

# Design and Development of a Point of Sale (POS) System for the CAPTAIN-J Takoyaki Business

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## Abstract —

CAPTAIN-J, a food and beverage business in Madridejos, Cebu, previously relied on manual recording for sales, inventory, and daily transactions. This approach made order processing slower, increased the risk of computation errors, and made stock monitoring difficult during busy hours. To address these problems, this study designed and developed a Point of Sale (POS) and Inventory Management System using PHP, MySQL, Bootstrap, and PDO. The system was built to support day-to-day stall operations through user authentication, inventory management, order creation, order history monitoring, sales visualization, and printable receipts. The developed system records transactions in a centralized database, deducts stock automatically after completed sales, and provides the owner with visual summaries of business activity through dashboard charts. Technical quality was evaluated using ISO/IEC 25010, while usability was evaluated through the USE Questionnaire. Based on the evaluation results used in this study, the expert technical evaluation obtained an overall mean of 3.8 interpreted as Good, the end-user evaluation obtained 4.1 interpreted as Strongly Agree, and the core system module evaluation obtained 4.6 interpreted as Very Good. The findings indicate that the system is a practical and effective tool for improving transaction speed, record accuracy, and inventory visibility in CAPTAIN-J's daily operations.

**Keywords** — Point of Sale System, Inventory Management, PHP, MySQL, ISO/IEC 25010, USE Questionnaire, Small Business Automation

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## I. INTRODUCTION

In the current scenario of a competitive food service sector, there is a need for small businesses to incorporate modernization in their operations to sustain their businesses in the future [2][3][20]. The evolution of point-of-sale systems from traditional manual methods to modern digital and mobile solutions has significantly improved business efficiency and transaction speed [10]. For a food service business like Captain-J Takoyaki, manual record-keeping and inventory management often create bottlenecks in operations, such as calculation errors, loss of records, and delays during peak hours [20]. A research study indicates that "technostress" and information overload resulting from manual record-keeping and inventory management often hinder a company's

productivity, thus necessitating a more efficient and streamlined system of operations [1].

However, despite the availability of computerized systems, there is a lack of studies focusing on the development and usability evaluation of customized Point of Sale (POS) and inventory management systems specifically designed for small-scale food businesses in local settings like Madridejos. Limited research has also been conducted on how these systems improve operational efficiency and user experience among small business staff, particularly in micro-business environments [6][7][8]. Existing studies primarily focus on large-scale enterprises and generalized system implementations, often overlooking the unique operational constraints, limited technical resources, and workflow dynamics present in small food businesses. This gap highlights the need for further research on the design, development, and usability evaluation of customized systems that are specifically

tailored to the needs of micro-scale enterprises, ensuring that such solutions are practical, accessible, and effective in real-world settings.

To address this gap, this study focuses on the design and development of a customized POS and Inventory Management System specifically tailored for the CAPTAIN-J Takoyaki business. The system aims to enhance transaction speed, improve record accuracy, and provide real-time inventory monitoring suited to the fast-paced environment of small food service operations. A computerized system is considered "useful" and "easy to use," aligning with the Technology Acceptance Model, thus ensuring a high level of user acceptance and improved operational efficiency among staff members [3]. Furthermore, ensuring a high level of software quality is essential when transitioning from a manual to a computerized system, particularly in terms of functionality, reliability, and security, as defined by international standards such as ISO/IEC 25010 [4]. Therefore, evaluating both usability and technical quality is critical to determine whether the system effectively meets the operational needs of the business [5].

**Objectives** — The general objective of this research is to create, develop, and deploy a customized Point of Sale (POS) and Inventory Management System for the CAPTAIN-J Takoyaki Business. This research has the specific objectives to replace the manual process with a digital platform to enhance the speed of transactions and accurately track sales using a computerized system for the J.D. Villacarlos St. branch in Poblacion, Madridejos.

