

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology



ISSN 2320-088X

IMPACT FACTOR: 7.056

IJCSMC, Vol. 14, Issue. 11, November 2025, pg.30 – 51

GROCERER: Grocery Management System with Mobile Application

**Reniel L. Tiauzon¹; Christian Anthony S. Gemelo²;
John Eric Blancia³; Kristine T. Soberano, PhD⁴**

¹Carlos Hilado Memorial State University

²Carlos Hilado Memorial State University

³Carlos Hilado Memorial State University

⁴State University of Northern Negros

¹reniel.tiauzon@chmsu.edu.ph; ²christian.gemelo@chmsu.edu.ph; ³johneric.blancia@chmsu.edu.ph; ⁴ksoberano@sunn.edu.ph

DOI: <https://doi.org/10.47760/ijcsmc.2025.v14i11.003>

Abstract: This study aimed to design and develop a system called GROCERER: Grocery Management System with Mobile App with the following technical features: mobile and web-based transactions, web-based product management, app-based messaging, dynamic product inventory, and report generation. The system utilized the developmental and descriptive method. The level of acceptability of GROCERER was evaluated by the store owner, customers, and IT experts. There were twenty (20) respondents composed of four (4) IT experts, two (2) store owners, and fourteen (14) customers who evaluated the system's usability using the PSSUQ questionnaire and its functionality through test cases. The system was rated as 100% functional and operational and was found highly acceptable in terms of usability, information quality, interface quality, and overall performance. A user manual was created to guide users in operating the software. The Waterfall Model was used in development, including planning, requirements, design, development, testing, and review phases. The researchers recommend that Tiangchon Grocery Store consider implementing GROCERER to improve online sales and modernize the process of purchasing groceries. Evaluators further suggested enhancing the final reports and manual purchasing procedures.

Keywords: PSSUQ, mobile app, grocery management, chat support, reports

INTRODUCTION

By 2022, there were 30.4 million adult grocery app users in the United States. Since March 2020, grocery apps worldwide gained more than 500 million downloads—a 33% increase from the previous year—due to the global pandemic. The growth of mobile grocery shopping indicates a shift in consumer behavior, but few studies have explored delivery app service quality and customer satisfaction, which directly affect the food service industry. Therefore, this study examines the service quality parameters that influence customer satisfaction and reuse intention, providing insights for improving delivery app services (Statista, 2022).

Smartphones have revolutionized people's daily lives, integrating communication, entertainment, and internet services into one device (Kim et al., 2011). In this context, the study aims to make ordering meals and grocery items more convenient and safer through a system that allows local and online transactions, emphasizing safety, efficiency, and user experience.

OBJECTIVES OF THE STUDY

The primary objective of this study is to develop the GROCERER: Grocery Management System with Mobile App to enhance and streamline grocery store transactions. Specifically, the study aims to:

1. Design and develop a grocery mobile application with the following technical features:
 - a. Mobile and web-based transactions
 - b. Web-based product management
 - c. App-based messaging
 - d. Dynamic product inventory
 - e. Report generation
2. Evaluate the functionality of these features.
3. Assess the system's usability in terms of:
 - a. System usefulness
 - b. Information quality
 - c. Interface quality
 - d. Overall usability
4. Develop a user manual to guide users in navigating and operating the system.

BACKGROUND OF THE STUDY

Today's generation is part of the "one-click" era, where technology has made daily tasks—including grocery shopping—faster and more accessible. The COVID-19 pandemic accelerated this transition, with online businesses in the Philippines increasing from 1,700 in early 2020 to nearly 88,000 by the year's end. Online grocery platforms have thus become essential for convenience and safety.

The GROCERER mobile application was developed to address these needs by allowing users to order groceries, clothing, and medicine from local stores and have them delivered efficiently. This system offers practicality, affordability, and accessibility to local consumers while supporting small businesses in transitioning to digital operations.

SCOPE AND LIMITATION

This study focuses on developing the GROCERER system for Tiangchon Grocery Store in Isabela, Negros Occidental. The system's main goal is to improve the marketplace through online business by allowing users to transact, chat, and receive deliveries conveniently. The system includes features for mobile and web-based transactions, product management, chat support, inventory tracking, and report generation.

The study's scope is limited to Tiangchon Grocery Store and does not cover multiple-store integration or advanced analytics. The system was developed using Java and Android Studio for mobile interfaces and web integration.

DEFINITION OF TERMS

- **Compatibility:** Ability of the system to run on mobile devices used by local customers.
- **Cost of Materials:** Refers to the retail price listed for each product in the system.
- **Functional Suitability:** Appropriateness and completeness of the system's features.
- **Grocerer:** The developed grocery management system with a mobile app.
- **Inventory:** Refers to stock-in and stock-out of products in the system.
- **Tiangchon:** The grocery store used as the case study for the system.

MATERIALS AND METHODS

Research Design

The study utilized a descriptive-developmental research design to guide the creation and evaluation of the GROCERER: Grocery Management System with Mobile Application. This design allowed the researchers to describe the current challenges of manual grocery transactions and develop a technological solution addressing these problems. The project followed a systematic process of system analysis, design, implementation, and evaluation to ensure functionality and usability.

The system was developed following the Waterfall Model, which includes the following phases:

1. **Planning and Requirements:**
Data were gathered through interviews and observation at Tiangchon Grocery Store to identify issues and define user requirements.
2. **Analysis and Design:**
Diagrams such as context, data flow, entity relationship, and use case diagrams were created to visualize the system's structure and processes. The design focused on usability, clarity, and accessibility.
3. **Implementation:**
Actual coding and debugging were performed using Java and Android Studio. The design and system documentation were refined for deployment.
4. **Testing and Evaluation:**
The system underwent functionality and usability testing using standardized instruments, including the PSSUQ (Post-Study System Usability Questionnaire).
5. **Deployment:**
After testing, the system was deployed at Tiangchon Grocery Store. The researchers provided training to the store owner to ensure smooth system operation.

System Design

The system architecture consists of two main components: a mobile application for customers and a web-based interface for administrators and store owners. These components are interconnected via a centralized database, enabling real-time synchronization of data such as inventory, product details, and transactions.

System Features

- User registration and login (via Google account)
- Product browsing and order placement
- Chat-based communication between store and customer
- Order tracking and delivery management
- Report generation for sales and inventory
- Admin control for verification and management

System Development Life Cycle (SDLC)

The researchers employed the Waterfall Model as the system development framework. This linear model ensures that each phase is completed before proceeding to the next:

Phase	Description
Planning	Identified needs, objectives, and constraints.
Requirements	Defined functional and non-functional requirements.
Design	Created diagrams and user interfaces.
Development	Implemented the system using Android Studio and Java.
Testing	Conducted usability and functionality tests.
Review	Evaluated user feedback and refined system functions.

Conceptual Framework

The conceptual framework of the study follows the Input-Process-Output-Outcome (IPOO) model:

- Input: User requirements, store data, and technical specifications.
- Process: System analysis, design, development, and evaluation.
- Output: Fully functional grocery management system with mobile and web interfaces.
- Outcome: Improved efficiency in grocery transactions and customer satisfaction.

Table Summary:

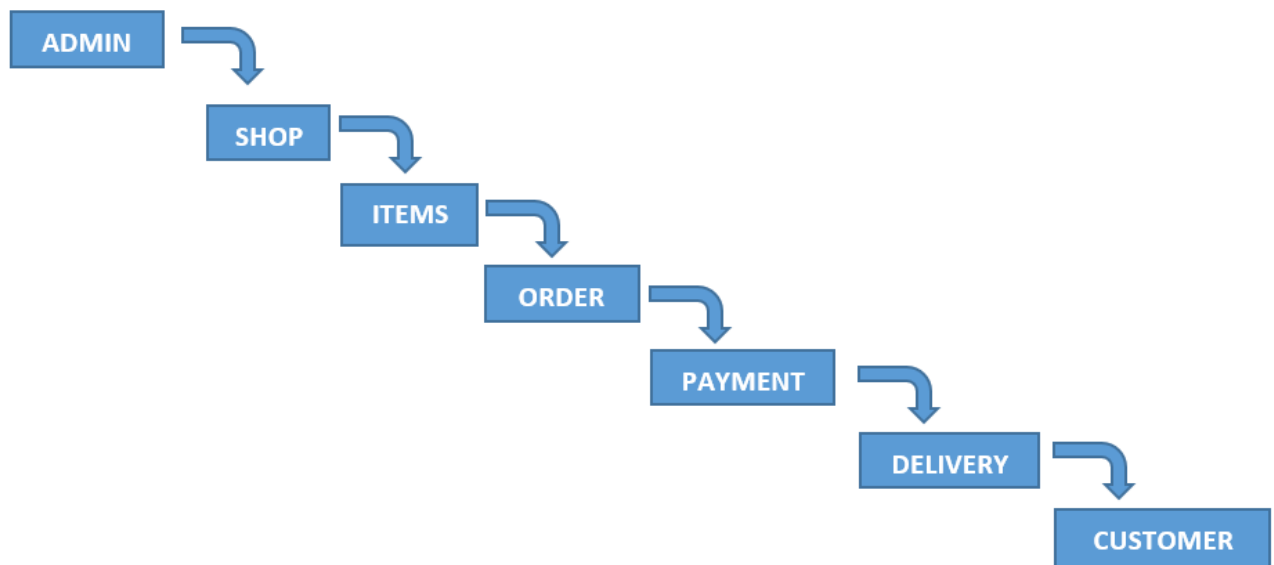


Figure 1. Water Fall Model

Systems Development Method refers to the framework used to structure, plan, and control the process of developing an information system. The system development method that the proponents would use is an incremental development model.

