

QR-STORE ONLINE: DEVELOPMENT OF A WEB APPLICATION WITH QUICK RESPONSE (QR) TECHNOLOGY FOR SMALL-SCALE BUSINESSES

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ABSTRACT

This study aimed to design and to develop a web application for small-scale businesses serving as a virtual store interface with access to all enrolled stores providing their customers the services to check the store and product availability and choose items to purchase. This study would not only help consumers and store owners conveniently do buying and selling but also help in limiting the time spent for face-to-face interaction which is very important in mitigating the spread of any virus such as COVID-19. The web application will be responsive and available on mobile phones for easier access. It also has integrated Quick Response (QR) Code technology which was used to provide a reference code to customers. The system was developed using Agile development model, a conceptual framework for undertaking software engineering. Bootstrap Framework was also used in designing the application's user interface to easily achieve responsive user interface (UI) maintaining ease of use and functionality in various mobile and desktop views. Prior to development, a qualitative interview with the consumers and store owners regarding the traditional shopping

processes was conducted to determine system requirements. Processes were observed, documented, and evaluated to serve as basis for system design and development. Furthermore, a usability survey was conducted to know the perception of the users in terms of usefulness, satisfaction, and ease of use/learning the web application. By closely observing the current processes of buying and selling, a more efficient and convenient system was successfully developed and tested and based on the survey result, the developed web application was useful and easy to use, and users were satisfied with the application. The paper will also provide the information of the processes involved during the development of the application and will present the system design and overall functionality of the system.

Keywords: *Web Application, Local Store, Small-scale Businesses, Quick Response (QR) Technology, Online Shopping*



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Published by the National Research Council of the Philippines

INTRODUCTION

Over the years, there has been a shift from traditional shopping to online shopping. Online shopping opens a new world of possibilities for consumers and marketers (Vigg Kushwah et al., 2019). Many companies are using it because it represents a more economical and convenient approach to purchasing than traditional shopping. On the other hand, consumers buy online because it allows them to buy what they need at any time without going to the store. This has been made possible through buying in stores with delivery options and online or cash-on-delivery (COD) payment options. However, not all consumers have the capacity to pay online and carry the delivery cost. Some would go to the store personally and follow the traditional system of people lining up with or without priority numbers and waiting for their turns which becomes inefficient, especially if the product is unavailable. The same applies to stores that don't have delivery options and online or cash-on-delivery (COD) payment options; they need to require their customers to visit their stores to inquire about their products and pay for their purchases personally through cash. With this, this study intends to develop a web application with QR code integration for small businesses or stores that would not only help consumers and store owners conveniently do buying and selling but also help in limiting the time spent for face-to-face interaction which is very important to mitigate the spread of the virus in times of pandemic. The application would serve as an interface accessing all enrolled stores to provide their customers with the services to check the store and product availability. The web application will be responsive and available on mobile phones for easier access. The QR Code technology will also be used in this study to provide a reference code to customers before going to the store. The reference code will serve as a ticket that the consumer needs to bring, containing all the products the customer needs to buy, thus making the transaction faster. With the need to mitigate the spread of viruses such as Covid19, this study would help store owners provide their customers with a convenient shopping mode while minimizing the time for face-to-face interaction. In addition, the application developed could become a competitive strategy for local stores, eliminating queues for product inquiry and enumerating product information to buy.

Objectives

The main objective of this study is to design and to develop a web application for small-scale businesses serving as a virtual store interface with access to all enrolled stores providing their customers the services to check the store and product availability and choose items to purchase.

