Livestock and Roasting Order Management System with Data Analytics

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ABSTRACT

The livestock industry remains an essential contributor to agricultural productivity and rural livelihoods. However, small and medium enterprises (SMEs) in this sector often face inefficiencies caused by manual processes in inventory management, order tracking, and payment recording. This study presents the Livestock and Roasting Order Management System with Data Analytics, a mobile-based platform designed to automate operational processes and enhance decision-making through predictive insights. The system integrates modules for order placement, inventory tracking, delivery coordination, and payment management. Data analytics tools generate business insights, such as sales trends and payment performance. The prototype was developed using Android Studio and Firebase, tested for functionality, and evaluated by local business owners and IT experts. Results indicate that automation significantly reduces processing time and improves data accuracy, improving order tracking by 40%. This study concludes that implementing data-driven systems in livestock operations can enhance transparency, operational efficiency, and business intelligence.

Key words: Livestock management, order tracking, data analytics, inventory system, mobile application, agricultural digitalization

1. INTRODUCTION

The livestock sector plays a crucial role in global agriculture, contributing to food security, rural livelihoods, and economic development [1]. In recent years, digital transformation has accelerated within livestock operations, driven by the need to enhance efficiency, sustainability, and precision in farm management [2]. Modern precision livestock farming (PLF) incorporates advanced technologies—such as sensors, automation, and machine learning—to monitor animal health, optimize resource utilization, and improve production outcomes [3]. These innovations also enhance animal welfare, reduce operational losses, and support predictive analytics for better decision-making [4].

Globally, digital livestock technologies have improved traceability, disease detection, and environmental management [5]. Integration of data analytics, artificial intelligence (AI), and IoT-enabled platforms enables real-time monitoring of farm conditions and animal behavior [6]. Wearable devices, automated feeding systems, and intelligent monitoring tools reduce labor requirements while increasing productivity [7]. Such technological advancements also promote sustainability by encouraging resource-efficient and climate-smart livestock practices [8].

Emerging tools such as blockchain and IoT-based platforms are increasingly applied to supply chains, enhancing transparency, food safety, and traceability from farm to consumer [9]. Digital solutions also support better inventory control, production planning, and record management—areas where traditional livestock operations often encounter inefficiencies [10]. Despite these global improvements, many small-scale and rural livestock enterprises in the Philippines still rely on manual processes, resulting in delayed payments, inaccurate records, and difficulty tracking orders [11].

The livestock industry in the Philippines continues to grow, fueled by rising meat consumption and modernization programs [12]. However, local SMEs frequently rely on verbal transactions and unstructured recordkeeping, leading to operational inefficiencies, missed deadlines, and poor data visibility [13]. These challenges underscore the need for digital platforms that can streamline workflows, ensure transparency, and automate operational tasks.

Mobile applications have proven effective for rural agribusinesses, enabling real-time communication, structured record-keeping, and accessible financial tracking [14]. Studies show that mobile-based systems reduce information gaps, enhance customer engagement, and facilitate data-driven decisions for both producers and buyers [15]. As local livestock enterprises expand services—including lechon roasting, livestock sales, and slaughtering—technology-enabled solutions become increasingly necessary to manage growing customer demand and operational complexity [16].

In response to these needs, this study develops the Livestock and Roasting Order Management System with Data Analytics, a mobile-based platform that integrates order tracking, payment monitoring, inventory management, and analytics. The system aims to improve operational efficiency, accuracy of records, and customer satisfaction among local livestock SMEs.

This software development study aimed to design and develop the Livestock and Roasting Order Management System with Data Analytics. Specifically, it sought to answer the following questions:

1. How may the Livestock and Roasting Order Management System with Data Analytics be developed using the Waterfall Model and IEEE Recommendations?
    1.1 Requirements Specification
    1.2 Planning
    1.3 Designing
    1.4 Development/Implementation
    1.5 Testing
    1.6 Deployment
    1.7 Maintenance

2. How may the system be evaluated by IT experts and end-users based on the ISO 25010 quality model?
    2.1 Functional Suitability
    2.2 Performance Efficiency
    2.3 Compatibility
    2.4 Usability
    2.5 Reliability
    2.6 Security
    2.7 Maintainability
    2.8 Portability

2. METHODOLOGY
2.1 Research Design
The software development of the Livestock and Roasting Order Management System with Data Analytics follows the IEEE Recommendations in software engineering and adopts the Waterfall Model as its development approach.