Phase 1. Planning and Requirements

The researcher conducted interviews and collected data at the shop. The researcher determined the issue with the store they went into. The researchers made the decision to create a system or store that they could utilize or benefit from as well as provide a solution to the issue.

Phase 2. Analysis and Design

The researcher created a design or system function after data collection. The diagrams the researcher produced to illustrate how the system works include context diagrams, data flow diagrams, entity relationship diagrams, and use case diagrams. The researcher created a design that makes it simple to grasp how the features work.

Phase 3. Implementation

The actual code and system design were finished at this point. Debugging and actual coding were performed multiple times. After the system was developed, the documentation and manual were appropriately organized and formatted.

Phase 4. Testing and Evaluation

The researchers now tested the system to make sure it functioned properly. The PSSUQ (Post-Study System Usability Questionnaire) is a common tool that the researchers use to assess the system's usability and quality.

Phase 5. Deployment

In the last stage, the System is prepared for deployment to the store owner. The System was ready to be deployed at Tiangchon Grocery Store after the researcher taught the owner how to use it and tried to operate or test the function of the System.

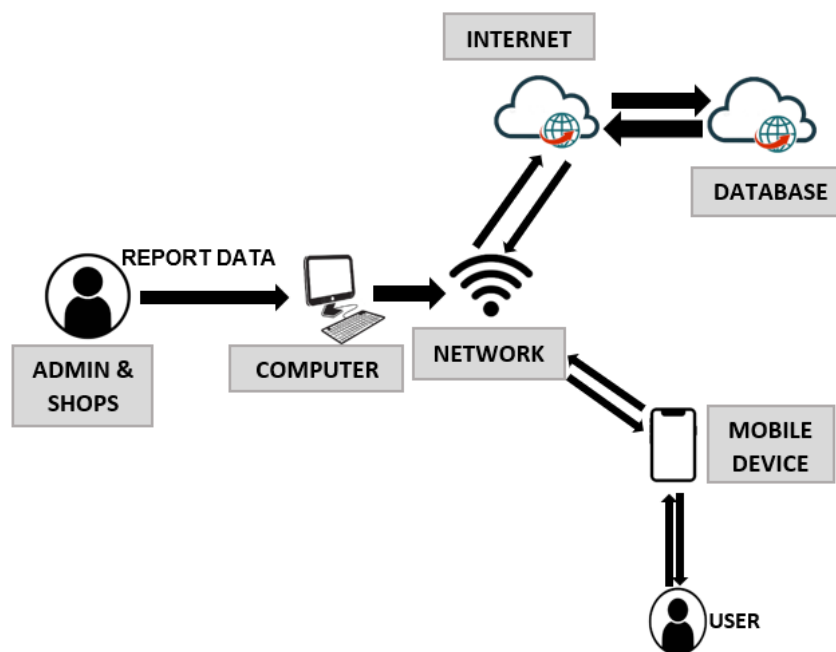


Figure 2. Operational Framework

This figure shows the operational framework of the developed system, a mobile grocery application data from the admin to the database and to the customer.

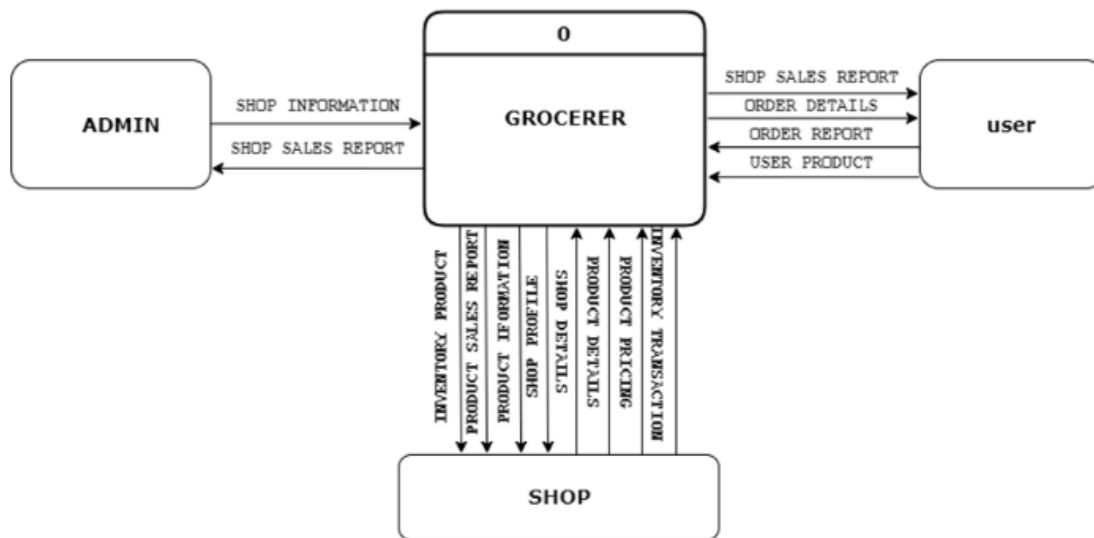


Figure 3. Context Diagram

This figure shows the context diagram of a grocery mobile-based store. The three external entities are interconnected with the System, particularly the user, admin, and shop. The flow of the data and information are shown in the diagram.

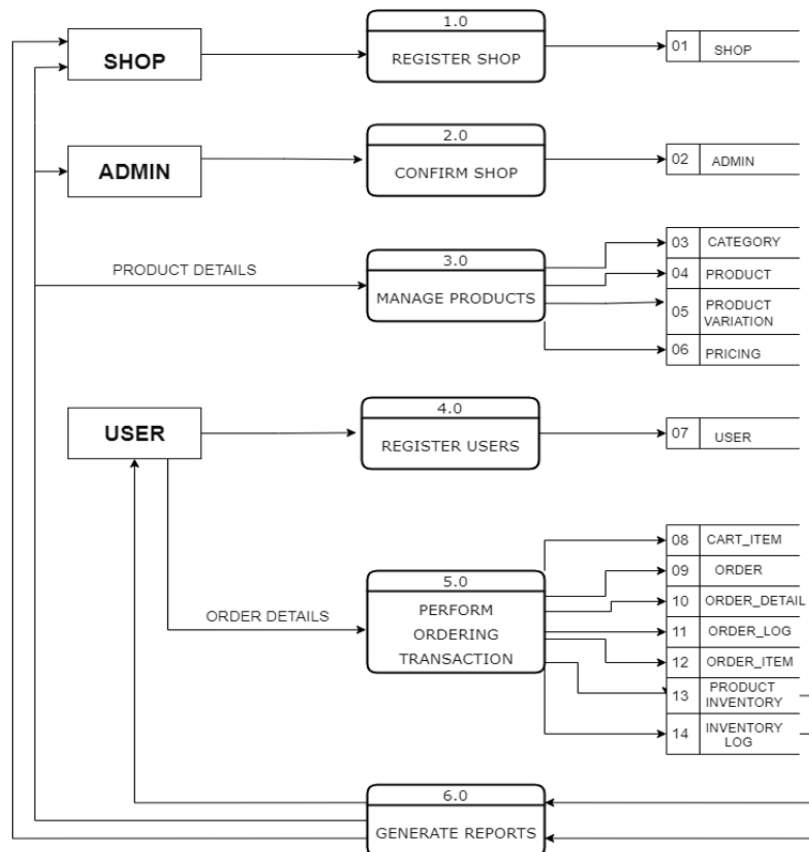


Figure 4. Data Flow Diagram

The system design's data flow flowchart is depicted in this picture. It illustrates the data and information flow for many important system processes. The data flow diagram is typically used in the basic stage of developing an online grocery mobile application system to create an overview of the System without going into great detail, which may be extended later. The system process methods and the overall application data flow are typically included.

