamline operations and enhance decision-making processes. The authors describe the implementation process, starting from system analysis and design to the actual development and deployment of the web-based inventory system. The paper provides a detailed explanation of the methodology employed to achieve the research objectives. The authors utilize a combination of qualitative and quantitative approaches, conducting interviews and surveys to gather data from relevant stakeholders. The use of both primary and secondary data sources strengthens the reliability and validity of the study's findings. However, more information regarding the sample size and selection criteria would have further enhanced the study's rigor [19].

Sinaga et al. (2023) have studied on enhancing the efficiency and effectiveness of administration processes in motorcycle dealerships through web-based technology. The study involves the development and implementation of the web-based administration application for motorcycle dealerships using the Framework for Application and Service Telecommunication (FAST) framework. The application is designed to streamline and automate administration tasks, including customer registration, sales data management, vehicle inventory tracking, and report generation. The authors describe the functionalities and features of the application, emphasizing its user-friendly interface and real-time data updates. The FAST framework provides a structured approach to develop web-based applications, integrating various technologies such as HTML, CSS, JavaScript, PHP, and MySQL database. Based on this study, it is found that the FAST framework is flexible and scalable for building robust web applications [20].

3. Methods

This application adhered to the Software Development Life Cycle (SDLC) model for its development process. It was constructed utilizing the Vue 2 framework, JavaScript, HTML 5, and Tailwind CSS to code the web-based platform. Within this web-based application, Google Firebase serves as the primary database, operating as a JSON database structure.

Each user is assigned dedicated data management capabilities, with stringent access controls in place to prevent unauthorized access or modifications. Upon user creation, the application automatically generates several sub-collections within the database, populated with sample data. These sub-collections encompass account details, product categories, restocking records, sales data, and product information.

Shopkeepers are granted the ability to input comprehensive product information into the system, ensuring a comprehensive record of products for future reference and utilization. Fig. 1 illustrates the workflow of shopkeepers adding products to the system. Concurrently, as products are added, shopkeepers have real-time visibility into the remaining quantities of each product. When the quantity of a product approaches a specified threshold, the system proactively notifies the shopkeeper, facilitating timely replenishment. Additionally, this system offers comprehensive tools for shopkeepers to monitor their business status effectively.

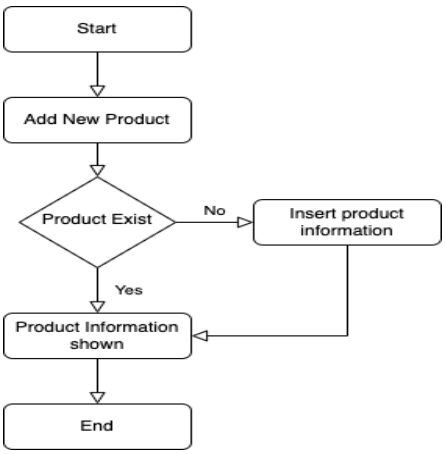

Fig. 1 Flowchart of shopkeeper add product

The system offers shopkeepers a range of cashier functionalities, including the computation of total amounts for customer baskets and the generation of receipts. Fig. 2 illustrates the cashier process. Initially, the shopkeeper scans the customer's QR code, prompting the system to display the contents of the customer's shopping cart. Subsequently, the customer proceeds to make a payment. If the checkout is declined, the process terminates. Conversely, if the checkout is successfully completed, the system generates a receipt and, if provided, sends it to the customer's email address, concluding the process.

Fig. 3 depicts the flowchart outlining how shopkeepers restock their products using the system. This feature simplifies the restocking process by allowing shopkeepers to swiftly replenish stock without manually searching through stock lists and making edits. The procedure begins with the shopkeeper scanning the product's barcode. The application then conducts a product search. If no product is found, the shopkeeper must rescan the barcode. However, if the product is located, all pertinent product information is presented. The shopkeeper proceeds to input the necessary restocking details, and the application initiates an update to the database. In the event of an unsuccessful update, the process returns to the input restocking details phase. Conversely, if the update is successful, the process concludes, and the database is duly updated.