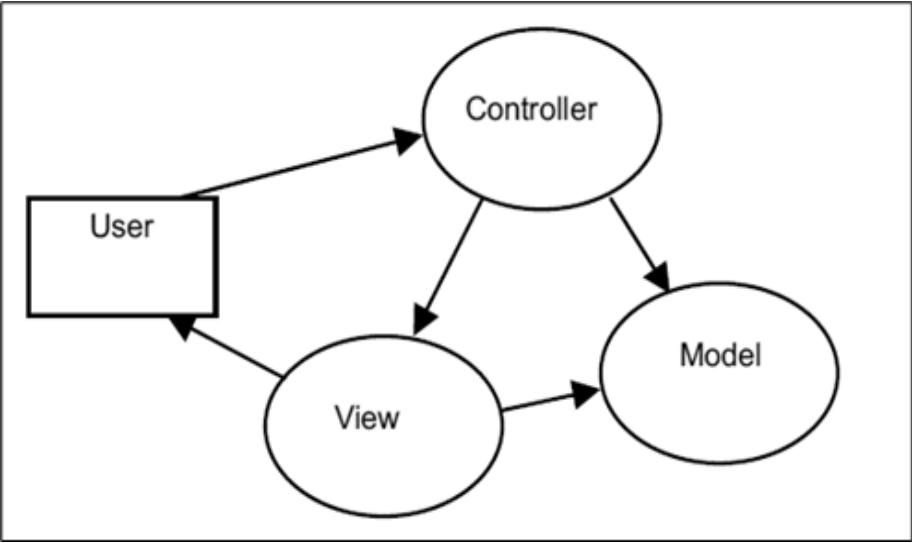
METHODOLOGY

Software Development

In developing the system, the Agile methodology, a conceptual framework for undertaking software engineering, was utilized. The process will undergo several quick iterations until the development of the system is completed. Each iteration will follow the stages of Planning, System Analysis, Design, Development, Testing, and Evaluation. To determine system requirements, a qualitative interview with the consumers and store owners of small-scale businesses regarding their existing shopping processes was conducted. Processes were documented and evaluated to serve as the basis for system design and development. The use-case-based requirement diagram was then used to depict the functional requirement and the web application design based on the observed interview results and processes. The web-based system was developed using CodeIgniter web development Framework using PHP programming language along with client-side scripting technologies, JavaScript, and Cascading Style Sheet (CSS). Furthermore, the XAMPP web server solution stack package utilized the Apache Server as a web server, MySQL as administrator, and phpMyAdmin as a database. To easily achieve a responsive user interface (UI), Bootstrap Framework was used to design the application UI matching the system's features while maintaining ease of use and functionality in various views like mobile and desktop views.

Figure 1

The MVC Architecture



The system architecture used in the development of the application was the Model-View-Controller (MVC) architecture, as shown in Figure 1. MVC architecture can improve the modularity and reusability of the system through its more presentable source code and more explicit separation between business logic and user interface. It can significantly reduce the software's source code complexity, thus increasing the flexibility and modularity of the software system.

Software Testing

For the final testing of the web application, major system test items were identified, as shown in Table 1. This is to ensure that the needed requirements were met and expected results were generated. During the conduct of the testing, test results were noted as shown in Table 2, which has the remarks of Passed or Failed; Passed if the test case generated the expected result, otherwise, Failed.

Table 1*Test Items*

Test Items	Expected Result
Login Account	Successfully logged in
Access the web application	Web application's landing page is loaded
Search Stores	All enrolled stores with the search keyword are shown
Search Store Products	All products in selected store with the search keyword are shown
Visit Store	View specific store
Confirm Order	Order is confirmed and the QR code is generated
Add product to cart	Product is added to the cart
Clear Cart	All items in the cart are removed
Remove Cart Item	Selected item in the cart is removed
View Cart	All items in cart can be viewed
Manage Profile Setting	Can successfully add, edit, and delete store products
Manage Store Products	Sellers can successfully view and manage inquiries
Manage Transactions	Sellers can manage sales transactions and can successfully scan QR code and view all items under it
Log out Account	Account successfully logged out

Data Gathered

A Usability, Satisfaction, Ease of use (USE) questionnaire was adopted to gather the system users' feedback. The first section of the questionnaire was the respondent's profile, where the name, age, home address, highest educational attainment, and gadgets owned were asked. The second section was the respondent's rating of the software application based on its Usefulness, Satisfaction, and Ease of use/learning. In the questionnaire, also included were the respondents' comments or suggestions of the web application for further system improvements. The researchers conducted the survey online using Google Form and sent it to two-hundred sellers and buyers. The methods being used to interpret the results were frequency distribution and 5-point Likert scale weighted mean interpretation.

Ethical Considerations

The study adhered to the National Ethical Guidelines 2017 for research involving human participants and the Data Privacy Act of 2012. The proponents did software testing using mobile phones and laptops. Feedback from the respondents was gathered using the USE Questionnaire and would be used to improve the system's functionality. This study assumed an expedited review.

Data Management

The researchers strictly adhered to ethical standards and data privacy laws. Tight security measures of storing guaranteed data management, encoding, coding, accessing, and sharing. Accessing the completed research files was restricted to the funding agency and the target publisher for monitoring and validation purposes. For other researchers who would like to make secondary data analysis, they could request the Office of the Research Director upon the consent of the researchers. The research files should be stored for a minimum of three years. The proper disposal of the files should be observed.

RESULTS AND DISCUSSIONS

Based on the interview results and the conducted close observation of the processes in doing the current buying and selling in local stores, the functional requirements and the design of the web application were formulated. Use-case-based requirement diagrams were used to depict them. The use-case-based requirements diagram for customers presented in Figure 2 shows the different use cases that should be available to all customers.