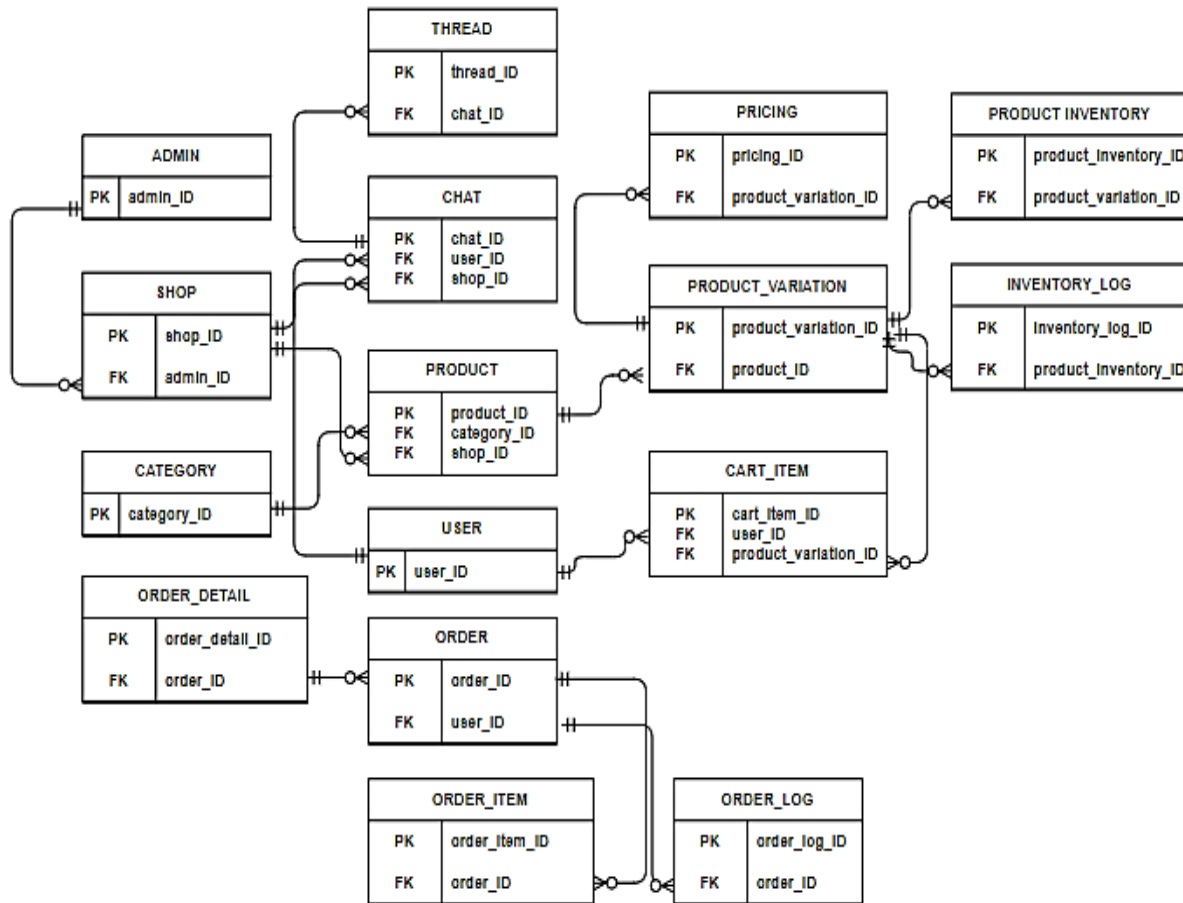


Figure 5. Entity Relationship Diagram

This smartphone software for online grocery stores includes descriptions of all the important entities, their characteristics, and their connections. From browsing through payment, it gives a high-level overview of all parties. Making a grocery system can help make sure that all of the critical components are covered. When using a supermarket application system, you may need to study the software from a variety of angles. The user interface, administrative interface, product identification, and full billing process must all be taken into account

Respondents of the Study

A total of 20 respondents participated in evaluating the system:

Group	Number	Description
IT Experts	4	Evaluated the system's functionality and performance.
Store Owners	2	Tested the system's practicality and efficiency in actual operations.
Customers	14	Assessed usability and user experience.

The selection of respondents used purposive sampling, focusing on individuals with direct involvement or experience with grocery operations or system use.

Instrument Used

Two evaluation tools were employed:

1. Functionality Test Cases – to determine if the system features perform as expected.
2. PSSUQ (Post-Study System Usability Questionnaire) – to assess usability based on four criteria:
 - System usefulness
 - Information quality
 - Interface quality
 - Overall satisfaction

The questionnaire used a 7-point Likert scale, with lower scores indicating higher agreement and better performance.

Data Gathering Procedure

1. Interviews were conducted with store owners to identify system needs.
2. Observation was used to assess current manual processes and inefficiencies.
3. Questionnaires were distributed to respondents after testing the system to gather usability feedback.
4. Functionality testing was performed using predefined scenarios and test cases.

All collected data were recorded and analyzed using descriptive statistics.

Data Analysis

The collected data were analyzed using the mean and Likert scale interpretation to determine the system's overall usability and functionality levels.

Interpretation followed this scale:

- 1.00–1.49: Strongly Agree
- 1.50–2.49: Agree
- 2.50–3.49: Neutral
- 3.50–4.49: Disagree
- 4.50–5.00: Strongly Disagree

Ethical Considerations

Ethical protocols were observed throughout the study. Participants were informed of the purpose of the research and assured that their responses would remain confidential. Participation was voluntary, and consent was obtained before administering any instruments. Data collected were used strictly for academic purposes.

RESULTS AND DISCUSSION

This section presents the results of the functionality testing and usability evaluation of the GROCERER: Grocery Management System with Mobile Application. The findings address the study's objectives—specifically, to assess the system's functionality and determine its level of usability based on the Post-Study System Usability Questionnaire (PSSUQ) criteria: system usefulness, information quality, interface quality, and overall satisfaction.

Profile of Respondents

Table 1. Profile of Respondents

Group	Frequency (f)	Percentage (%)
Store Owners	2	10%
Customers	14	70%
IT Experts	4	20%
Total	20	100%

Twenty (20) respondents participated in evaluating the system, consisting of two (2) store owners, fourteen (14) customers, and four (4) IT experts. This combination ensured a balanced assessment between technical functionality and end-user experience.

Screen Prototype and Description

This section represents the System's actual screen layout. All the layouts were based on the System's functional design. For the System to meet the requirements, both hardware and software criteria must be met.

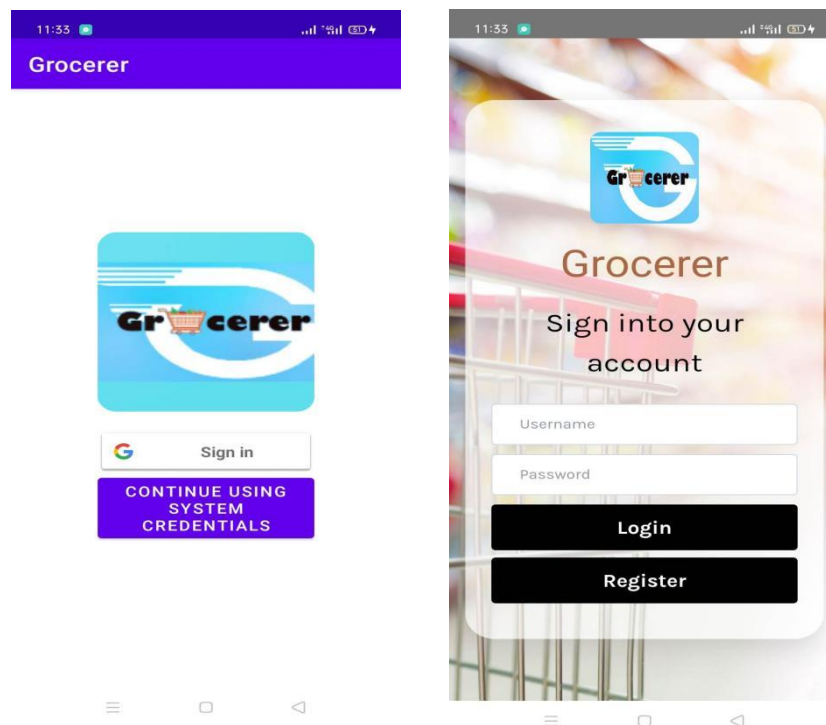


Figure 8. Application Login Interface

This figure shows the user's login form. The login form was made to make the system secure. This form also identifies what kind of user has logged in to gain access to the system's processes intended for that type of user.

