

KAINAN: Design and Implementation of a Gui-Based Python Restaurant Ordering and Billing System with SQLite Integration

Abella, Gerald Z., Ampis, Jorsha Myle C., Aquino, Princess A., Doctor, Francine Ann T., Taborada, Sean Allen A., Velasco, Ma. Jessa C. Velasco, Engr. Meshelle N. Fabro

Department of Computer Engineering Eulogio “Amang” Rodriguez Institute of Science and Technology (EARIST), Nagtahan, Manila, Philippines

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ABSTRACT

Efficient management of restaurant orders and billing is critical for providing quality service, minimizing errors, and improving operational workflow. Traditional manual billing systems are prone to inaccuracies, delays, and difficulty in tracking orders, particularly during peak hours. This study presents **KAINAN**, a **GUI-based restaurant ordering and billing system** developed using **Python** and integrated with an **SQLite database**. The system allows restaurant staff to create, view, update, and delete orders while automatically calculating bills and managing inventory. Object-Oriented Programming (OOP) principles ensure modularity, code reusability, and maintainability, while the graphical user interface (GUI) provides an intuitive and user-friendly environment. Functional testing confirmed that all modules, including order management, billing computation, and record updates, perform as expected. KAINAN improves accuracy, reduces human error, and streamlines restaurant operations, demonstrating the practical application of Python programming, GUI development, and database management in small to medium-scale food service establishments. Limitations include the absence of online payment integration and multi-user network functionality, which can be incorporated in future versions.

Keywords: KAINAN, Restaurant Ordering System, Billing System, Python, GUI, SQLite, Object-Oriented Programming, Inventory Management

INTRODUCTION

Background of the Study

This study focuses on “**KAINAN: Design and Implementation of a GUI-Based Python Restaurant Ordering and Billing System with SQLite Integration**”, a desktop application designed to improve the efficiency, accuracy, and usability of restaurant operations. Technology has become an essential part of modern business operations, particularly in the **food service industry**, where speed, accuracy, and customer satisfaction are highly valued. Restaurants manage multiple tasks daily, including taking customer orders, processing payments, monitoring inventory, recording sales, and generating reports. In many small and medium-sized restaurants, these processes are still done manually, which can lead to delays, incorrect billing, misplaced records, and challenges in tracking daily transactions.

Traditional ordering and billing methods, relying on handwritten orders or spreadsheets, are prone to **human error**. Mistakes in order taking, incorrect bill computation, inventory miscounts, and disorganized transaction records can negatively impact staff efficiency and customer satisfaction. Long waiting times and inaccurate billing can reduce the quality of the dining experience and create operational inefficiencies for restaurant owners and employees.

To address these issues, computerized **restaurant management systems** have emerged as practical solutions. Such systems automate order processing, billing, inventory management, sales recording, and reporting,

reducing manual tasks and improving operational efficiency. **KAINAN** uses **Python** for programming, **Tkinter** for GUI, and **SQLite** for data storage, enabling secure management of orders, transactions, inventory, and sales records.

The system aims to help restaurant owners and staff **manage operations more effectively**, provide **faster service**, and improve **billing accuracy**. Additionally, it serves as a **learning reference** for students and developers studying GUI development, database management, and Object-Oriented Programming in practical applications.

This study focuses on the development of a Restaurant Ordering and Billing System using SQLite Database. The system is designed to automate important restaurant processes including menu ordering, billing computation, payment processing, inventory monitoring, sales recording, and report generation. It is developed using Python as the programming language, Tkinter for the graphical user interface (GUI), and SQLite as the database management system. The use of SQLite allows the system to securely store and manage customer orders, transaction records, inventory data, and sales information in a structured and accessible database. The researchers chose this study because restaurants need an efficient and reliable system that can simplify operations while improving accuracy and organization. Through automation and database integration, the proposed system aims to help restaurant owners and staff manage transactions more effectively while reducing manual workload. The system also intends to provide customers with faster service, accurate billing, and a more convenient dining experience.

Furthermore, this study contributes to the growing use of computerized systems in business operations by demonstrating how software development and database management can be applied in restaurant services. It also serves as a useful reference for future students, developers, and researchers who plan to create similar systems related to restaurant management, business automation, and transaction processing. Ultimately, the development of the Restaurant Ordering and Billing System using SQLite Database aims to improve restaurant efficiency, productivity, and customer satisfaction through practical and user-friendly technological solutions.

STATEMENT OF THE PROBLEM

This project aims to develop a Restaurant Ordering and Billing System using SQLite Database to improve the efficiency, accuracy, and organization of restaurant operations. Specifically, this study seeks to answer the following questions:

Ordering and transaction processing

- How can the system automate customer ordering and billing processes to provide faster restaurant service?
- How can the system improve the accuracy of order processing and payment computation?
- How can the system support different payment methods such as cash, online payment, and card transaction?

Inventory management

- How can the system automatically monitor and update inventory levels based on customer orders?
- How can the system help staff identify low-stock and out-of-stock items efficiently?
- How can the inventory management feature improve stock monitoring and reduce manual recording errors?

Record management and database storage

- How can the system store customer orders, transaction records, inventory data, and sales reports using the SQLite database?
- How can the system provide organized and fast retrieval of transaction and inventory records through search and filtering functions?

- How can the system improve the management and security of restaurant records and reports?

Sales monitoring and reporting

- How can the system generate accurate receipts, transaction summaries, and sales reports automatically?
- How can the analytics and record management features assist restaurant staff in monitoring daily sales and transactions?
- How can the system help improve the accuracy and organization of restaurant sales data?

Efficiency, usability, and customer satisfaction

- How can the graphical user interface (GUI) improve the usability and accessibility of the system for restaurant staff?
- How can the system reduce manual work and save time in restaurant operations?
- How can the system improve the efficiency and productivity of restaurant employees in handling daily tasks?
- How can the system enhance customer satisfaction through a faster, more convenient, and reliable ordering and billing process?

Objectives of the Study

The main objective of the study is to develop a Restaurant Ordering and Billing System using SQLite Database that will improve the efficiency, accuracy, and organization of restaurant operations through automated ordering, billing, inventory management, sales monitoring, and record management.

1. To develop a system that automates customer ordering, billing, and payment processing to provide faster and more accurate restaurant service.
2. To create an inventory management feature that automatically monitors and updates stock levels based on customer orders while reducing manual recording errors.
3. To develop a database system that securely stores, organizes, and retrieves customer orders, transaction records, inventory data, and sales reports using SQLite Database.
4. To implement sales monitoring and reporting features that can generate accurate receipts, transaction summaries, and sales reports for restaurant operations.
5. To design a user-friendly graphical user interface (GUI) that improves operational efficiency, reduces manual work, and enhances customer satisfaction through a faster and more reliable ordering and billing process.

Significance of the Study

This project is developed to provide an efficient and user-friendly Restaurant Ordering and Billing System using SQLite Database. It is important and will be helpful to the following:

To the developers, this project provides an opportunity to improve their skills in programming, system design, and database integration. It also allows them to gain practical experience in creating a functional application that can be applied in real-world restaurant operations. The project strengthens their understanding of Object-Oriented Programming concepts and database management.

To the restaurant owners and employees, this system offers a more efficient way of managing customer orders, payments, and sales records. It helps reduce human errors, saves time during transactions, and enables staff to organize information more effectively through a computerized process. The system can also make daily restaurant operations more organized and convenient.

To the customers, this application contributes to faster transactions and accurate computation of bills, creating a smoother and more convenient dining experience. It also helps ensure that orders and purchases are properly

processed and recorded. Customers may experience better service quality because of the improved transaction process.

To the future students and programmers, this project may serve as a useful reference in developing similar systems related to business automation and database management. It can also provide ideas and inspiration for enhancing future applications and technologies. The project may encourage learners to create more innovative and efficient software systems.

This research is made with the aim of providing crucial information and knowledge about the development of a Restaurant Ordering and Billing System using SQLite database. It significantly emphasizes how database integration enhances record management, reduces errors and improves overall transaction processes.

SCOPE AND LIMITATION

The study focuses on the creation of a restaurant and billing system intended to enhance restaurant transaction management through an automated process. The system is developed using the Python programming language with Tkinter for the graphical user interface (GUI) and SQLite for local database management. It is designed to improve the efficiency, accuracy, and organization of restaurant operations by automating menu ordering, billing computation, payment processing, inventory tracking, sales recording, and report generation. The system also provides a user-friendly GUI to ensure smooth interaction between users and the system, making daily restaurant operations faster and more convenient. It is intended for small to medium-sized restaurant businesses and supports essential functions such as order management, inventory monitoring, sales tracking, search, filtering, and record retrieval to improve data accessibility and operational efficiency. However, the study is limited to a desktop-based application and does not include mobile or web-based platforms, online ordering systems, mobile application integration, or cloud-based services. It also does not support real-time online payment gateway integration, delivery management, customer reservation systems, employee payroll, supplier management, or multi-branch synchronization. The system operates only on local storage using SQLite Database, meaning it functions on a single device without multi-user or network-based synchronization. Advanced cybersecurity features and enterprise-level protection mechanisms are also not included. Additionally, system performance may depend on the hardware specifications of the device used during implementation.

REVIEW OF RELEVANT THEORY, STUDIES, AND LITERATURE

This chapter discusses the **theoretical foundations, related studies, and technological frameworks** that form the basis for the development of **KAINAN: GUI-Based Python Restaurant Ordering and Billing System with SQLite Integration**. The review focuses on restaurant management systems, database integration, graphical user interfaces (GUI), object-oriented programming (OOP), and automated billing technologies.

Skariya (2023) developed a study entitled “Revamping Restaurant Billing System through React JS Development”, which focuses on improving traditional restaurant billing systems by using modern web technologies, specifically the React JavaScript framework. The study highlights that many restaurants still rely on manual or outdated billing processes that are slow, inefficient, and prone to human error. These issues often lead to inaccurate billing, longer waiting times, and reduced customer satisfaction.

The study proposes the use of React JS to modernize the billing system by creating a fast, responsive, and user-friendly interface. According to the research, React’s component-based structure allows developers to build reusable and maintainable UI components, making system updates and improvements easier. It also improves system performance by efficiently updating only the necessary parts of the interface instead of reloading the entire page.

Furthermore, the study explains that automation in billing processes helps reduce operational errors and improves transaction accuracy. By integrating ordering and billing into a single system, restaurants can streamline operations, improve workflow, and enhance overall customer experience. The research concludes

that adopting modern frameworks like React JS can significantly improve scalability, maintainability, and efficiency in restaurant billing systems.

Wang (2024) developed a web-based restaurant ordering and management system designed to improve and automate restaurant operations. The system includes key functions such as menu management, order processing, table management, and billing. It was developed using C# programming language and PostgreSQL database to ensure efficient data storage and processing.