Figure 2

Use-case-based requirements diagram of the system for customers

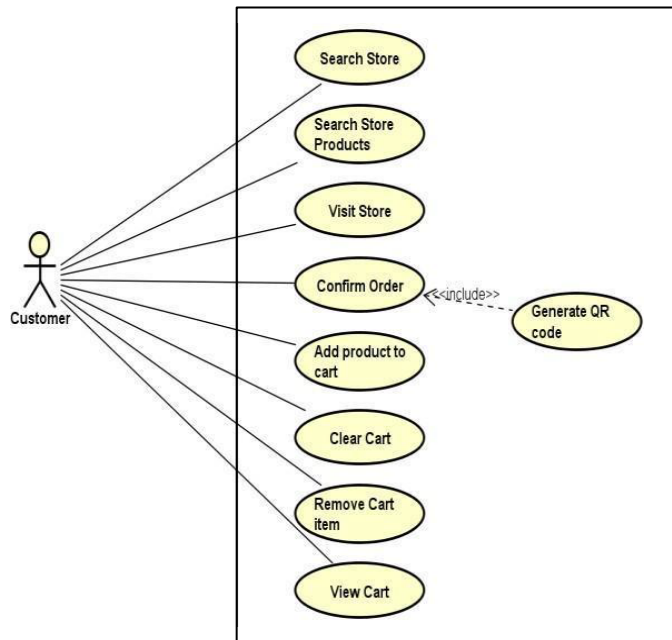
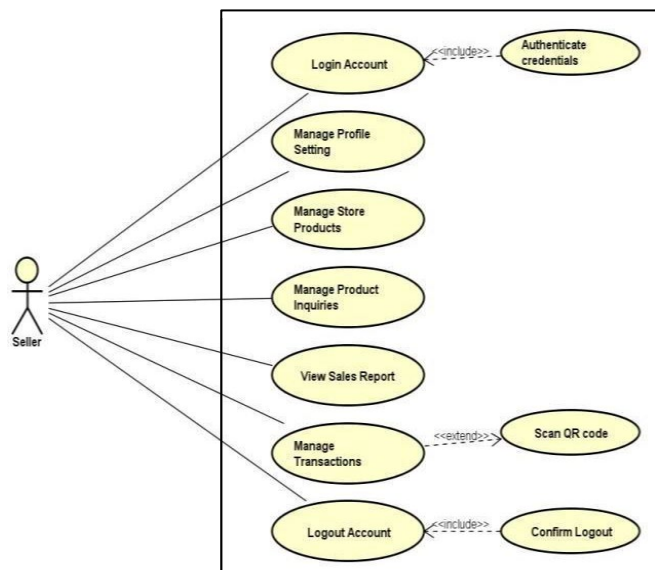


Figure 3

Use-case-based requirements diagram of the system for store seller



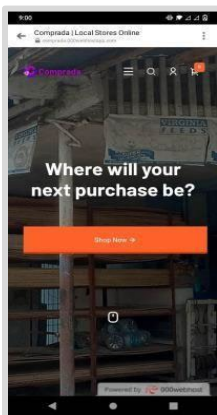
Use-case based requirements diagram for customers is composed of the following main user actions: (1) search store, (2) visit store, (3) search store products, (4) add product to cart, (5) remove an item to cart and, (6) view cart and/or confirm the order of items in cart which triggers the generation of QR code as a reference.

On the other hand, the different use cases that should be made available for the store sellers were shown in Figure 3. It is composed of the following main user actions: (1) login and logout account, (2) manage profile settings, (3) manage store products, (4) manage product inquiries, (5) view sales report, and (6) manage transactions.

Meanwhile, sample views of each module were shown in Figure 4a and 4b. Views presented were of two types: the mobile and desktop views to depict the responsiveness of the user interface. The landing page view as shown in Figure 4a and 4b is the first page that the user can access when visiting the application. The users can browse and search all enrolled stores in the application as shown in Figure 5a and 5b. Stores were categorized and categories are shown in the navigation bar located on the upper part of the page. It is also where users can access the Log in button to access the login page and view cart items.

Figure 4

(a) Landing Page Mobile View



(b) Landing Page Desktop View

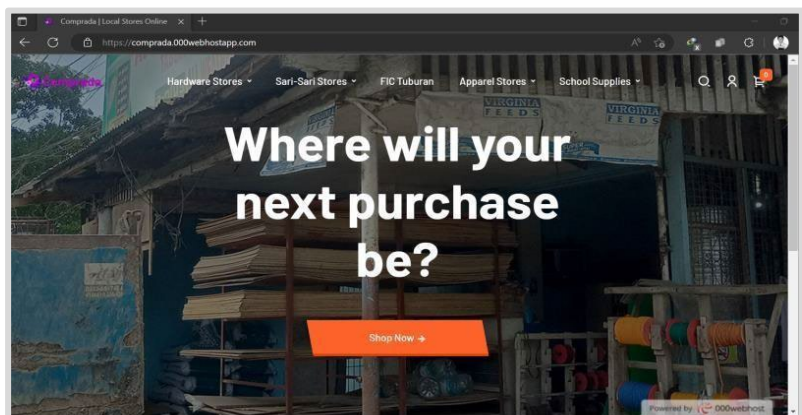
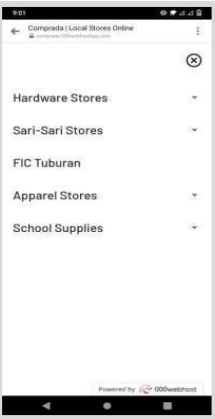
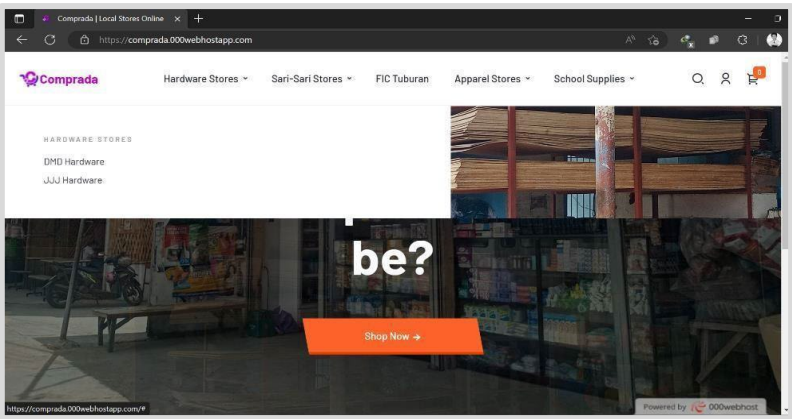