The Waterfall Model is a sequential and linear methodology in which each phase begins only after the previous phase has been completed. The phases do not overlap and are carried out in the following order: Requirements Specification, Planning, Designing, Development/Implementation, Testing, Deployment, and Maintenance.

Following the IEEE Recommendations ensures adherence to best practices in software engineering, including requirements analysis, system design, coding, testing, and documentation. This approach supports high quality, reliability, and maintainability of the system.

2.2 Software Development Phases
2.2.1 Requirements Specification
This phase played a vital role in the development of the Livestock and Roasting Order Management System with Data Analytics. The Requirements Specification defines and documents the functional and non-functional requirements that the system must fulfill to address the operational needs of the client.

The researchers conducted a structured interview with the primary stakeholder, the business owner of the livestock and lechon roasting enterprise in Pagadian City, Zamboanga del Sur. As the main decision-maker and daily operator, the client provided comprehensive information regarding the existing workflow, operational challenges, and desired system features. Interviewing the primary stakeholder was considered sufficient, as the client oversees all business operations and is the authoritative source of requirements.

During this phase, data were gathered on the current ordering process, payment workflow, record-keeping methods, livestock inventory management, and challenges related to tracking customer orders and overdue payments. These insights served as the basis for identifying key system requirements, including:

- Order monitoring and tracking
- Livestock inventory management
- Payment reminders and overdue payment alerts
- Delivery fee computation based on location
- Data analytics for decision-making

The documented requirements from this phase became the foundation for all subsequent phases of the Waterfall Model. Ensuring that the system aligns with the client's operational needs enhances efficiency, improves record accuracy, and supports effective business management.

2.2.2 Planning
The Planning phase served as the foundation for the he planning phase was essential in the development of the Livestock and Roasting Order Management System with Data Analytics. During this phase, project objectives, system requirements, resources, and constraints were defined and

organized to ensure successful execution. The developers prepared a comprehensive plan that served as a guide throughout the project, outlining the steps, tools, and potential risks to be managed.

As the project progressed, changes and additional requirements were accommodated through regular reviews and updates to the plan, ensuring smooth development and alignment with the client's needs.

2.2.3 Designing

The designing phase transformed the gathered requirements into a detailed system blueprint to guide development. The system is a mobile application supporting order tracking, payment monitoring, livestock inventory management, and analytics.

a. Technical Specification

The mobile application is designed for Android devices. Required hardware includes a smartphone or tablet with internet access. Key technologies include:

- Android Studio (Kotlin/Java)
- Firebase (Backend & Database)
- Figma (UI/UX design)

b. Use Case Diagram

Use case diagrams (Figure 1 and Figure 2) illustrates the system's functional requirements and user interactions.
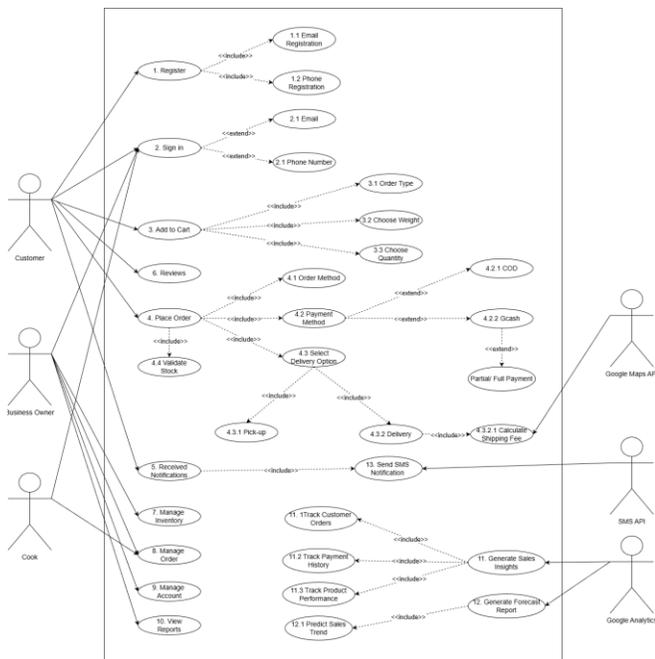

