LBDAIRY: A WEB-BASED DAIRY LIVESTOCK MONITORING AND MANAGEMENT SYSTEM USING QR CODE TAGGING WITH PRODUCTIVITY ANALYSIS FOR LUCBAN AGRICULTURE OFFICE

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CERTIFICATE OF ORIGINALITY

This is to certify that the thesis titled "LBDairy: A Web-Based Dairy Livestock Monitoring and Management System Using QR Code Tagging with Productivity Analysis for the Lucban Agriculture Office" has been submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Information Technology at Southern Luzon State University.

We declare that this thesis is our original work and has not been submitted for any other degree or diploma. It contains no material previously published or written by others, except where proper acknowledgment is made. Any guidance or assistance received during its preparation has been duly recognized.

This work represents our honest effort to contribute to the advancement of technology in the field of agriculture and livestock management. We take full responsibility for the accuracy, integrity, and authenticity of the study's content and findings.

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DEDICATION

This thesis is dedicated to my beloved **family and friends**, who have been my support during this journey. To the cherished memory of my **late Father**, whose guidance gives me the courage to chase my dreams, and to my **Mother**, for her sacrifices and constant support that has shaped me into what I am today, thank you both for being my major strength in those critical moments of my life.

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MJB

DEDICATION

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ABSTRACT

Title: **LBDAIRY: A WEB-BASED DAIRY LIVESTOCK MONITORING AND MANAGEMENT SYSTEM USING QR CODE TAGGING WITH PRODUCTIVITY ANALYSIS FOR LUCBAN AGRICULTURE OFFICE**

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LBDAIRY is a web-based livestock monitoring and management system developed for the Lucban Municipal Agriculture Office to digitalize and enhance dairy farm operations. It provides a comprehensive platform for recording, tracking, and analyzing essential livestock information, including health records, milk production, reproductive data, feeding logs, and financial and inventory management. Built using a development-based methodology, the system integrates QR code–based livestock identification, dashboards for real-time insights, and productivity analytics that align with agricultural workflows and administrative processes. The system was evaluated by IT experts and end-users using ISO 25010 software quality standards to assess its overall performance and acceptability. Results from IT experts indicated that LBDAIRY achieved "Acceptable" ratings across all attributes, including functional suitability (3.74), performance efficiency (3.76), compatibility (3.84), interaction capability (3.64), reliability (3.68), security (3.70), maintainability (3.76), flexibility (3.78), and safety (3.70). End-users similarly rated all system characteristics as Acceptable, contributing to an overall Average Weighted Mean of 3.73. These findings confirm that LBDAIRY is functional, reliable, secure, and capable of meeting operational requirements. Overall, the results demonstrate that LBDAIRY effectively supports the Lucban Municipal Agriculture Office in streamlining livestock management and improving operational efficiency. Its structured modules, real-time analytics, and user-friendly interface enhance decision-making and daily farm administration. Continuous evaluation, user feedback, and iterative improvements are recommended to further strengthen system performance and usability.

Keywords: *livestock monitoring, dairy management system, qr code tagging, productivity analysis, web-based application, agricultural information system, lucban agriculture office*

Chapter I

INTRODUCTION

Livestock production plays a vital role in shaping societies by providing food, income, employment, and cultural value. From smallholder farms to large commercial operations, these systems are deeply tied to human development and food security. Their structure and practices vary widely across regions, influenced by geography, available resources, and local traditions. While some rely on time-tested methods, others are shaped by innovation and changing market demands. As Pandey and Upadhyay (2021) explain, factors such as culture, economy, environment, and technology all play a role in determining how livestock systems function. Understanding these dynamics is essential to meeting the growing global demand for animal products in a sustainable and resilient way.

This contrast is especially evident in the dairy sector. Modern technology and strong infrastructure have enabled countries like the United States, New Zealand, and the Netherlands to lead the global dairy industry, with large-scale farms and data-driven systems achieving high levels of productivity and efficiency. In contrast, many developing nations continue to rely on traditional methods and small-scale operations, limiting their ability to compete—even as global milk production grows by more than 2% annually and consumer demand rises steadily ((Food and Agriculture Organization [FAO], 2023, p.7; International Farm Comparison Network [IFCN], 2024).

The Philippines, for example, is still in the early stages of dairy development, with the majority of producers being small-scale farmers. Most local dairy farms manage just five to ten cows on land no larger than three hectares (Solutions South-South Galaxy, 2024). These

limitations significantly constrain national output, with local production accounting for only 1.8% of total domestic dairy demand. As a result, the country relies heavily on imports and lags behind regional neighbors like Thailand, where the dairy market was valued at USD 1.594 billion in 2023 and is projected to reach USD 2.149 billion by 2029 (StrategyHelix, 2024).

One of the main reasons why the country depends so much on imported dairy products is because of the lack of infrastructure and the use of old farming methods (Serd, 2024). Currently, imported dairy makes up 98.2% of the total supply. Things got even harder when imports dropped by 13% and exports fell by 57% (PSA, 2023). Most small farms depend on cooperatives, but problems like poor breeding programs, insufficient feed, old technology, and poor management make it difficult for them to be productive and sustainable.

Today, cooperatives are very important for many small farmers in the Philippines because they not only provide support but also help keep the farms running. However, the assistance provided may not be enough to address all their problems. The situation makes it difficult for them to concentrate on producing and organic growth, which affects overall production. The most common reasons for this are poor breeding methods, old equipment, lack of new tools and technology, and insufficient management. Due to these difficulties, dairy farmers are often faced with lower milk yields, sickly animals, and non-productive farm businesses, which, in the end, make it very difficult for them to meet the dairy requirements of the country.

Globally, first-world and advancing countries are currently improving their livestock industries through the introduction of advanced technologies such as Precision Livestock Farming (PLF). These technologies help farmers to take proper care of the animals and production, making them efficient and ensuring the productivity of the whole process. In the Philippines context, the situation in the dairy sector unfortunately remains the same because most local farmers still rely on manual record-keeping and old farming traditions. This puts them at a disadvantage because they cannot keep up with the new technologies that other dairy industries around the world are already using.

To address these challenges, this study proposes LBDAIRY, a web-based management system designed for small-scale dairy farms. Through the use of advanced technologies like QR code tagging, it will be easier for farmers to access and update their animal records using their mobile devices. Fabiyi et al. (2022) developed a low-cost mobile platform for livestock monitoring using affordable RFID readers and a cross-platform app. This system allowed farmers to scan RFID tags or QR codes to manage animal IDs and health records. Through real-time data, farmers can productively manage their livestock and make the production process a whole lot better.

Also, Hendry et al. (2024) showed that web-based apps with CRUD (Create, Read, Update, Delete) features helped farmer groups manage things like fertilizers, seeds, and tools better. Their system made accounting easier and helped the groups work more efficiently, showing that digital tools can really help with managing resources. This kind of system could also help build a stronger and more independent local dairy industry, especially since digital platforms are already working well in other places.

Background of the Study

Dairy farming in Lucban, Quezon, mirrors many of the challenges faced across the Philippines. Most farms are small-scale, often managed by families with just a few cows and limited land. These farmers still rely on traditional ways of running their operations such as using notebooks and cards for records or sharing updates through word of mouth. This manual system, which is still commonly used by the Lucban Municipal Agriculture Office, makes it hard to keep track of important information like milk output, animal health, and feeding schedules.

A study by Basir et al. (2024) stated that using pen and paper for record-keeping limits how well farms can manage and trace their data. Without quick access to accurate information, farmers and agricultural officers struggle to make timely decisions. This often leads to delays in treating sick animals, missed chances to improve productivity, and more time spent on manual work.

In other parts of the world, dairy farming is changing thanks to Precision Livestock Farming (PLF) technologies. Examples of such technologies include sensors, mobile apps, cloud-based platforms, and even QR codes that enable farmers to track the performance of each animal in real-time (GeoPard, 2023). With these technologies, farmers will be able to be more efficient, detect issues at an early stage, and improve the welfare of their animals.

Countries that have adopted such tools are seeing enhanced profits and smooth operations. Better revenues and more productive operations are being observed in nations that have implemented these tools.

But here in the Philippines, especially in rural areas like Lucban, these innovations are not widely known and used. Kassahun et al. (2022) note that the lack of accessible digital tools is one of the biggest hurdles to improving farm performance in developing countries. Even though farmers are becoming more aware of these solutions, challenges like cost, lack of training, and limited internet access still get in the way.

The Lucban Municipal Agriculture Office plays a key role in supporting local farmers by providing training, veterinary care, and technical help. But without a shared digital system, it's hard for them to monitor the performance of farms in real-time or offer data-driven advice. That's where this study comes in. LBDIARY is a system for monitoring and management tailored for dairy farmers and agriculture offices in Lucban. The system uses QR code tagging, digital recordkeeping, and productivity analysis to increase the modernity and efficiency of farm operations. With LBDAIRY, farmers can shift from manual work to data-driven decisions, helping them run better farms, improve milk production, and build a more self-sufficient local dairy industry.

Objectives of the Study

The main objective of the capstone project is to assist the Lucban Municipal Agriculture Office in the monitoring, management, and productivity analysis of dairy livestock.

Specifically, it aims to:

1. To design and develop "LBDAIRY: A Web-Based Monitoring and Management System Using QR Code Tagging with Productivity Analysis for Dairy Livestock for the Lucban Municipal Agriculture Office," offering a functional and intuitive platform designed to support dairy management and evaluate animal wellness alongside operational output.

    a. Offer real-time access to insights on livestock status, farming operations, and output progress via a centralized online dashboard.

    b. Employ QR code identification to assign a unique tag to each dairy animal, streamlining tracking and data access.

    c. Facilitate supply management by monitoring inventories of feed, veterinary supplies, and farming tools to ensure stock readiness.

    d. Keep detailed financial logs to track expenditures, earnings, and farm-related financial activities to aid in budgeting and informed decisions.

    e. Include performance analysis tools to measure metrics like milk yield, weight development, and growth over time.

    f. Track the reproduction and breeding of livestock animals within the herd.

g. Supported by Progressive Web App (PWA) standards, enabling seamless use across multiple platforms like mobile phones, tablets, and desktop computers.

h. Apply protective measures for data integrity and confidentiality to prevent unauthorized access and ensure information safety.

2. To evaluate the acceptability of the LBDAIRY system based on the ISO 25010 standards in terms of:

a. Functional Suitability

b. Performance Efficiency

c. Compatibility

d. Interaction Capability

e. Reliability

f. Security

g. Maintainability

h. Flexibility

i. Safety

3. To prepare a deployment plan for the implementation of LBDAIRY, ensuring its successful implementation and effective utilization by the Lucban Municipal Agriculture Office through system deployment and user training.

Significance of the Study

This study evaluates the significance of creating a web-based dairy livestock management system in municipal agriculture offices, highlighting the effects it has on stakeholders and advancing agricultural technology and livestock monitoring. This study aims to provide benefits to the following:

The Department of Agriculture (DA) will benefit from the system as it aligns with its initiatives to boost agricultural productivity and innovation by transforming traditional farm management into a digitized and modernized system. The web-based system supports modern farming practices by providing accessible technological solutions to address present-day challenges.

Local Government Units (LGUs) will also benefit by using the system to monitor dairy-related programs, comply with agricultural reporting requirements, and assess the impact of livestock initiatives. The generated reports enable transparent resource distribution and evidence-based policymaking to support sustainable dairy farming.

Lucban Municipal Agriculture Office will improve its operations through the LBDAIRY system by enhancing data accuracy and reducing manual record-keeping. This will allow officers to focus more on key duties such as breeding programs, farmer support services, and livestock health interventions. By automating productivity analysis and reporting, the system will further strengthen decision-making and resource allocation for local dairy development initiatives.

Dairy Farmers, both small-scale and commercial, will benefit from real-time access to livestock data such as milk production trends, health records, and feeding schedules.

With its user-friendly design, the system will help farmers with limited technical expertise manage their herds more efficiently and increase farm productivity through data-driven practices.

Agricultural Professionals, including veterinarians, livestock specialists, and agricultural extension workers, will use the system as a collaborative platform for advising farmers, monitoring disease outbreaks, and implementing best practices. The centralized data storage will help improve interventions and policies for the local dairy sector.

Researchers will benefit by gaining valuable insights from the study, contributing to the growing body of research on digital livestock management technologies. The findings can support further developments in agricultural management systems and be applied to other livestock industries, agricultural cooperatives, and rural development initiatives.

Future Researchers will find this study a strong foundation for designing scalable digital solutions in agricultural management. Insights on system usability and effectiveness will guide future innovations in livestock technology, including mobile application integration and expanded analysis features.

Scope and Limitations

LBDAIRY is a Progressive Web App (PWA) for the Lucban Municipal Agriculture Office and local farmers to digitalize livestock management processes. Available on modern web browsers without app store installation, it eliminates manual recording issues and scattered farm data through centralized digital processes.

The system uses QR code marking for animal identification, enabling mobile scanning of livestock profiles. It monitors animal health, milk production, feeding habits, breeding history, and livestock mortality tracking. The livestock loss tracking function tracks death of animals while recording proof of cause of death, loss classification, and date of record for effective inventory control, trend evaluation, and veterinary compliance.

LBDAIRY has three distinct user roles: Super Admin (Municipal Agriculture Office) for user management and generation of reports, Admin users (veterinarians and agricultural staff) for health registers and system notices, and End Users (dairy farmers) for production logging and livestock data management.

Development takes place over two semesters (second semester AY 2024-2025 and first semester 2025-2026) for planning, development, testing, and implementation. The system replaces paper-based procedures with searchable electronic files and facilitates trend analysis of key performance indicators including mortality rates.