Figure 5

(a) Navigation Bars Mobile View



(b) Navigation Bars Desktop View



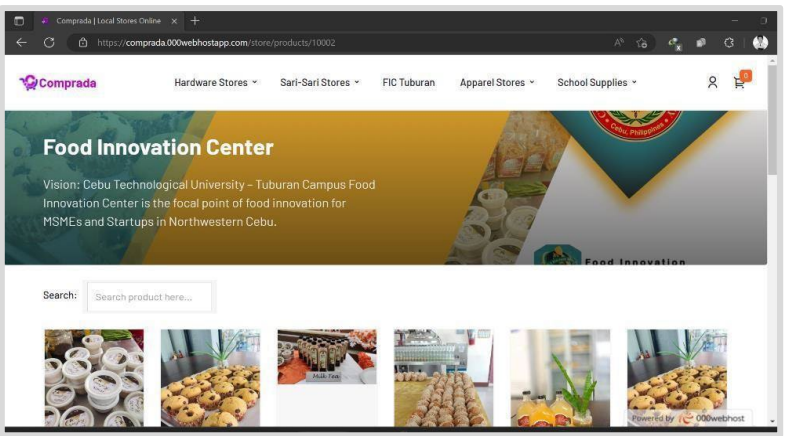
On the Store page presented in figure 6, customers can browse the store and view different products with their respective prices within their selected store. Customers will be able to add their chosen items to their cart through the item's add-to-cart option. The cart icon will also show the number of items they have added to the cart. Customers can also search for a particular item within the store by typing the search keywords in the search field.

Figure 6

(a) Store Page Mobile View



(b) Store Page Desktop View

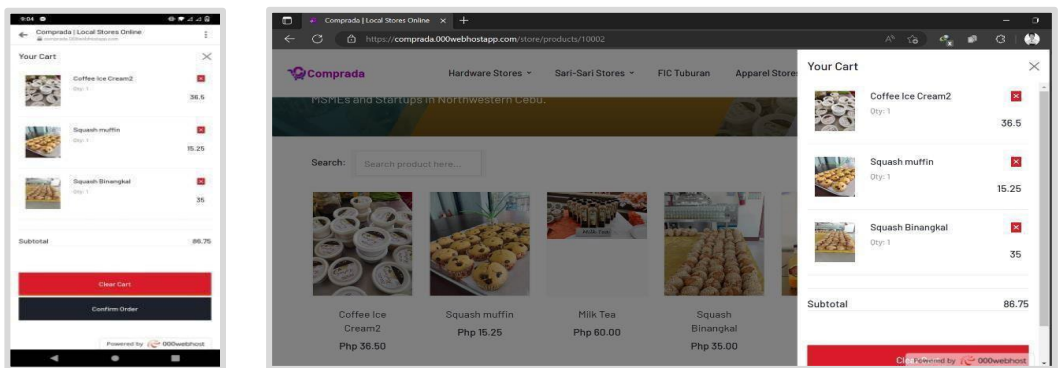


Customers can view their reserved items on the Customer Cart page where the name of the items, quantity, price, and subtotal is displayed as shown in figure 7a and b. They have the option to remove the item by clicking the red 'x' icon; to clear the cart by clicking the Clear Cart button; and to confirm their order by clicking the Confirm Order button.