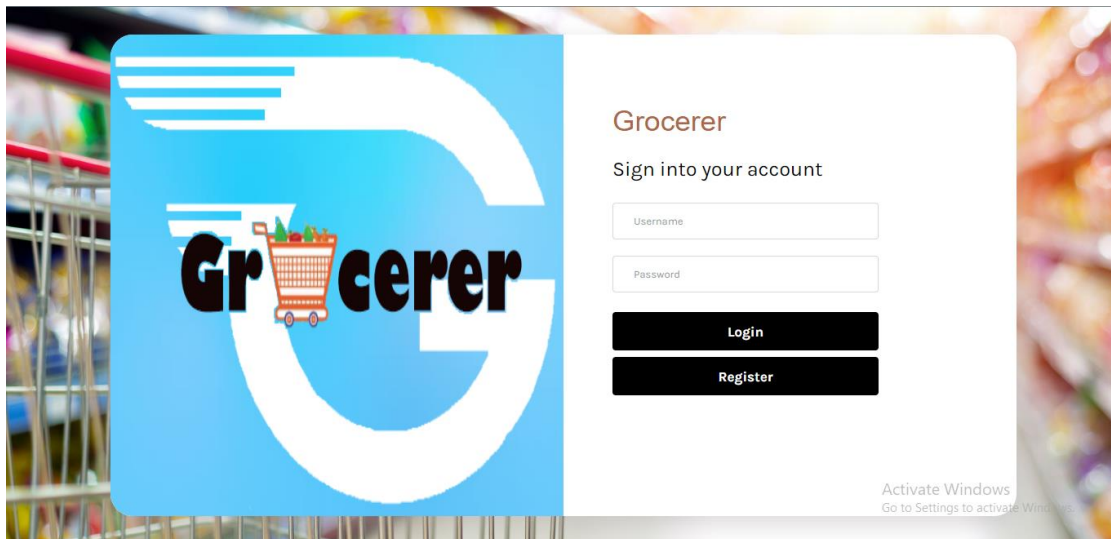


Figure 9. Admin & Shop Login Interface

Figures depict the admin and shop login interfaces. In this interface, the admin or shop owner can input her or his registered username and password to proceed to the main interface.

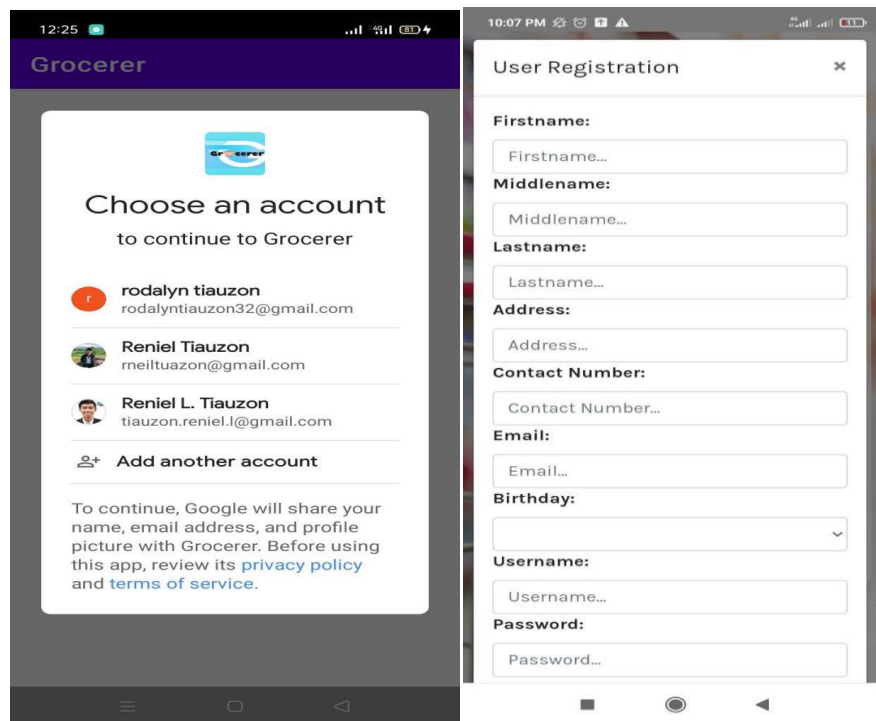


Figure 10. User Login and Registration Interface

The figure shows the user’s login interface. Using a Google verified account, the user can select his or her account. Then, if they do not yet have an account, the user will need to register in order to open the application.

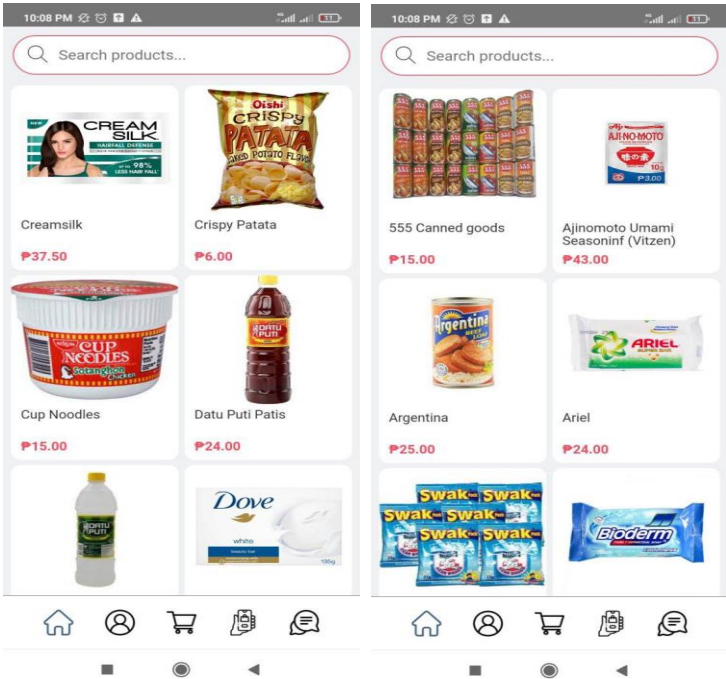


Figure 11. Home page

The figure illustrates the homepage of the app, where you can check out the items that they offer. You will see the total number of items.

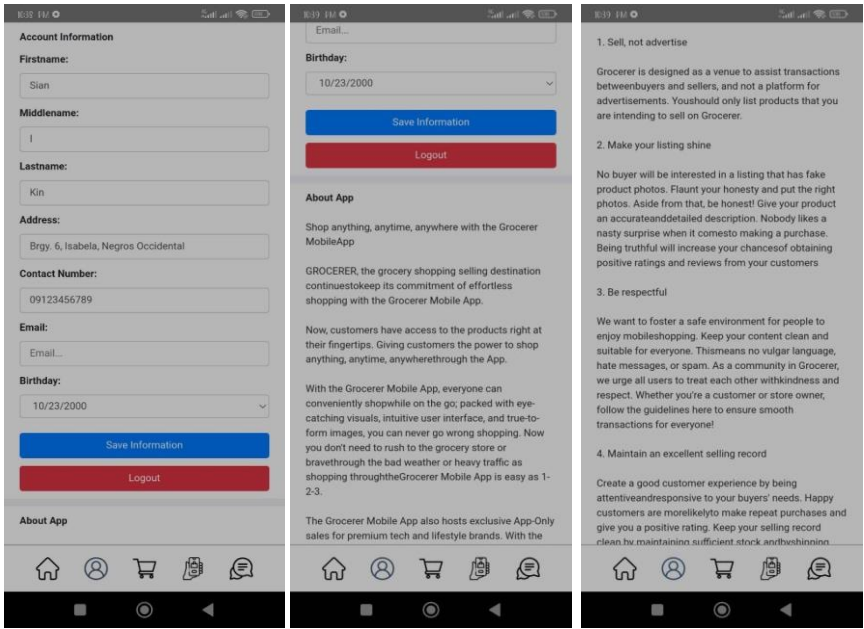


Figure 12. Account Information

The figure illustrates the account information where you can change your details, username, and password if you forget yours. You can learn more about the app as well as the dos and don'ts.

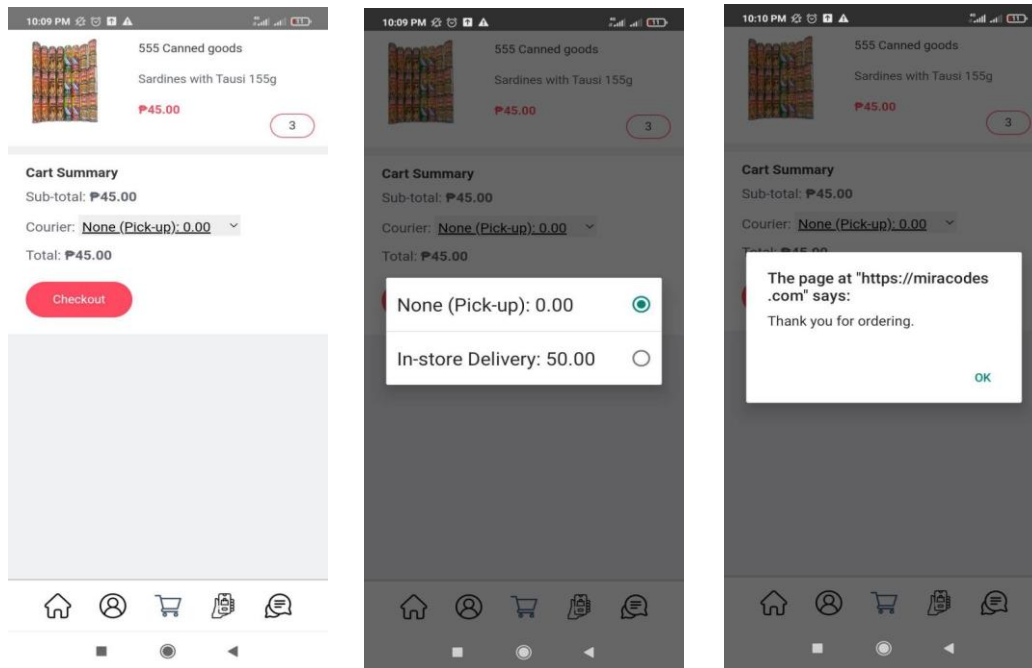


Figure 13. Cart Summary

This figure depicts the cart summary, to which the customer added the items that he or she desired to purchase.