While LBDAIRY significantly enhances data organization and responsiveness, it has limitations. The system does not automate physical tasks such as feeding or milking, as it is not integrated with Internet of Things (IoT) devices or sensors. It also depends on manual data entry, which requires consistent input from users to maintain accurate records. Additionally, the platform requires internet connectivity to access full features, particularly real-time data synchronization and remote access to farm profiles. On some Android devices, limitations in PWA support may affect features such as background synchronization or offline access, which could impact usability in areas with poor internet coverage. Moreover, LBDAIRY is currently not available for iOS devices, limiting accessibility for users of Apple products.

Definition of Terms

The following terms are technically and operationally defined to facilitate this study:

Admin is the system role granted to veterinarians and agricultural workers who are authorized to input health records, manage schedules, and access system alerts.

Breeding and Reproduction Tracking in LBDAIRY enables users to follow reproductive cycles, artificial insemination dates, pregnancies, and birthing records of dairy cows.

Compatibility refers to the extent to which LBDAIRY can be integrated with existing agricultural systems and can operate effectively in the existing information technology infrastructure of the Lucban Municipal Agriculture Office.

Data Analysis is the process of examining datasets to discover useful information, draw conclusions, and support decision-making.

Data Security and Privacy pertains to protective measures such as encryption and access control implemented to safeguard farm data in the LBDAIRY system.

Dairy Livestock are domesticated animals, primarily cattle, raised for the purpose of milk production and dairy product supply.

Deployment Plan refers to the process of launching the LBDAIRY system, including setup, scheduling, and preparing all components for actual use, along with training users to operate the system effectively.

Digitization involves converting non-digital (analog) information into digital format that can be stored, processed, and accessed electronically.

End Users are dairy farmers who utilize the LBDAIRY system to manage livestock information, perform daily activity logging, and receive automated updates or reminders.

Flexibility is the ability of the system to be adapted to different scales of operations, types of animals, as well as its ability to function across devices without the need for installation from app stores.

Functional Suitability measures the extent to which LBDAIRY's features meet the practical needs of users as defined by ISO 25010 standards.

Health and Nutrition Records are digital logs within LBDAIRY that maintain each animal's medical history, dietary intake, supplements, and vaccination status.

Interaction Capability is the measure in which the LBDAIRY interface facilitates effective use by farmers and far personnel, such as adequate usability for scanning barcodes, data entry, and understanding analysis of animal productivity.

Inventory and Financial Tracking covers the logging and organization of farm supplies, assets, and expenses, assisting farmers with budgeting and cost control through the system.

ISO 25010 defines a quality model used to evaluate software systems based on characteristics like functionality, usability, reliability, and efficiency.

LBDAIRY is the developed web-based platform used by the Lucban Municipal Agriculture Office to streamline dairy livestock monitoring and productivity analysis through digital tools like QR tagging.

Maintainability in which the LBDAIRY can easily be modified in order to adjust faults, refine performance, or fit new dairy livestock management requirements.

Management System consists of coordinated processes and procedures designed to help organizations achieve specific goals effectively.

Manual Record-Keeping refers to the traditional approach of documenting livestock data on paper, which LBDAIRY aims to modernize and replace.

Monitoring System is a technology-enabled setup that continuously observes and records specific parameters, behaviors, or conditions for review and action.

Performance Efficiency describes how effectively LBDAIRY performs tasks using minimal resources while achieving user goals accurately and reliably.

Precision Livestock Farming (PLF) uses smart technologies and data analytics to monitor individual farm animals, aiming to improve productivity, health, and welfare.

Productivity Analysis within LBDAIRY evaluates dairy performance metrics such as milk output, feed use, health indicators, and reproduction rates to improve farm management decisions.

Progressive Web Application (PWA) is a type of web app that uses modern web capabilities to deliver an experience similar to a native app, including offline access and push notifications.

QR Code stands for Quick Response Code, a type of barcode that stores data readable by devices such as smartphones for quick access to digital content.

QR Code Tagging is the process of assigning a scannable code to each animal, enabling quick access to its complete profile in the LBDAIRY system.

Reliability is the capability of the system to operate in the same way repeatedly under field conditions common to Lucban Municipality, without loss of data integrity and availability under normal dairy management operations.

Safety refers to the ability of the system to reduce risk when it comes to monitoring dairy health, medication, and regulation adherence of dairy production safety standards.

Security is concerned with protecting farmer information and livestock information, ensuring appropriate access controls are enforced and sensitive farm data processed in the system.

Super Admin is the top-level user in LBDAIRY, designated to the Lucban Municipal Agriculture Office, with permissions to manage the system's users, records, and reports comprehensively.

User Training is a systematic learning process to provide necessary skills and knowledge to three user groups namely Super Admin, Admin, and End Users in order to help them use the system efficiently.

Chapter II

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents important insights relevant to the current study by reviewing the literature and related research the researcher has explored. To gather supporting information, the researcher consulted various sources such as journals, articles, books, studies, and online materials that help strengthen the foundation of the investigation.

Global Approaches to Agriculture and Livestock Management

Agriculture and livestock management play a big part in solving many of the world's serious problems, such as climate change, loss of biodiversity, food shortages, and public health issues. According to Alders et al. (2021), livestock are not only a source of food and fiber, but also have social, cultural, and environmental importance. They support local traditions, help economies, and play a role in maintaining ecosystems. Because of these many roles, livestock are important in reaching the Sustainable Development Goals (SDGs). But for the sector to be truly helpful, it needs to move toward systems that create positive effects for people, animals, and the environment.

Using modern technology in farming is now seen as a key way to improve food production and make agriculture more sustainable. Smart farming, which relies on tools connected through the Internet of Things (IoT), helps farmers watch and control things like watering, pest control, and animal health in real time. Mohamed et al. (2021) explains that technologies like drones, robots, and artificial intelligence can help farms use their resources better and produce more. In developing countries, these tools are starting to make a difference, especially with faster internet like 5G, which helps move data quickly and makes farming decisions easier and more efficient.

Another helpful method is precision agriculture, which uses data and technology to manage farms more carefully and exactly. Erickson and Fausti (2021) say this approach improve how farms use water, fertilizer, and animal feed, while also reducing harm to the environment. Precision agriculture can help keep food supply stable and improve food security. But not all farms can afford or access this kind of technology. Many small farms, especially in poorer countries, still rely on traditional methods. This creates a gap between high-tech farms and those that struggle to keep up.

This problem is also seen in India, where farming and livestock are important parts of the economy. Rangayasami and Kannan (2022) say many farms still use old practices and lack knowledge about newer, science-based ways to raise animals. However, modern communication tools like mobile phones, television, and the internet are helping farmers learn more. These tools give farmers useful tips about farming and connect them to markets. There is also more interest in using animal waste as a natural and safe alternative to harmful chemical pesticides, which is better for the environment and for human health.

Focusing on dairy production, high-performing dairy farms show that using advanced methods can lead to better results with less harm to the environment. Britt et al. (2021) explains that only about 15.4 percent of dairy cows are responsible for nearly half of the world's milk production. These cows are raised on farms that use technology such as genetic testing, carefully planned feeding, and health monitoring through sensors. These modern farms are able to produce more milk while using fewer resources for each unit of output. However, they also generate more waste, so it is important for them to apply environmental practices that help reduce pollution and keep the systems sustainable.

Agriculture and Livestock Management in the Philippines

In the Philippines, local and foreign livestock breeds differ in terms of productivity and their ability to adapt to the environment. Modern breeds are generally more productive, but native breeds are still important because they are tougher and require less care and input. According to Ortega et al. (2021), livestock in the Philippines varies between local and foreign breeds in terms of productivity and adaptability to the environment. Nevertheless, even though native breeds do not produce as much, they are very useful since they can survive in harsher conditions and provide healthy meat for local communities. Due to this, the government-initiated programs to help protect these native breeds. However, as Ortega et al. (2021) emphasized, the main challenge is balancing the need to produce more with the need to preserve native breeds. A potential solution, they argue, could be the integration of both traditional farming methods and modern technological systems.

In addition, the Philippine livestock and poultry industries have prospered, particularly augmented by the expansion of backyard farming. As noted by Briones and

Espineli (2022), the growth of the commercial sector, albeit slower for dairy, has transformed the structure of the entire value chain. The backyard sector's relatively lower barriers to entry have allowed many smallholders to engage in livestock farming. However, as the authors mention, this sector also faces other challenges, such as the inability to implement consistent governance to provide robust production subsidization support. The increase in consolidation and commercialization of farming, particularly regarding swine, suggests that sophisticated livestock monitoring systems, such as the one proposed in this study, will benefit both smallholder and commercial farms.

Additionally, the complex relationship between farming methods and environmental preservation stands as an intricate system. The research by Muoneke et al. (2022) demonstrates that agricultural technology advancement in the Philippines follows a downward trend when compared to the agrarian economy. The process initially begins with poor practices yet through technological advancement it moves toward a better environmental condition. The transformation can gain speed by adopting technologies that produce low amounts of carbon emissions. Moreover, Muoneke et al. (2022) argue how the appropriate technological tools will enable environmental preservation and farm productivity to work together effectively. Through online livestock management systems farmers can operate more efficiently while conserving environmental resources which in turn reduces ecological damage.

Furthermore, Senate Bill No. 1965, known as "An Act Supporting The Dairy, Livestock, And Poultry Industry Of The Philippines," was passed in the Senate in 2024. The Senate of the Philippines (2024) states that the bill emphasizes the need for the sector to advance food self-sufficiency and access the domestic market, which serves as a source of employment in the economy. This bill also supports a roadmap for reducing the contention of agricultural coordination and issues between agencies. This study aims to propose a real-time data livestock management system that can assist in more effective policy execution and resource allocation that the bill hopes to achieve.

In terms of agriculture, the Philippines experienced growth in 2023, with increased output of livestock and poultry as the key contributors. The Department of Agriculture (2023) cited the recovering agriculture sector economy as being in part due to technology adoption, better overall farming practices, increased funding, and an increase in support from authorities. The Department of Agriculture envisions further growth being boosted by continued investments in technology, mechanization, and trained personnel. The web-based livestock management system we propose to design in this research is intended to streamline operations on farms to enable more advanced strategic decision-making to improve efficiency and productivity.

Advancements in precision farming, along with the Internet of Things (IoT), are transforming the livestock industry. Taer and Taer (2025) observed that some tools, such as automatic feeders, intelligent incubators, and IoT-based systems, can enhance productivity as well as improve animal welfare. However, they also point out that many small farmers cannot utilize these technologies yet due to high costs and infrastructural constraints. They argue that there is too little collaboration among stakeholders to make these technologies easier to obtain. The web-based livestock management system proposed in this study can assist by being more cost-effective and user-friendly for small-scale farmers.

Finally, the Philippines still faces challenges regarding dairy production, which include low output as well as minimal investment. Milk relies mainly on importation, as Miguel (2023) mentions, and local production is still lacking. The USDA (2023) also states that the Philippines' milk production per cow is significantly lower than that of Thailand and Vietnam. There are, however, attempts at increasing these, such as the government's dairy development programs. However, Miguel (2023) stressed that more investments and better strategies are needed. With the help of a digital livestock management system, farms could improve operations and boost milk production.

Municipal Agriculture Management Systems in the Philippines

In the Philippines, despite the gradual increase in our milk production, the dairy industry is still not without challenges. The emphasis must be placed on raising awareness about green technology among dairy MSMEs in Cagayan Valley as the most relevant theme that emerges from Alvarez and Cañete (2022). A marketing campaign more widely disseminated among farmers is needed about the efficiencies and cost savings likely to come with these technologies. Moreover, Local Government Units (LGUs) should provide access to financial assistance as an incentive for adopting green initiatives in dairy enterprises. Government agencies such as the Philippine Carabao Center (PCC) and the National Dairy Authority (NDA) must share all technical know-how to allow farmers to adopt green technologies such as solar energy, biodigesters, and composting in the value chain. Such agencies should also develop models for making green technology commercially sound, thus allowing farmers to include environmental concepts in their processes.

Addressing funding, infrastructure, and dismal private sector investment would require a more comprehensive approach to supporting smallholder dairy farms. Research conducted by Turaja et al. (2024) points out that the most important things are not just to harmonize programs but also to strengthen collaboration between government agencies, research institutes, and private sectors to promote sustainable growth. Though dairy farms in Cagayan Valley and Davao may be logistically and financially challenged, the blossoming middle class and expanding population both provide ample opportunity for future potential. Still, local milk productivity stands short.

Moreover, Loresco et al. (2022) mention that in dairy production, CALABARZON has the largest herd and the best milk-producing farm, but the farms in Cagayan Valley and Davao have smaller herd sizes and have not been producing as greatly as CALABARZON farms, as stated in their focus on the disparities within these regions. Such differences create the necessity of establishing municipal agriculture management systems since municipal setups are associated with geographical and economic conditions. For example, mechanization and labor efficiency are not necessarily the same for other regions. Municipalities, particularly CALABARZON, have an advantage in this regard, while other regions require more assistance to follow improved production practices.

In addition, Palacpac et al. (2022) emphasized the need for municipal-level interventions that enhance the adoption of buffalo dairying technologies. They recommended that these be geared towards improving farmers' perception of such technologies: the extent to which they believe in its relative advantage, how compatible it is with their current practices, and the ease of using it, as per the Department of Agriculture-PCC. Municipal agriculture management systems, such as the Farmer Livestock School (FLS), are capable of providing hands-on training in all seasons and have promising outcomes, such as those experienced in Nueva Ecija and Ilocos Norte. Through strengthening the municipalities' extension services and technology transfer activities, sustainable and efficient practices may be adopted by farmers, thereby benefiting them from both production and environmental dimensions.

Furthermore, the challenges that goat farming faces demonstrate a need for more efficient agricultural management systems. Orden et al. (2021) state that these smallholder goat farmers use traditional methods, which do not support good productivity or profitability. They lack knowledge of sound breeding practices and proper health management, thus contributing to the poor performance of their goats. It is the responsibility of governments and private initiatives to disseminate science-based interventions aimed at improving the management practices of these farmers.