Figure 7

(a) Customer Cart Page Mobile View

(b) Customer Cart Page Desktop View

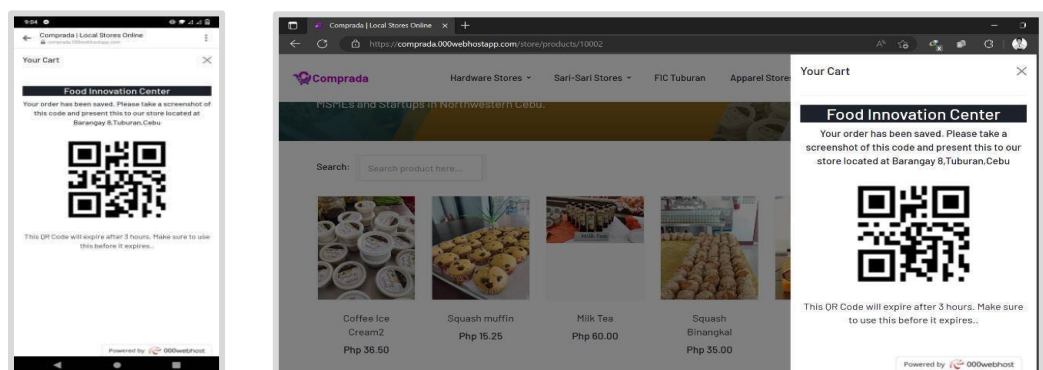


When a customer confirms their order by clicking the Confirm Order button, a QR Code will be auto generated and displayed on this page as shown in figure 8a and b. The customer will be informed that the order has been saved and asked to take a screenshot of the code to present it to the store upon claiming the order. The generated code will expire within three hours by default or may be changed as set by the store.

Figure 8

(a) QR Code Generation Page Mobile View

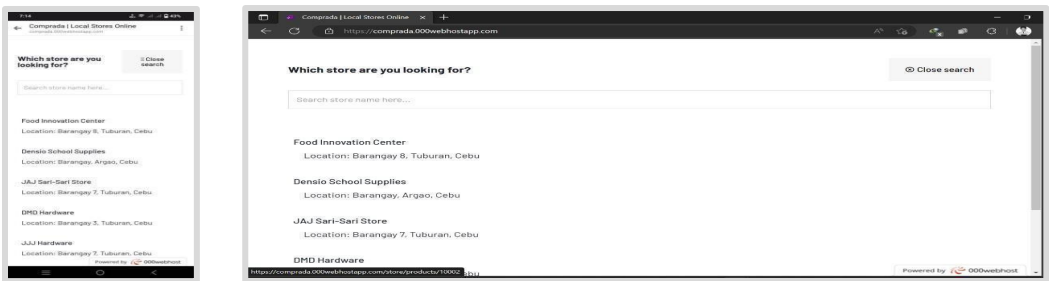
(b) QR Code Generation Page Desktop View



Search Enrolled Stores page is accessed by clicking the search button on the menu tab as shown in figure 9a and b. Customers can search for a particular store by typing in the search field. Each store's location is also displayed on this page to provide convenience to the customer.

Figure 9

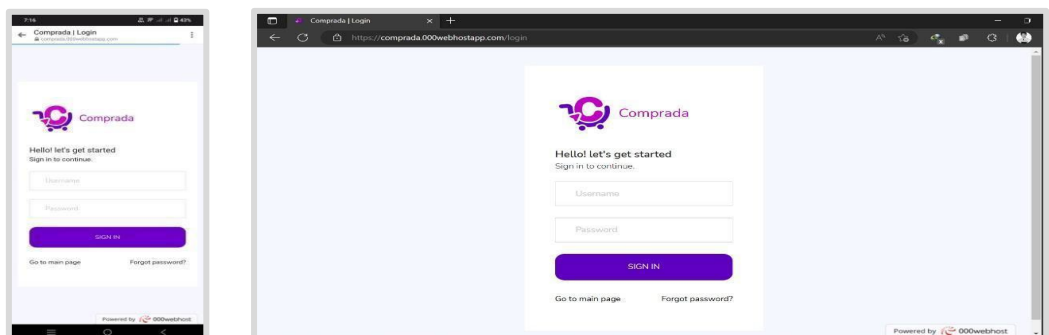
(a) Search Enrolled Stores Page Mobile View (b) Search Enrolled Stores Page Desktop View



The login and logout module covers the accessibility to the user's pages. It determines the access rights of the users. Figure 10 shows a sample view of the module. The user login page allows store account users to log in with his/her username or email and password. It provides a Login button to confirm login and a Cancel button to cancel an attempt. The user should input the correct username or email and password to gain access and successfully log in. After a successful login, the user will be directed to the account user dashboard as shown in figure 11. However, when a login attempt is unsuccessful, an error message will be shown on the login page to inform the user about the error.