The study revealed that computerized restaurant systems significantly improve operational efficiency by reducing manual work, minimizing human errors, and speeding up transaction processes. Compared to traditional manual ordering systems, the computerized approach provides more accurate and organized data handling, resulting in better overall restaurant performance.

Sari et al. (2024) developed a GUI-based restaurant order management system using the Tkinter framework. The system was designed to improve order recording, queue management, and billing processes in cafés and restaurants. Queue and stack data structures were implemented to organize customer orders efficiently. The study found that GUI-based systems improve operational accuracy, reduce transaction time, and provide easier interaction for users compared to manual restaurant management systems.

According to the Central Journal of Applied Science and Technology (2020), Informatics systems play a crucial role in running and management of restaurants and other businesses. There are two types of information systems: general purpose and specialized information systems. Transaction processing systems, management information systems, decision support systems, and executive support systems are some of the informatics systems that can be used by restaurants. The transaction processing systems help to combine all the transactions that take place in the restaurant. It makes it easy for the restaurants to manage their transactions and monitor their performance levels. The management information system is vital for the collection and communication of relevant information in the restaurants. It will help to ensure that the management can come up with strategic decisions that will help propel the business forward in the future.

Similarly, Karuppusamy and Geethamani (2025) stated that computerized restaurant billing systems help automate order processing, billing computation, and sales monitoring, resulting in faster and more accurate restaurant transactions. Their study emphasized that integrating database technologies into restaurant systems reduces manual errors and improves the organization of transaction records. The researchers also explained that automated billing systems allow restaurant staff to manage customer orders and payments more efficiently while providing reliable data storage and retrieval. This study is related to the current project because both systems focus on improving restaurant operations through automation, database management, and computerized billing processes.

The study by Nasharuddin Zainal et al. (2024) focused on developing an automated Point-of-Sale (POS) system using computer vision and the YOLOv4 object detection algorithm to improve the retail checkout process. Traditional POS systems rely on cashiers manually scanning barcodes, which often causes long queues and delays during peak hours. To address this issue, the researchers designed a smart checkout system capable of automatically detecting and identifying multiple retail products in real time using a camera and machine learning technology. The researchers created a custom dataset consisting of common Malaysian retail products such as KitKat, Maggi, tissue, Vicks, and yogurt. A total of 550 images were collected and enhanced through image augmentation techniques to improve the model's learning capability. The YOLOv4 model was trained using Darknet and later deployed on a Raspberry Pi device connected to a webcam. During testing, the system achieved an average accuracy of 98% and was able to process transactions within approximately 14 seconds. The findings showed that the automated POS system successfully identified and quantified products in real time while generating itemized bills automatically. The study concluded that integrating computer vision into POS systems can reduce waiting times, improve customer experience, and support the development of unmanned retail stores. However, the researchers recommended expanding the dataset to include more products and adding features such as weight sensors for future improvements.

According to Studies in Computational Intelligence, Ahmed et al. (2025) developed a machine learning-enhanced Point of Sale (POS) system designed to improve customer segmentation, product recommendation, and inventory management. The study utilized different machine learning algorithms such as K-means clustering for customer segmentation, Random Forest for personalized product recommendations, and LightGBM for inventory analysis and stocking suggestions. The researchers implemented the system using tools including MySQL, Pandas, and Scikit-Learn. The findings of the study revealed that the proposed system effectively grouped customers into distinct segments, which can support targeted marketing strategies. In addition, the recommendation system successfully suggested relevant products based on customers' previous purchase history, improving personalization and customer satisfaction. The inventory management component also demonstrated efficiency in analyzing stock levels and providing stocking recommendations to optimize inventory control. Furthermore, the researchers emphasized that integrating machine learning into POS systems helps businesses adapt to changing customer preferences and market trends. The study concluded that the system supports entrepreneurs in making data driven decisions while providing a seamless shopping experience and improving operational efficiency. This literature is relevant to the present study because it highlights how intelligent POS systems can enhance business performance through automation, recommendation systems, and predictive inventory management.

According to the study of Kulkarni, Iftexhar, Pathan, and Tiwari (2025), restaurant operations are often burdened by inefficiencies in manual order processing, inventory mismanagement, and fragmented feedback mechanisms. Their research developed a cost-effective and scalable Restaurant Management System (RMS) that integrated order management, billing, real-time inventory tracking, and feedback processing within a single platform, targeting small and mid-sized restaurants using Python Flask and MySQL. The system demonstrated that consolidating these functions into one unified application significantly reduced operational errors and improved service efficiency. This study is relevant to the present research as both aim to automate core restaurant processes — ordering, billing, and inventory — within a single system. The current study, however, differs by utilizing a desktop-based approach through Python and Tkinter rather than a web-based framework, making it more suitable for offline environments with limited internet connectivity.

As presented in the study of Divina, Olan, Perez, Sarmiento, and Acepcion (2025), point-of-sale and inventory systems are essential tools for improving operational efficiency in small food businesses. Conducted in the Philippine context, their research developed a web-based POS and inventory system for a small food enterprise using PHP, MySQL, and the Waterfall SDLC approach, integrating transaction processing, inventory management, and sales forecasting into one platform. The system was evaluated by 50 respondents using ISO/IEC 25010 quality standards and received high ratings for functionality and usability. This study is closely related to the current research as both address the automation of sales transactions and inventory tracking in small food establishments within the Philippine setting. The present study similarly automates these processes but through a standalone desktop application built with Python and SQLite, rather than a web-based system.

In the study conducted by Pandey and Ruia (2025), the development of a Restaurant Management System was undertaken to automate restaurant operations and reduce dependence on manual methods. Using Java Swing for the graphical user interface and MySQL as the database management system, the system covered modules for reservation management, menu handling, and automated billing, with the goal of minimizing billing errors and improving transaction accuracy. The study concluded that automating the billing process directly contributed to faster service and reduced human error in financial transactions. This study shares the same fundamental objective as the present research — eliminating manual billing inaccuracies through system automation. The current study differs in its choice of technology, utilizing Python with Tkinter and SQLite, which are more lightweight and accessible tools suited for a student-developed desktop application.

GUI-Based Restaurant Ordering Systems

Graphical User Interface (GUI) systems in restaurants enhance operational efficiency by allowing staff to manage orders and billing electronically. GUI-based applications improve **speed, accuracy, and usability** compared to manual record-keeping.

- **Bhavani et al. (2025)** highlighted that Python-based GUI systems streamline small business operations, improving accuracy in transactions and data management.
- **Suya et al. (2026)** implemented a smart point-of-sale (POS) system, showing that GUI interfaces reduce errors in order processing and facilitate real-time inventory monitoring.
- **Madamidola et al. (2024)** demonstrated that interactive systems for small businesses enhance operational efficiency, reduce processing time, and minimize manual errors.

These studies confirm that GUI-based ordering and billing platforms improve staff efficiency, customer satisfaction, and operational organization.

Database Integration

Databases are essential for tracking products, orders, transactions, and customer information. **SQLite** is commonly used for small to medium-scale desktop applications because it is lightweight, serverless, and integrates seamlessly with Python.

Key benefits of database integration in restaurant systems include:

- **Persistent storage** of menu items, orders, and transactions
- **Real-time updates** for inventory and billing
- **Data integrity and accuracy** through primary keys and constraints
- **Efficient record retrieval** for generating reports and sales summaries
- **Kumar & Singh (2021)** emphasized that relational databases improve data consistency and accessibility.
- **Pushpa et al. (2024)** highlighted the importance of structured database design for reliable small business systems.

The integration of a database in KAINAN ensures **accurate storage and efficient retrieval** of menu, order, and billing information.

Object-Oriented Programming (OOP)

OOP organizes code into **classes and objects**, promoting modularity, code reusability, and maintainability. In KAINAN:

- Classes represent **entities** such as MenuItem, Order, or Transaction.
- Methods perform actions like **adding orders, updating inventory, and generating bills**.
- OOP supports **future scalability**, allowing new features such as online ordering or multi-user access to be added without major restructuring.
- Bhavani et al. (2025) found that OOP improves functionality and reduces complexity in small business management systems.

Automation in Billing and Ordering

Automated billing and order management reduce manual errors and improve workflow:

- Automatic **price calculation** prevents billing mistakes.

- **Inventory updates** are executed in real-time after each order.
- **Transaction logs** maintain accurate historical records.

Studies show that automated systems save time, reduce errors, and enhance customer satisfaction (Smith & Jones, 2022).

Synthesis

The reviewed literature indicates:

1. **Manual restaurant operations** are prone to errors, slow processing, and record mismanagement.
2. **GUI-based systems** improve usability and operational efficiency for staff.
3. **Database integration (SQLite/MySQL)** ensures secure, reliable, and persistent storage of menu items, orders, and transactions.
4. **OOP and modular coding** facilitate scalability, maintainability, and future feature implementation.
5. **Automated billing and inventory management** streamline operations, reduce human error, and improve customer satisfaction.

KAINAN applies these principles by integrating **Python programming, OOP design, GUI interface, and SQLite database** into a cohesive system that automates restaurant ordering, billing, and inventory management while providing an efficient and user-friendly experience.

METHODOLOGY

Research Design

This study used a system development research design approach in developing the proposed Restaurant Ordering and Billing System. This research design was appropriate because the study focused on the design, development, testing, and evaluation of a computerized system intended to improve restaurant ordering and billing operations through the use of a Graphical User Interface (GUI). The system was developed using the Python programming language, Tkinter for the GUI, and SQLite for database management to provide an efficient and user-friendly transaction process.

The system development research design allowed the researchers to analyze existing manual restaurant processes, identify operational problems, and create a computerized solution that automates ordering, billing, and record management. Furthermore, the study included system testing and evaluation to ensure that the proposed system functions accurately, efficiently, and meets the needs of restaurant staff and customers.

System Development Process

The following steps were followed in the development of the Restaurant Ordering and Billing System:

1. **Planning** – The researchers identified the common problems encountered in restaurant transactions such as slow billing processes, manual calculation errors, and difficulties in monitoring orders and sales. System requirements, features, and objectives were also determined during this phase.
2. **Design** – The researchers designed the system interface, menu layout, database structure, and overall system flow to ensure that the application would be user friendly, organized, and efficient for restaurant operations.