Finally, Monleon (2024) outlines the many regulations created to improve biosecurity and food safety throughout the livestock industry. While the regulations are vital and critical, they may scare away investments from large-scale industries that may fear for public health and welfare; however, Monleon (2024) notes that the regulatory reforms and updates currently underway give hope for the improvement in production systems in compliance with international standards. Hence, agricultural management systems at the municipal level must navigate these regulations to help promote sustainable development of the livestock field.

Livestock Management Systems and Technologies

The growing global population, expected to reach 9.8 billion by 2050, continues to increase the demand for food (Dadios et al., 2022). At the same time, urbanization is turning farmlands into cities, which makes food supply a bigger problem. To help with this, urban agriculture, especially precision farming, is seen as a smart way to produce more food using less space. Moreover, Dadios et al. (2022) explained that adaptive management systems, using tools like machine learning and fuzzy logic, can help control crop environments better. These systems work with sensors and cloud-based dashboards to track and adjust growing conditions in real-time, helping crops grow more efficiently.

In addition, the growth of the Philippines' livestock industry is hindered by several factors, including outdated practices, a lack of government assistance, and inadequate infrastructure. Notwithstanding these obstacles, the sector remains crucial to the agricultural economy, significantly boosting rural incomes and food security. Domingo et al. (2022) claim that smallholder farmers are the main driving force behind the Philippine livestock industry, especially in the production of dairy and poultry. However, it remains underdeveloped due to a lack of adequate support mechanisms. The 2020 COVID-19 pandemic and the 2019 African Swine Fever outbreaks exposed these weaknesses and underscored the need for the sector to upgrade and strengthen its resilience.

Additionally, technologies such as the Internet of Things (IoT), machine learning (ML), and even QR code systems help solve some of the challenges in precision farming. According to Vlaicu et al. (2024), these technologies improve the overall health of an animal, optimizes feeding, and tracks productivity in real time. They further mention that beyond improving productivity, these technologies also enhance sustainability by minimizing resource use and waste creation. Furthermore, Haldar et al. (2022) stated that the application of digital technology in livestock farming can optimally sustain operations while lowering the ranch's ecological impact, which is important for the long-term sustainability of the industry.

Moreover, integrating livestock with other agricultural practices may enhance efficiency. As Mujahed et al. (2023) argue, Integrated Farming Systems (IFS) that involve livestock rearing alongside cropland and agroforestry open new avenues for optimal resource utilization, improved farm incomes, and enhanced sustainability. This integration increases the farmer's income while reducing their input costs and increasing their overall resilience to economic and environmental shifts.

Finally, Gabato et al (2024) highlight the importance of record management systems in livestock farming. Farmers can make informed decisions through QR code systems for monitoring animal health and production performance, thus improving herd management and productivity. These technologies, when adopted at the community level, have the potential to greatly facilitate economically and ecologically sound practices of livestock management in the Philippines and serve as a solution to the issues in the industry.

Web-based Agricultural Information Systems

Today, digital technology has become the primary force driving livestock management into the modern era. Farm Management Information Systems (FMIS) represent essential tools for managing and processing farm data. Research by Giua et al. (2020) shows that FMIS adoption at the farm level depends on technical capabilities as well as human user characteristics. Both technical barriers stemming from interoperability issues and high costs, and human factors, such as farmers' assessments of system usability, customization levels, and benefit comparison, make key differences in the adoption process. User demographics, including educational level and computer skill expertise, strongly determine the adoption rates of these technologies. A QR code-based livestock record system presents opportunities for simple, accessible, and affordable digital solutions that can benefit owners of smallholder and municipal farms.

Related to the study, Friedman et al. (2024) studied how small and medium-sized farmers currently collect data. The research confirms that farmers currently use memory and loose handwritten documentation instead of formal digital record systems. Several obstacles present themselves through farmer reluctance toward new technology and technical know-how limitations, as well as insufficient system infrastructure support. Systems that support and enhance farmers' current operational approaches demonstrate higher potential for successful integration than those that intend to substitute existing practices. The web-based system's utilization of QR codes demonstrates its capacity to streamline record management while preserving user-friendliness that is friendly to rural areas.

Additionally, Zheng et al. (2021) developed a poultry farming information management system that combined smart sensors and wireless networks with cloud storage for practical implementation. The system included multiple functions to detect diseases, track production processes, and establish product tracing capabilities. Due to its flexible design, farmers could seamlessly connect their hardware with software, which facilitated real-time livestock condition monitoring. The implementation of web-based solutions, along with user-focused design principles, resulted in more efficient farm operations with improved responsiveness.

Research conducted by Laksmi et al. (2025) demonstrated how the SIDEWI electronic data system operated at a Bali cattle breeding center. Through this system, farmers could digitally track their cattle's health, growth progress, and breeding parameters, as well as owner identification. The system enhanced data precision while enabling smart decision support and positioned the center to serve as a best-practice example for digital farming methods. SIDEWI system's success demonstrates how digital livestock record systems can work effectively at local and community levels, thus demonstrating their potential to improve municipal agricultural livestock management.

Finally, Melzer et al. (2023) noted the expanding need for features within FMIS to support automation while improving traceability capabilities and meeting agricultural policy requirements. Research shows that operational and regulatory requirements drive commercial system development, which the government promotes through incentive programs and regulatory standards. The outcome demonstrates the need to build systems that function effectively while also meeting institutional objectives, including modern livestock record-keeping modernization goals set by local agriculture offices.

Progressive Web Applications (PWA)

Progressive Web Applications (PWAs) serve as a common solution for improving web-based system performance and user accessibility. Rochim et al. (2023) found that PWAs outperform native applications and mobile web apps at delivering faster performance in situations where caching is activated and users re-access pages repeatedly. The research reveals that file size and network conditions influence loading speed, but PWA performance is enhanced by content caching, which stores data offline. The quick data retrieval capability of PWAs makes them ideal for municipal agriculture systems because they provide consistent access to livestock data despite potentially unstable rural internet signals.

Hidayat et al. (2024) developed a PWA-based agricultural consultation application that serves as a tool for farmers to connect with agriculture officers. The application incorporated consultation forms combined with scheduling features, while offering a mobile-friendly interface. The application performed well thanks to its caching capability, which led to shorter load times. The study identified two major drawbacks: it lacked real-time functionality and its geographic testing was restricted to a single region. The research findings validate PWAs as an acceptable technology solution for agricultural service delivery. Livestock record keeping could gain the same advantages of accessibility and responsiveness by adopting comparable technology and integrating QR code functionality.

Yeong et al. (2024) also developed a software platform to monitor agricultural machinery through Progressive Web Apps (PWA) and web technology applications for smart farming. The system monitored historical and real-time machine data for better farming operations and maintenance optimization. A combination of real-time alerts with a scalable architecture demonstrates the potential of web-based systems for increasing agricultural efficiency through intelligent data management. The equipment-focused platform demonstrates parallel concepts to a QR-based livestock system by showing how data storage functions alongside collection and utilization processes.

Moreover, PWA technology proves valuable for rural locations and resource-limited environments because it functions across multiple platforms and provides flexible solutions. Cuenca-Enrique et al. (2024) conducted evaluations of different mobile development approaches and determined that PWA represents the best solution for rural populations because it unifies essential elements from web platforms and mobile applications. A Panama-based rural energy access tool case study deployed with PWA technology demonstrates practical PWA benefits for developmental environments. The positive outcome of this initiative validates that Progressive Web Apps prove suitable for various rural solutions, including livestock system management, which demands affordability, ease of use, and offline functionality.

Ali et al. (2023) demonstrate how PWAs utilize Service Workers found in modern browsers to create offline functionality while offering enhanced load times. Modern web browsers support their operation without requiring installation through official app stores. PWAs remove user barriers by working across all devices, regardless of technical sophistication or hardware functionality. PWA technology utilizes platform capabilities effectively to develop user-centric, lightweight systems, such as livestock record management platforms.

However, there are some challenges. Fauzan et al. (2022) did a review of PWA systems and found that issues like browser compatibility and framework requirements can make development harder. But as web standards improve and more people use PWAs, these problems are slowly being solved. With growing academic and industry interest, PWAs are becoming a popular choice for modern app development. Their offline function, simple design, and cross-platform access make them ideal for agriculture offices to digitize livestock records effectively.

QR Code Technology Applications

The use of QR code technology proves essential for modernizing traditional agricultural information distribution operations. Atheequlla et al. (2024) explored how QR codes were used in the horticulture sector and found that they offer a sustainable and effective alternative to traditional printed materials like booklets and pamphlets. Personnel from every demographic background and occupation sector reported favorable attitudes toward QR codes because they provide simple access to useful information. The implementation faced difficulties stemming from poor Internet connectivity and the persistence of traditional method preferences. The study prescribes implementing QR codes for sustainable innovative information distribution because it establishes these methods for livestock information systems.

In livestock management, QR codes are part of the move toward digital systems. For example, Banta et al. (2025) discussed the HerdHero platform, which combines QR scanning with data analytics to help farms run more efficiently. Both users and IT professionals gave positive feedback. They liked how the system offered easy access to livestock data, worked well across devices, and simplified tasks. The research showed that combining QR codes with digital tools makes livestock management more practical and productive for farmers.

Kikitamara et al. (2024) conducted a case study on livestock monitoring in Sambilawang Village to demonstrate how local farmers supported the development of a QR code-based system while underlining their essential involvement. Through collaboration, researchers ensured that the app functioned optimally for community members, directly addressing their needs. The project demonstrates how digital tools help rural livestock managers yet concerns about QR code longevity and user training persisted. These digital tools transform into powerful farmer-supporting solutions because of community stakeholder involvement that melds system improvements with local knowledge.

The broad functionality and large data storage capabilities of QR codes demonstrate their suitability for multiple uses even though security risks have begun to emerge. Al Dallal and Al Mukhtar (2023) discovered that most QR codes store unencrypted data, making them susceptible to misuse. The researchers developed an encryption system comprising multiple levels to guard user data while keeping QR functionality operational. Animals' health records and farm information require secure protection in livestock systems. Improved trust in digital livestock records alongside responsible use would result from implementing encryption layers

To make QR systems reliable, strong scanning and decoding methods are also important. Jain et al. (2021) conducted a review of QR code scanning systems and pointed out that while most phones today have strong hardware, the main challenge is scanning accuracy. They suggested using deep learning techniques and stronger static image detection to improve reliability. These recommendations are key for ensuring livestock with QR tags are scanned accurately, supporting real-time data tracking and reducing errors.

Lastly, Dineva and Atanasova (2022) developed a smart farming system that uses animal ear tag QR code scanning to provide individual animal information from cloud databases. Their solution follows green computing principles through its implementation of eco-efficient server setups. The system enhances monitoring speed and puts sustainability objectives into practice. Their model shows how QR codes improve livestock traceability and management transparency while reducing environmental impacts, which corresponds to the objectives of modern sustainable agriculture.

Dairy Livestock Production Management

Dairy livestock production serves major functions in both agricultural operations and food production stability. The expanding global population produces rising requirements for animal products. The contemporary livestock management systems work to optimize productivity yet they must maintain proper attention to animal welfare. The animal management methods identified by Orihuela (2021) create various types of stress that hinder both animal performance and health status. Animal behavior serves as both an affordable and practical research approach that aids in enhancing animal welfare and productivity according to his point of view.

The introduction of Precision Livestock Farming (PLF) brings advanced smart technologies that enhance herd management and monitoring capabilities for farmers. Feedback systems equipped with sensors and automation tools provide dual advantages by cutting down manpower needs and decreasing animal stress alongside higher productivity improvements. Simitzis et al. (2021) explained that these technologies not only improve productivity but also support animal well-being and sustainable practices. However, they also noted that farmers must be properly trained to use these systems and handle animals correctly.

Monteiro et al. (2021) supported this by showing that Precision Agriculture (PA) represented by PLF enables farmers to manage their resources effectively. The combination of smart tools enables automatic animal monitoring that lets farmers optimize their outcomes and sustain the environment. Current use of these farming tools takes place mainly in controlled test environments but requires additional research to achieve practical everyday implementation.

Neethirajan and Kemp (2021) discussed how livestock farming can benefit from biometric sensors combined with big data processing alongside blockchain solutions. Animal farmers can monitor their livestock health through these technologies for spotting diseases while ensuring product safety and tracking the origins of all products. Before farm-wide adoption of these innovations' developers must resolve privacy issues and ensure appropriate data usage since these tools provide multiple advantages.

Research conducted by Džermeikaitė et al. (2023) demonstrated how biosensors enable early disease detection in animals. Biosensors enable farmers to take prompt actions and limit losses while stopping disease outbreaks. Wearable sensors together with mobile tools enable animal monitoring which helps ensure both excellent welfare standards and optimal productivity.

Finally, Akash et al. (2021) also demonstrated livestock farming generates financial benefits while ensuring food availability for rural populations. The authors argued that farmers require education about effective livestock management practices to deliver both safe and healthy products which achieve high-quality standards. The nutritional completeness of livestock products becomes essential for food security during periods when crops fail to produce harvests.

Data Analysis and Productivity Measurement

Data analysis and productivity measurement systems act as essential tools for livestock management improvement within municipal agriculture management operations throughout the country. Animal welfare concerns are gaining greater importance in all livestock production systems. Tools developed by Poulopoulou et al. (2023) help farmers monitor animal health through real-time performance feedback on their management practices. These monitoring tools simultaneously improve farm productivity while enhancing livestock sustainability through better animal health and reduced antibiotic utilization and enhanced overall management practices.

Dairy farming utilizes benchmarking techniques as critical instruments to enhance operational and monetary operational effectiveness.

Studies by Ramsbottom et al. (2020) showed that farms that benchmark their financial data more often deliver superior resource management along with environmentally friendly outcomes. Philippine municipalities that face financial resource constraints benefit from these tools by maximizing farm operations to minimize waste and increase profits. The potential of these tools to manage the expanding performance gap between farms represents an essential aspect in encouraging equitable community growth according to Ramsbottom et al. (2020).