**Specific Objectives:**

1. *Develop a system which can:*
  - 1.1 *To Synthesize Business Intelligence with Data Integrity (Dashboard):* The system is designed to generate dynamic data visualizations, such as bar and line charts, directly from a relational database, enabling decision-makers to quickly interpret and analyze business performance. Business intelligence dashboards aggregate and synthesize data to provide actionable insights, supporting strategic and operational decisions. To ensure data integrity, structured queries, normalization, and data validation mechanisms are implemented, guaranteeing that the information presented is accurate and reliable. Additionally, role-based access control (RBAC) is applied to protect sensitive business information, such as sales totals, restricting visibility exclusively to users authenticated with "Admin" privileges. By combining visualization, data integrity, and secure access, the system provides a reliable and secure platform for business intelligence.
  - 1.2 *To Implement Comprehensive Inventory CRUD with Input Sanitization (Inventory):* To design a system

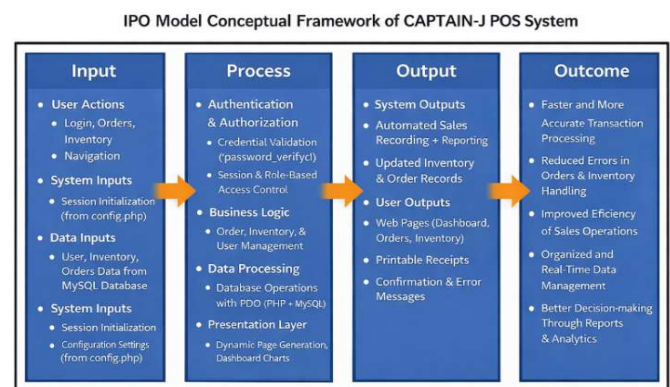
that can facilitate the full CRUD (Create, Read, Update, Delete) process for the inventory module while ensuring that the use of Parameterized Queries prevents SQL injection attacks when users add a new item or quickly update the stock levels by "+1 Stock."

- 1.3 *To Enforce Secure Access through Credential Encryption (Users):* To design a system that can secure the system from unauthorized access by implementing Unique Credential Authentication while ensuring that all passwords are One-Way Cryptographically Hashed (e.g., Bcrypt or Argon2) to ensure data protection and compliance with software security standards.
- 1.4 *To Optimize Transactional Logic with Session Security (Create Order):* To design a system that can dynamically display a responsive "Create New Order" interface that utilizes Secure Session Management to track the authenticated user's session to identify the staff member working on the order; the system must execute Atomic Transaction to decrement the inventory.
- 1.5 *To Maintain a Persistent, Tamper-Proof Audit Trail (Orders):* To create a secure digital ledger that records all transactions with an Automated Timestamp and a link to the specific User ID; the digital ledger must be protected by Role-Based Access Control (RBAC) to ensure that only high-clearance users can "Delete" the records, while all activities are audited.

2. *Verify Technical Quality via ISO/IEC 25010:* To have IT experts evaluate the software's Functional Suitability, Performance Efficiency, and Security using the ISO/IEC 25010 standard to ensure it meets international engineering benchmarks [4].

3. *Validate User Satisfaction via the USE Model:* To test how well the system actually works for the staff by measuring Usefulness, Ease of Learning, and Satisfaction through the standardized USE Questionnaire [5].

**Conceptual Framework:**



## II. MATERIALS AND METHODOLOGY

This study employed a developmental research approach in building a functional POS system for the CAPTAIN-J Takoyaki Business, aiming to create a system appropriate for the fast-paced environment of the Parkway Food Strip near Madridejos Plaza. This approach is defined as the systematic study of design, development, and evaluation processes with the aim of establishing an empirical basis for the creation of products and tools [6]. Furthermore, the implementation of such a system is vital for small-scale enterprises, as automated POS solutions provide a structured framework for profitability measurement and retail business growth [7]. This methodology ensures that the technological intervention is not only functionally sound but also tailored to meet the real-world operational needs of the business.

### A. Software Development Life Cycle (SDLC)

The researchers employed a structured approach to the Waterfall Development Life Cycle, a sequential software development methodology widely used in system design and implementation [6]. This approach was selected due to its clear, linear progression of phases, allowing each stage of development to be completed and validated before proceeding to the next, ensuring a systematic and well-documented transition from the existing manual process to a computerized system. It is particularly suitable for projects with well-defined requirements, such as replacing traditional business processes with a digital solution.