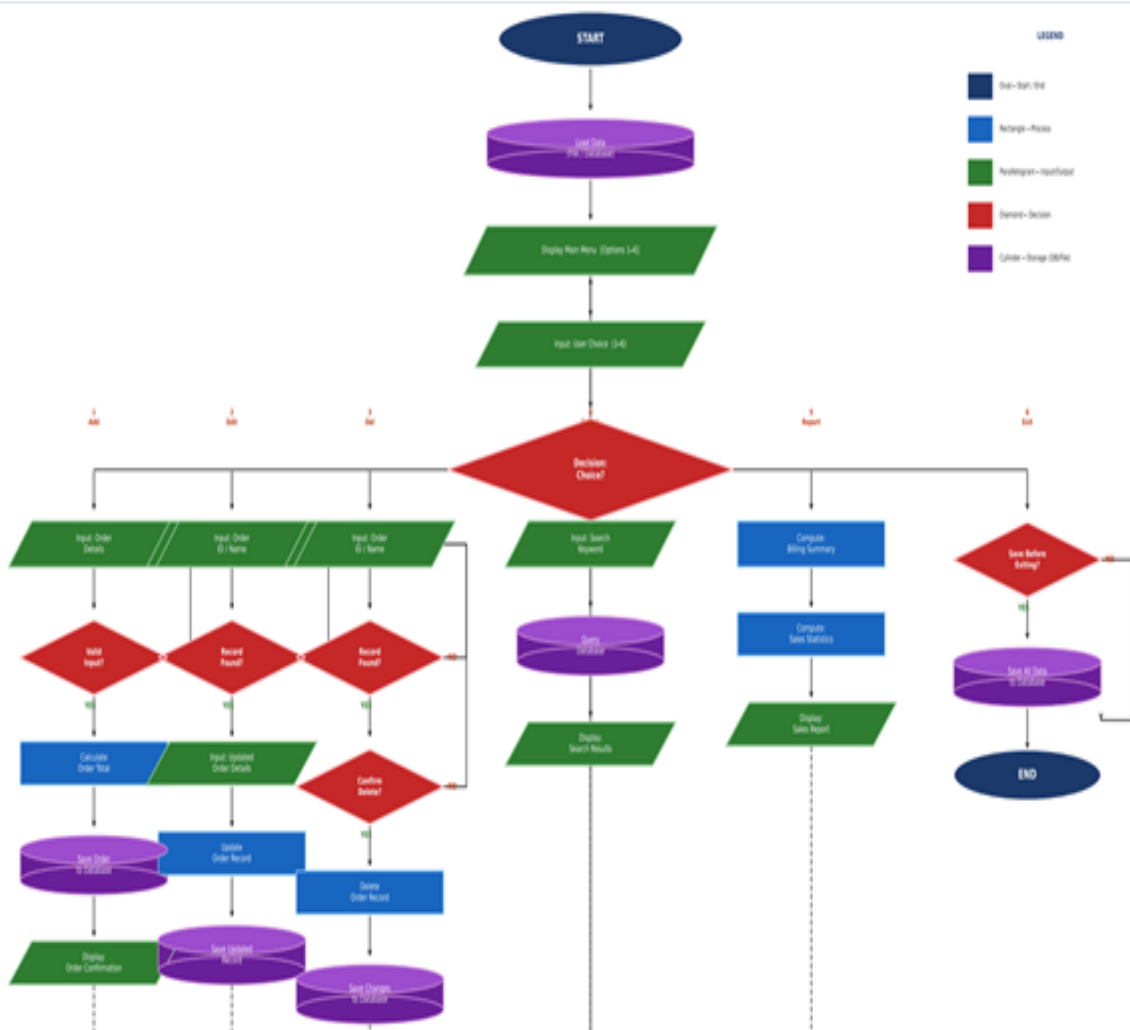
3. **Development** – The system was developed by implementing features such as menu ordering, billing computation, payment processing, inventory monitoring, sales recording, and report generation. The graphical user interface and database functions were also integrated during this stage.
4. **Testing** – The developed system was tested to identify errors, bugs, and performance issues. The researchers evaluated the accuracy of calculations, transaction processing, inventory updates, and report outputs to ensure the reliability of the system.
5. **Implementation** – After successful testing, the system was finalized and integrated with the database and graphical interface. The completed Restaurant Ordering and Billing System was then prepared for actual restaurant transaction management and operational use.

System Design

The Restaurant Ordering and Billing System was designed following a structured and modular approach to ensure clarity, usability, and functional accuracy. The system design phase involved planning the overall structure of the application, including the user interface layout, database schema, and system workflow, before actual development began.

The system follows a client-application architecture where all processes, including ordering, billing, inventory management, and record retrieval, are handled within a single standalone desktop application. The database layer is managed using SQLite, which stores all transaction records, inventory data, and order information in a local database file. The graphical user interface layer, built using Tkinter, serves as the main point of interaction between the user and the system.

Figure 1. Flowchart of the KAINAN Restaurant Ordering and Billing System



The database schema consists of two main tables: the orders table, which stores transaction details such as customer name, table number, items ordered, quantities, prices, payment method, and timestamps; and the stock table, which maintains the current inventory levels of all menu items. The system design ensures that all data inputs are validated, all computations are automated, and all records are properly stored and retrievable at any time.

This figure shows customer details, ordered items, quantity, unit price, total, payment method, and transaction status in a structured visual format retrieved from the SQLite database.

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This figure shows the table structures for orders, stock, and SQLite sequence, including field names, data types, constraints, and default values, providing a clear view of the database layout used for managing restaurant operations.

Overall, the system design prioritizes simplicity, efficiency, and reliability to meet the operational needs of small to medium-sized restaurant businesses while remaining accessible and easy to use for restaurant staff.

TOOLS AND TECHNOLOGY USED

Programming Language

Python was used as the primary programming language in developing the Restaurant Ordering and Billing System because of its simplicity, efficiency, and suitability for graphical user interface (GUI) application development.

GUI Framework / Application Design

Tkinter was utilized to create a user-friendly graphical user interface (GUI). The interface includes a main window, input fields, buttons, and a table display area for easier navigation and transaction management.

Database Management System

SQLite was used as the database management system for storing customer orders, menu details, billing records, and transaction history. The database ensures accurate data storage and retrieval.

Integrated Development Environment (IDE)

PyCharm was used as the Integrated Development Environment (IDE) for designing, coding, testing, and debugging the system efficiently.

Data Visualization Library

Matplotlib was used for generating charts and graphical reports, such as daily sales summaries and transaction statistics, to help monitor restaurant performance.

Image Processing Library

Pillow was used for handling and displaying images such as restaurant logos, menu images, and background customization within the system interface.

System Functions

The system provides essential functions such as Add, View, Update, Delete, Clear, and Exit. It also includes proper error handling and user-friendly notifications to improve usability and system reliability.

Hardware Devices

Hardware devices such as computers, touchscreen monitors, receipt printers, barcode scanners, and cash drawers are utilized to support restaurant operations and billing transactions.

Networking Technology

Wi-Fi or Local Area Network (LAN) technology is used to connect ordering and billing terminals within the restaurant system, allowing faster and more efficient transaction processing.

The Restaurant Ordering and Billing System was developed using Python as the primary programming language because of its efficiency and ease of use in application development. Tkinter or CustomTkinter was

utilized to create a graphical user interface (GUI) with a main window, input fields, buttons, and a table display area. SQLite or MySQL was used as the database management system for storing customer orders, menu information, billing records, and transaction history. The system was designed, coded, tested, and debugged using PyCharm. In addition, Matplotlib was used for creating graphical reports and sales charts, while Pillow was utilized for image processing and interface customization. Furthermore, the system includes essential functions such as Add, View, Update, Delete, Clear, and Exit with proper error handling and user-friendly notifications. Hardware devices such as computers, touchscreen monitors, receipt printers, barcode scanners, and cash drawers support restaurant operations and billing processes. Moreover, Wi-Fi or Local Area Network (LAN) technology is used to connect ordering and billing terminals for faster, more organized, and efficient restaurant transactions.

RESULT AND DISCUSSION

System Overview

The Restaurant Ordering and Billing System, named KAINAN, is a desktop-based point-of-sale application developed to automate and manage restaurant operations through an integrated and user-friendly platform. The system was developed using Python as the primary programming language, Tkinter for the graphical user interface, SQLite for local database management, Matplotlib for sales data visualization, and Pillow for image processing and interface customization.

The system is designed to serve small to medium-sized restaurant businesses by replacing manual ordering and billing processes with a fully automated and computerized solution. It operates as a standalone desktop application that stores all data locally using an SQLite database file, making it functional without the need for internet connectivity or a server environment.

Upon launching the system, users are required to log in using valid credentials to ensure security and restrict unauthorized access. Once authenticated, the user is directed to the main ordering interface, which displays a categorized menu of food items, beverages, and desserts. Staff can browse menu items, view prices and stock availability, and add selected items to the cart. The system automatically computes the total amount, applies any applicable discounts, and processes payments through supported methods including cash, online payment, and card transactions. After each successful transaction, the system generates a detailed receipt and automatically updates the inventory database.

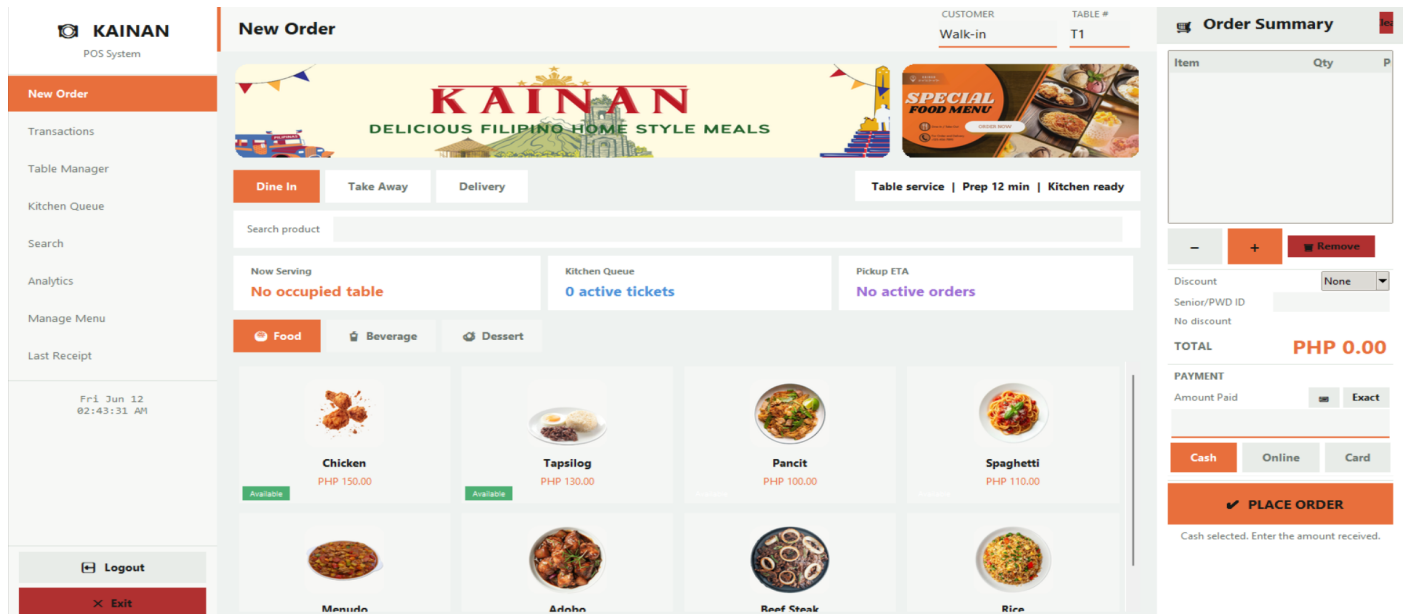
Beyond transaction processing, the system also provides a records management module for viewing, searching, updating, and deleting stored transactions. An inventory management module monitors stock levels in real time, displays low-stock warnings, and allows staff to manually restock items. A sales analytics module generates visual charts summarizing total transactions, sales by category, and top-selling menu items to support business monitoring and decision-making.