Through their research, Kofler et al. (2022) show that benchmarking systems used by Austria's dairy sector to monitor health data effectively enhance animal welfare through claw health assessment. The installed systems help dairy farmers decrease expenses related to lameness which affects their herds. The adoption of benchmarking systems identical to those established for Philippine municipalities would provide local farmers better animal welfare and higher productivity through reduced operational expenditures. The participation of local farmers in these municipal programs helps municipalities direct livestock efficiency and improve general livestock health.

The Dairy Victory Platform (DVP) created by Freitas and Cabrera (2024) offers dairy farmers important benefits for their decision-making processes through its digital platform. The cloud-based platform processes limited data to deliver performance insights about key performance indicators at both individual cows and entire herds. Digital platforms serve Philippine municipal farming well through process tracking and management guidance that helps farmers achieve more effective operational approaches. Through data-driven tools rural dairy operators can maximize their milk production results while improving feed utilization which leads to better business performance.

The implementation of financial benchmarking within livestock management systems helps farmers discover financial problems early so they can be resolved before they become severe. The analysis from Martinez et al. (2021) shows that financial benchmarks based on balance sheets enable dairy farmers to restructure their expenses while obtaining improved lending conditions. Municipal government officials utilize these benchmarks to help farmers optimize funding decisions which helps sustain their agricultural businesses for extended periods.

The livestock sector is undergoing a rapid transformation thanks to recent advances in digital technologies such as big data and wireless sensors alongside blockchain applications. Abiri et al. (2023) define these technologies as instruments that can optimize farming efficiency while strengthening agricultural yield and tracking food origins. Digital innovations bring improved productivity along with enhanced food security and better environmental management to municipal farming systems. Municipalities should actively support farmers to adopt accessible digital solutions that will help maintain their competitive advantage in the swiftly changing agricultural sector.

PHP and Laravel for Backend Development

Recent developments in agricultural technology have highlighted the efficacy of PHP and Laravel frameworks in developing robust web-based livestock management systems. Aryo Bhagaskoro et al. (2025) developed a Laravel-based backend application to support farm animal information management at Sein Farm in Bandung City, demonstrating improved data handling and system scalability. Similarly, Alhari et al. (2022) implemented a Laravel framework for managing palm agriculture information systems, emphasizing its adaptability and efficiency in agricultural contexts.

In the aquaculture sector, the Sense-IT system utilized a PHP Laravel-based web application to control and configure autonomous data acquisition devices, facilitating real-time monitoring of water bodies (Kamruzzaman et al., 2022). K. et al. (2021) discussed the development of a poultry farm management information system using PHP, which streamlined sales, purchases, and product management processes. Furthermore, a web-based instant messaging system for organic farmers and researchers was developed using Laravel, enhancing communication and knowledge dissemination within the agricultural community (Arogundade et al., 2022). These studies collectively underscore the versatility and effectiveness of PHP and Laravel in creating scalable, efficient, and user-friendly web-based systems for livestock monitoring and management.

HTML, JavaScript, CSS, and Tailwind CSS for Frontend Development

Developments in agricultural web systems have demonstrated the practical application of modern frontend technologies such as HTML, JavaScript, CSS, and Tailwind CSS in enhancing user interface design, responsiveness, and overall user experience. Gabato et al. (2024) created an RFID-based record management web portal for goat farming, integrating HTML for structure, CSS for styling, and JavaScript for interactivity. This combination enabled a seamless and intuitive system that facilitated the real-time tracking of livestock health records, breeding schedules, and productivity data, which are essential for informed decision-making in livestock management.

In a related study, Martínez-Cepeda et al. (2024) developed the ESPE Security web application, leveraging modern frontend tools including Tailwind CSS and JavaScript to deliver a responsive and accessible interface for issuing real-time alerts. This design approach could be adapted to monitoring critical livestock parameters and notifying users of emergencies or anomalies. Okokpujie et al. (2023) focused on developing a sustainable Internet of Things-based system for monitoring cattle health and location, utilizing web and mobile application feedback to provide real-time data to farmers and stakeholders.

Their implementation highlighted the effectiveness of integrating frontend technologies to enhance user engagement and system usability.

Additionally, Shwetabhand & Ambhaikar (2024) developed a low-cost livestock sorting and information management system by integrating deep learning, AI, and IoT technologies with web interfaces built using HTML, CSS, and JavaScript. Their system supports real-time livestock classification and monitoring, improving the efficiency of animal management through an intuitive and responsive digital platform. Lastly, a study by Tambunan (2023) focused on developing a web-based livestock sale platform using design thinking and rapid prototyping methodologies. They utilized HTML, CSS, and JavaScript to create user-friendly interfaces that facilitate efficient data management and real-time monitoring, highlighting the effectiveness of these technologies in enhancing user experience and operational efficiency in the agricultural sector.

MySQL for Database

Advancements in livestock monitoring and management systems have highlighted the effective use of MySQL in handling structured agricultural data in real-time web-based environments. Zheng et al. (2021) developed a cloud-based poultry farming information system using MySQL 5.7, enabling real-time disease detection and production tracking through wireless sensors integrated on Alibaba Cloud. Kusnadi et al. (2021) implemented a cattle farming knowledge management system that used MySQL to store and retrieve expert-based agricultural knowledge efficiently. Another project, “Mi Granja,” utilized

MySQL within a Laravel framework to manage sensor data from LoRa-based IoT devices, contributing to improved farm productivity and environmental control (Saban et al., 2023).

Wang & Qi (2022) proposed an intelligent animal husbandry cloud platform where MySQL played a key role in maintaining the consistency and accuracy of livestock data across different modules. Additionally, Liu & Wu (2024) explored how MySQL database technology can be used to process and analyze agricultural data, proposing a novel data processing scheme based on MySQL and verifying its effectiveness through experiments. These studies underscore MySQL's pivotal role in enhancing data management, system scalability, and real-time monitoring in modern livestock farming practices.

Chart.js and HTML5 QR Code for API and Libraries

The incorporation of open-source libraries such as Chart.js and HTML5 QR code solutions has significantly improved the development of dynamic, data-driven web applications, particularly in systems that demand real-time analytics, effective data encoding, and seamless user interaction. Chart.js, a lightweight and flexible JavaScript charting library, serves a crucial function in presenting complex datasets in a visually understandable format through responsive and customizable chart types. Its application in various systems, including monitoring dashboards and educational frameworks, allows accessible tracking of trends and performance metrics (Vučetić et al., 2023).

The HTML5-QRCode library is a lightweight JavaScript tool that enables real-time QR code scanning directly within web applications through browser-supported camera access. It functions efficiently across major browsers and platforms, making it suitable for both mobile and desktop environments that require fast and accessible QR code reading. The library supports live camera scanning and file-based scanning, providing users with the flexibility to upload an image or scan directly through their device camera. It also offers customizable settings—such as frame rate control, scanning regions, and camera selection—to optimize scanning performance in various conditions. Because it uses standard HTML5 APIs, the library requires secure contexts like HTTPS or localhost, ensuring user privacy and security.

On the whole, HTML5-QRCode has become a widely adopted and versatile tool for web-based QR code systems due to its ease of integration and broad compatibility with modern devices (Zhou & Kong, 2022). Similarly, web-based application frameworks such as HTML5 and JavaScript are widely used to embed QR code functionalities, enabling instant access to digital resources and supporting more interactive and efficient system processes (Rosli & Zin, 2025).

Service Workers for Offline Synchronization

Service Workers, a powerful and standardized web API, have revolutionized modern web application development by enabling features such as offline access, background sync, and push notifications—capabilities that were once exclusive to native applications. Operating independently of the web page or user interface, service workers function as programmable network proxies that intercept and manage network requests, allowing developers to create responsive and resilient applications that continue to function under unstable or disconnected network conditions (Fauzan et al., 2022).

These features are central to the architecture of Progressive Web Applications (PWAs), where service workers help bridge the gap between traditional web apps and native mobile apps by ensuring smooth and uninterrupted user experiences (Panwar, 2024). Moreover, in systems that integrate artificial intelligence or data analytics, service workers enable asynchronous data processing, allowing complex machine learning models to run efficiently in the background while maintaining UI responsiveness—especially useful in data-intensive environments with fluctuating connectivity (Charan, 2022).

The ability of service workers to handle background synchronization also allows deferred user actions, such as form submissions or transactions, to be queued and completed automatically once network access is restored, which significantly enhances the robustness of transactional applications (Gerges & Elgalb, 2024). Additionally, in geospatial web systems, service workers improve performance by caching frequently used map data, ensuring faster rendering and smoother navigation across digital maps—even in offline or rural contexts (Wang et al., 2025). Overall, the use of service workers as an API not only advances the technical capabilities of web applications but also ensures higher user satisfaction through reliable, efficient, and context-aware web experiences.

Hostinger for Web Hosting

Recent studies highlight the effectiveness of using hosting services like Hostinger in IoT-based systems, particularly in smart agriculture and remote management platforms. Chakraborty & Chakraborty (2024) utilized Hostinger in their blockchain-based smart door system, citing its affordability, ease of deployment, and support for static IPs as critical features for web-hosted control interfaces. In another study, a web-based livestock monitoring system successfully leveraged Hostinger to host a centralized platform for real-time tracking of animal health, movement, and environment, demonstrating the hosting provider's suitability for data-driven farm management (Bandara et al., 2024).

Similarly, Cui et al. (2022) emphasized the importance of reliable web hosting in smart fertigation systems, where real-time data processing and user dashboards are essential. The work of Eduardo et al. (2025) further supports this by implementing a smart greenhouse solution using IoT technologies, highlighting how responsive web platforms enable remote agricultural oversight. Additionally, Budiyanto et al. (2021) described the integration of cloud-hosted systems in IoT agriculture, noting that low-cost hosting options like Hostinger help scale precision agriculture without the need for enterprise-grade infrastructure. Collectively, these studies show that Hostinger offers a practical, scalable solution for web-based livestock monitoring and other smart farming applications.

Visual Studio Code for Development Tool

Visual Studio Code (VS Code) has increasingly been adopted as the primary development environment in various livestock and animal monitoring systems due to its lightweight nature and extensibility. Mahadi and Alduais (2024) utilized VS Code in the creation of a web-based pet welfare community, showcasing its effectiveness in building responsive interfaces and managing real-time data flows. Gabato et al. (2024) also used VS Code as the main development tool in an RFID-based record management system for goats, emphasizing the seamless integration between web technologies and hardware components. Hansbhanvi et al. (2024) implemented VS Code in a smart farm management system using cellular IoT, taking advantage of its extensions for REST API testing and debugging during development.

Similarly, Villanueva et al. (2023) used VS Code to develop a mobile platform for livestock monitoring, which benefited from VS Code's integration with version control systems and cross-platform frameworks (Fabiyi et al., 2022). Lastly, Thannithi et al. (2024) applied VS Code in designing a mobile application for beef cattle farm management, citing its utility in building scalable, maintainable, and user-centered systems Thannithi et al. (2024). These studies illustrate how VS Code continues to support efficient and scalable development of web-based livestock monitoring solutions.

ISO 25010

The ISO/IEC 25010 model has become the prevailing standard for measuring the quality of software applications in different fields. Being a sequel to the ISO/IEC 9126 model, ISO/IEC 25010 offers major improvements in keeping pace with the changing needs of software systems. According to Temkar and Bhaskar (2021), the new model builds upon its predecessor by incorporating extra properties like compatibility and security, which are highly critical in the current networked computing environment. Similarly, Canlas (2021) and coauthors highlight that ISO/IEC 25010 is based on the building block of ISO 9126 but offers a more comprehensive and detailed framework to facilitate the measurement of live software products.

Also titled "Systems and software engineering – Systems and software Quality Requirements and Evaluation (SQuaRE) – System and software quality models," ISO 25010 defines two core models: one for software product quality and another for software quality in use. According to Britton (2021), these are organized around a wide set of characteristics and sub-characteristics, thereby bestowing conceptual simplicity as well as operational guidance for implementation. Such a dual model facilitates not only a high-level analysis of technical performance but also facilitates the assessment of user experience and operational efficiency. Use of ISO 25010 goes far beyond modeling in theory. Bodnar's (2025) new book depicts extensive use of the standard across healthcare, automotive, and financial industries—industries where strict software quality is a critical requirement. Strength of the standard is in flexibility; it defines a broad structure with the autonomy for organizations to tailor their methods of quality assurance to accommodate given conditions of operations. The blend of standardization and adaptation makes ISO/IEC 25010 a foundational element in coordinating software development practice with international standards of quality.

Functional Suitability

Functional suitability describes to what degree a software system is able to deliver functions to meet explicitly stated and implicitly anticipated user needs. Functional suitability stands at the absolute core of the ISO/IEC 25010:2023 standard and is pivotal in deciding if a system is able to meet the functions for which it is intended (QMII, 2024). Perforce Software (2021) states that functional suitability has three sub-characteristics, namely functional completeness, functional correctness, and functional appropriateness. Functional completeness verifies if the system contains all the functions, it needs according to its design to meet user requirements and technical requirements. Functional correctness verifies if the system is able to deliver right outputs with the desired level of accuracy, and functional appropriateness verifies how well the features allow the users to accomplish different tasks (Britton, 2021).

Rebeś and Rebeś (2025) strengthened this idea by asking questions that are crucial to determining functional adequacy: Does the application contain all the functions it is intended to execute? Are the outputs correct? Most importantly, does it do what it's supposed to do? These questions constitute a pragmatic set of criteria to judge applications like LBDAIRY, a dairy livestock monitoring and management application, to ensure that they are meeting technical specifications as well as user requirements in a productive and meaningful manner. High functional suitability does not only lead to user satisfaction and system reliability but directly enables the achievement of organizational ambitions, especially in industries where precision and usability are paramount, like agriculture and livestock monitoring.