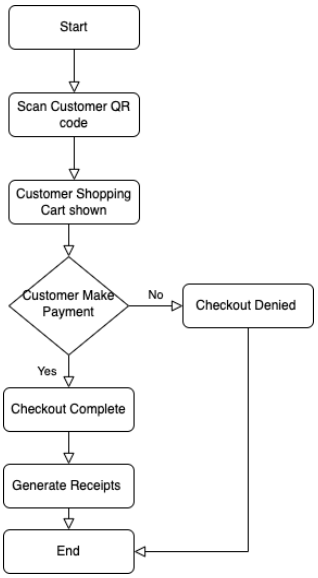

Fig. 2 Flowchart of receipt generation

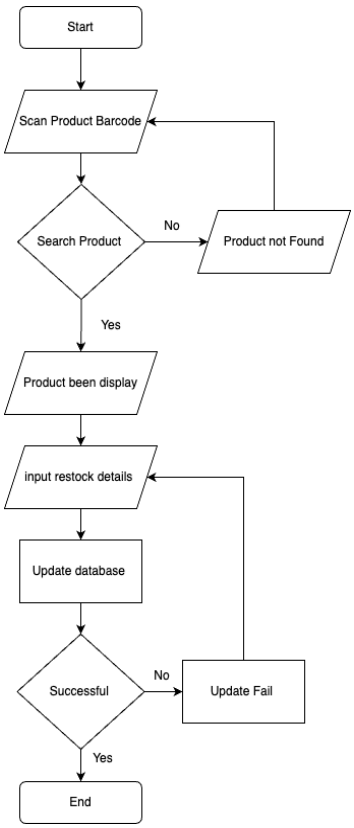

Fig. 3 Flowchart of restock.

The flowchart in Fig. 4, shows how the application generates a T-account for shopkeeper. Initially, the application prompts the shopkeeper to input a start date

and an end date, establishing a defined data range for subsequent calculations. Upon completing this input, the application displays comprehensive details. Furthermore, the system provides a field for the shopkeeper to insert any additional expenses incurred during the specified period. In the absence of expenses within the given timeframe, the application proceeds to the subsequent phase.

In the ensuing step, the entire T-account record is preserved in the database, and an Excel file is dynamically generated and made available for download directly from the page. The system concludes its operations upon successful record storage and the download of the Excel file onto the shopkeeper's device.

Customers are afforded the capability to scan products to access comprehensive product information. This functionality enables customers to add selected products to their virtual shopping cart. Upon completing their shopping, customers can initiate the checkout process by presenting the generated QR code, created by the system, to the shopkeeper for scanning and payment processing, as depicted in Fig. 5.