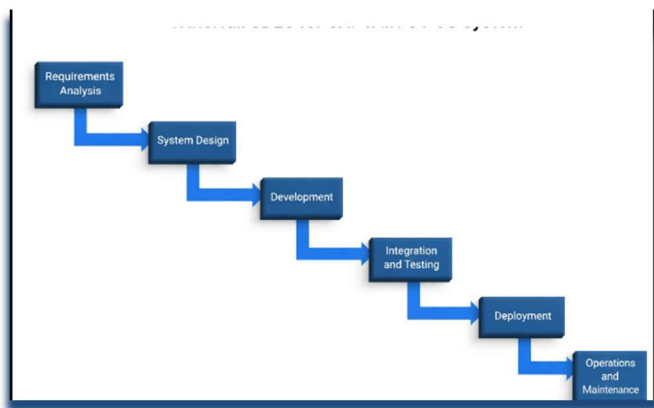


Fig. 1 The CAPTAIN-J POS Waterfall Development Life Cycle.

As shown in Figure 1, the Waterfall SDLC for CAPTAIN-J POS System illustrates a linear and sequential flow of development phases. Each stage must be completed before the next begins, ensuring a structured transition from a manual to a computerized system through the following six steps:

1. *Requirements Analysis:* Documenting system requirements for the stall environment, such as a "quick-

2. *System Design:* Developing the blueprint for the MySQL database, user interface, and user experience tailored for a 10-inch tablet, emphasizing simplicity, speed, and clarity for staff operations [6][8].
3. *Development:* Writing the main PHP backend code and establishing secure database connections, enabling dynamic generation of dashboards, sales reports, and inventory tracking [7][10].
4. *Integration and Testing:* Connecting peripheral devices such as the thermal printer and performing stress testing to ensure the system could handle multiple concurrent transactions and maintain data integrity [12].
5. *Deployment:* Replacing the legacy manual system with the new POS at the CAPTAIN-J Takoyaki Business, ensuring minimal downtime and continuity of operations [7][10].
6. *Operations and Maintenance:* Establishing procedures for regular data backups, system monitoring, and ongoing support to maintain performance, security, and reliability over time [5][6].

### B. System Architecture

The Web-based Point of Sale and Inventory Management System for CAPTAIN-J transitions operations from manual paper logs to a modern, 3-tier Layered Architecture. Built using a PHP and MySQL stack, the system is optimized for space-efficiency in a compact stall, operating on a 10-inch tablet paired with a thermal printer.

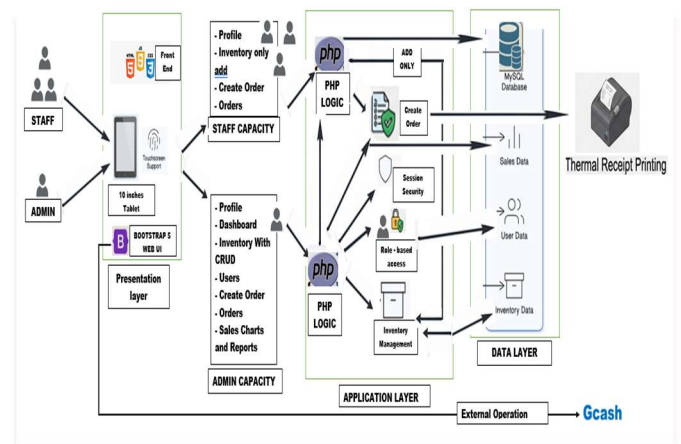


Fig. 2 The System Architecture of the System.

As illustrated in Figure 2, the system utilizes a 3-tier Layered Architecture consisting of a Presentation Layer (built with HTML5, CSS3, JS, and Bootstrap 5 for a tablet-optimized UI), an Application Layer (driven by PHP logic for order processing and real-time stock deduction), and a Data Layer (utilizing a MySQL database for centralized storage). This layered architecture follows modern mobile point-of-sale

system design principles that emphasize modularity, scalability, and efficient data processing [8][12].

1. *Presentation Layer*: The web-based interface is optimized for 10-inch tablets using Bootstrap 5, enabling staff to perform rapid order entry while providing administrators with detailed dashboards for monitoring sales, inventory, and other business metrics [12][13].
2. *Application Layer*: Powered by PHP, this layer functions as the system's "brain," managing secure user authentication, order processing, and real-time inventory adjustments through PDO. It enforces business rules and ensures data integrity across all transactions [7][10].
3. *Data Layer*: A centralized MySQL database serves as the single source of truth, replacing manual paper logs with instant data retrieval, accurate reporting, and secure backup procedures, ensuring reliability and integrity for all business operations [2][7].