Performance Efficiency

Performance Efficiency is one of the important features of ISO 250101 standard. It's a key factor for the success of web-based systems used to monitor farming, especially when there are limited computer resources. ISO 9241-11 and ISO/IEC 25010:2011 is focused on the quality of software products. ISO 9241-11 mostly looks at how easy and comfortable a system is to use, while ISO/IEC 25010 also considers how well the software performs from a technical point of view (Fukuzumi et al., 2022).

As per the standard, performance efficiency is characterized by the extent to which a system performs its tasks within given limits of time and the way in which it makes use of resources like memory, CPU capacity, and network bandwidth. It is also distinguished by three dimensions: time behavior (the rate at which it executes), usage of resources (the efficiency with which it is capable of using available hardware and software), and capacity (the quality with which it executes during overload) (ISO 25010, 2024). In a study that assessed the effectiveness of the open-source initiative asset planning software. The system was subjected to high-pressure conditions to mimic real usage, observing the response of the system when multiple users tried to access it at the same time. They recorded important parameters like response time and resource usage, thus directly correlating their measurements with the performance efficiency sub-characteristics defined in the ISO 25010 standard. This demonstrated how the framework could be applied to quantify enterprise software and enable the determination of the boundaries of performance in a structured and coherent way (Panduwiyasa et al., 2023).

Compatibility

According to the ISO/IEC 25010 software quality model, compatibility means how wel, a software system, product, or part can share information and work properly in the same hardware or software setup (ISP 25010, 2024). This feature is important to make sure that systems can run together without problems, especially in large or connected systems. According to Britton (2021), compatibility not only supports the coexistence of different systems within the same operational context but also ensures that their performance is not hindered by mutual interference.

The ISO/IEC 25010 model explains compatibility by dividing it into two main parts, the co-existence and interoperability, co-existence means the system can work well next to other systems without slowing down. Interoperability means the system can share and use information with other systems, allowing them to work together smoothly.

Peters and Aggrey (2020) agree with this idea, saying that compatibility is a software product’s ability, like an ERP system to work with other software without problems, even when using the same hardware or software setup, such as an enterprise resource planning (ERP) system to interact with other software solutions without operational issues, even when sharing the same hardware or software environment. This makes sure that systems can work on their own and also work well together in a smooth and efficient digital setup. As software becomes more complex and connected, being compatible is important to help systems fit together easily, avoid problems with shared resources, and keep everything running smoothly.

Interaction Capability

Interaction capability, as defined by ISO/IEC 25010 and supported by ITEH Standards (2024), refers to the extent to which a product or system enables users to interact effectively through a user interface to exchange information and accomplish tasks across various usage contexts. This characteristic consists of multiple sub-characteristics that collectively shape the quality and accessibility of user interaction. According to Fukuzumi et al. (2022), these sub-characteristics include appropriateness, recognizability, learnability, operability, user error protection, user engagement, inclusivity, user assistance, and self-descriptiveness.

The appropriateness of a system measures how easily users can determine whether its features meet their objectives, whereas the learnability of a system measures how quickly users can adopt the skills they require to use it. Operability refers to how quickly a user can control and use the interface. User error protection assesses the system's ability to reduce or prevent user mistakes. User engagement points out how the interface retains attention and encourages continuous interaction. Inclusivity refers to the system's ability to cater to users from various backgrounds, accounting for differences in age, skills, language, and culture. User assistance measures how well the system helps users accomplish their goals, particularly those with differing levels of expertise or capacity. Self-descriptiveness measures how clearly the system communicates its functions and how intuitively users can understand it without relying heavily on external documentation (ISO 25010, 2024).

Reliability

Reliability is one of the quality attributes of a system that refers to its capability to perform its planned tasks continuously in varying conditions, particularly in high-risk or mission-critical systems (ITEH Standards, 2024). Some of the major aspects of software reliability, based on the study of Keibach and Shayesteh (2022), are availability (how often the system is accessible when needed), fault tolerance (the ability to operate despite faults), and recoverability (the ability of the system to return to normal after a failure). In the context of low-code and no-code (LC/NC) platforms, the reliability is mainly supported by cloud-based architectures that feature inherent redundancy, failover through automated mechanisms, and recoverable options on a scalable level. Such architectural features make the platform as a whole more resilient by minimizing downtime and maintaining data integrity.

Nonetheless, the degree of reliability offered by LC/NC platforms can vary extensively. Some platforms may require additional configurations, especially when supporting complex applications, to ensure the proper handling of unexpected disruptions (Pratama & Mutiara, 2021). Assessing platform reliability through the use of standard frameworks, including ISO/IEC 25010, offers a systematic way to measure these abilities. This method ensures that tools are not only tested for their minimum functionalities but also for their ability to withstand practical usage.

Security

Security is one of the most notable quality characteristics of a software that is assigned with safeguarding systems against unauthorized access and possible misuse. As further noted by both the ITEH Standards (2024) and the ISO/IEC 25010 software product quality model, system security becomes more essential in applications which are built on low-code/no-code (LC/NC) technologies. The ISO/IEC 25010 model also advances key sub-characteristics of security, i.e., confidentiality, integrity, non-repudiation, accountability, and authenticity, that are key measures for the assessment and implementation of sound security practices.

In LC/NC environments, these security considerations must be satisfied both within the application itself as well as the underlying infrastructure of the platform. Confidentiality is generally satisfied by mechanisms such as role-based access control, multi-factor authentication, and encryption. Integrity requires maintaining data consistency and accuracy, generally supplemented by validation rules, encrypted communication channels, and secure auditing. Non-repudiation is satisfied through systems logging transactions and user actions in such a manner as to provide good evidence of involvement. Accountability provides for the monitoring of all user activity to assist in the prevention and detection of abuse, while authenticity establishes user and system identity to prevent impersonation or forgery.

Although, LC/NC platforms generally contain features making such objectives simple to satisfy—such as access controls and integrity checking—the security vulnerabilities remain. Drag-and-drop development tools make bypassing important validation processes simpler, particularly when incorporating third-party services. Incomplete or erroneous access permissions or failure of users to include essential security best practices also leave applications vulnerable. Integrating LC/NC development with the ISO/IEC 25010 framework mitigates such vulnerabilities and offers

a robust methodology to develop secure, trusted software (ITEH Standards, 2024; Naqvi et al., 2025).

Maintainability

Maintainability is the ability of a system of software to be changed, extended, or fixed throughout the system's running life. It encompasses five core sub-characteristics in the ISO/IEC 25010 quality model, namely testability, modifiability, analyzability, reusability, and modular design (Naqvi et al., 2025). Testability promotes good unit and integration testing, and modifiability and modular design promote specific changes with negligible disruption. Analyzability helps in quick defect identification, and reusability helps in pieces of software code being reused on other projects and thus improving the productivity of software development.

This characteristic is particularly significant in software product lines (SPLs) considering that it is the platform upon which the assessment of product line architectures (PLAs) is done. Cordeiro et al., (2022) indicates that virtually 92% of the metrics used to measure SPL artifacts are concerned with maintainability, highlighting its significance in making it simple to modify and maintain development. However, the absence of standardized measurement methods is the primary challenge. To tackle the issue, the SMartyMetrics framework was conceived to assess PLA maintainability based on systematic metrics following ISO standards. To further the cause, Mena and Santorum (2021) employed ISO/IEC 25010 to examine maintainability and portability in the React Native framework, providing revealing results on its versatility across various platforms.

Flexibility

Flexibility, as recast in the new ISO/IEC 25010:2023 standard, is the ability of a software system to successfully adapt to altered requirements, usage conditions, or operating conditions (ISO 25000, 2024). This new model is a radical departure from earlier models, in which flexibility was an aspect of the wide-ranging attribute of "portability." The recasting is a truer representation of current perceptions of software requirements in more fluid technological environments. Loesch (2023) supports this reformulation, hypothesizing that flexibility now covers the pragmatic needs for system flexibility and is better differentiated from other characteristics like compatibility. A notable addition in the latest modification is the categorization of scalability as a sub-characteristic of flexibility, which highlights a system's ability to adapt performance capability with changing workloads without compromising reliability. This addition further reinforces the importance of flexibility in supporting software resilience, longevity, and responsiveness.

Outside the ISO standard, flexibility is commonly accepted as a key property of high-quality, forward-looking software. The property empowers the programs' functionality throughout various devices, platforms, and systems and permits easy implementation with external tools. SYNDICODE Marketing (2023) emphasizes the need for flexibility for consistent improvement and implementation, thereby opening new business opportunities and improving competitive edge. From the software engineering perspective, flexibility is naturally associated with other quality attributes like maintainability and testability.

Abdullah et al. (2015) argue that flexibility is key to designing modular, testable, and economical systems, especially in object-oriented design. Their regression-based model of flexibility stresses its pragmatic relevance and potential impact on long-term software quality. However, they warn that flexibility is typically overlooked in early design stages, with a potential to result in inflexible and expensive systems that are difficult to maintain or evolve. Overall, the updated ISO/IEC 25010 definition and accompanying literature place flexibility as a key attribute for scalable, adaptable, and strategically consistent software systems.

Safety

Safety has emerged as a leading software quality attribute in the new ISO/IEC 25010:2023 model, which characterizes it as the extent to which an item, under specified conditions, prevents states that might jeopardize human life, health, property, or the environment (ISO/IEC 25010:2023, 2023). Differing from conventional safety definitions that focus on freedom from unacceptable risk, this revision characterizes safety in terms of prevention from unacceptable exposures, thus focusing more on preventing risks in a proactive manner. The standard suggests some sub-characteristics—operational constraint, risk identification, fail-safe mechanisms, hazard warning, and safe integration—each dealing with different aspects of system behavior that aim to prevent harm.

In the context of low-code/no-code (LC/NC) platforms, safety assurance is a special concern. LC/NC platforms facilitate the development of applications at speed through abstraction and automation but can hide the intricacy of the underlying systems, thereby amplifying the risk of serious safety oversights (Naqvi et al., 2025). Furthermore, the LC/NC development cycles common to these environments tend to minimize the duration of stringent safety testing, with the risk of undetected exposures. While LC/NC platforms bring software development opportunities to a wider population, their limited mastery over system internals necessitate the imposition of efficient safety measures. It is necessary that, even upon failure, systems developed on these platforms never compromise user safety or result in material loss (ITEH Standards, 2024).

Synthesis

The literature reveals a recognition of persistent challenges and emerging opportunities in the Philippine livestock and dairy sectors. Traditional farming methods remain common among smallholder and municipal farmers due to affordability, simplicity, and cultural familiarity, yet they often fall short in meeting demands for food security, climate resilience, and economic viability. Native breeds, though resilient and well-suited locally, produce lower yields than commercial breeds, creating a dilemma between preserving traditions and adopting modern technologies.

Digital innovation is increasingly seen as transformative in livestock management. QR code tagging, cloud databases, and IoT sensors enable real-time tracking of health, productivity, environmental conditions, and breeding cycles, supporting precise data collection, better decisions, reduced waste, and improved welfare. Digital systems streamline operations and aid long-term planning and early interventions.

Backyard and smallholder farms, a major part of the industry, could benefit from low-cost, user-friendly solutions. Adoption, however, is hindered by weak infrastructure, limited funds, and insufficient training. Progressive Web Applications (PWAs) offer offline functionality, cross-device compatibility, and minimal hardware requirements—key in rural areas with unstable internet.

Municipal agriculture offices are vital enablers. Local government units deliver education, financial and technical support, and adapt digital tools to local needs. Programs like Farmer Livestock Schools improve farmers' knowledge and capacity for smart technologies. Municipal interventions also standardize practices, improve regulation compliance, and strengthen extension services.

Smart technologies have fostered data-driven agriculture. Precision Livestock Farming (PLF) and Integrated Farming Systems (IFS) combine digital monitoring with holistic strategies to boost efficiency and sustainability. Record-keeping tools with QR scanning and dashboards give streamlined access to animal histories, enabling early health diagnosis, optimal inputs, and productivity planning. Open-source frameworks support scalability and accessibility. PHP, Laravel, and MySQL offer secure backends, while HTML, JavaScript, Tailwind CSS, Chart.js, and HTML5-QR Code provide dynamic, user-friendly interfaces and analytics. Modular, customizable systems are cost-effective and adaptable to local contexts. PWAs enhance accessibility by avoiding app store downloads and supporting offline work via service workers. Their intuitive design encourages adoption and long-term engagement.

Software quality, guided by ISO/IEC 25010, ensures systems meet functional, reliable, usable, secure, maintainable, and portable standards. Applying this framework aligns systems with user needs and supports continuous improvement.

In conclusion, technological innovation, local governance, and community education are shaping a new paradigm in Philippine livestock management. While traditional practices hold value, integrating inclusive, scalable, data-driven systems is essential for sustainable, productive, and resilient agriculture.

Conceptual Framework

The growing demand for efficient and sustainable livestock management in the Philippines, particularly in rural municipalities like Lucban, Quezon, has highlighted the need for modern digital solutions in agricultural practices. Traditional livestock monitoring methods often rely on manual record-keeping, which is prone to errors, delays, and data loss. These limitations hinder productivity analysis, compromise animal health monitoring, and create inefficiencies in breeding, inventory, and financial tracking. In response to these challenges, this study introduces an innovative solution: a web-based dairy livestock monitoring and management system called LBDAIRY, equipped with QR code tagging and real-time productivity analysis features.

LBDAIRY integrates digital record-keeping, inventory systems, and analytics tools into a centralized platform designed specifically for the Lucban Agriculture Office and local dairy farmers. The system makes use of QR code technology to provide each livestock with a unique, scannable ID, allowing instant access to essential data such as health records, nutrition status, breeding history, and productivity metrics. The system is developed as a Progressive Web Application (PWA) to ensure cross-platform accessibility for administrators and users alike.