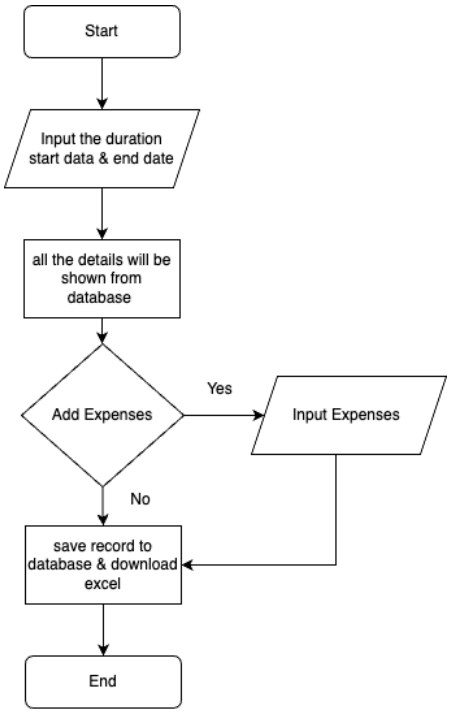

Fig. 4 Flowchart for T-account generation

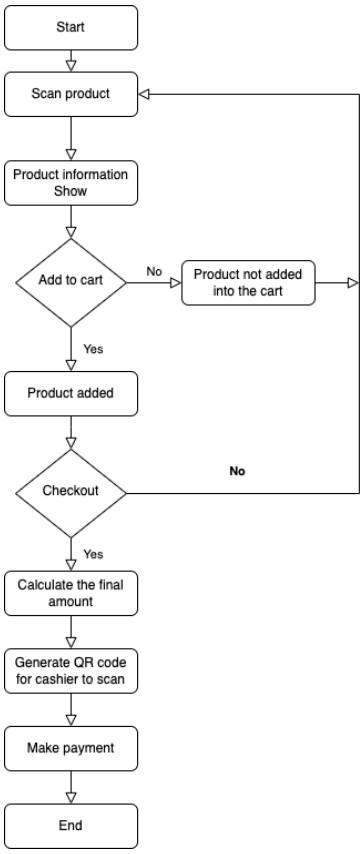

Fig. 5 Flowchart of item purchasing by customer

4. Results and Discussion

Within the web-based application, a multitude of features is seamlessly integrated, contributing significantly to the overall benefits it offers to shopkeepers. The user interface (UI) plays a pivotal role in conveying and elaborating on these application features. Illustrated in Fig. 6 is the primary dashboard, the initial view presented to shopkeepers upon signing into the application.

The dashboard is organized into four distinct rows, each providing a summarized view of essential business information. In the first row, a summary of the shop's name and shopkeeper details is displayed. These details can be modified within the account page. Additionally, this row features a "Sale of the Day" section, showcasing the total sales generated on the specific day. Shopkeepers have the capability to download this sales list in Excel format, with the file name reflecting the respective date, facilitating future accounting calculations.

The second row presents a list of products that shopkeepers have added to the application. To add a product, shopkeepers can navigate to the "Add Product" page. Once products are added, they are comprehensively listed, alongside a category list that enables efficient

filtering for product searches. This category list becomes increasingly beneficial as more products are incorporated into the application.

Moving on to the third row, it offers a breakdown of sales into paid and unpaid categories. To the right, a dynamic chart provides insights into sales statistics over specified date ranges. The application generates this information in the form of a bar chart, enabling shopkeepers to analyze and compare data effectively.

The final row of the dashboard features a QR code generator. This QR code allows customers to enter the shop, scan products, make purchases, and complete payments. The generated QR code includes a link for customers to initiate scanning, directing them to the customer page, followed by the shop's unique identifier (ID). Fig. 7 serves as an illustrative example of a generated QR code.

Fig. 8 showcases the user interface of the "Add Product" page, a structured form where shopkeepers input comprehensive product details, encompassing product name, buying price, selling price, quantity, product image, and product barcode. The application offers a convenient feature allowing shopkeepers to employ their device's camera for barcode scanning, with the scanned barcode data populating the respective form field. Fig. 9 provides a visual representation of the camera scanning process, displaying the resulting barcode details. After filling in all required fields, shopkeepers simply click the "Submit" button to add the product to the system.