### C. Admin Dashboard and Analytics Interface

We designed the Captain J Admin Dashboard (see Fig. 3) to give the owner an instant snapshot of the business's health. Instead of digging through raw MySQL tables, the owner can see visualized data at a glance.



Fig. 3 The CAPTAIN-J Admin Dashboard showing the data visualization suite including itemized sales bars, monthly revenue trends, and a percentage-based sales share distribution.

As shown in Figure 3, the Captain J Admin Dashboard provides a centralized interface for real-time business monitoring through a clean, card-based layout. The interface is divided into a red navigational sidebar on the left and a main data visualization area on the right, which features the following components [13][15]:

1. *Key Metric Cards*: High-level counters that display the current status of the database, such as Total Users, Total Orders, and Total Product count (182 items). These cards allow managers to get a quick overview of critical information at a glance, improving decision-making efficiency [1].

2. *Sales per Product (Bar Chart)*: This visualization compares top-performing items, like "ABBA (Brown Sugar) Large" and "Americano Small," helping the business quickly identify bestseller trends and allocate resources accordingly [14].
3. *Monthly Sales Trend (Line Graph)*: A time-series chart tracks revenue fluctuations over the month, enabling the prediction of peak periods and better planning for inventory and staffing [13][15].
4. *Sales Share (Pie Chart)*: A proportional breakdown of revenue by product highlights which items contribute most to overall sales, supporting strategic focus and product prioritization [14].

### D. Inventory Management and Stock Control

The Captain J Inventory Management interface provides a streamlined method for tracking product availability and pricing, offering real-time stock monitoring, which is essential for effective inventory control in operations management [8][9]. This functionality allows the admin to maintain accurate inventory levels, prevent stockouts, and make timely decisions regarding procurement and sales planning.

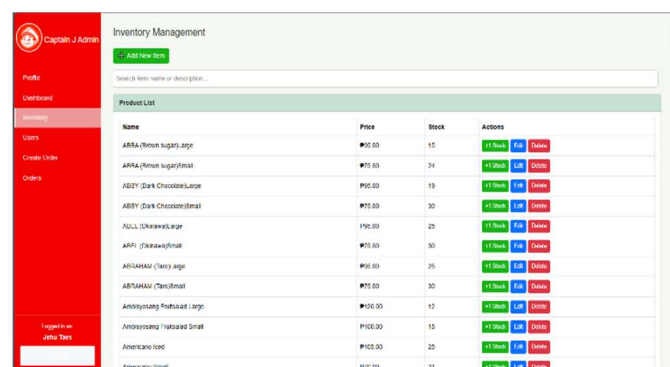


Fig. 4 The CAPTAIN-J Inventory Management module featuring real-time stock monitoring and administrative action tools.

As shown in Figure 4, the Captain J Inventory Management interface provides a robust system for overseeing the store's product catalog. The module utilizes the same red sidebar for navigation while dedicating the primary workspace to a clean, organized Inventory List. The layout is built for speed and accuracy through the following four components:

1. *Dynamic Product List*: A structured table displays item names, precise pricing (e.g., ₱95.00 for large items), and current stock levels, reducing the risk of overselling and ensuring accurate inventory tracking [7][10].
2. *Rapid Stock Adjustment*: A dedicated "+1 Stock" button enables quick inventory increments, minimizing the time needed for routine stock updates and improving operational efficiency [7].

3. **CRUD Functionality:** Integrated "Edit" and "Delete" actions allow the admin to modify product details or remove discontinued items directly from the database, supporting dynamic inventory management [10][12].
4. **Global Search and Entry:** A search bar for filtering specific inventory items, along with an "Add New Item" feature, facilitates seamless menu expansion and efficient navigation of large product catalogs [7][11].

### E. User Management and Access Control

The researchers implemented the Captain J User Management interface (see Fig. 5) to ensure secure administrative oversight and accountability. This module allows the head admin to control who can access the backend of the system. As shown in the interface.