The KAINAN Restaurant Ordering and Billing System integrates all of these features into one cohesive platform, providing restaurant owners and staff with a practical, efficient, and reliable tool for managing daily restaurant operations.

SYSTEM FEATURES

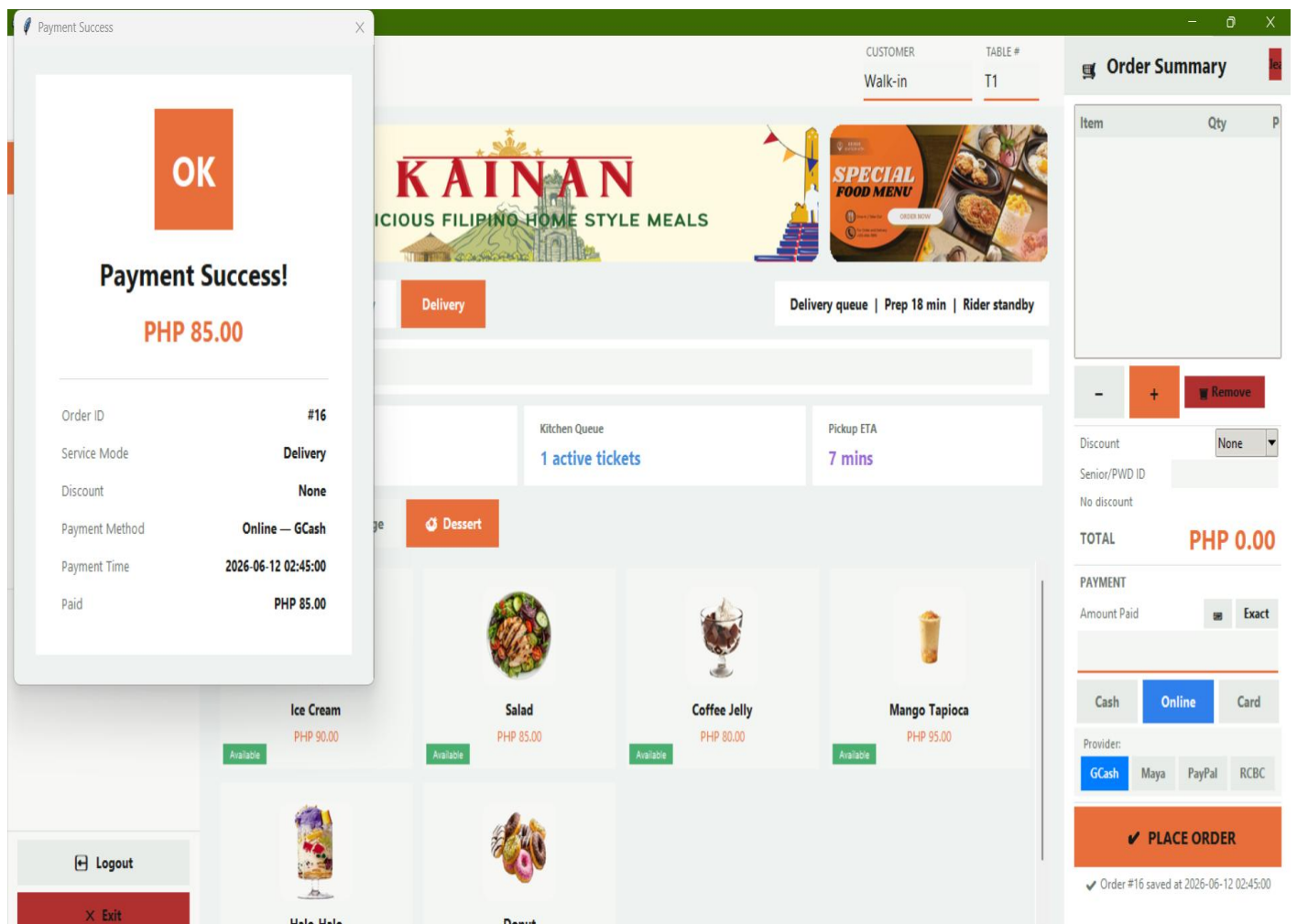
This section presents the key features of the Restaurant Ordering and Billing System, which are designed to support efficient, accurate, and organized management of restaurant transactions and records.

Figure 4. Main GUI Window of the KAINAN Restaurant Ordering and Billing System



This interface serves as the primary dashboard for the system, providing users with quick access to all key functionalities, including order creation, product browsing, order summary, and navigation to other modules such as inventory management and record review. It presents a visually organized layout for efficient restaurant order processing.

Figure 5. Add Order Window of the KAINAN Restaurant Ordering and Billing System



Add Record

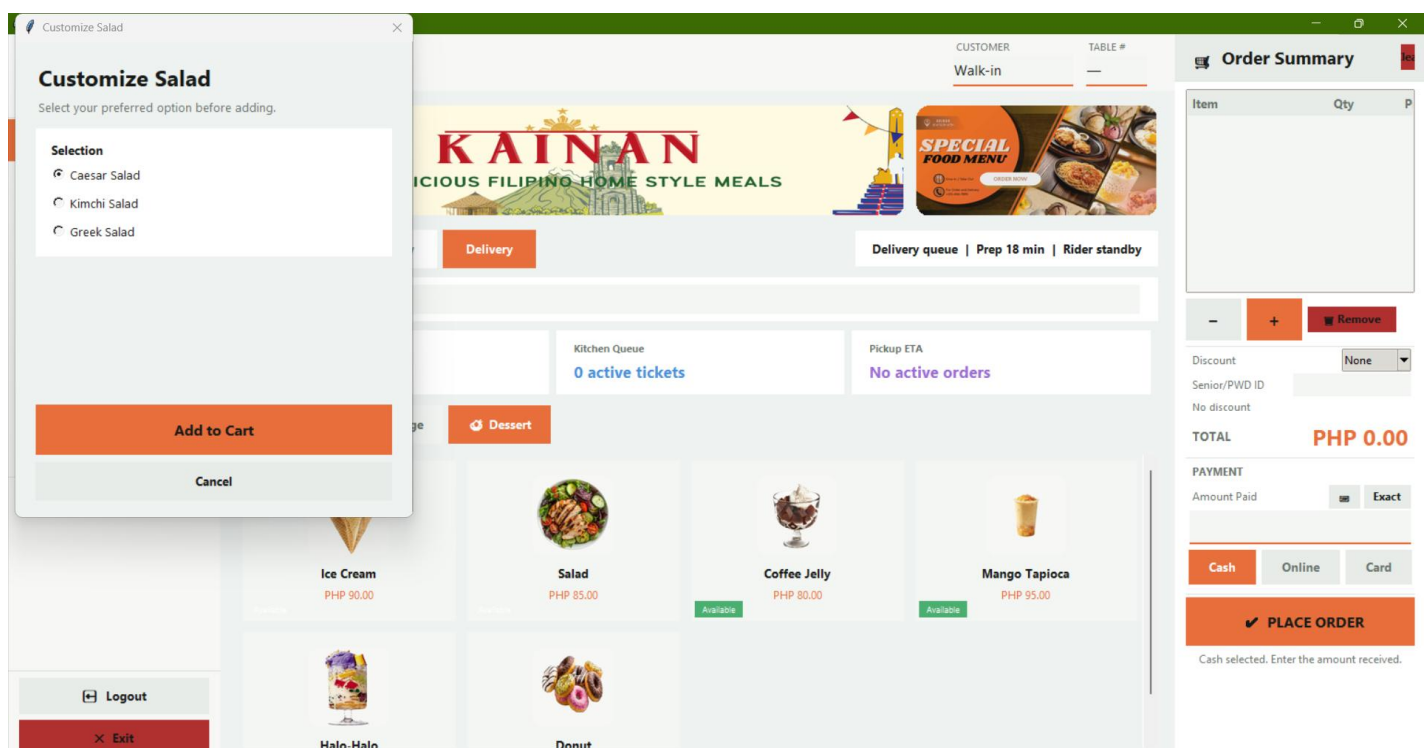
This feature allows the user to add new customer orders and transaction details into the system. The entered data is automatically saved and stored in the SQLite database for future access and monitoring.

This interface allows customers to customize and add menu items to their order. Users can select item-specific options (e.g., flavor, size) before adding items to the cart. The system dynamically updates the order summary and total, ensuring accurate tracking of selected items.

View Records

This feature enables the user to display and review all saved restaurant records stored in the database. It shows important transaction details such as order ID, customer name, ordered items, quantity, prices, and billing information.

Figure 6. Add Order & View Window of the KAINAN Restaurant Ordering and Billing System



This interface allows users to select menu items, specify quantity, and view the order summary. It also displays real-time updates for stock levels and estimated preparation times, enabling efficient order placement and management.

Update Record

This feature allows the user to modify or edit existing records in the system. The updated information is automatically reflected in the database.