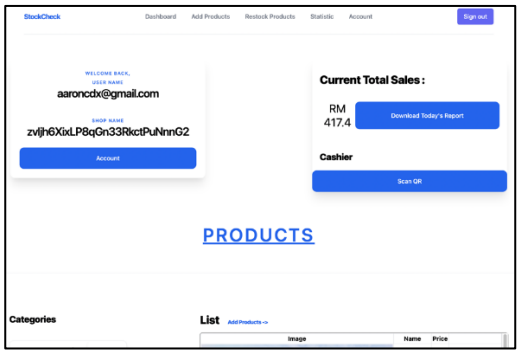

Fig. 6 Dashboard of the Stock-Checking application

Fig. 7 Generated QR Code

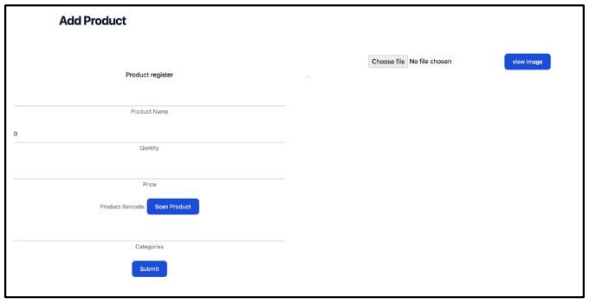

Fig. 8 Add Product Page

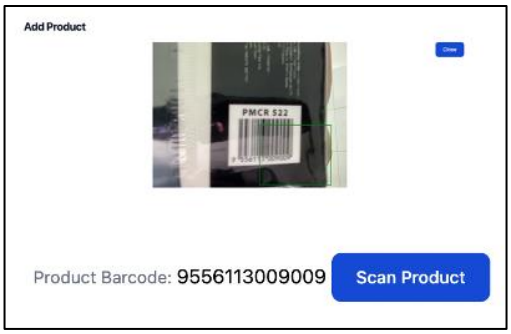

Fig. 9 Scanning process and the result

The restock page serves as the solution when a specific product's inventory is depleted and requires replenishment by the shopkeeper. In this interface, shopkeepers are presented with a streamlined process: they simply employ their device's camera to scan the product's barcode, prompting the immediate display of comprehensive product details. This feature simplifies stock quantity updates, eliminating the need for shopkeepers to manually locate the product within a product list and make adjustments.

By utilizing this feature, shopkeepers can swiftly update product quantities. Simultaneously, all restocking data is meticulously stored in a distinct database collection, encompassing essential details such as the product's buying price. This meticulous data organization

facilitates more precise T-account calculations, as it aggregates all buying prices on the credit side of the ledger. Fig. 10 provides an illustrative example of the user interface for the restock page, showcasing the intuitive design and functionality of this critical feature.

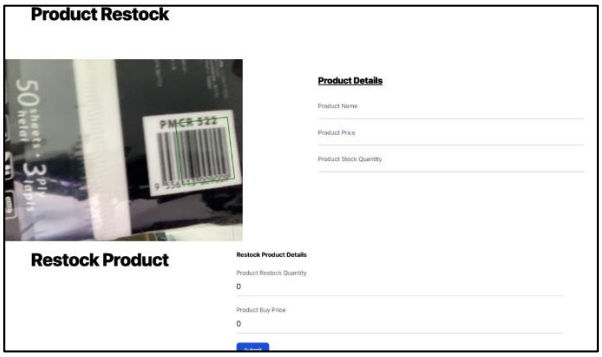

Fig 10 Restock Page UI

This application empowers shopkeepers with comprehensive customization capabilities for their data management needs. One key facet is the Product Details page, which offers the flexibility to make minor adjustments to product information. Additionally, the application provides the option to delete products when necessary. Below the product details, the interface displays vital metrics for the current month: the quantity of units sold and the number of visits the product has received.

Whenever a customer scans a product and accesses its details, the visit count increments, reflecting customer interactions. Similarly, the quantity sold increases each time a customer makes a purchase.

Furthermore, the application furnishes shopkeepers with two vacant charts, complete with fields for specifying start and end dates. These charts facilitate real-time tracking of specific products over varying time intervals. Leveraging these statistical features, shopkeepers can make informed decisions regarding product inventory adjustments, whether increasing or decreasing quantities. Fig. 11 provides an illustrative example of the application's statistical capabilities, presenting a bar chart depicting data over multiple months, generated to assist shopkeepers in data-driven decision-making.