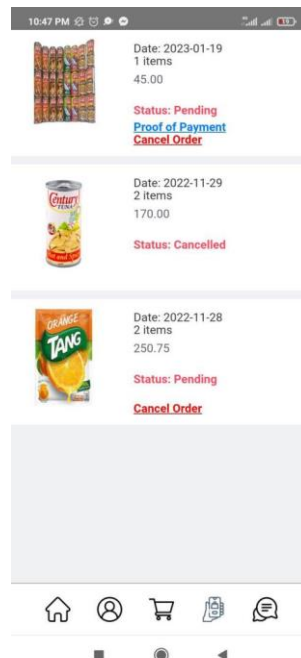


Figure 14. Status order

The figure depicts the status of the customer's order, indicating whether it is pending, canceled, or accepted.



Figure 15. Chat interface

Figure depicts the chat interface through which the customer can communicate with the store owner about their issue.

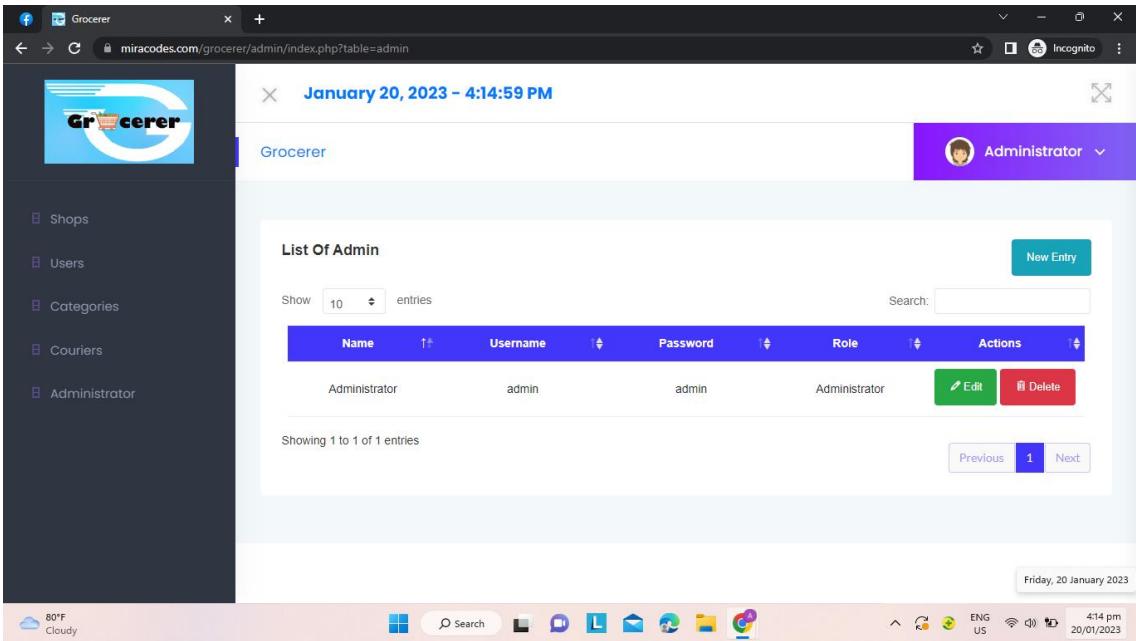


Figure 16. List Of Admin

This figure shows the list of administrators within the management system. The administrator is the overall manager of the system, including the mobile app.

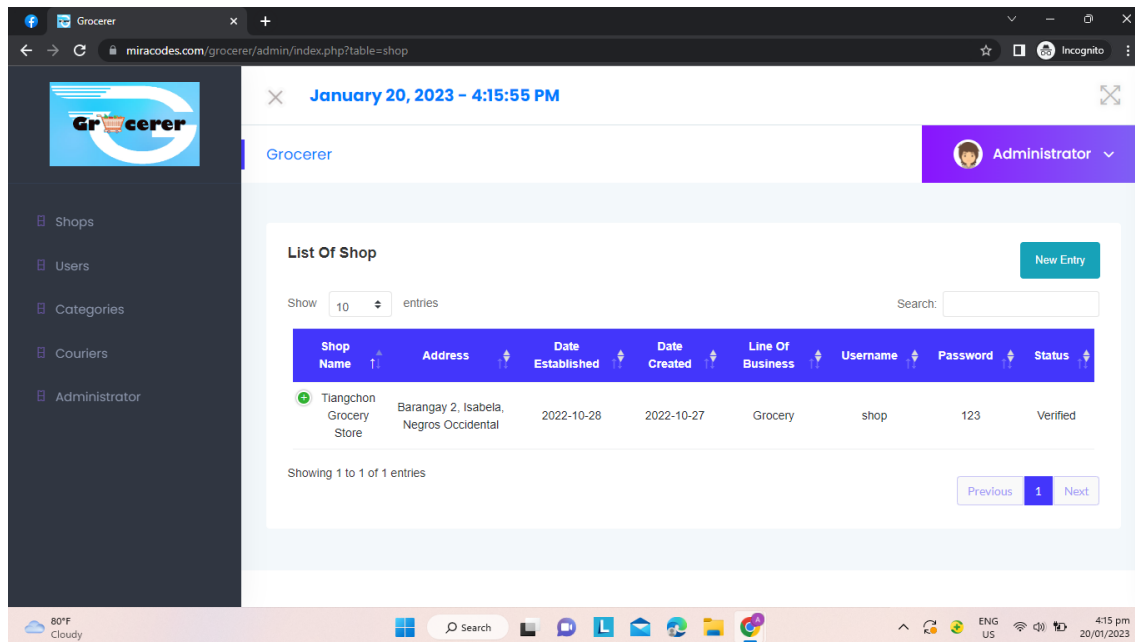


Figure 17. List Of Shop

This figure shows the list of shop that is available within the system. You may also add another store in the system if possible.

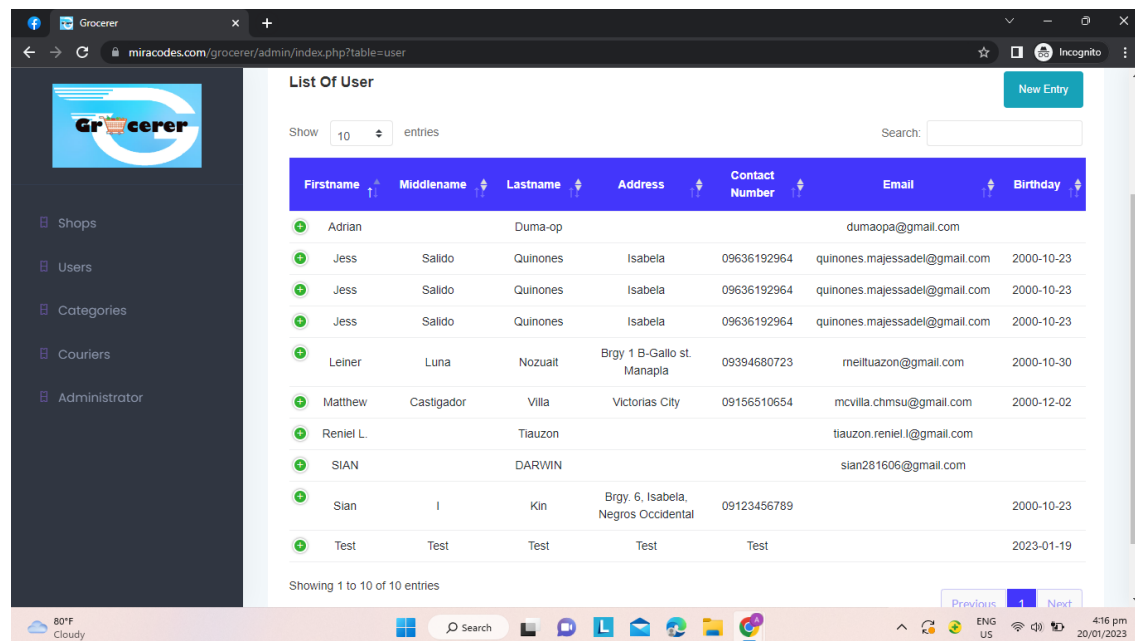


Figure 18. List Of User

This figure shows the list of users that have registered within the application. The administrator will still confirm the registration of each user who registers for the mobile application.