Key features include modules for real-time information access, inventory and financial monitoring, health and nutrition tracking, productivity analysis, and breeding cycle management. In addition, reporting and compliance tools are embedded to streamline documentation, while data security protocols safeguard confidential farm data. The development utilizes technologies such as Firebase, Java, HTML/CSS, Node.js, and Figma for design and deployment.

This system is expected to enhance operational efficiency, support informed decision-making, and promote digital transformation in livestock management. Ultimately, LBDAIRY aims to contribute to the advancement of the agricultural sector in Lucban by addressing the core issues of outdated tracking systems, data inaccessibility, and limited productivity insights.

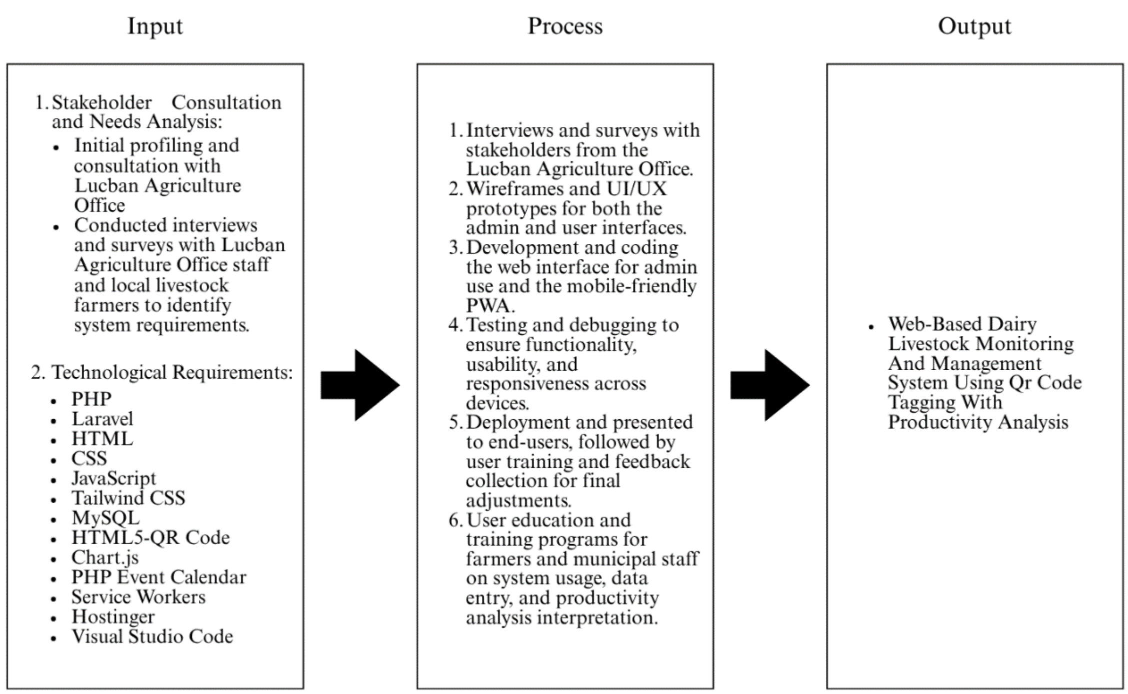


Figure 1. Input-Output-Process (IPO) diagram for Lbdairy

Figure 1 presents the input, process, and output (IPO) of the development of the LBDAIRY: web-based dairy livestock monitoring and management system using QR code tagging with productivity analysis. In the initial phase, the. Technical requirements such as QR code generation tools, database systems (MySQL), web frameworks (PHP, Laravel), frontend technologies (HTML, CSS, JavaScript, Tailwind CSS), and additional tools like Chart.js and HTML5 QR Code were identified and studied to ensure optimal implementation. Devices such as laptops and smartphones were essential for system development and user testing.

In the process phase, the researchers conducted interviews and surveys with stakeholders from the Lucban Agriculture Office to gather user requirements. This involved undertaking several technical steps to prepare the design and components, they then created wireframes and UI/UX prototypes using design tools like Figma and Photoshop. Development proceeded through a sprint-based approach, focusing on building both the admin dashboard and the Progressive Web Application (PWA) for mobile use. Educational materials and training modules were concurrently developed, including user manuals and hands-on training curricula tailored for farmers and municipal staff to address digital literacy gaps and ensure sustainable system adoption.

In the output phase, the LBDAIRY system was tested, debugged, and deployed to end-users. Comprehensive training sessions covered system navigation, QR code scanning, data entry, and productivity analysis interpretation to ensure effective system utilization. User feedback was gathered for final improvements, with ongoing educational support established for sustained system effectivenes

Chapter III

METHODOLOGY

This chapter contains information regarding the research design, the population participating in the study, the creation of the research tool, the evaluation of its reliability, the data collection methods, and the methods used for the data analysis and statistical calculations for the data analysis.

Research Locale

This study aimed to develop a Web-based Dairy Livestock Monitoring And Management System Using QR code Tagging With Productivity Analysis to help increase the productivity of dairy farmers. Through the electronic process of monitoring and managing livestock, the dairy farmers in Lucban were able to view real-time data, which significantly enhanced the process overall and reduced mismanagement or delay in intervention. The system is designed for three main user groups: Municipal Agriculture Office staff who manage livestock programs and compile authorized reports, veterinarians and agricultural technicians who manage health registers and provide technical guidance, and dairy farmers who directly input production data and monitor their livestock.

The research was conducted in the municipality of Lucban, located in Quezon Province. Conducting the study in Lucban allowed the researchers to gain insights into the local agricultural practices, challenges faced by dairy livestock farmers, and the effectiveness of a web-based livestock system in addressing these issues among the three user groups. Lucban's distinct geographic and economic conditions made it an ideal setting for evaluating how digital tools can improve livestock productivity and management at the municipal level.

Research Design

Developmental research is utilized in this study as it focuses on systematically designing and improving technological tools based on real-world applications. This method enables the researchers to develop LBDAIRY, a web-based dairy livestock monitoring and management system using QR code tagging, in a way that directly addresses the needs of the Lucban Agriculture Office and local farmers. By engaging in a continuous cycle of design, testing, and refinement, the researchers ensure that the system is both functional and user-friendly for its intended users.

Furthermore, developmental research supports the integration of innovative technology in agriculture by offering a structured framework to evaluate the effectiveness of new tools like web platforms and Progressive Web Applications (PWA). This research design helps in assessing how the system enhances livestock monitoring, record-keeping, and overall productivity. By focusing on practical application and iterative development, developmental research ensures that LBDAIRY not only meets the goals of modern agricultural management but also provides accessible and responsive support for field operations. This approach ultimately contributes to a more efficient and data-driven environment for local livestock management.

Requirement Analysis

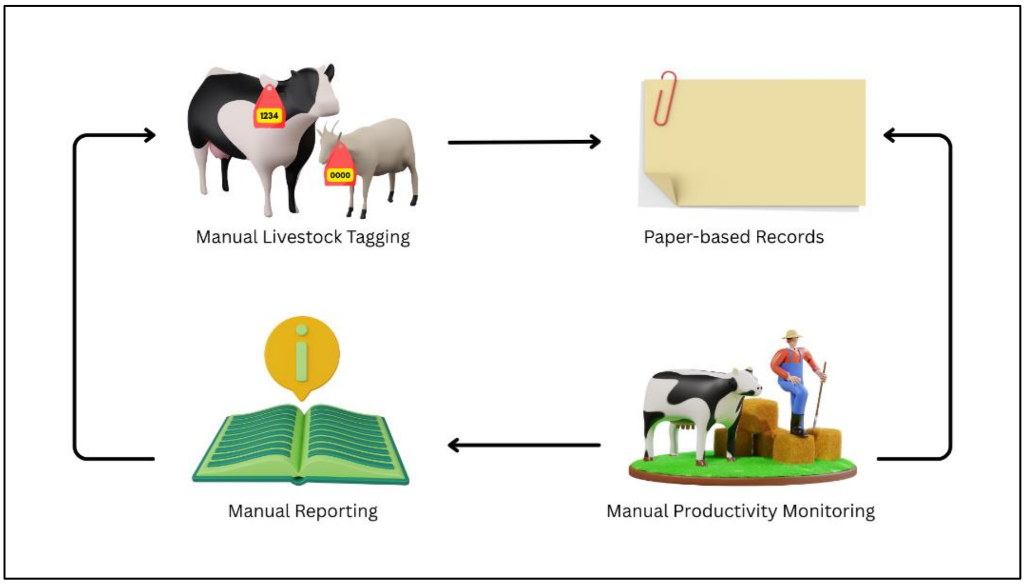


Figure 2. Current Livestock Monitoring Framework of Lucban Agriculture Office

In the current setup of the Lucban Agriculture Office, the processes of livestock monitoring and management are still mostly done manually. Livestock are identified using handwritten records or ear tags, and updates on their health, productivity, and breeding are recorded on paper or in basic spreadsheets. Reports are created by going through these records manually, which takes time and increases the risk of errors or data loss. This system also makes it harder to access real-time data or track livestock performance over time.

Although this method has worked for years, it presents challenges in terms of efficiency, data accuracy, and long-term monitoring. To improve these areas, the office needs a more reliable and tech-based solution that can simplify data management, support decision-making, and help with compliance reporting. A digital system that uses QR code tagging and real-time monitoring would help streamline these operations while also making data more accessible and organized.

Requirement Documentation

Functional Requirements

The functional requirements describe the key operations and features that the LBDAIRY system must provide to support the Lucban Agriculture Office in monitoring and managing dairy livestock. These include the roles, inputs, outputs, and activities the system must perform:

Super Administrator Account. The Super Admin has full control over the entire LBDAIRY system. This role is responsible for creating and managing Admin accounts, performing system-wide configurations, viewing analytics, and managing security settings. Super Admins can also monitor user activity logs and ensure data privacy compliance.

Administrator Account. The Admin, typically assigned from the Lucban Agriculture Office staff, handles day-to-day system management. Admins can create and manage accounts for farmers, technicians, and veterinarians. They can register livestock, manage records, generate reports, and manage their own profile.

Farmer Account. Farmers can log into the system to view and manage their own livestock data. They can scan QR codes to view each animal's profile, update health or feeding records, monitor productivity, milk production, inventory and financial tracking, and check upcoming tasks (e.g., vaccination dates, feeding times). Farmers have limited access to features and can only edit their own data.

Non-Functional Requirements

Functional Suitability. This system must offer all the important features that users need, such as signing up, matching with pets, sending rescue requests, and handling adoptions. The system should ensure these functions are reliable and helpful in real-world situations.

Performance Efficiency. The platform must be fast and responsive even when many people are using it at the same time, such as during rescue operations or adoption events. It should not freeze or slow down, and pages should load quickly. This helps build trust with users and encourages them to continue using the system regularly.

Compatibility. The system should work on any device, whether it's a computer, tablet, or smartphone. It should also support different operating systems (like Windows, Android, iOS) and popular browsers (like Chrome, Firefox, Safari). This ensures all users have the same smooth experience no matter how they access the platform.

Interaction Capability. The interface must be simple and user-friendly so that users can easily find what they're looking for. They should be able to explore pets available for adoption, read detailed profiles, and understand educational content like the benefits of spaying/neutering. The design should help users complete their tasks quickly and without confusion.

Reliability. The system must work consistently without crashing or showing frequent errors. It should always be available when users need it and must be able to handle small problems without shutting down completely. If something does go wrong, the system should recover quickly and protect any important data.

Security. To protect users' personal information, the system should have secure login options, encrypt all sensitive data, and control who can access what. It must prevent hacking, unauthorized access, and any misuse of private information. This is critical for gaining and maintaining user trust.

Maintainability. The platform should be designed in a way that makes it easy to fix bugs, update features, and make improvements without breaking anything. Developers should be able to understand the structure of the system and make changes quickly when needed, ensuring it stays up-to-date and efficient.

Flexibility. The system should be able to grow and change over time. If new features are needed or existing ones need to be adjusted, it should be possible without redoing the entire system. This flexibility makes it easier to respond to feedback and meet future needs.

Safety. Every part of the system should be designed to avoid harm or errors that could confuse or frustrate users. The system must clearly guide users on what to do, help them recover from mistakes, and avoid doing anything that could affect the performance or damage trust in the platform.