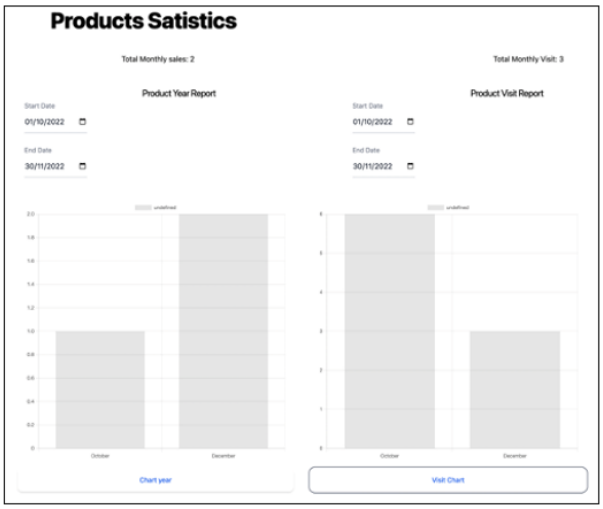

Fig 11 Generated Bar Chart Statistic

The Stock Checking web-based Application extends its functionality to include customer interaction. As previously mentioned, the shopkeeper's dashboard generates a QR code, enabling customers to engage with the application. Fig. 12 represents the initial interface that customers encounter upon entry, providing them with the choice of entering their email address or proceeding as a guest.

Customers opting to provide their email address gain the advantage of receiving an email receipt for their purchases. Following this selection, customers have the capability to scan product barcodes, facilitating the retrieval of comprehensive product information, with a particular focus on product pricing. This action triggers the appearance of a data-toggle model, as exemplified in Fig. 13 , presenting all pertinent product details to the customer.

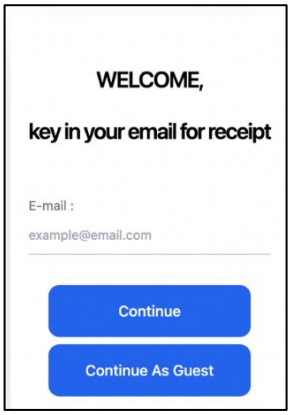

Fig. 12 Customer page UI

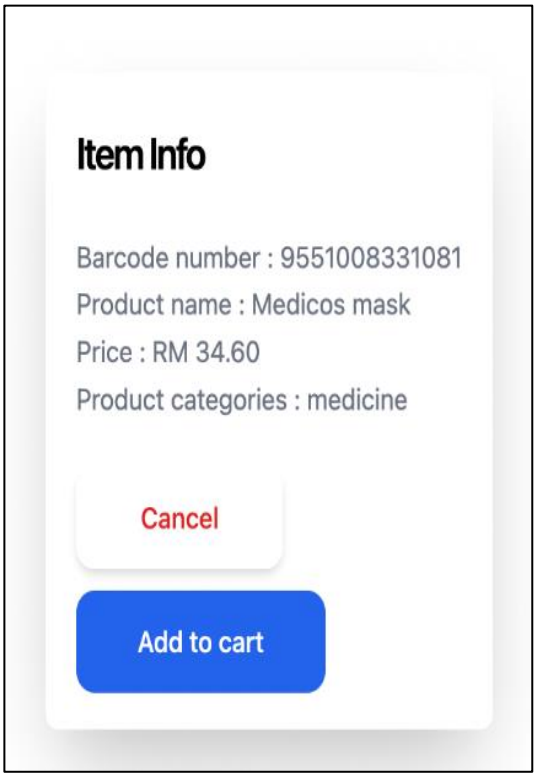

Fig. 7 Product Details Data-Toggle

Customers have the capability to populate their shopping-cart list with selected products, with the resulting cart view displayed in Fig. 14. Upon completing their shopping, customers can initiate the checkout process by clicking the "checkout" button. The application then proceeds to compile a summary of the shopping cart contents and facilitates the payment process.