Figure 10

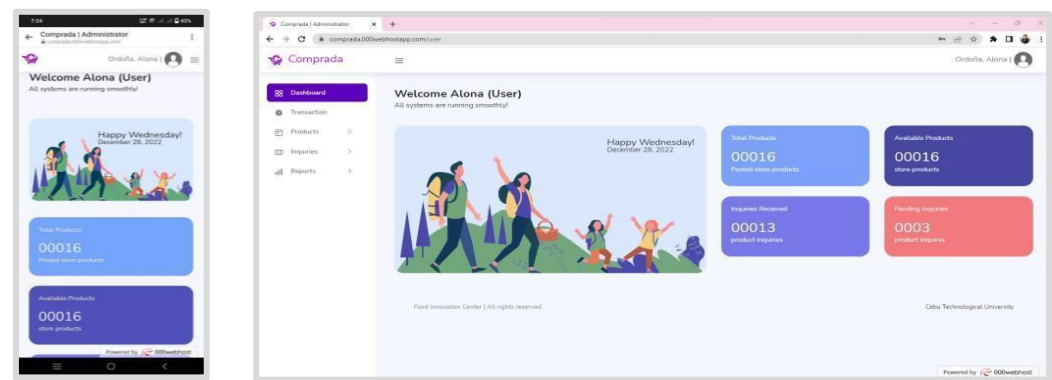
(a) Login User Page Mobile View (b) Login User Page Desktop View



The dashboard page shows the user the total number of products, available products, inquiries received, and pending inquiries. At the menu tab, the user can manage the following modules: Transaction, Products, Inquiries, and Reports.

Figure 11

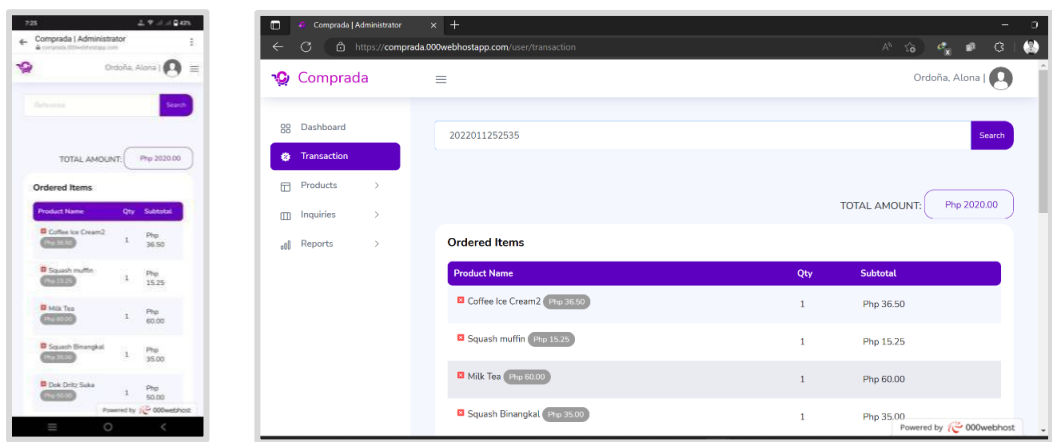
(a) Dashboard Page Mobile View (b) Dashboard Page Desktop View



The figure 12a and b shows the Store Transactions page where store users can scan a QR code or reference code wherein if the scanned QR code is valid, user can view all view all the ordered items under it. The user can also view that total amount of the order. A remove button is also made available to store users to modify customers' order if needed. An ordered item can be removed from the list if the user clicks on the red 'x' button before the product name of the item.

Figure 12

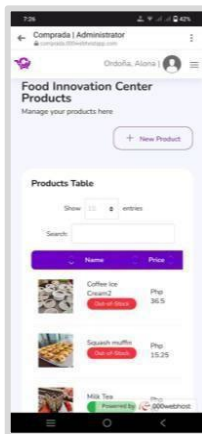
(a) Store Transaction Page Mobile View (b) Store Transaction Page Desktop View



The user can manage all the items shown in the store through the products management module. Within this page, the user can add and edit store products as shown in figure 13a and b. The user can also set a particular product as available or out of stock. By clicking on the New Product button, the user can add a new product. The user also has the option to adjust the number of entries to be shown in the products table through the show entries field and filter products shown through the search field.