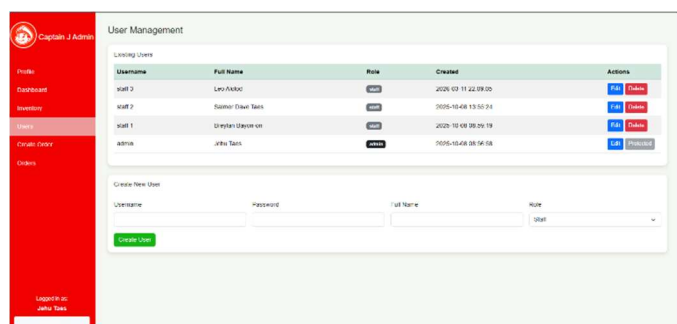


Fig. 5 The CAPTAIN-J User Management interface illustrating administrative control over user roles, account creation, and system permissions.

1. **Role-Based Access Control (RBAC):** Users are assigned specific roles, such as Admin or Staff, which determines their level of access within the POS system [16][18].
2. **User Accountability Log:** A detailed table showing usernames, full names, and exact Creation Timestamps to track when each account was added, enhancing accountability [17].
3. **Account Protection Protocols:** Security features like the "Protected" status for the primary admin account prevent accidental deletion or misuse of critical accounts [18].
4. **On-the-fly User Creation:** A simplified registration form allows the owner to instantly add new employees by defining their credentials and roles, balancing operational efficiency with RBAC enforcement [19].

### F. Order Processing and Transaction Interface

The Captain J Order Creation interface (see Fig. 6) was designed to streamline the point-of-sale workflow, ensuring fast and accurate order entry during peak hours. This module serves as the primary bridge between the customer and the database.

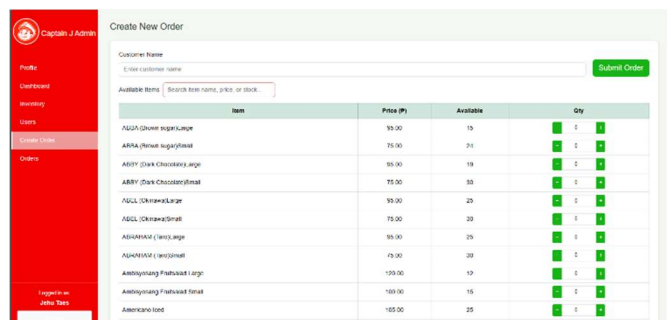


Fig. 6 The CAPTAIN-J "Create New Order" interface featuring real-time inventory synchronization and simplified quantity controls.

As shown in Figure 6, the Captain J Order Creation interface provides a streamlined point-of-sale workflow designed for high-speed transaction processing. The layout uses a clean, data-driven table format that integrates seamlessly with the red navigational sidebar, featuring the following four key components:

1. **Customer Attribution:** A dedicated input field for the Customer Name ensures that every transaction is linked to a specific buyer, supporting personalized service, customer tracking, and order history analysis [7][11].
2. **Real-Time Stock Availability:** A tabular display showing product prices and current stock levels (e.g., 15 units available for ABBA Large) prevents staff from accepting orders for items that are out of stock, maintaining inventory accuracy [7][10].
3. **Quantity Adjustment Controls:** Intuitive +/- increment buttons allow staff to quickly modify item counts without manual typing, minimizing input errors and improving transaction speed [12].
4. **Integrated Search Filter:** A responsive search bar enables users to filter the menu by item name, price, or stock, significantly reducing the time spent scrolling through the product list and enhancing usability [11][12].

### G. Transaction History and Order Monitoring

The Captain J Orders List (see Fig. 7) serves as the system's central ledger, providing a transparent record of every transaction processed through the POS. This module is essential for auditing and resolving customer inquiries.

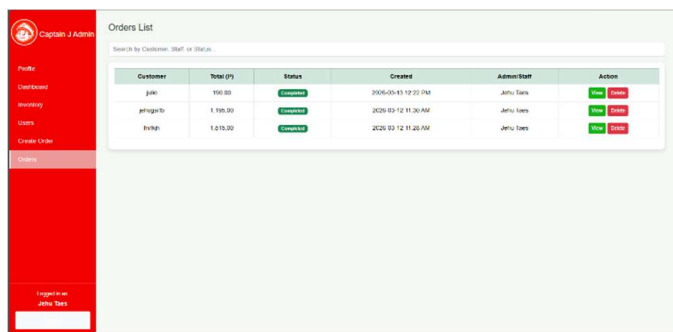


Fig. 7 The CAPTAIN-J Orders List interface illustrating the transaction history, staff accountability logs, and order status monitoring.