During payment, customers are presented with three payment options: cash, e-wallet, or online banking. For cash and e-wallet payments, a QR code is dynamically generated. Customers are required to present this QR code to the shopkeeper for scanning at the cashier's counter. Upon successful scanning, the application directs both the customer and shopkeeper to the cashier page, which will be further discussed later.

Conversely, for online banking transactions, the application redirects the customer to a dedicated page, where online banking operations are facilitated through PayPal, as depicted in Fig. 15.

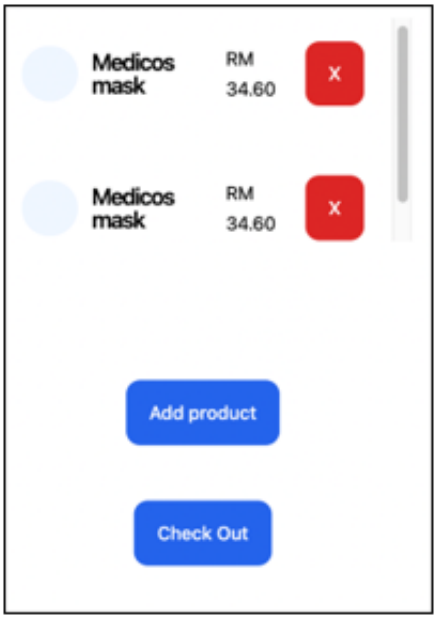

Fig. 14 Shopping Cart

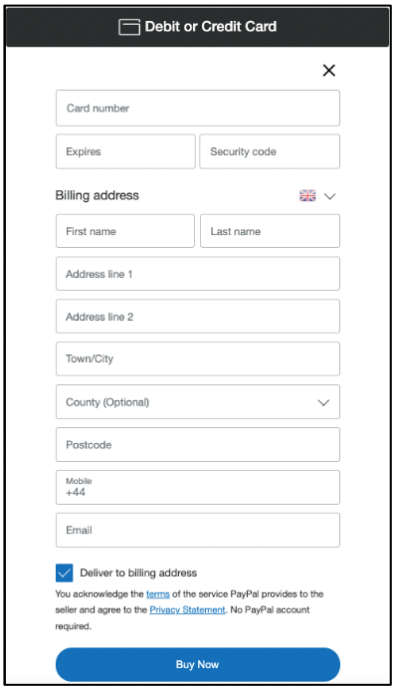

Fig. 15 Online-Banking Payment

Customers opting for cash or e-wallet payments are mandated to furnish the QR code for scanning by the shopkeeper. For the shopkeeper's convenience, a dedicated button for QR code scanning is positioned within the dashboard interface. Upon selecting "scan QR," the application activates the device's camera to facilitate the scanning of the customer's QR code.

Subsequently, the application seamlessly redirects to the cashier page, as exemplified in Fig. 16.

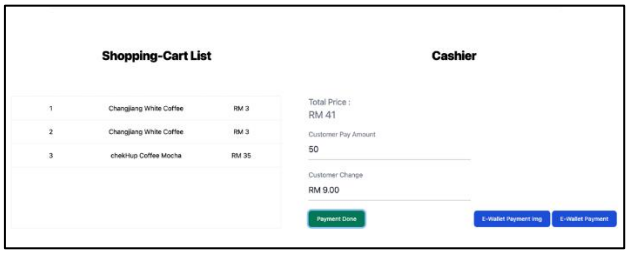

Fig. 16 Cashier Page UI

Upon successful completion of all payments and the conclusion of the transaction, the database is promptly updated to reflect a status of "paid." Customers who have provided their email addresses will receive an email receipt instantaneously, detailing the items they have purchased.

5. Conclusion

In this research initiative, we have engineered a robust database infrastructure designed to empower shopkeepers in securely managing their shop-related data on a cloud-based platform. This strategic approach aligns with key ESG principles, particularly in mitigating potential risks stemming from disasters and human errors, thus promoting resilience and bolstering the continuity of business operations.