Delete Record

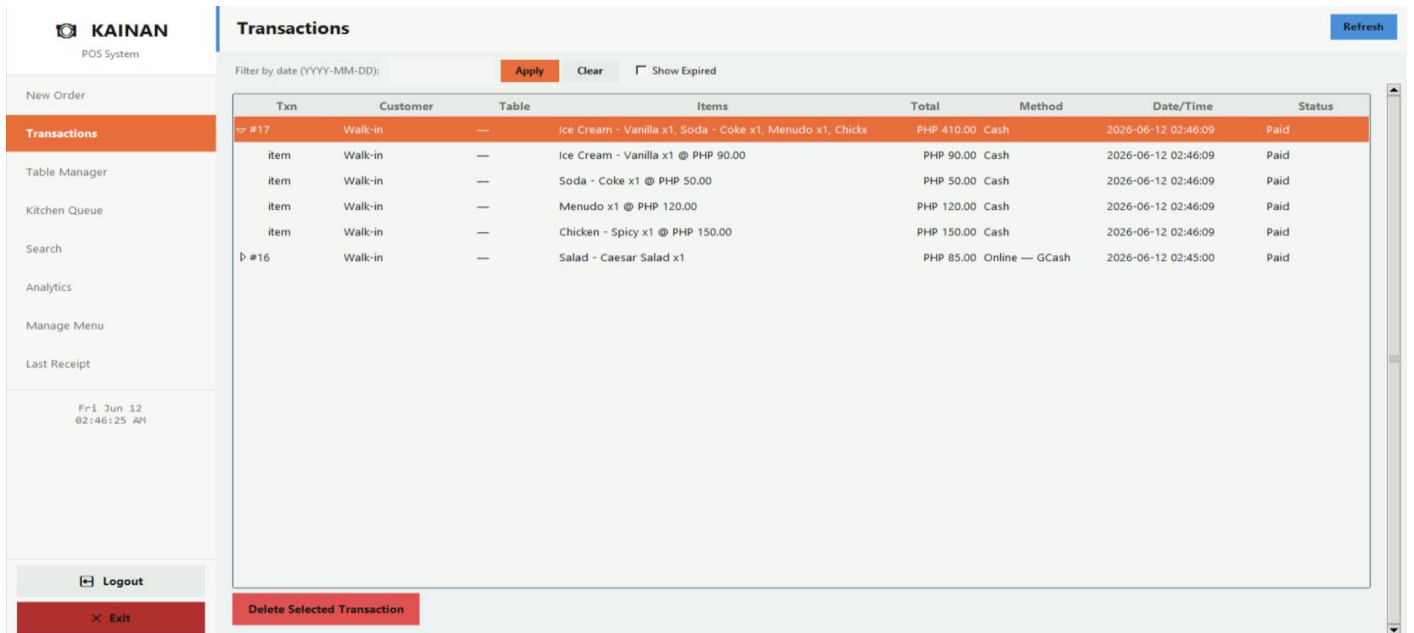
This feature enables the user to remove unnecessary or incorrect records from the system database. It helps maintain accurate and organized transaction records.

Clear Fields

This feature allows the user to clear or reset all input fields in the system interface. It helps users prepare the

form for a new transaction or record entry.

Figure 7. All Records Interface of the KAINAN Restaurant Ordering and Billing System



Txn	Customer	Table	Items	Total	Method	Date/Time	Status
#17	Walk-in	—	Ice Cream - Vanilla x1, Soda - Coke x1, Menudo x1, Chicks	PHP 410.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	—	Ice Cream - Vanilla x1 @ PHP 90.00	PHP 90.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	—	Soda - Coke x1 @ PHP 50.00	PHP 50.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	—	Menudo x1 @ PHP 120.00	PHP 120.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	—	Chicken - Spicy x1 @ PHP 150.00	PHP 150.00	Cash	2026-06-12 02:46:09	Paid
#16	Walk-in	—	Salad - Caesar Salad x1	PHP 85.00	Online — GCash	2026-06-12 02:45:00	Paid

Displaying stored customer orders with detailed information including item names, quantities, unit prices, total amounts, payment method, and date/time. The interface also allows updating and deleting selected records for efficient management.

Exit System

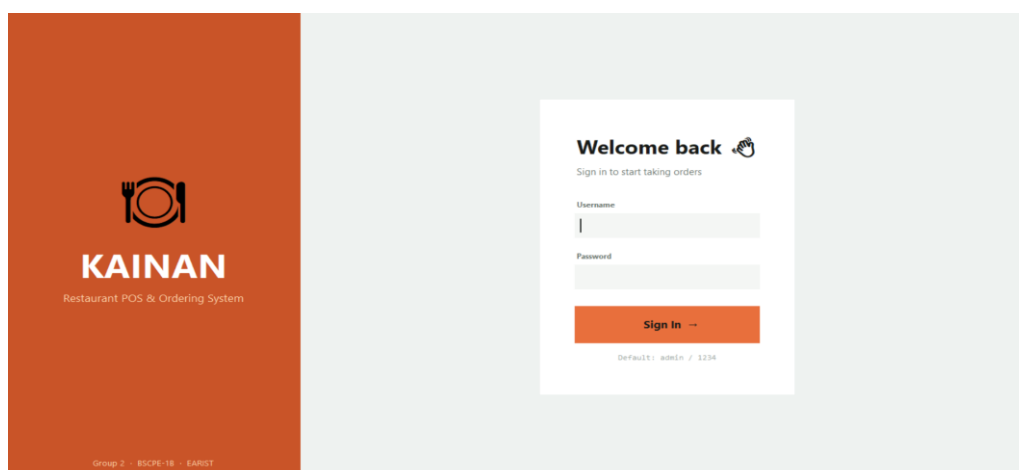
This feature allows the user to safely close and exit the Restaurant Ordering and Billing System. All records and transactions are automatically saved in the SQLite database before exit.

SYSTEM INTERFACE

This section presents the developed Restaurant Ordering and Billing System interface. The system was designed using Python with Tkinter and a graphical user interface (GUI) to ensure ease of use, efficiency, and smooth transaction processing.

Login Interface - The system starts with a login interface where the user must enter a valid username and password before accessing the system. This interface ensures security and restricts unauthorized access to the system. Once authenticated, the user is redirected to the main dashboard.

Figure 8. Login Window of the KAINAN Restaurant Ordering and Billing System



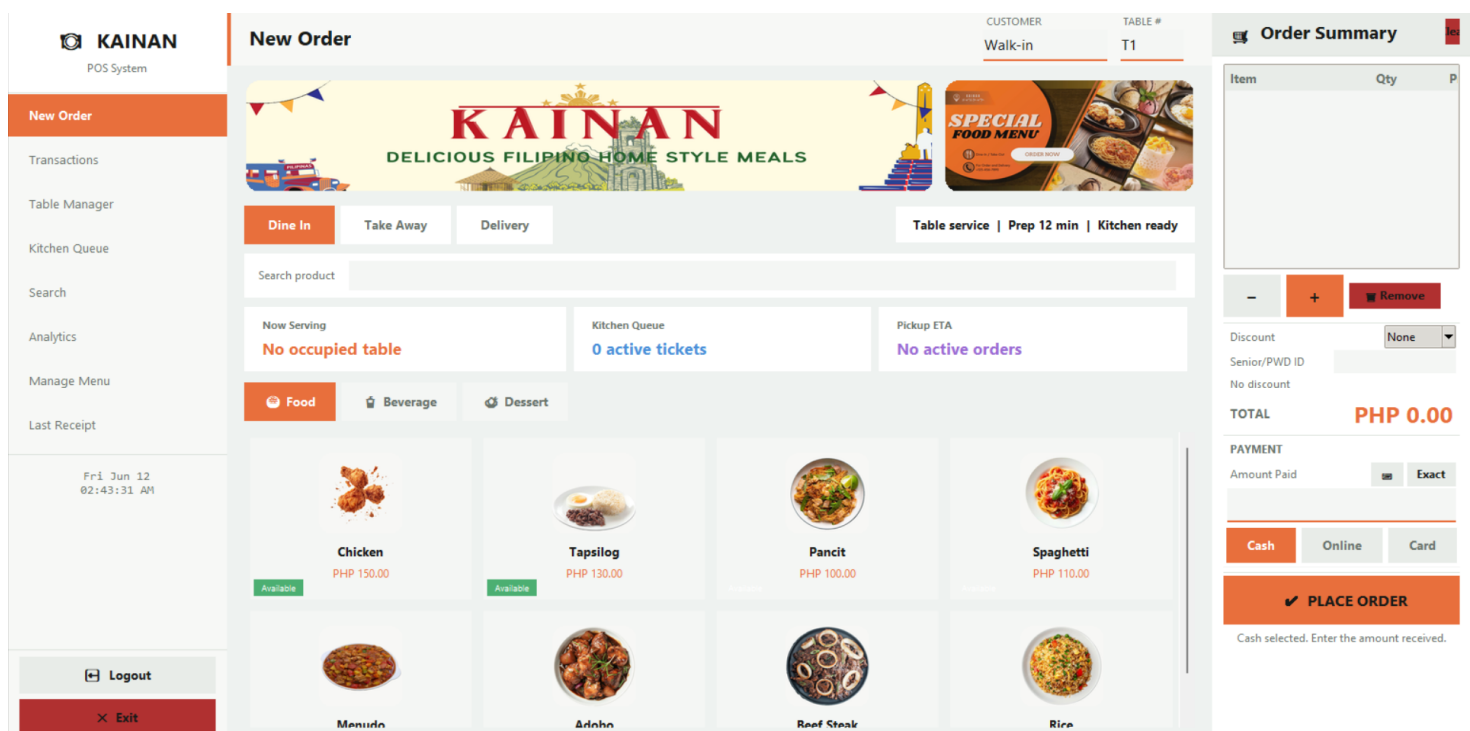
This interface serves as the entry point for users, allowing them to sign in with a username and password. It includes input validation to ensure only authorized access, while new users can navigate to create an account.

Main Ordering Interface - This interface serves as the core of the system where restaurant transactions are processed. It allows users to:

- Select menu items categorized into Food, Beverages, and Desserts
- View item images, names, prices, and menu availability
- Add items to the cart and adjust quantity
- Automatically compute total amount and apply discounts
- Input customer name and table number
- Search menu items for faster ordering

This interface improves order accuracy and speeds up transaction processing.

Figure 9. Main Ordering Interface of the KAINAN Restaurant Ordering and Billing System

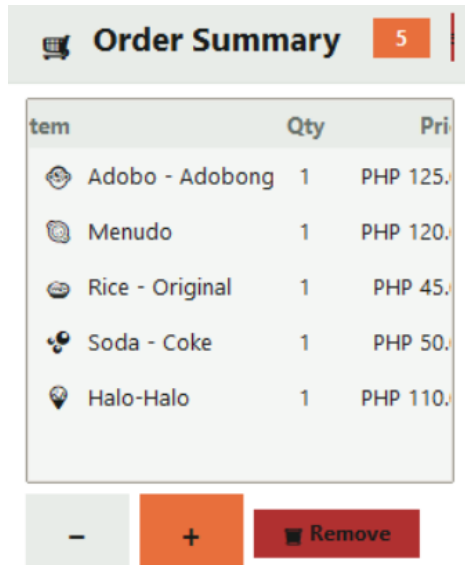


Core interface for processing restaurant transactions, adding items, adjusting quantities, applying discounts, and inputting customer details.

Cart and Billing Interface - The cart section displays all selected items with their quantity, price, and subtotal. It also includes:

- Automatic total computation
- Discount input feature
- Payment input section (cash, online, card modes)
- Change computation for cash transactions

Figure 10. Cart and Billing Interface of the KAINAN Restaurant Ordering and Billing System



tem	Qty	Pri
Adobo - Adobong	1	PHP 125.
Menudo	1	PHP 120.
Rice - Original	1	PHP 45.
Soda - Coke	1	PHP 50.
Halo-Halo	1	PHP 110.