As shown in Figure 7, the Captain J Orders List serves as the system's central ledger, providing a transparent and organized record of every transaction. The interface continues the consistent red-and-white design language, presenting a comprehensive Orders List table with the following four key components:

- Comprehensive Transaction Ledger:** A structured table displays the Customer Name, Total Amount (P), and exact Creation Timestamp for every order, ensuring accurate and traceable transaction records [7][10].
- Staff Accountability Tracking:** Each entry is linked to a specific Admin or Staff member (e.g., Jehu Taes), allowing the owner to monitor employee activity and maintain accountability [16][17].
- Real-Time Status Indicators:** Color-coded status labels, such as a green "Completed" tag, provide at-a-glance visibility of the order fulfillment state, supporting efficient workflow management [14][15].
- Administrative Action Suite:** Integrated tools for post-sale management, including "View" buttons for detailed itemized receipts and "Delete" options for removing erroneous entries, enable administrative control and maintain data integrity [16][18].

#### IV. RESULT AND DISCUSSION

The evaluation of the "Design and Development of a Point of Sale (POS) System for the CAPTAIN-J Takoyaki Business" used a five-point scale where a score of 5.0 represents "Very Good" (or Strongly Agree), while 4.0 is "Good," 3.0 is "Average," 2.0 is "Fair," and 1.0 is "Poor." By looking at both the technical expert data and the actual user feedback, we can get a full picture of how the system performs in a real-world kitchen and sales environment.

##### A. 5 Point-Likert Scale

The researchers used a 5-point Likert scale to quantify the responses from both technical experts and end-users. This scale allowed for a structured evaluation of the CAPTAIN-J Takoyaki POS system's performance and usability.

TABLE I

Likert Scale Interpretation for POS System Evaluation

Scale	Mean Range	Qualitative Interpretation
5	4.51 – 5.00	Very Good (Strongly Agree)
4	3.51 – 4.50	Good (Agree)
3	2.51 – 3.50	Average (Neutral)
2	1.50 – 2.50	Fair (Disagree)
1	1.00 – 1.50	Poor (Strongly Disagree)

##### B. Core System Module Evaluation

The system's specific functional components were evaluated to measure how effectively the software handles sensitive data and complex business logic. This stage focused on the "back-end" power that ensures the business remains secure and the inventory remains accurate.

TABLE II

Mean Scores and Verbal Interpretation of Core System Modules

Criteria	Mean	Verbal Interpretation
Business Intelligence & Dashboard	4.7	Very Good
Inventory CRUD & Input Security	4.4	Very Good
User Security & Credential Encryption	4.5	Very Good
Transactional Logic & Session Management	4.4	Very Good
Audit Trail & Order History	4.9	Very Good
Grand Total	4.6	Very Good

Discussion: The core module evaluation yielded a Grand Total Mean of 4.6 (Very Good), underscored by perfect 4.4 scores in Transactional Logic and User Security, which guarantee a fail-safe sales process and professional-grade encryption. The high rating for the Audit Trail (4.9) provides total transparency for every transaction, while the Business Intelligence (4.7) and Inventory modules (4.4) effectively automate real-time stock control. Ultimately, these results confirm the system is a high-performance asset that significantly bolsters the operational security and data accuracy of the CAPTAIN-J Takoyaki business.

##### C. Expert Technical Evaluation (ISO/IEC 25010)

To verify the system's structural integrity, technical experts used the ISO/IEC 25010 model. Their scores reflect a platform that is secure and functionally sound for small business use.

TABLE III

Mean Scores and Verbal Interpretation of Expert Evaluation

Criteria	Mean	Verbal Interpretation
Security	4.3	Very Good

Compatibility	4.0	Very Good
Reliability	3.7	Good
Functionality	3.6	Good
Performance Efficiency	3.6	Good
Expert Overall Mean	3.8	Good

Discussion: The technical evaluation resulted in an Expert Overall Mean of 3.8 (Good), driven by a high Security rating of 4.3 that ensures data confidentiality and a Compatibility score of 4.0 for seamless hardware integration. While Reliability (3.7), Functionality (3.6), and Performance Efficiency (3.6) received slightly lower ratings, they remain well within the "Good" range, proving the system is stable and technically capable of managing the daily operational demands of the CAPTAIN-J Takoyaki business without errors or significant lag

#### D. End-User Evaluation (USE Questionnaire)

The "human element" of the POS was tested by those who will actually operate it. Their feedback shifted the perspective from technical code to daily productivity.