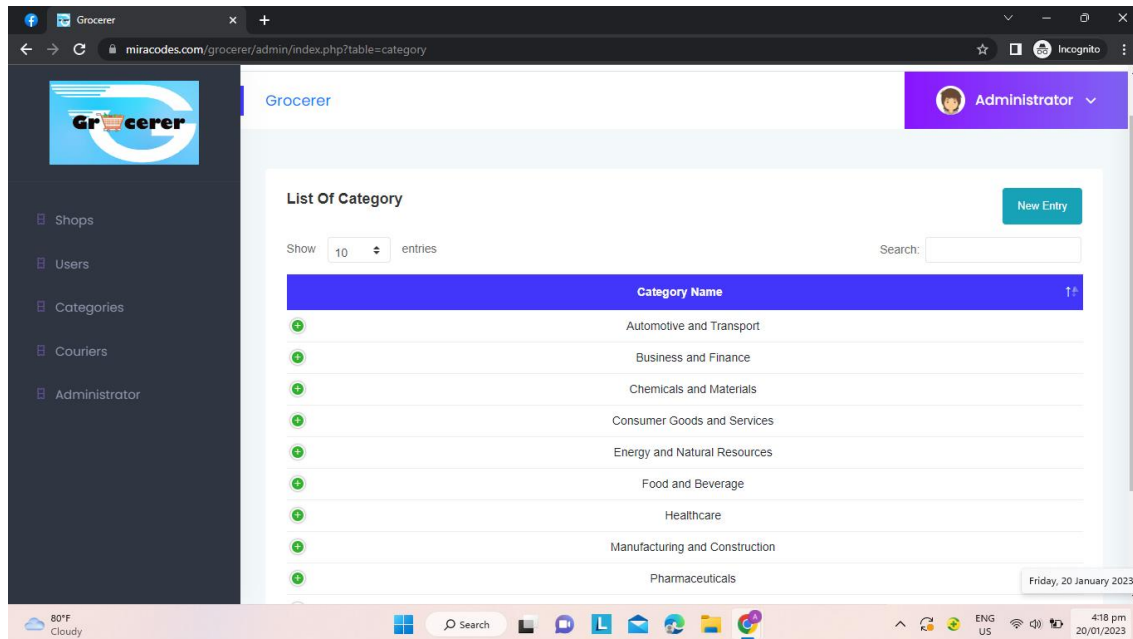


Figure 19. List of Category

This figure shows the list of categories or the variety of items within a shop. You may also add an item depending on what category it belongs to.

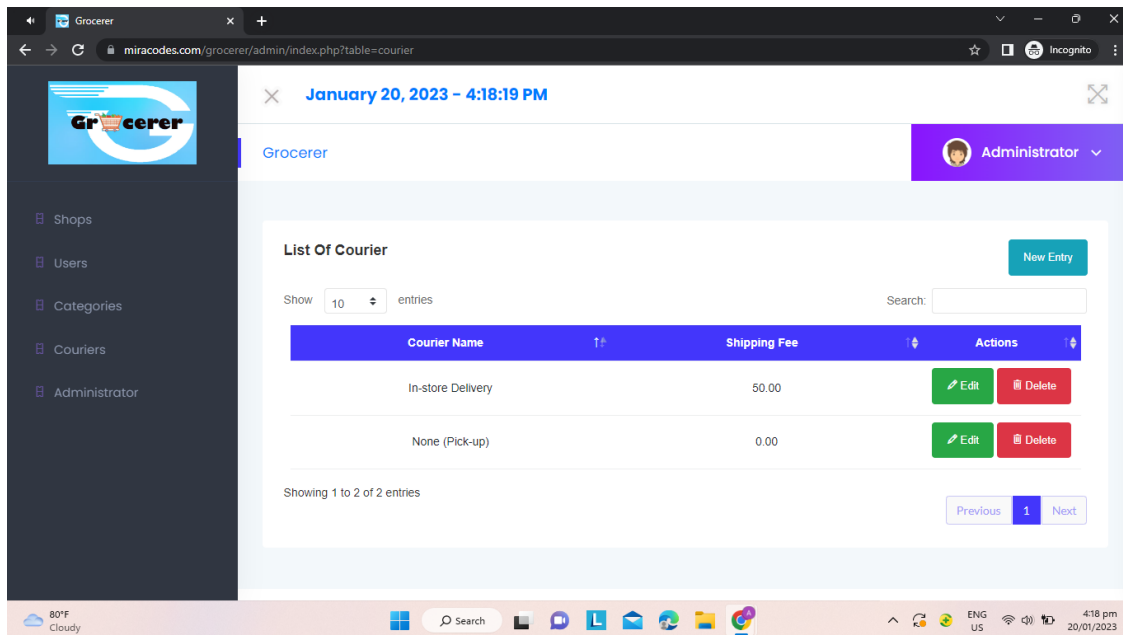


Figure 20. List of Courier

This figure shows the list of couriers within a system; the local store provided its own delivery services. The system will also support in-store pickup.

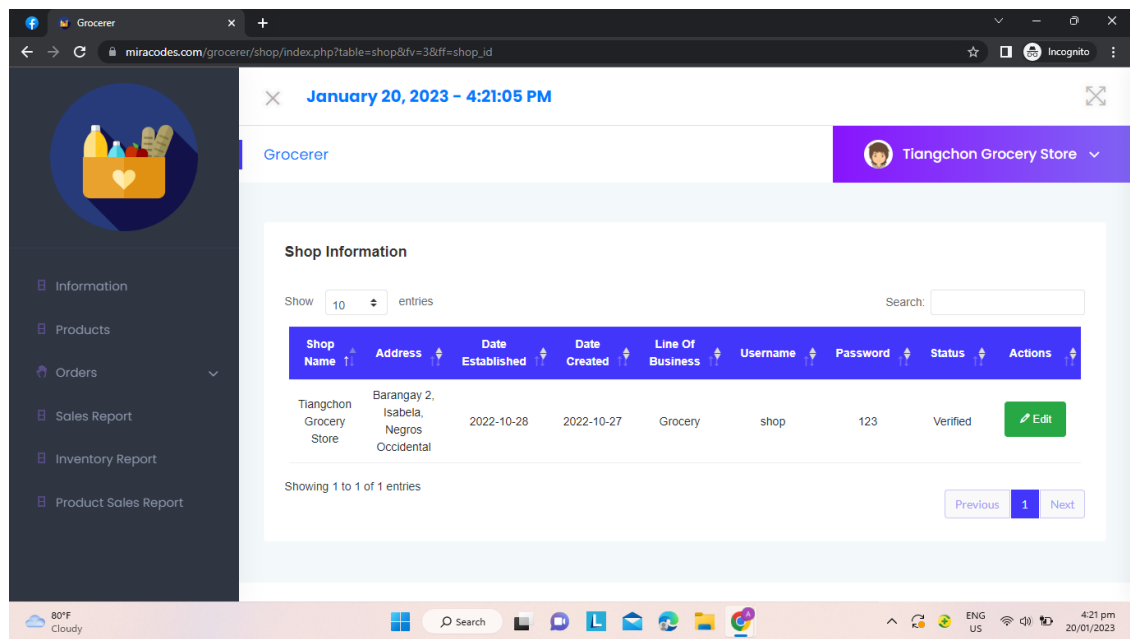


Figure 21. Shop Information

This figure shows what stores have been registered within a system and their information. The admin has the authority to verify the store or not.