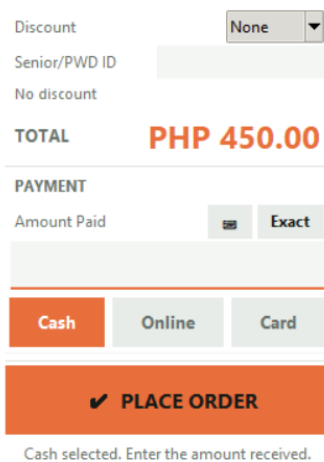
Buttons: -, +, Remove

This interface ensures accurate billing and reduces manual computation errors. It displays the selected menu items with their quantities, individual prices, and the computed total. Users can modify item quantities or remove items from the order before finalizing the transaction.

Payment Interface - The system supports multiple payment methods including Cash, Online, and Card. Depending on the selected mode, the interface adjusts accordingly. After successful payment, a confirmation window is displayed showing:

- Order ID
- Payment method
- Discount Selection
- Total amount paid
- Change
- Transaction time

Figure 11. Payment Interface of the KAINAN Restaurant Ordering and Billing System



Discount:

Senior/PWD ID:

No discount

TOTAL PHP 450.00

PAYMENT

Amount Paid:

☒ Cash ☐ Online ☐ Card

✓ PLACE ORDER

Cash selected. Enter the amount received.

This interface allows the user to finalize customer transactions by selecting the payment method (Cash, Online, Card) and inputting the exact amount. Online payment options include GCash, Maya, PayPal, and RCBC, ensuring accurate and convenient payment processing.

Receipt Interface - After completing a transaction, the system generates a detailed receipt interface showing all purchased items, quantities, prices, total amount, discount, payment method, and change. The receipt can also be saved or printed for record purposes.

Figure 12. Receipt Interface of the KAINAN Restaurant Ordering and Billing System

```

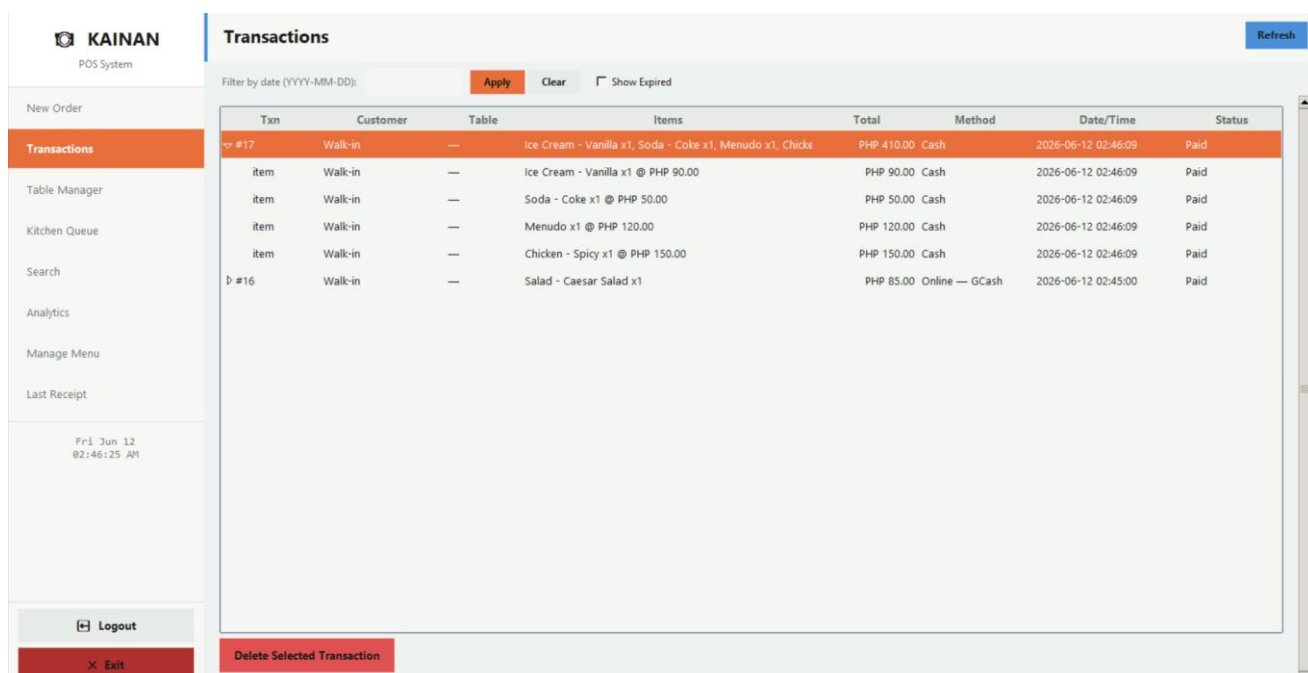
KAINAN RESTAURANT
EARIST Campus, Manila, PH
Tel: +63 912 345 6789
-----
Receipt No: KRN-00017
Date/Time : 2026-06-12 02:46:09
Customer  : Walk-in
Table     : -
Service   : Take Away
-----
ITEM              QTY  PRICE  TOTAL
-----
Ice Cream - Vanilla  1   90.00  90.00
Soda - Coke         1   50.00  50.00
Menudo              1  120.00 120.00
Chicken - Spicy     1  150.00 150.00
-----
VATable Sales                366.07
VAT 12%                      43.93
Senior/PWD Discount         0.00
Grand Total                  410.00
Payment Method               Cash
Amount Paid                  410.00
Change                       0.00
-----
Thank you for dining with KAINAN!
Please come again soon.
-----

```

Records Interface - This interface displays all saved transactions stored in the database. It includes:

- Customer details
- Item purchased
- Quantity and price
- Total amount
- Date and time of transaction

Figure 13. Records Interface of the KAINAN Restaurant Ordering and Billing System



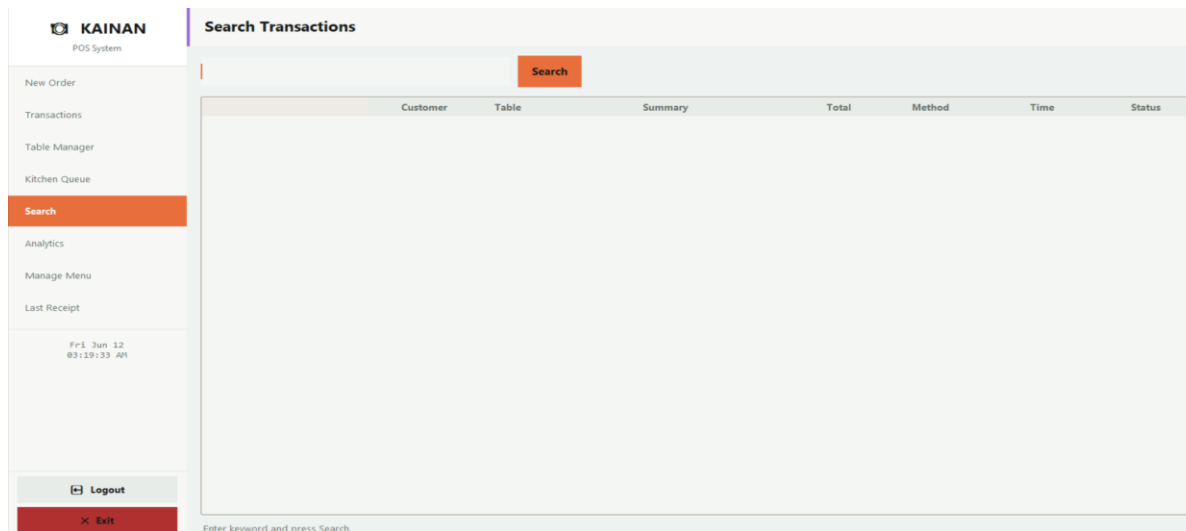
The screenshot shows the 'Transactions' interface of the KAINAN POS System. The interface includes a sidebar with navigation options: New Order, Transactions (selected), Table Manager, Kitchen Queue, Search, Analytics, Manage Menu, and Last Receipt. The main area displays a table of transactions with columns: Txn, Customer, Table, Items, Total, Method, Date/Time, and Status. The table shows two transactions: Txn #17 and Txn #16. Txn #17 is a 'Walk-in' transaction for 'Ice Cream - Vanilla x1, Soda - Coke x1, Menudo x1, Chicks' with a total of PHP 410.00, paid via 'Cash' on 2026-06-12 02:46:09. Txn #16 is a 'Walk-in' transaction for 'Salad - Caesar Salad x1' with a total of PHP 85.00, paid via 'Online - GCash' on 2026-06-12 02:45:00. The interface also includes a 'Filter by date (YYYY-MM-DD):' section with 'Apply', 'Clear', and 'Show Expired' buttons, and a 'Delete Selected Transaction' button at the bottom.

Txn	Customer	Table	Items	Total	Method	Date/Time	Status
#17	Walk-in	---	Ice Cream - Vanilla x1, Soda - Coke x1, Menudo x1, Chicks	PHP 410.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	---	Ice Cream - Vanilla x1 @ PHP 90.00	PHP 90.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	---	Soda - Coke x1 @ PHP 50.00	PHP 50.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	---	Menudo x1 @ PHP 120.00	PHP 120.00	Cash	2026-06-12 02:46:09	Paid
item	Walk-in	---	Chicken - Spicy x1 @ PHP 150.00	PHP 150.00	Cash	2026-06-12 02:46:09	Paid
#16	Walk-in	---	Salad - Caesar Salad x1	PHP 85.00	Online - GCash	2026-06-12 02:45:00	Paid

Displaying all transactions stored in the kainan.db SQLite database, including customer details, table number, category, ordered items, quantity, unit price, total, payment method, and date/time of each transaction. This interface allows the admin to update or delete records efficiently.

Search Interface - The search interface allows users to quickly locate specific transactions using keywords such as customer name, item name, table number, or order ID. This improves record retrieval and reduces time spent searching data.