Furthermore, we've meticulously developed an advanced web-based system engineered to facilitate comprehensive stock checking and monitoring capabilities. This innovation not only empowers shopkeepers to gain invaluable statistical insights into their product inventory but also actively notifies them of dwindling stock levels. These functionalities synergistically contribute to the achievement of SDG goals related to responsible consumption and production, as well as furthering ESG objectives in inventory management sustainability.

In line with sustainable practices, our system has successfully transitioned to the adoption of softcopy receipts as the default option for customers. This transition addresses significant ESG concerns by mitigating the reliance on non-recyclable hardcopy receipts containing harmful chemical substances. These actions demonstrate our commitment to SDG targets related to environmental preservation and resource efficiency.

The holistic contribution of our web-based application extends beyond the realm of individual businesses. By fostering streamlined inventory management and reducing paper consumption, it significantly contributes to the broader community. This innovative approach embodies SDG and ESG principles, emphasizing the societal benefits derived from this technological advancement while driving sustainable and responsible business practices.

6. Acknowledgements

The research work is financially supported by the UCSI University, under UCSI University Research Excellence & Innovation Grant (REIG) Grant Number: REIG-ICSDI-2023/047 and Faculty of Business, Multimedia University (MMU).

References

1. Kumar A, Rajagopal H. Automated Seeding and Irrigation System using Arduino. Journal of Robotics, Networking and Artificial Life, 2022, 8(4): 259–262.
2. J. Fernando, “Understanding The Law of Supply And Demand,” Investopedia, 08-Feb-2022.
3. G. M. Cidal, Y. A. Cimbek, G. Karahan, O. E. Boler, O. Ozkardesler, and H. Uvet, “A Study On The Development of Semi Automated Warehouse Stock Counting System,” 2019 6th International Conference on Electrical and Electronics Engineering (ICEEE), 2019.
4. Milind Amrutkar, Anup Palsokar, Pankaj Raibagkar, “QR Code Based Stock Management System” (IRJET).
5. R. Focardi, F. L. Luccio, and H. A. Wahsheh, “Security Threats And Solutions For Two-Dimensional Barcodes: A Comparative Study,” Computer and Network Security Essentials, pp. 207–219, 2017.
6. Ma’aji, M.M., Abdullah, N.A.H. and Khaw, K.L.H., 2018. Predicting financial distress among SMEs in Malaysia. *European Scientific Journal, ESJ*, *14*(7), pp.91-102.
7. K. R. Ravindranath, A. I. Sanjay, and C. M. Prashant, “RFID based Supermarket Shopping System,” 2017 International Conference on Big Data, IoT and Data Science (BID), 2017.
8. Ambarish N.Kulkarni, Surabhi G. Lohiya. (2017). Cloud Computing Expose for online Retail Management System. International Journal of Emerging Technologies in Engineering Research (IJETER)
9. Milind Amrutkar, Anup Palsokar, Pankaj Raibagkar, QR code Based stock management system, International Research Journal of Engineering and Technology (IRJET), 2017.
10. R. Padaya, S. Suvarna, A. Channe, and C. Shah, “Smart Local Shopping System,” 2018 Second International Conference on Electronics, Communication and Aerospace Technology (ICECA), 2018.
11. P. K. V. Jayananda, D. H. D. Seneviratne, P. Abeygunawardhana, L. N. Dodampege, and A. M. B. Lakshani, “Augmented reality based Smart Supermarket System with indoor navigation using Beacon Technology