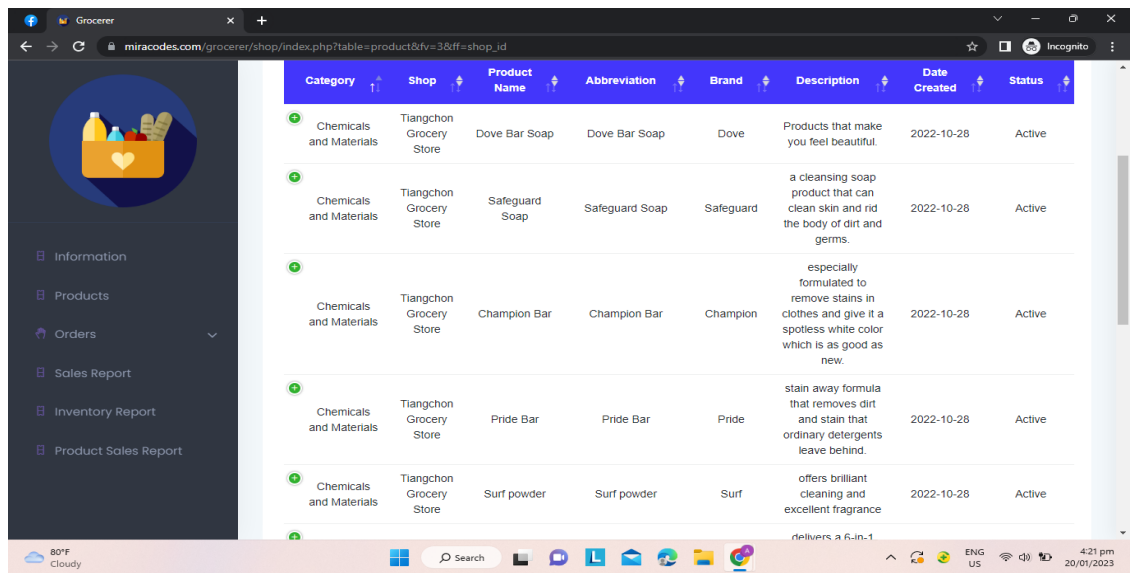
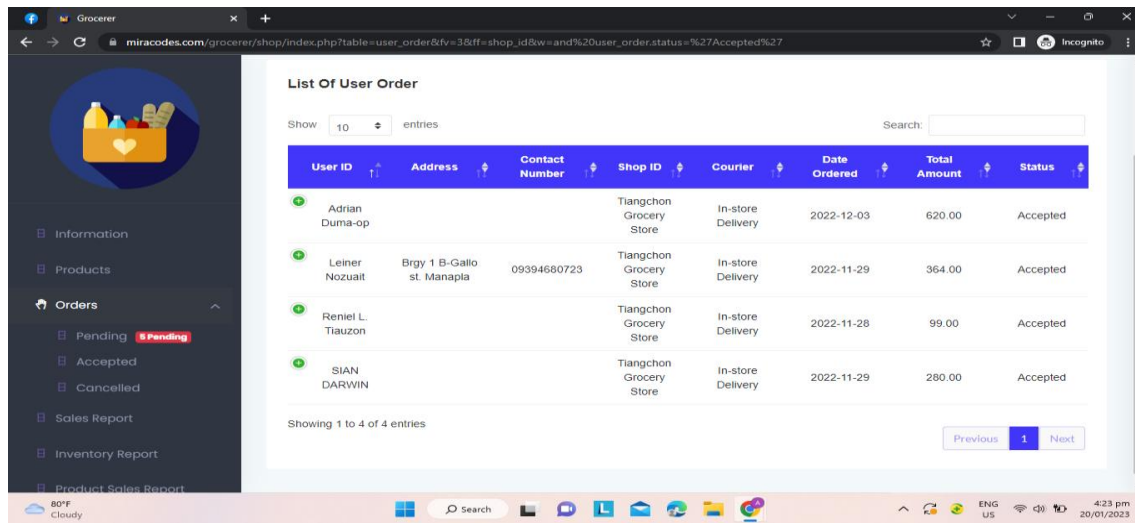


Figure 22. List Of Products

This figure shows the list of products the shop has encoded within the system. The products encoded in the system are the products available within the store.



List Of User Order

Show 10 entries Search:

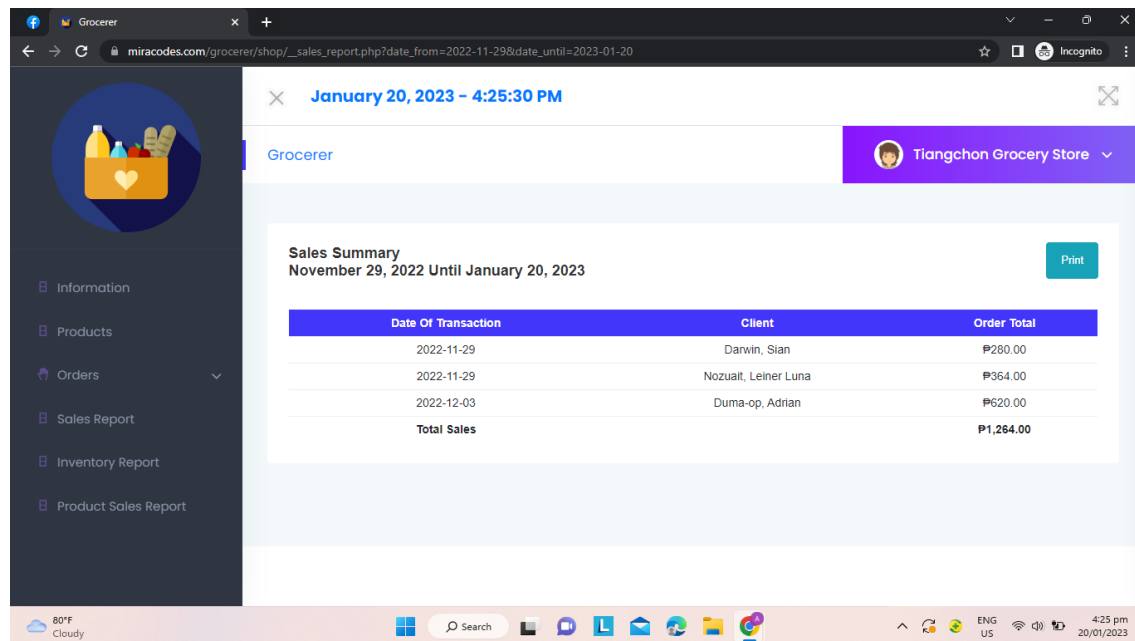
User ID	Address	Contact Number	Shop ID	Courier	Date Ordered	Total Amount	Status
Adrian Duma-op			Tiangchon Grocery Store	In-store Delivery	2022-12-03	620.00	Accepted
Leiner Nozuait	Brgy 1 B-Gallo st. Manapla	09394680723	Tiangchon Grocery Store	In-store Delivery	2022-11-29	364.00	Accepted
Reniel L. Tiauzon			Tiangchon Grocery Store	In-store Delivery	2022-11-28	99.00	Accepted
SIAN DARWIN			Tiangchon Grocery Store	In-store Delivery	2022-11-29	280.00	Accepted

Showing 1 to 4 of 4 entries

Previous 1 Next

Figure 23. List Of User Order

This figure shows the status of every customer's order, whether it is pending, accepted, or canceled. The administrator may also change the status of every order entered by the customer in the system.



Sales Summary
November 29, 2022 Until January 20, 2023

Print

Date Of Transaction	Client	Order Total
2022-11-29	Darwin, Sian	P280.00
2022-11-29	Nozuait, Leiner Luna	P364.00
2022-12-03	Duma-op, Adrian	P620.00
Total Sales		P1,264.00

Figure 24. Sales Report

This figure shows the total sales report of the client and its order within the system. This displays the total number of clients who have ordered as well as their total price order.

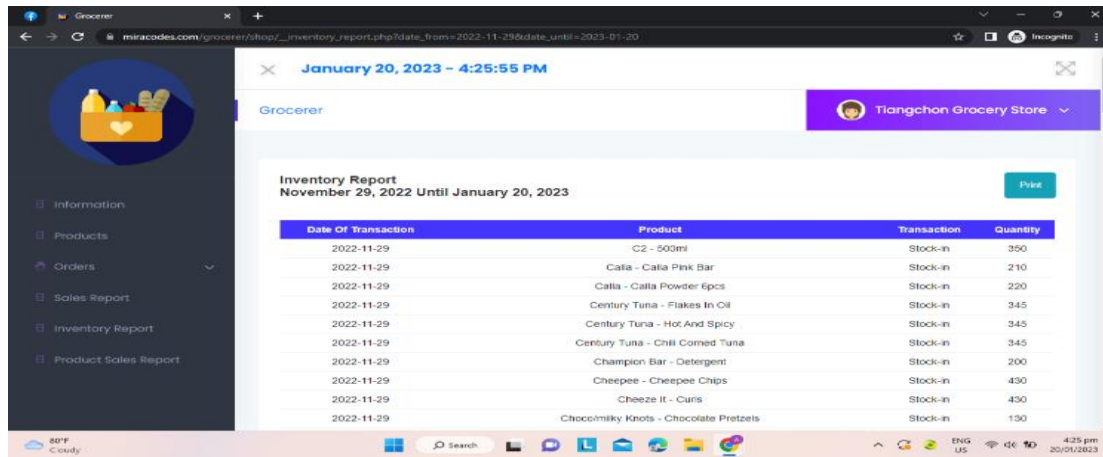


Figure 25. Inventory Report

This figure shows the stock-in or stock-out of items within a shop and the number of stocks available within the system. It also shows the overall stocks that are also available within the store.