Figure 13

(a) Store Products Page Mobile View



(b) Store Products Page Desktop View

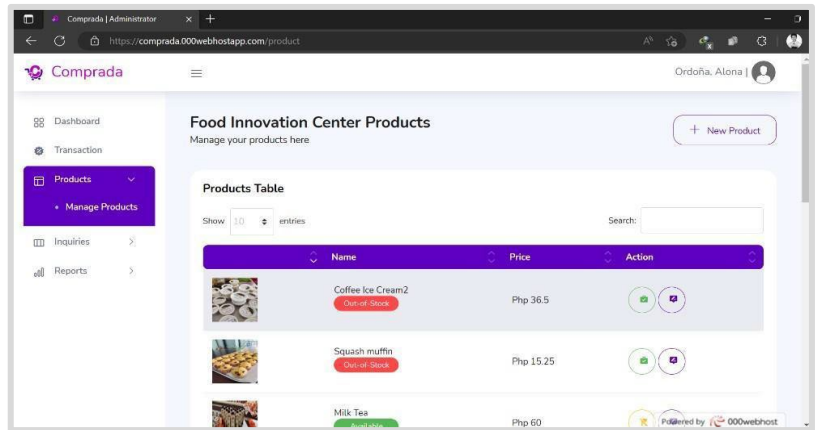


Table 2*Software Testing Final Results*

Test Items	Expected Result	Result
Login Account	Successfully logged in	PASSED
Access the web application	Web application's landing page is loaded	PASSED
Search Stores	All enrolled stores with the search keyword are shown	PASSED
Search Store Products	All products in selected store with the search keyword are shown	PASSED
Visit Store	View specific store	PASSED
Confirm Order	Order is confirmed and the QR code is generated	PASSED
Add product to cart	Product is added to the cart	PASSED
Clear Cart	All items in the cart are removed	PASSED
Remove Cart Item	Selected item in the cart is removed	PASSED
View Cart	All items in cart can be viewed	PASSED
Manage Store Products	Can successfully add, edit and delete store products	PASSED
Manage Product Inquires	Sellers can successfully view and manage inquiries	PASSED
Manage Transactions	Sellers can manage sales transactions and can successfully scan QR code and view all items under it.	PASSED
Log out Account	Account successfully logged out	PASSED

Furthermore, after testing all the modules developed, expected results were successfully generated and the overall result were "PASSED" as shown in Table 2. This means that the application met the requirements and the expected results. Error messages and prompt messages intended for users to read and understand were also successfully shown during testing.

Usability and Satisfaction of Consumers with the Application

Adapting the Usefulness, Satisfaction, and Ease of Use/learning (USE) Questionnaire by Lund (2001), the system was rated by the respondents as to its Usefulness,

Satisfaction, and Ease of use, on a scale of 1 to 5 with the following verbal descriptions: 5 - Strongly Agree, 4 - Agree, 3 - Neutral, 2-Disagree and 1 - Strongly Disagree.

Table 3

Respondents Responses in terms of "Usefulness" of the Application

Usefulness	4 Strongly Agree	3 Agree	2 Disagree	1 Strongly Disagree	TWM	WM	VD
It helps me be more effective.	83	120	0	0	692	3.41	Strongly Agree
It helps me be more productive.	70	133	0	0	679	3.34	Strongly Agree
It is useful	104	100	0	0	716	3.51	Strongly Agree
It gives me more control over the activities in my life.	69	130	2	1	671	3.32	Strongly Agree
It makes the things I want to accomplish easier to get done.	83	120	1	0	694	3.40	Strongly Agree
It saves me time when I use it.	82	120	2	0	692	3.39	Strongly Agree
It meets my needs as a buyer/seller	73	130	1	0	684	3.35	Strongly Agree
It does everything I would expect it to do.	68	133	2	0	675	3.33	Strongly Agree
					AVERAGE	3.38	Strongly Agree

Respondents’ responses in terms of the usefulness of the application, as shown in Table 3, showed an agreement to its usefulness with an average weighted mean of 3.38, which, when translated, means a verbal description of “Strongly Agree.” This shows that the web application is adequately useful as the indicated items in the table include effectiveness and productivity.

Table 4
Respondents Responses in terms of “Satisfaction” with the Application

Satisfaction	4	3	2	1	TWM	WM	VD
	Strongly Agree	Agree	Disagree	Strongly Disagree			
I am satisfied with the application	100	130	1	0	792	3.43	Strongly Agree
I would recommend it to a friend.	110	110	1	0	772	3.49	Strongly Agree
It is fun to use.	91	109	1	0	693	3.45	Strongly Agree
It works the way I want it to work.	71	100	0	0	584	3.42	Strongly Agree
It is wonderful.	95	105	1	0	697	3.47	Strongly Agree
I feel I need to have it.	61	140	0	0	664	3.30	Strongly Agree
It is pleasant to use.	90	106	1	0	680	3.45	Strongly Agree
AVERAGE					3.43		Strongly Agree

When respondents were asked about their satisfaction after using the application, the responses’ average weighted mean was 3.43, as shown in Table 4, which translates to a verbal description of “Strongly Agree.” It showed that respondents were satisfied with the web application.

Table 5
Respondents Responses in terms of the Application's "Ease of Use"

Ease of Use	4	3	2	1	TWM	WM	VD
	Strongly Agree	Agree	Disagree	Strongly Disagree			
It is easy to use.	105	96	1	0	710	3.51	Strongly Agree
It is simple to use.	103	97	0	0	703	3.52	Strongly Agree
It is user-friendly.	98	100	1	0	694	3.49	Strongly Agree
It requires the fewest steps possible to accomplish what I want to do with it.	90	111	2	0	697	3.43	Strongly Agree
It is flexible.	91	112	0	0	700	3.45	Strongly Agree
Using it is effortless.	106	93	2	0	707	3.52	Strongly Agree
I can use it without written instructions.	95	105	2	0	699	3.46	Strongly Agree
I don't notice any inconsistencies as I use it.	97	102	2	0	698	3.47	Strongly Agree
Both occasional and regular users would like it.	99	101	3	0	705	3.47	Strongly Agree
I can recover from mistakes quickly and easily.	84	117	0	0	687	3.42	Strongly Agree
I can use it successfully every time	92	110	1	0	700	3.45	Strongly Agree
I can use the application using my mobile phone	111	91	0	0	717	3.55	Strongly Agree
					AVERAGE	3.48	Strongly Agree

As to the respondents’ response when asked in terms of the Application’s “Ease of Use”, responses as shown in table 5 showed an average weighted mean of 3.48 which indicates that the developed web application is simple and easy to use.