(easy shopping android mobile app)," 2018 IEEE International Conference on Information and Automation for Sustainability (ICIAFS), 2018.
12. S. Mekruksavanich, "Supermarket shopping system using RFID as the IOT Application," 2020 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering (ECTI DAMT & NCON), 2020.
13. S. K. Yedla, V. M. Manikandan, and P. V., "Real-time scene change detection with object detection for automated stock verification," 2020 5th International Conference on Devices, Circuits and Systems (ICDCS), 2020.
14. K. Umamaheswari, M. Susneha, and B. S. Kala, "IOT based Smart Cold Storage System for efficient stock management," 2020 International Conference on Communication and Signal Processing (ICCSP), 2020.
15. K. L. M. Siva Sangari, "Intelligent Smart Shopping and stock notification using IOT," Annals of the Romanian Society for Cell Biology. Available: https://www.annalsofrscb.ro/index.php/journal/article/view/4290.
16. Y. Jain and U. Maherwal, "GoShop: A Digital Bridge between shopkeepers and consumers," International Journal of Engineering, Business and Management, vol. 5, no. 3, pp. 94–99, 2021.
17. AgboolaF. F., MalgwiY. M., MahmudM. A., & OguntoyeJ. P. (2022). Development of a Web-Based Platform For Automating An Inventory Management Of A Small And Medium Enterprise. Fudma Journal of Sciences, 6(5), 57 - 65.
18. Mursyida binti Ahmad Tarmizi, W. A., Ismail, S. A., & Hariro bin Samsudin, A. Z. (2022). Shifting The Information Organization Module Implementation of Library Management System from ClientServer Architecture to Web-Based Application. International Journal of Information & Knowledge Management (22318836), 12(2).
19. Iskandar, D., & Yanuar, A. T. (2023). Inventory Information System Integration at CV. XYZ Web-Based. International Journal of Computer and Information System (IJCIS), 4(1), 8-13.
20. Sinaga, T. H., Hardiansyah, H., & Dewi, A. R. (2023). Web-Based Administration Applications For Motorcycle Dealers Using FAST Framework. Journal of Computer Networks, Architecture and High Performance Computing, 5(1), 182-197.

Authors Introduction

Mr.Cheah Dei Xuan

He has completed his Bachelor of Computer Science (Hons) Mobile Computing and Networking, UCSI University, Malaysia, currently.

Dr. Heshalini Rajagopal

She received her PhD and Master's degree from the Department of Electrical Engineering, University of Malaya, Malaysia in 2021 and 2016, respectively. She received the B.E (Electrical) in 2013 Currently, she is an Assistant Professor in UCSI University, Kuala Lumpur, Malaysia. Her research interest includes image processing, artificial intelligence and machine learning.

Dr. Shayla Islam

She is an Associate Professor in UCSI University, Malaysia. She has completed PhD degree in Engineering from Electrical and Computer Engineering (ECE) departmentat International Islamic University Malaysia (IIUM) in 2016. She completed her MSc.at the department of Electrical and Computer Engineering in InternationalIslamic University Malaysia in 2012. She completed her BSc. in ComputerScience and Engineering from International Islamic UniversityChittagong, Bangladesh. Her current researchinterests include data communications and networking, computer networks and wirelesscommunication, network mobility in heterogeneous network, computer architecture & cloudcomputing.

Dr. Neesha Jothi

She received her PhD from the School of Computer Sciences, Universiti Sains Malaysia in 2020. She is currently an Assistant Professor in UCSI University, Malaysia. Her research interest areas are Data Mining in Healthcare and Health Informatics.

Dr. Sook Fern Yeo

She obtained her Bachelor of Business Administration (Hons) Management and Master of Business Administration (Multimedia Marketing) from Multimedia University, Malaysia, and her Doctor of Philosophy (Ph.D.) majoring in Service Innovation from Universiti Sains Malaysia (USM), Malaysia. She is currently a lecturer in the Faculty of Business. Her current research areas are social media marketing, consumer behaviour, etc.

Dr. Kay Hooi Keoy

He received his PhD from the Sheffield Hallam University, UK. He is currently an Associate Professor at Graduate Business School, UCSI University, Malaysia. His research interest areas are operation management, knowledge management and technology driven application.