Figure 14. Search Interface of the KAINAN Restaurant Ordering and Billing System

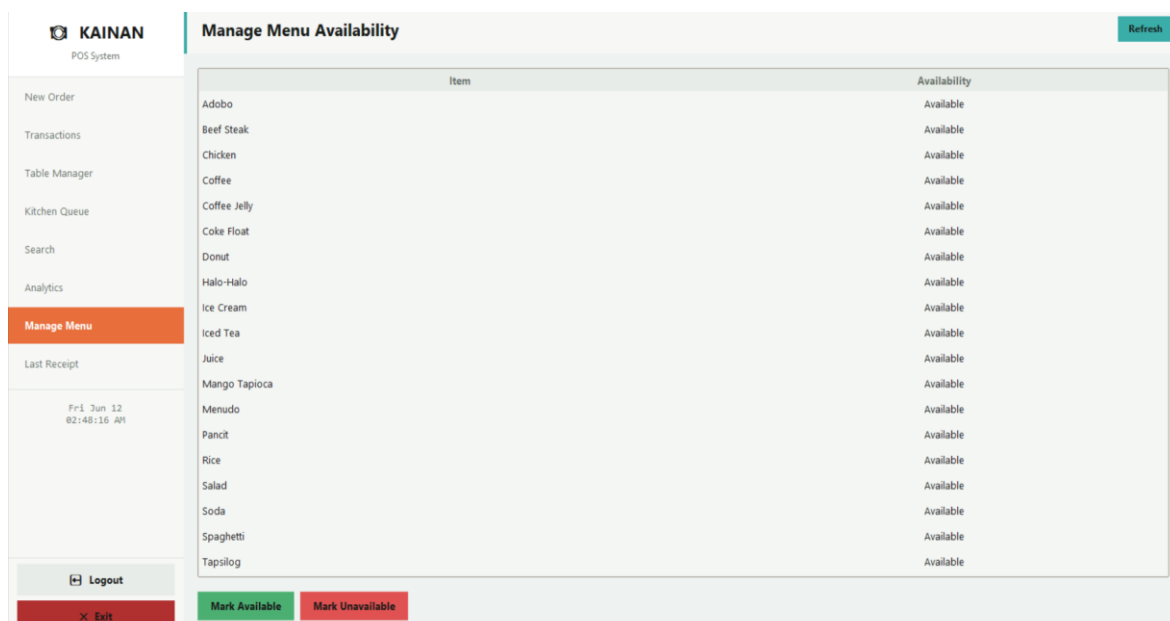


Inventory Interface - The inventory interface monitors stock levels of all menu items. It shows:

- Current stock per item
- Low-stock indicators
- Automatic stock deduction after every purchase
- Restock function

This helps prevent stock shortages and improves inventory control.

Figure 15. Inventory Management Interface of the KAINAN Restaurant Ordering and Billing System



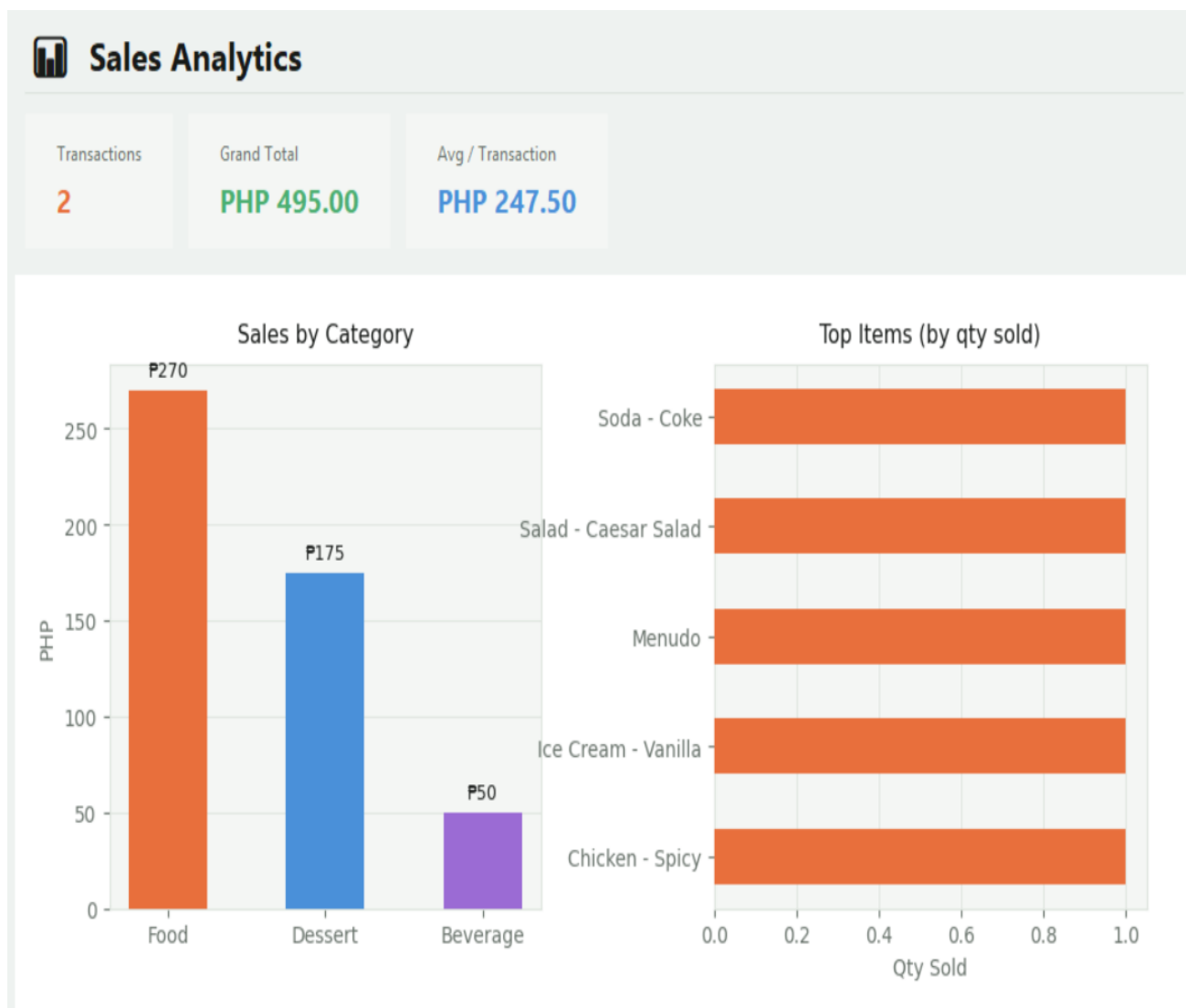
This interface displays all menu items along with their stock levels and current status. Administrators can monitor inventory, update stock for individual items, and perform bulk restocking. The interface ensures efficient tracking of restaurant inventory and prevents stockouts.

Analytics Interface - This interface provides a summary of sales performance, including:

- Total sales
- Number of transactions
- Sales breakdown per category (Food, Beverage, Dessert)
- Top-selling items

This helps management analyze business performance efficiently.

Figure 16. Sales Analytics Interface of the KAINAN Restaurant Ordering and Billing System.



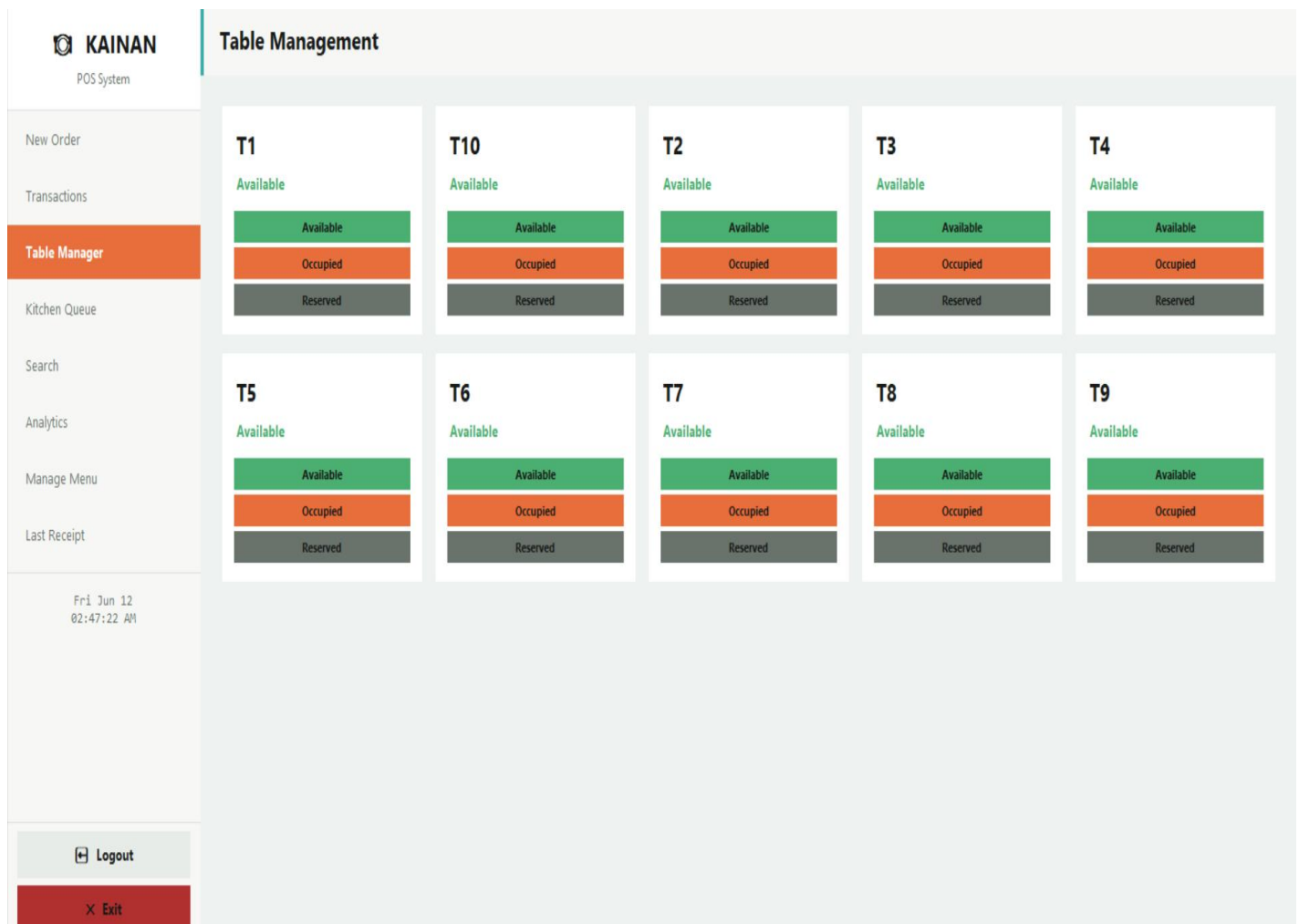
This interface presents visual representations of sales data, showing the total transactions, grand total revenue, average transaction amount, sales distribution by category, and top-selling items to help management monitor and analyze business performance.

Table Management Interface - This interface displays the current status and occupancy of all tables within the restaurant.