Table 6
Respondents Responses in terms of the Application's "Ease of Learning"

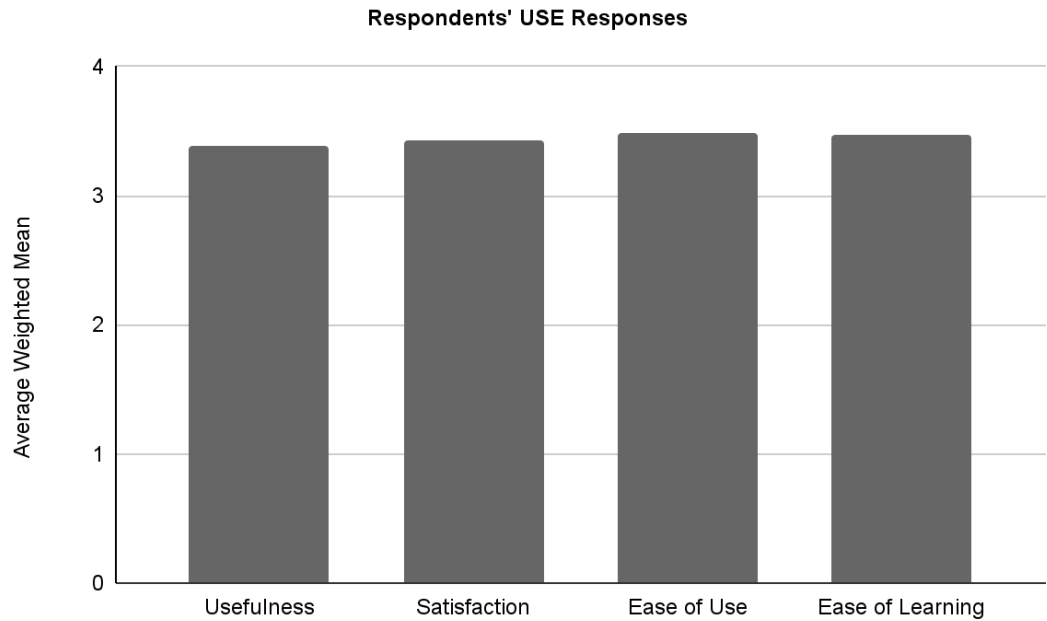
	4	3	2	1	TWM	WM	VD
Ease of Learning	Strongly Agree	Agree	Disagree	Strongly Disagree			
I learned to use it quickly.	93	105	1	0	689	3.46	Strongly Agree
I easily remember how to use it.	96	106	1	0	704	3.47	Strongly Agree
It is easy to learn to use it.	92	111	1	0	703	3.45	Strongly Agree
I quickly became skillful with it.	101	101	2	0	711	3.49	Strongly Agree
					AVERAGE	3.47	Strongly Agree

In terms of the application’s ease of learning, respondents’ responses showed an agreement with an average weighted mean of 3.47 translated to a verbal description of “Strongly Agree,” which means that it’s easy to learn how to use the developed web application.

The overall responses of the respondents in terms of Usefulness, Satisfaction, Ease of Use, and Ease of Learning showed a verbal description of “Strongly Agree,” which means that the developed web application meets the user requirements as shown in figure 14.

Figure 14

Respondents' responses to the use of the developed web application



CONCLUSION

Based on the results, the web application with QR Technology for small-scale businesses was successfully developed and tested, which resulted in a more convenient process for buying and selling products in local stores. The developed web application was able to execute the expected functionalities and could provide customers with an avenue to check product availability without even going to the physical store, helping minimize the time for face-to-face interaction. With the QR technology successfully integrated into the application, customers could already generate a QR code to reference their product orders before going to the physical store, thus making store transactions faster and eliminating queues just for product inquiry and enumerating product information to buy. The application's responsive user interface helped maintain ease of use and functionality in various mobile and desktop views. Further, the developed web application was useful and easy to use, and users were satisfied with the application as presented in the survey results.

RECOMMENDATION

It is recommended that payment options be considered and integrated with the application for convenience and to allow customers to pay before going to the physical store. Also, re-evaluation after months of deployment should be done quarterly. The result of the re-evaluation will be the basis for further improvement of the application that would bring solutions to the relevant issues encountered by the users of the application in E-commerce and M-commerce.

ACKNOWLEDGMENTS

This endeavor was an approved research project funded by the General Appropriations Act (GAA) budget of Cebu Technological University (CTU). With this, the proponents would like to thank CTU for the approval and financial grant.

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