Design of Software, System, Product, and Process

System Architecture Diagram

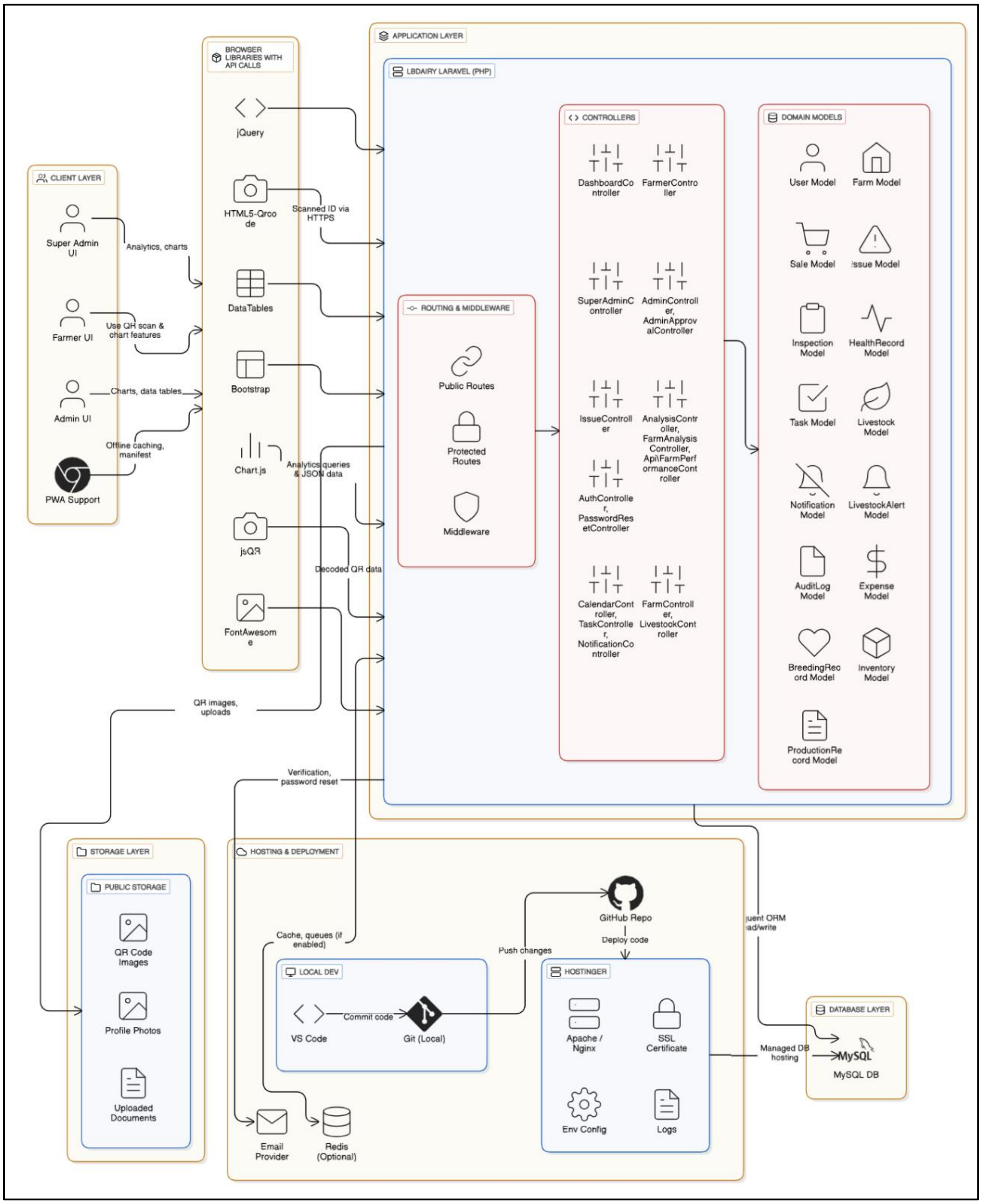


Figure 3. System Architecture Diagram of LBDairy

The diagram shows a system architecture diagram of the Laravel-based web application, structured across multiple layers from client to database. The client layer features three distinct user interfaces—Super Admin, Farmer, and Admin—each with tailored functionalities including analytics, charts, QR scanning, and offline caching support enhanced by PWA capabilities.

The monolithic backend, built with modern libraries and API integrations, employs Laravel PHP framework at its application layer with an MVC architecture containing numerous domain models for users, farms, livestock, products, sales, issues, expenses, inventory, inspections, health records, breeding, tasks, notifications, and audit logs. Controllers manage business logic across dashboards, forms, authentication, and administrative functions, while routing and middleware handle request flow and security through public and protected routes.

The infrastructure spans hosting and deployment with a local development environment using VS Code and Git, a GitHub repository for version control, and a Hortinger-managed production server running Apache/Nginx with SSL certificates, environment configuration, and centralized logging. The data persistence layer utilizes MySQL as the primary database with managed hosting, while the storage layer handles public assets like QR codes, uploaded documents, and profile photos, with additional optional Redis caching for performance optimization and email provider integration for notifications—all connected through a cohesive flow that supports verification, password resets, QR image uploads, and cache queue management.

Software Methodology

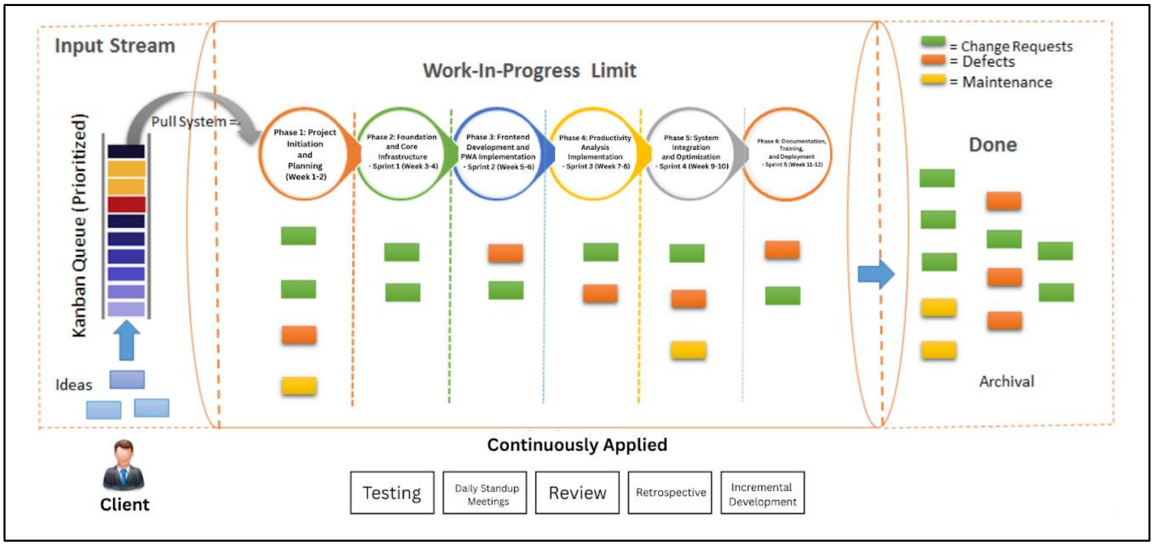


Figure 4. Agile-Kanban Methodology

The development of LBDAIRY: A Web-Based Dairy Livestock Monitoring and Management System Using QR Code Tagging with Productivity Analysis followed the Agile-Kanban methodology, which allowed the team to work efficiently while staying flexible to changes. This method uses a visual Kanban board to manage tasks and monitor progress, helping the team focus on completing features in manageable stages. Each task was written as a card and moved through phases such as Backlog, In Progress, Code Review, Testing, Review, and Done. This approach allowed the researchers to continuously deliver updates and quickly respond to feedback from the Lucban Agriculture Office.

This method supports real-time updates, user feedback, and flexible planning, especially useful in agricultural settings like Lucban, where operational needs can change quickly. The development process involves active collaboration with stakeholders from the

Lucban Agriculture Office to ensure that each feature fits the office's actual workflows. Regular reviews, retrospectives, and feedback cycles are used to guide improvements during each sprint.

Requirements Gathering and Analysis. In this phase, the researchers met with officers from the Lucban Agriculture Office to identify problems in their current manual processes. Issues like slow reporting, difficulty in tracking livestock health, and unreliable productivity monitoring were discussed. These insights helped define the system's core requirements such as QR code tagging, health records, productivity analysis, and offline support.

Design and Planning. In this stage, the researchers began sketching wireframes and planning the system's interface. A mobile-first approach was used, focusing on features like the dashboard, livestock profile, QR code scanner, and reporting tools. Tools like Figma were used to design each screen, while the Kanban board was updated with tasks to guide development.

Implementation. The development phase started with the creation of the system's backend including the database, user roles, QR code generation, and API endpoints. After that, the frontend was developed, adding the main dashboard, data forms, animal profiles, and the QR code scanner. During this stage, placeholder data was used while backend integration was in progress.

Testing. Once the basic features were implemented, the team focused on checking the system's performance across different devices. This included testing the QR scanner, offline access, and dashboard responsiveness. Unit and integration tests were done to ensure accuracy and usability.

Evaluation and Feedback. After each sprint, a review session was conducted with the Lucban Agriculture Office. The team collected feedback on how the system performed in actual field conditions and made improvements based on user suggestions. Adjustments were made to layouts, form flows, and feature behavior to match the needs of the end-users. Depending on the complexity of the feedback, changes were scheduled in the next sprint.

Software Requirements

HTML. The researchers utilized HTML as the base to set up the layout and interface of the LBDAIRY system, enabling the presentation of forms, reports, dashboards, and ensuring ease of access and multi-browser use.

JavaScript. The researchers utilized JavaScript as the key client-side scripting language for dynamic interface behavior, real-time calculations, interactive dashboards, and asynchronous communication within the system.

CSS. The researchers implemented CSS to guarantee coherent visual layouts, branding, and responsive design across multiple devices, influencing polished appearance and user-friendly interface.

Tailwind CSS. The researchers utilized Tailwind CSS to streamline development using a utility-first approach, enabling rapid prototyping and consistent styling throughout the platform.

MySQL. The researchers utilized MySQL as the core database system to securely store, retrieve, and manage user data, login histories, transaction logs, and application settings.

HTML5-QRCode. Used for in-browser scanning of QR codes using device cameras, improving mobile interaction and data input.

Chart.js. The researchers utilized Chart.js for data visualization, enabling the graphical presentation of statistics, reports, and analytics through various interactive chart types.

Service Workers. The researchers utilized Service Workers to enable offline functionality, background syncing, and intelligent caching, improving app speed and reliability.

Hostinger. The researchers utilized Hostinger as the web hosting provider for its stable infrastructure, SSL support, domain services, and performance optimization.

Visual Studio Code. The researchers utilized Visual Studio Code as the main IDE for its code editing features, integrated Git, and support for various languages and extensions, guaranteeing efficient development.

Hardware Requirements

To support the efficient development, deployment, and usage of **LBDairy**, a system designed for monitoring and analyzing dairy farm productivity, the following hardware specifications are recommended. The requirements are grouped based on their usage: development, system administration, and user accessibility.

Desktop Computer. For system administration, testing, and local deployment, desktops should meet the following minimum specifications: Windows 10 or higher as the operating system, an Intel Core i5 processor or equivalent, at least 8GB of RAM, and 256GB SSD storage. A Full HD display with a resolution of 1920×1080 on a 22–27-inch screen is recommended for clear viewing and accurate monitoring. These specifications ensure stable performance during administrative tasks and on-site system use.

Mobile Devices. The LBDairy system is optimized for mobile access, allowing farmers and staff to interact with the platform in the field. Mobile devices should have Android 10 or above, at least 3GB of RAM, 2GB of available internal storage, and a screen capable of displaying 1920×1080 resolution images. This ensures smooth navigation and clear image uploading for livestock records and health documentation.

Laptop. Developers working on the LBDairy platform require laptops capable of handling programming, testing, and database management. Recommended specifications include Windows 11 Home, an AMD Ryzen 5 or Intel Core i5 processor, 8GB of RAM, and 512GB SSD storage. A dedicated GPU such as an NVIDIA RTX 2050 is ideal for rendering charts or reports, along with a 15.6” Full HD display to support productivity and clarity during system development

Unified Modeling Language Diagram

Use Case Diagram

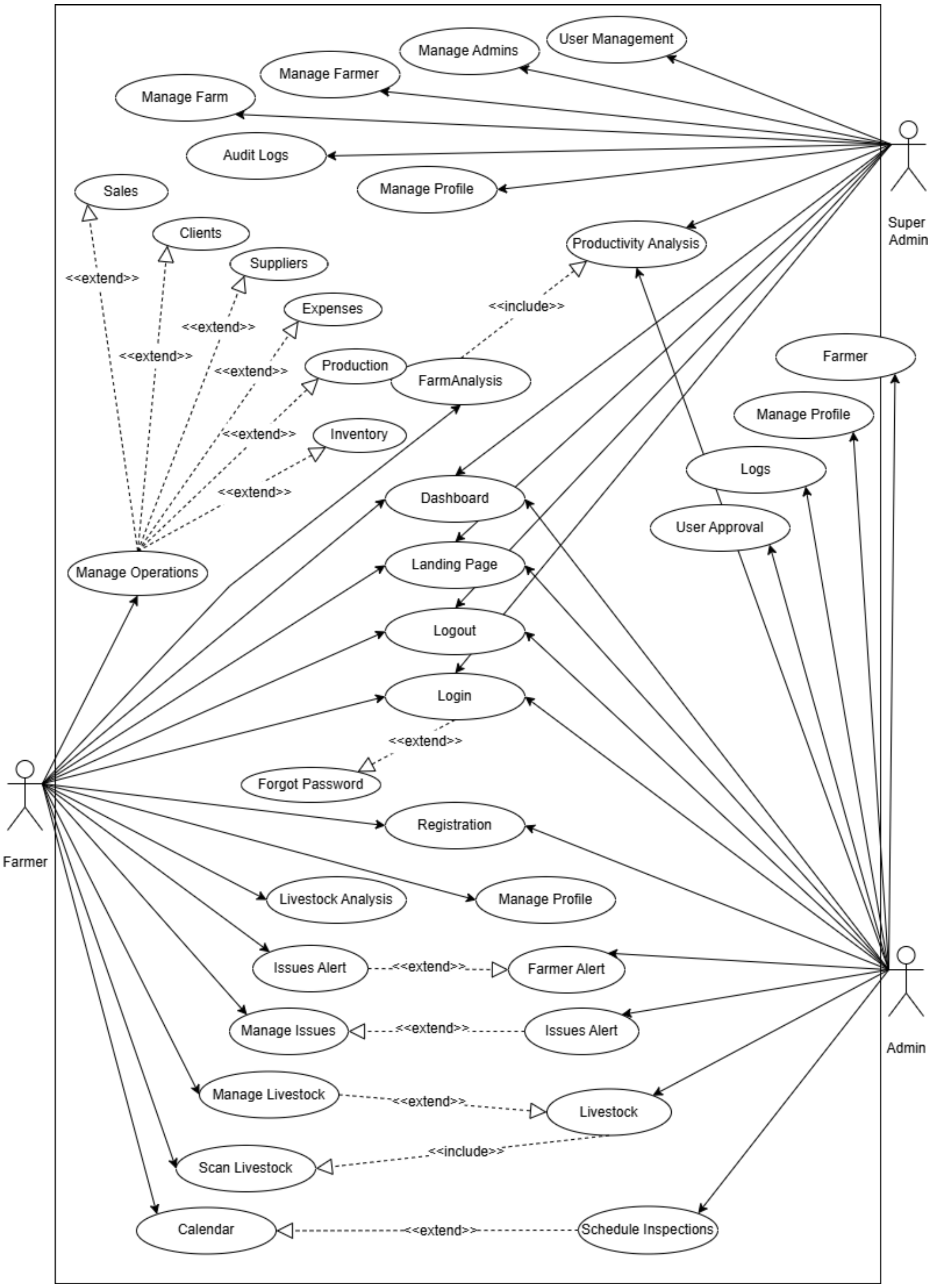


Figure 5. Use Case Diagram

The diagram maps out the interactions among the three main user types within the livestock farm platform: Farmers, Admins, and Super Admins. Each role has certain responsibilities and system access depending on what they do.