Administrators and staff can monitor which tables are available, occupied, or reserved in real time, allowing for efficient table assignment and customer management. The Table Management Interface includes the following features:

- **Table Status Overview** — displays a clear and organized view of all tables, indicating whether each is available, occupied, or reserved
- **Real-Time Updates** — reflects changes in table occupancy immediately after each transaction or seating assignment
- **Table Assignment Function** — allows staff to assign customers to available tables quickly and efficiently
- **Occupancy Monitoring** — tracks the number of currently active tables to support floor management decisions

Figure 17. Table Management Interface of the KAINAN Restaurant Ordering and Billing System



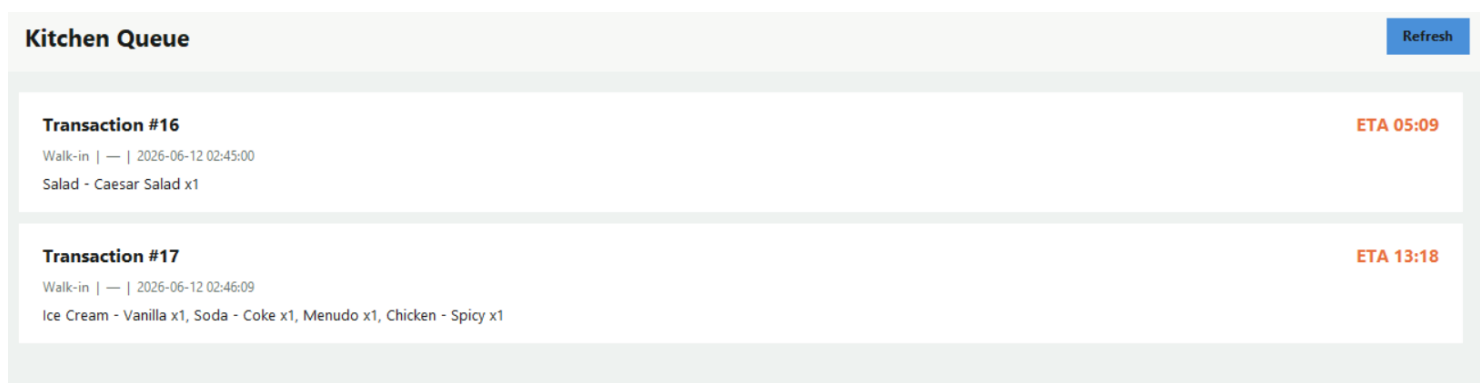
This interface streamlines the seating process and reduces wait times, improving the overall dining experience for customers and operational efficiency for restaurant staff.

Kitchen Queue Interface - This interface presents an organized queue of all incoming orders transmitted from the ordering system, allowing kitchen staff to monitor and manage meal preparation in real time.

The Kitchen Queue Interface includes the following features:

- Order Queue Display — lists all incoming orders in sequence, showing table number, ordered items, and quantities for each transaction
- Order Status Tracking — allows kitchen staff to mark orders as in-progress or completed, keeping the queue updated at all times
- Priority Management — enables staff to identify and prioritize orders based on queue position and order time
- Real-Time Synchronization — automatically updates the queue as new orders are placed from the ordering interface

Figure 18. Kitchen Queue Interface of the KAINAN Restaurant Ordering and Billing System



The system interfaces were designed to work together as a complete restaurant management solution. Each interface contributes to improving efficiency, reducing manual work, minimizing errors, and ensuring smooth restaurant operations from ordering to reporting.

SYSTEM TESTING

The Restaurant Ordering and Billing System was put through system testing to assess its overall performance, correctness, dependability, and functionality. Menu ordering, billing computation, payment processing, inventory management, receipt generation, record searching, and report handling are just a few of the functions that the researchers investigated. Errors, defects, and performance problems that can compromise the system's effectiveness during restaurant operations were also found during the testing phase.

The system's ability to process customer orders, compute totals and discounts, update inventory stocks, and store transaction records in the SQLite database was confirmed by the researchers. Additionally, the TKinter-developed graphical user interface (GUI) was assessed for responsiveness, usability, and ease of navigation. In order to verify correct processing and receipt generation, payment methods such cash, online payments and card transactions were also tested. The system was completed and ready for use in restaurant operations following successful testing and required adjustments.

Table 1.

System Feature	Description of Testing	Expected Result	Actual Result	Status
Login System	Tested username and password validation	Authorized users can access the system	Login credentials were validated correctly	Passed
Menu Ordering	Tested the addition of food and drink to the cart	Orders are added to the cart accurately	Items were successfully added	Passed

Billing Computation	Tested automatic calculation of totals and discounts	The right amount for billing is shown	Discounts and totals were produced with accuracy	Passed
Payment Processing	Tested cash, online, and card payment options	Payments are processed correctly	Payment transactions were completed successfully	Passed
Receipt Generation	Tested generation and saving of receipts	Receipts are displayed and saved correctly	Generating of receipts was successful	Passed
Inventory Management	Tested stock deduction after transactions	Inventory is automatically updated	Stock quantities updated correctly	Passed
Database Connectivity	Tested storage and retrieval of records using SQLite	Data is stored and retrieved properly	The database connection was successful	Passed
Search Function	Tested looking through transaction and customer records	Correct display of matching records	Search results were accurate	Passed
Table Management	Checked whether all tables display correct availability status upon launch	All tables show correct available, occupied, or reserved status	All tables displayed correct statuses as expected	Passed
Kitchen Queue	Placed multiple orders and verified they appear in the kitchen queue with correct details	All orders display table number, items, and quantities correctly	All order details appeared accurately in the queue	Passed
GUI Responsiveness	Tested interface usability and navigation	System interface is easy to use, responsive, and user-friendly	GUI responded smoothly	Passed
Error Handling	Tested fields that were empty and invalid	System displays proper error messages	Error handling worked correctly	Passed

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The SQLite-based Restaurant Ordering and Billing System was successfully developed to improve the efficiency, accuracy, and organization of restaurant operations. The study achieved its main objective of creating a computerized system capable of automating essential restaurant processes such as menu ordering, billing computation, payment processing, inventory monitoring, sales recording, and report generation. Through the use of Python, Tkinter, and SQLite Database, the researchers were able to design a user-friendly, reliable, and functional desktop application suitable for small to medium-sized restaurant businesses.

The developed system effectively minimized manual work and reduced common human errors associated with traditional restaurant transactions, such as incorrect billing computations, misplaced records, and inventory

mismanagement. Features including automated receipt generation, searchable transaction records, inventory updates, and sales analytics contributed to more organized and efficient restaurant management. In addition, the graphical user interface (GUI) provided easier navigation and improved usability for restaurant staff, resulting in faster transaction processing and better operational workflow.

System testing further confirmed that all major functions of the application operated accurately and efficiently. The system successfully processed customer orders, computed totals and discounts correctly, updated inventory levels automatically, generated receipts, and securely stored transaction records within the database. The positive testing results demonstrate that the system is reliable and capable of supporting daily restaurant operations.

Overall, the study concludes that the proposed Restaurant Ordering and Billing System serves as an effective technological solution for improving restaurant management and customer service. By integrating automation and database management into restaurant operations, the system enhances productivity, transaction accuracy, record organization, and overall customer satisfaction. Furthermore, the study contributes to the growing use of

computerized business systems and may serve as a valuable reference for future researchers and developers interested in restaurant automation and management system development.

Recommendations

The researchers recommend further enhancement of the restaurant ordering and billing system to improve its efficiency, security, usability, and scalability. Although the current system already provides essential features such as menu management, inventory tracking, payment processing, and sales visualization, additional improvements may strengthen its overall performance and reliability. Future versions of the system may implement stronger security measures such as user authentication, encrypted passwords, role based access control, and automated backup and recovery functions to protect important business data from unauthorized access and data loss. The integration of advanced inventory monitoring features such as automatic low stock alerts, ingredient based deduction, supplier management, and expiration tracking may also help restaurant owners manage resources more effectively and reduce food waste.

Furthermore, the researchers recommend the implementation of cloud based storage and synchronization to allow remote access, online backups, and support for multiple restaurant branches. Future development may also focus on creating mobile and tablet compatible versions to improve accessibility and customer convenience through self-service ordering and QR code menus. Additional enhancements to the user interface, including responsive layouts, search functions, dark mode support, and smoother navigation, may further improve user experience and reduce transaction errors. The researchers also suggest integrating real time digital payment processing, receipt generation through email or SMS, and advanced business analytics to provide restaurant owners with valuable insights into sales trends, customer preferences, and operational performance. Lastly, continuous testing, evaluation, and code optimization are recommended to ensure system stability, maintainability, and adaptability to future technological advancements and business needs.

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ABOUT THE AUTHORS

Gerald Z. Abella is a first-year Bachelor of Science in Computer Engineering student at Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), Manila. He completed his Senior High School education with honors and continues to demonstrate academic commitment in his pursuit of a degree in computer engineering. Outside of academics, he is an active member of a journalism organization, where he develops his communication, writing, and media skills alongside his technical education. He served as one of the core contributors to the development and documentation of the Restaurant Ordering and Billing System.

Jorsha Myle C. Ampis is a first-year Bachelor of Science in Computer Engineering student at Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), Manila. A Senior High School honors graduate, she brings dedication and analytical thinking to her academic and research endeavors. She is currently pursuing a Technical Education and Skills Development Authority (TESDA) certification, further demonstrating her commitment to expanding her technical competencies beyond the classroom. She contributed to the research documentation and review of related literature of the study.

Princess A. Aquino is a first-year Bachelor of Science in Computer Engineering student at Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), Manila. She graduated from Senior High School with honors and carries a strong academic foundation into her college education. She has developed a foundational background in C++ programming, which has supported her understanding of structured and object-oriented programming concepts. She contributed to the system testing and methodology sections of the research.

Francine Ann T. Doctor is a first-year Bachelor of Science in Computer Engineering student at Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), Manila. A Senior High School honors graduate, she is committed to applying her academic skills in the fields of programming and system development. She has established a foundational background in C++ programming, equipping her with core knowledge in structured problem-solving and software logic. She contributed to the background of the study, system overview, and objectives of the research.

Sean Allen A. Taborada is a first-year Bachelor of Science in Computer Engineering student at Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), Manila. He completed Senior High School with honors and serves as one of the lead developers of the Restaurant Ordering and Billing System, where he was responsible for designing and implementing the graphical user interface (GUI). He possesses a multidisciplinary programming background with proficiency in Python, C++, and HTML, enabling him to contribute significantly to both the technical development and visual design of the system. He was also responsible for the abstract and review of related literature sections of the research documentation.

Ma. Jessa C. Velasco is a first-year Bachelor of Science in Computer Engineering student at Eulogio Amang Rodriguez Institute of Science and Technology (EARIST), Manila. A Senior High School honors graduate, she brings practical, real-world experience to the research team through her work in the fast food industry, where she has developed firsthand proficiency in restaurant ordering and billing operations. Her applied knowledge of actual point-of-sale processes provided valuable insight into the functional requirements and operational design of the developed system. She contributed to the overall development and documentation efforts of the Restaurant Ordering and Billing System.

Engr. Meshelle N. Fabro is a licensed Professional Computer Engineer and educator at the Eulogio “Amang” Rodriguez Institute of Science and Technology (EARIST). She is currently pursuing a Master of Science in Computer Engineering at Bulacan State University and has professional industry experience as a Technical Engineer at Hewlett-Packard (HP) and an IT Engineer at IBM. She is also a TESDA CSS NC II and Trainers Methodology Level I (TM1) holder, demonstrating her commitment to technical excellence and competency-based education. Passionate about teaching and innovation, she is dedicated to guiding Computer Engineering students in becoming industry-ready, competent, and highly skilled individuals equipped for the evolving demands of the technology industry.