TABLE IV

Mean Scores and Verbal Interpretation of End - User Evaluation

Criteria	Mean	Verbal Interpretation
Usefulness	4.3	Strongly Agree
Ease of Learning	4.2	Strongly Agree
Ease of Use	3.9	Agree
Satisfaction	3.8	Agree
User Total Mean	4.1	Strongly Agree

Discussion: The end-user evaluation yielded a User Total Mean of 4.1 (Strongly Agree), highlighted by high scores in Usefulness (4.3) and Ease of Learning (4.2) which indicate the POS system effectively streamlines business tasks and requires minimal staff training. While Ease of Use (3.9) and Satisfaction (3.8) received slightly lower "Agree" ratings, the overall feedback confirms that the system is a highly productive tool that successfully simplifies the daily operations of the CAPTAIN-J Takoyaki business.

#### V. CONCLUSION

The study concludes that the developed Point of Sale (POS) and Inventory Management System for CAPTAIN-J Takoyaki was successfully implemented and evaluated, demonstrating its effectiveness in addressing the operational challenges caused by manual processes. The system significantly improved transaction accuracy, reduced human errors, and enhanced inventory management efficiency.

The evaluation results confirm that the system achieved its intended objectives and effectively met user needs. The Expert Technical Evaluation yielded a mean score of 3.8 (Good),

indicating that the system meets acceptable standards in terms of functionality, reliability, and security. The End-User Evaluation resulted in a mean of 4.1 (Strongly Agree), demonstrating that the system is user-friendly and improves daily operations. Additionally, the Core System Module Evaluation achieved a 4.6 (Very Good), highlighting the system's strong performance in secure transactions and real-time inventory tracking. These findings clearly indicate that the system fulfills the requirements and expectations of its intended users.

Moreover, the study successfully addressed the identified research gap by developing and evaluating a customized POS and inventory management system specifically designed for a micro-scale food business. Unlike existing systems focused on large enterprises, this system is tailored to the operational needs, limitations, and workflow of a small food service business, making it practical and effective in a real-world setting.

The system's 3-tier Layered Architecture further supports its efficiency and reliability. The Presentation Layer provides a responsive, tablet-optimized interface using HTML5, CSS3, JavaScript, and Bootstrap 5. The Application Layer, powered by PHP and PDO, manages secure user access, order processing, and real-time inventory updates. The Data Layer utilizes a centralized MySQL database data security, consistency, and system persistence.

However, the study is limited to a single business context and does not evaluate the system's applicability to larger enterprises or different industries. While the system includes data backup features, it does not yet implement full cloud-based synchronization, mobile accessibility, or advanced analytics. Future research may focus on integrating these features and assessing the system's scalability and adaptability in broader business environments.

Overall, the system proved to be a successful solution, as supported by positive evaluation results and user feedback. It effectively meets the operational needs of CAPTAIN-J Takoyaki by providing a reliable, efficient, and user-friendly platform that enhances business processes and supports better decision-making.

#### VI. RECOMMENDATIONS

Based on the findings and the feedback gathered during the evaluation, the researchers propose the following recommendations:

1. *Hardware Optimization:* While the current 10-inch tablet suits space constraints, it is recommended to use a tablet with at least 4GB of RAM to ensure stable performance during high-volume peak hours, reducing the risk of slow processing and system lags [2].

2. *Cloud Integration*: Future developers should consider migrating the local MySQL database to a cloud-based server. Cloud-based POS systems allow owners to monitor sales, inventory, and analytics remotely in real-time from any location, improving operational efficiency and business oversight [20].
3. *Expanded Payment Options*: To further modernize the business, the system could be integrated with mobile wallet APIs (e.g., GCash or Maya) to automate non-cash transactions, as mobile and contactless payment innovations are becoming essential in modern POS systems [11].
4. *Automated Re-order Points*: An automated alert system should be implemented that notifies the manager via SMS or email when specific ingredients (like octopus or flour) reach critical “low stock” thresholds, minimizing disruptions and preventing stockouts [7].
5. *Offline Capability*: Implementing a local-first synchronization feature ensures that the system remains fully functional even during unexpected internet interruptions at the food strip, maintaining continuous operations without data loss [12].

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