Figure 1: Use Case Diagram for Livestock & Roasting Order Management System – shows how the users interact with the system, including actions such as registering, logging in, placing orders, managing inventory, processing payments, tracking deliveries, and viewing reports.
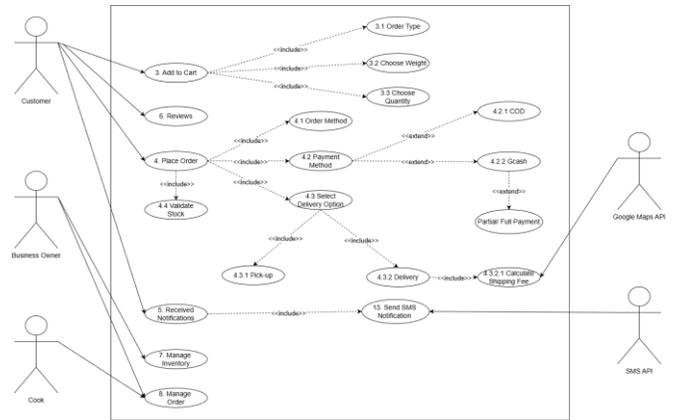
Figure 2: Use Case Diagram for Order Monitoring – shows how the user and admin track order status, view order details, receive notifications, and manage order updates within the system.

c. Interface Design

The system's GUI ensures a seamless experience for both staff and the business owner.
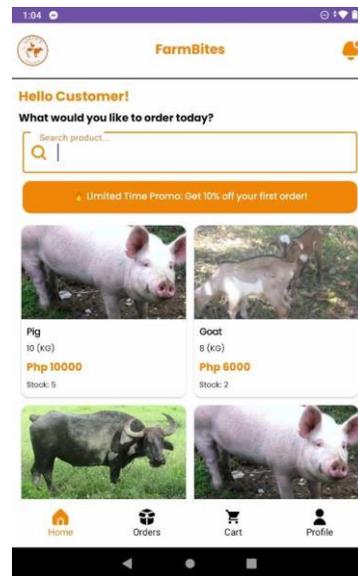
Figure 3: Customer Dashboard

Figure 3 displays the Customer Dashboard, which serves as the primary interface for ordering. Users can browse available livestock products, search for items, view promotions, check stock levels, and access their orders, cart, and profile. It provides a simple and organized layout to help customers easily select and place their orders.
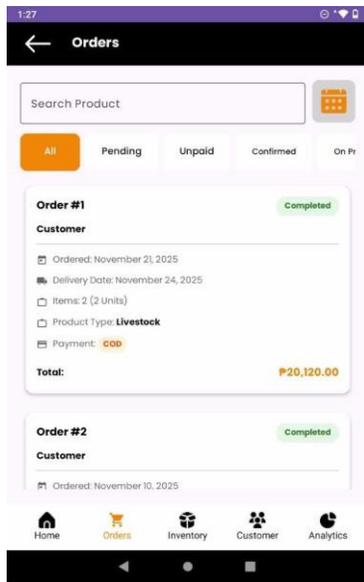
Figure 4: Order Management Module