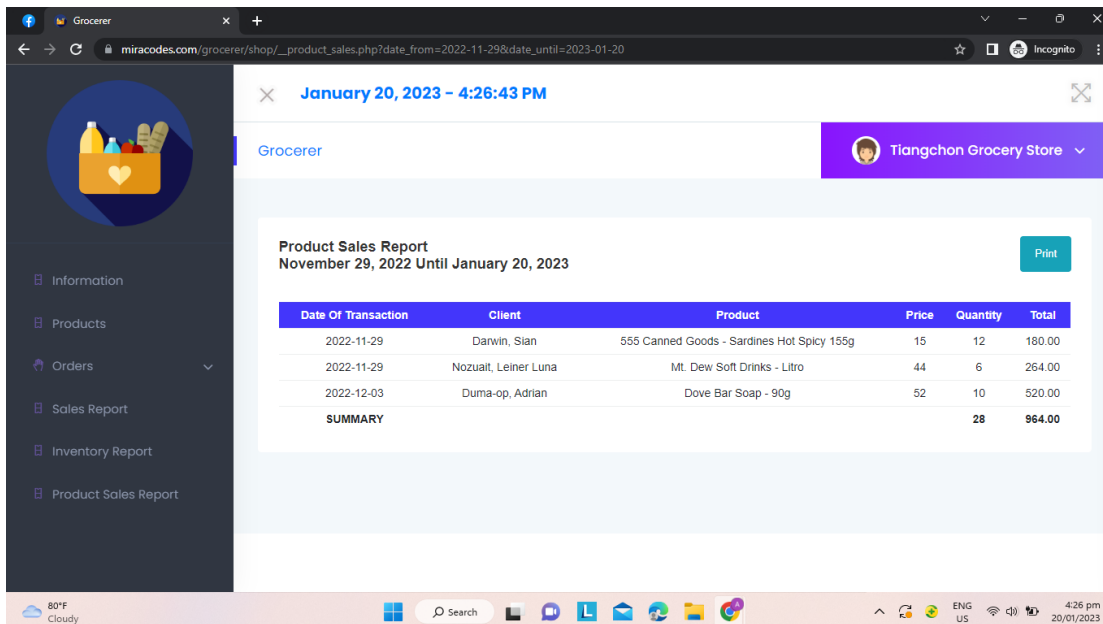


Figure 26. Product Sales Report

This figure displays the total number of items purchased within a specific date range as well as the total summary price of all items purchased within that time frame. It also shows the price of a product and multiplies it by the number of items ordered by the customer.

System Functionality Testing

Table 2. Summary of System Functionality Test Results

No.	Features	Result	Remarks
1	Delivery system	100%	Passed
2	Online payment (GCash, COD)	100%	Passed
3	Account creation and registration	100%	Passed
4	Google sign-in integration	100%	Passed

The results demonstrate that all core features function as intended. The system successfully handles delivery tracking, payments, and user registration, meeting the defined requirements and expectations.

Usability Evaluation

The **Post-Study System Usability Questionnaire (PSSUQ)** was used to determine the system's usability. Respondents rated their experience on a 7-point Likert scale, where 1 represents *strongly agree* (best performance) and 7 represents *strongly disagree* (lowest performance).

Table 3. Mean Scores in the Level of Usability of the System

Criteria	Mean	Interpretation
System Usefulness	1.77	Strongly Agree
Information Quality	1.85	Strongly Agree
Interface Quality	1.84	Strongly Agree
Overall Usability	1.90	Strongly Agree

The results show that respondents found the system highly usable and efficient. The mean values indicate that the system performs better than the industry norm of 2.82 (PSSUQ-3 benchmark), meaning users experienced smooth interaction, clarity of information, and overall satisfaction.

System Usefulness

Table 4. Summary of Mean Scores in System Usefulness

Item	Statement	Result
1	Overall, I am satisfied with how easy it is to use this system.	1.90
2	It was simple to use this system.	2.00
3	I was able to complete tasks quickly using this system.	1.70
4	I felt comfortable using this system.	1.47
5	It was easy to learn to use this system.	1.73
6	I could become productive quickly using this system.	1.83

The overall mean of **1.77** indicates that respondents found the system very useful and efficient. They particularly agreed that it was comfortable and easy to learn and use.

Information Quality

Table 5. Summary of Mean Scores in Information Quality

Item	Statement	Result
7	The system gave clear error messages.	1.67
8	I could recover easily after mistakes.	1.67
9	The system information was clear and helpful.	1.97

10	It was easy to find the information I needed.	1.47
11	The information helped me complete tasks.	2.13
12	Information on the screen was well-organized.	2.20

The **1.85** overall mean shows that the system presents information effectively. Respondents agreed that system messages and guidance were clear, helping them complete tasks accurately. Minor improvements were suggested for organization and information hierarchy.

Interface Quality

Table 6. Summary of Mean Scores in Interface Quality

Item	Statement	Result
13	The interface of this system was pleasant.	2.37
14	I liked using the interface of this system.	1.47
15	The system has all expected functions.	2.03
16	Overall, I am satisfied with this system.	1.47

With a mean score of **1.84**, respondents found the interface appealing, easy to navigate, and visually organized. They also confirmed that all system features were functional and accessible.

Overall Usability Results

The **overall usability mean score** of the GROCERER system is **1.82**, which is significantly better than the **PSSUQ industry norm of 2.82**. This indicates that the system exceeded usability expectations, providing a positive user experience. The findings validate that the system is easy to use, reliable, and meets user requirements.

User Manual Development

The researchers developed a comprehensive **User Manual** to assist end-users, particularly the store owner and customers, in operating the system. It contains instructions, step-by-step procedures, and visual guides for logging in, managing products, processing transactions, and generating reports. This manual ensures users can utilize the system effectively even without direct technical assistance.

Discussion Summary

The results confirm that **GROCERER: Grocery Management System with Mobile App** is both **functionally complete and user-friendly**. Respondents expressed strong satisfaction with its performance, accessibility, and interface design.

Overall, the study's objectives were achieved:

- The system's technical features operated at 100% efficiency.
- The usability evaluation demonstrated strong user approval.
- The developed manual provided adequate support for end-users.

CONCLUSION AND RECOMMENDATION

Conclusion

The study successfully designed, developed, and evaluated the **GROCERER: Grocery Management System with Mobile Application**, a platform that digitizes grocery transactions through mobile and web-based technology. The system integrates essential functionalities such as account registration, online payment, delivery tracking, real-time chat support, product inventory management, and report generation.

The results of functionality and usability testing revealed that the system achieved a **100% pass rate** across all technical features, confirming that it is fully operational and meets user expectations. Based on the **PSSUQ evaluation**, the system obtained an overall usability mean score of **1.82**, significantly higher than the industry benchmark of 2.82. This indicates strong acceptance from both technical evaluators and end-users, affirming the system's practicality, reliability, and ease of use.

Furthermore, the development of a **User Manual** provided clear guidance for end-users, ensuring they can navigate and utilize the system effectively without requiring constant technical supervision. The manual also supports sustainable system deployment in grocery store environments.

Overall, the study met all of its objectives:

1. **Design and development:** The system was successfully built with all specified features.
2. **Functionality testing:** All modules passed with 100% functionality.
3. **Usability assessment:** Users strongly agreed on its usefulness, information quality, and interface quality.
4. **User support:** A comprehensive user manual was developed for practical guidance.

The implementation of GROCERER has the potential to modernize local grocery store operations, making business management more efficient while enhancing customer convenience and satisfaction.

Recommendations

Based on the study's findings and evaluation, the researchers present the following recommendations:

1. **System Implementation:**
The Tiangchon Grocery Store may adopt the GROCERER System to enhance its sales and streamline grocery transactions through online and mobile platforms.
2. **Feature Enhancements:**
Future developers are encouraged to add new functionalities such as:
 - Push **notifications** for order status and promotions.
 - More detailed **sales analytics** and visual reports.
 - Integration with other payment systems (e.g., PayMaya, bank transfers).
3. **Scalability and Expansion:**
Future versions may support multi-store operations, enabling other local grocery stores to use the same system framework.
4. **Continuous Evaluation:**
Regular usability testing and customer feedback collection should be conducted to maintain high system performance and user satisfaction.
5. **User Training:**
Store owners and staff should undergo short orientation sessions to familiarize themselves with the app's features and data management tools.

Through these recommendations, the researchers aim to ensure that GROCERER remains sustainable, adaptable, and beneficial for both users and developers in the long term.

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APPENDIX

Appendix A – Survey Questionnaire (PSSUQ)

The **Post-Study System Usability Questionnaire (PSSUQ)** was used to measure the usability of the GROCERER system. The questionnaire includes items that evaluate system usefulness, information quality, interface quality, and overall satisfaction using a 7-point Likert scale (1 = Strongly Agree, 7 = Strongly Disagree).

Appendix B – Functionality Test Cases

Feature	Test Description	Expected Output	Result
User Registration	Register new user via mobile app	User successfully registered	Passed
Google Sign-In	Sign in with Google account	Redirects to homepage	Passed
Product Inventory	Add, edit, and delete product listings	Database updates accordingly	Passed
Order Transaction	Place and confirm customer orders	Order recorded and displayed	Passed
Report Generation	Generate sales and inventory report	PDF/CSV report generated	Passed

Appendix C – System Interfaces

Screenshots of the developed **GROCERER system** showing:

1. Login and registration pages
2. Home dashboard
3. Chat and messaging interface
4. Product management page
5. Order and delivery tracking
6. Sales report generation

Appendix D – Letters and Permissions

Includes communication letters used to:

- Request permission from **Tiangchon Grocery Store** for system testing.
- Administer usability questionnaires to customers and IT experts.
- Acknowledge participation of evaluators.