Figure 4 shows the Order Management Interface for business owners or administrators. It also includes the cook, who is responsible for helping manage and update customer orders. This interface enables users to view orders, access detailed information, and update order statuses throughout the processing cycle.
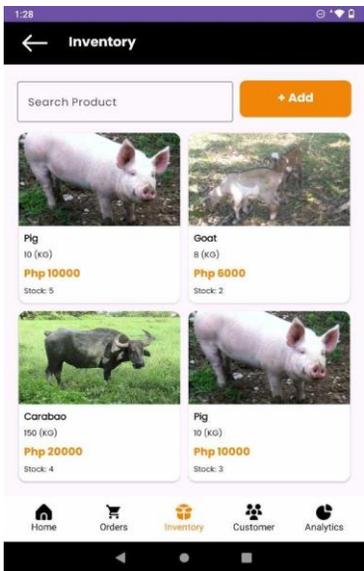
Figure 5: Inventory Management Module

Figure 5 displays the Customer Dashboard, which serves as the primary interface for ordering. Users can browse available livestock products, search for items, view promotions, check stock levels, and access their orders, cart, and profile. It provides a simple and organized layout to help customers easily select and place their orders.

2.2.4 Development/Implementation

The Development/Implementation phase involved translating the design into a functional mobile application. The developers wrote code based on the design specifications and integrated system modules to ensure proper functionality.

The following technologies and tools were used:
- Android Studio – for mobile app development
- Firebase – for real-time database, authentication, and storage
- Java/Kotlin – for application logic
- Figma – for UI/UX prototyping and interface reference

During this phase, the system features were implemented, including order monitoring, payment tracking, inventory management, delivery fee computation, and analytics dashboards. The implementation followed best practices to ensure modularity, maintainability, and efficiency.

2.2.5 Testing

This phase ensures that the Livestock and Roasting Order Management System with Data Analytics adheres to the requirements specified in the planning phase. Testing was conducted throughout development to identify and address issues, ensuring the system meets quality standards.

User acceptance and system testing were performed with the business owner, the client of this project, to evaluate usability, functionality, and overall satisfaction. The testing confirmed that the system improved operations by providing real-time order tracking, inventory updates, payment monitoring, and analytics reporting.

2.2.6 Deployment

This phase involved making the Livestock and Roasting Order Management System with Data Analytics accessible to end-users. The system was prepared for deployment by packaging it as a mobile application and uploading it to the Google Play Store.

The deployment ensured that registered users could download, install, and access the application on their devices. Coordination with the client was done to verify proper functionality, and final checks were performed to ensure the system operated smoothly in a real-world environment.

2.2.7 Maintenance

This phase refers to the continuous management of the system's performance and functionality during its operation. Maintenance is a vital part of the Livestock and Roasting Ordering Management System with Data Analytics because it ensures that the system remains reliable, efficient, and secure over time. The development team implemented a maintenance plan to support regular system updates, error correction, performance monitoring, and security improvements.

The maintenance activities include periodic checking of system functions, updating the database, improving data analytics accuracy, and ensuring secure handling of user and transaction data. Backup procedures are also applied to protect records related to orders, inventory, payments, and reports. These maintenance efforts help the system adapt to business changes and user needs while maintaining stable operation.

Based on the evaluation results, all software quality attributes—Functional Suitability, Performance Efficiency, Compatibility, Interaction Capability, Reliability, Security, Maintainability, Flexibility, and Safety—achieved a 90% pass rate. This result indicates that the system performs well in all essential areas and is easy to maintain. The high maintainability score confirms that future enhancements and updates can be implemented efficiently with minimal disruption to users.

3. CONCLUSION

The Livestock and Roasting Ordering Management System with Data Analytics was successfully developed and evaluated to support efficient order processing, inventory management, and data-driven decision-making. The evaluation results show that the system meets high standards in terms of functionality, performance efficiency, compatibility, interaction capability, reliability, security, maintainability, flexibility, and safety, with all attributes achieving a 90% pass rate. These findings indicate that the system is reliable, user-friendly, secure, and ready for practical use in business operations. Overall, the system has strong potential to improve the management of livestock and roasting orders by reducing manual processes and providing accurate analytics. Minor improvements may still be considered in future development to further enhance system performance and user experience.

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