Farmers handle livestock and associated activities. Farmers can create accounts, monitor livestock records, and save detailed information such as health, growth, breeding, and calving records. Farmers can send reminders of livestock conditions, generate and scan QR codes, and view productivity reports. Apart from animal management, farmers handle activities like inventory, expenses, sales, production, suppliers, and clients. Farmers have access to features like checking inspection schedules, updating their profiles, logging in and out, and reviewing their own audit logs.

Admins not only have all the capabilities of farmers, but they also take on additional responsibilities. They can issue and manage alerts, track livestock health and growth records, receive notifications, and set up inspection schedules. Admins are responsible for monitoring farmer accounts and ensuring smooth operation of the system. At the top level, Super Admins hold the highest level of control. In addition to everything available to admins and farmers, they can manage audit logs, oversee both admin and farmer accounts, generate system reports, and handle the export of report templates. They also have the ability to view detailed productivity analysis and schedule or manage expert farm visits.

In conclusion, the diagram illustrates a role-based access system where each user type possesses the tools and privilege, they require to perform their work while maintaining the farm management system efficient and secure.

Activity Diagram

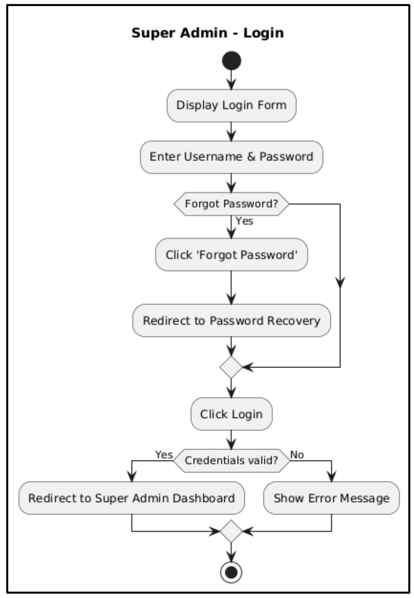


Figure 6. Super Admin - Login

The figure illustrates the Super Admin Login process. It starts with displaying the login form, followed by the super admin inputting their username and password. Super Admin can also click and use the forgot password for password recovery. After clicking the login button, the system authenticates the credentials. If the credentials are valid, the user is redirected to the Super Admin Dashboard; otherwise, an error message is shown.

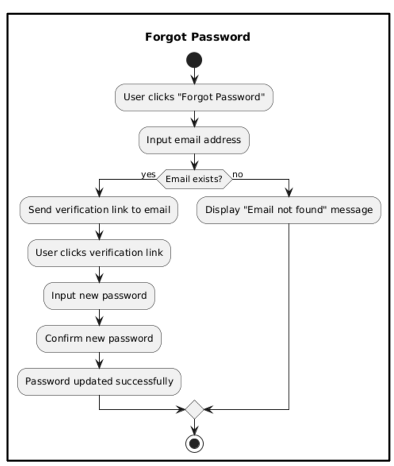


Figure 7. Forgot Password

The figure illustrates the Forgot Password process. It starts with the user accessing the Forgot Password page and inputting their registered email address. After clicking the submit button, the system verifies the email in the database. The user clicks the link, inputs a new password, and confirms it. The system then updates the password in the database and displays a success message. If the email does not exist, an error message is shown.

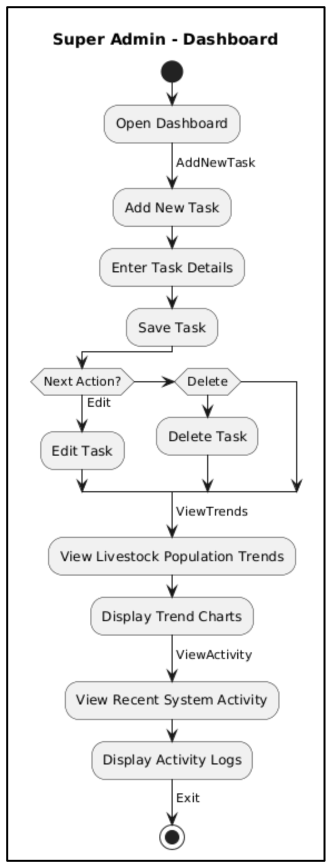


Figure 8. Super Admin - Dashboard

The figure shows how the Super Admin uses the dashboard. After logging in, the user can add a new task, view livestock population trends, or view recent system activity. When adding a task, the user enters details and saves it, with options to edit or delete.

Viewing trends or activity retrieves and displays the relevant data. The user can perform multiple actions before exiting, which ends the session and redirects to the login page.

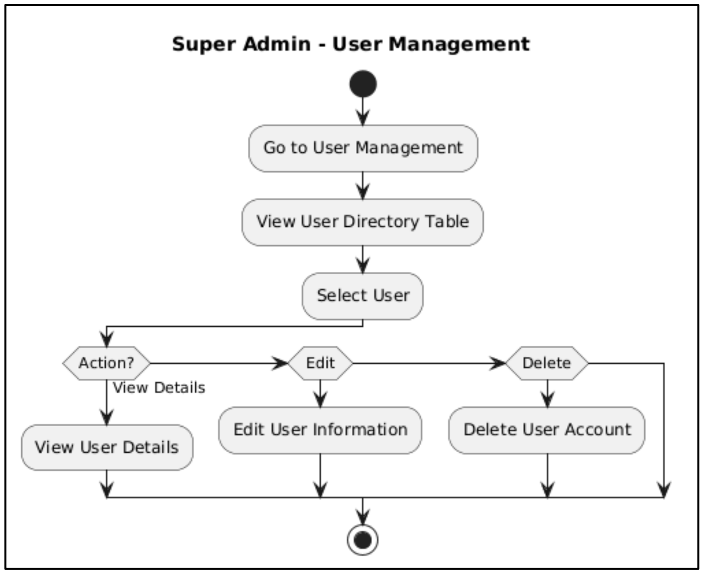


Figure 9. Super Admin - User Management

The figure illustrates how the Super Admin manages users in the User Management module. After accessing the dashboard, the user navigates to the User Management page and views the User Directory table. The Super Admin can select a user and perform actions such as viewing details, editing information, or deleting the account. The Super Admin can perform these actions for multiple users, with all updates reflected immediately in the system.

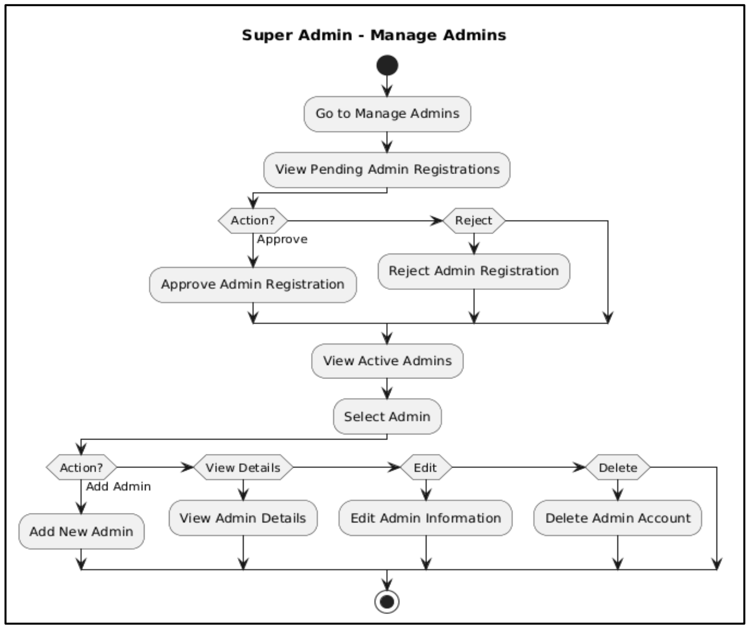


Figure 10. Super Admin - Manage Admins

The figure illustrates how Super Admin can Manage Admin. It starts with opening the 'Manage Admin' tab, and then it will display the pending admin registration table. The Super Admin can then view admin details, delete an admin, change their status (approve or reject) and toggle their activity status (active or inactive). In this tab also, the Super Admin can monitor the active admins, add new admins, view their details, edit, and delete.

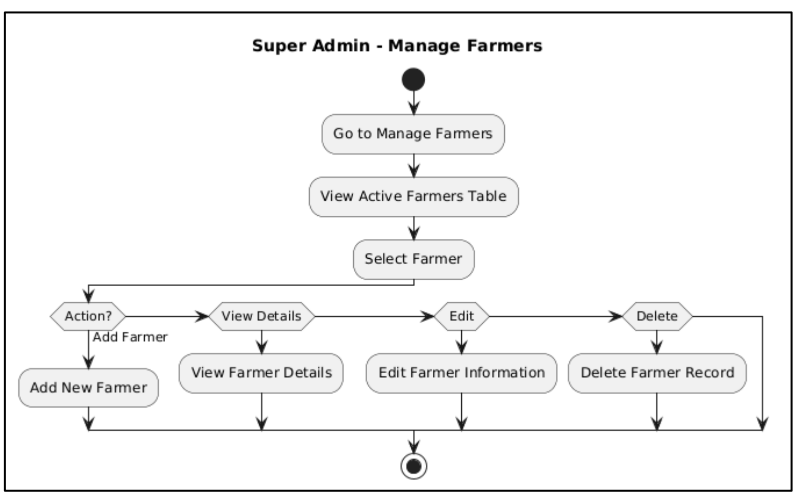


Figure 11. Super Admin - Manage Farmers

The figure illustrates how the Super Admin can manage farmers. It begins with opening the Manage Farmers tab, which displays the pending farmer registration table. The Super Admin can view farmer details, approve or reject registrations, and monitor their activity status. In the same tab, the Super Admin can also manage active farmers by adding new farmers, viewing their details, editing information, or deleting farmer accounts. All actions are reflected immediately in the system.

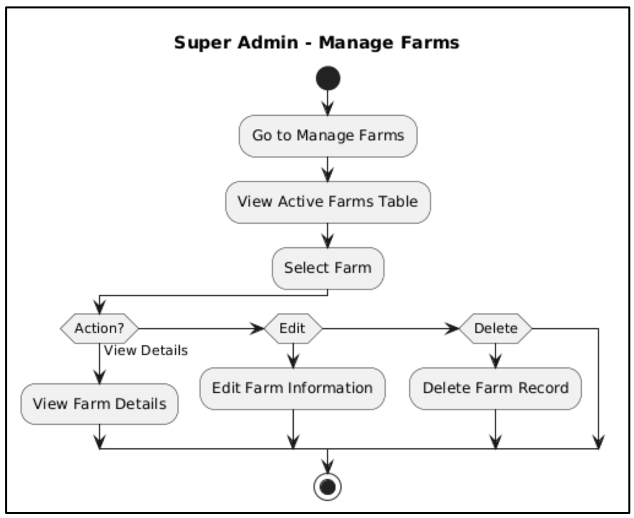


Figure 12. Super Admin - Manage Farms

The figure illustrates how the Super Admin can manage farms. It begins with opening the Manage Farms tab, which displays the list of active farms. The Super Admin can select a farm to view its details, edit the farm information, or delete the farm record. All actions performed are immediately reflected in the system, allowing the Super Admin to efficiently monitor and manage farm data.

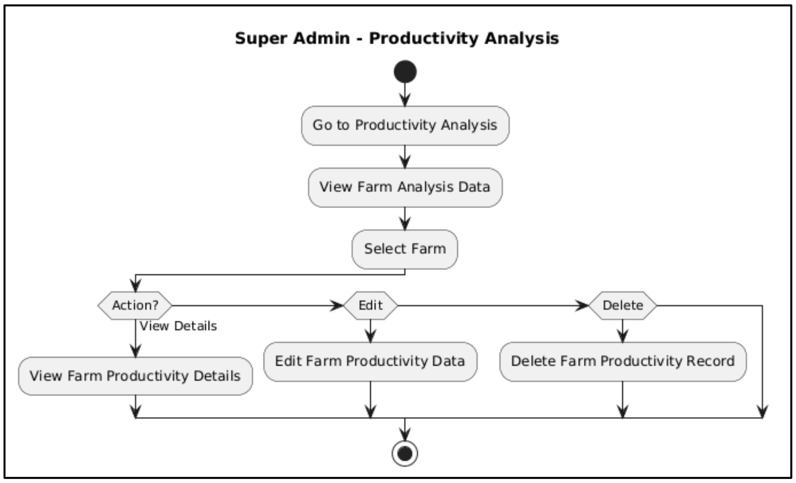


Figure 13. Super Admin - Productivity Analysis

The figure illustrates how the Super Admin can perform productivity analysis. It begins with opening the Productivity Analysis tab, which displays the farm analysis data. The Super Admin can select a farm to view details, edit information, or delete records. Additionally, the Super Admin can export productivity reports in multiple formats, including PNG, CSV, PDF, or print. All actions are reflected immediately in the system, allowing the Super Admin to efficiently monitor and analyze farm productivity.

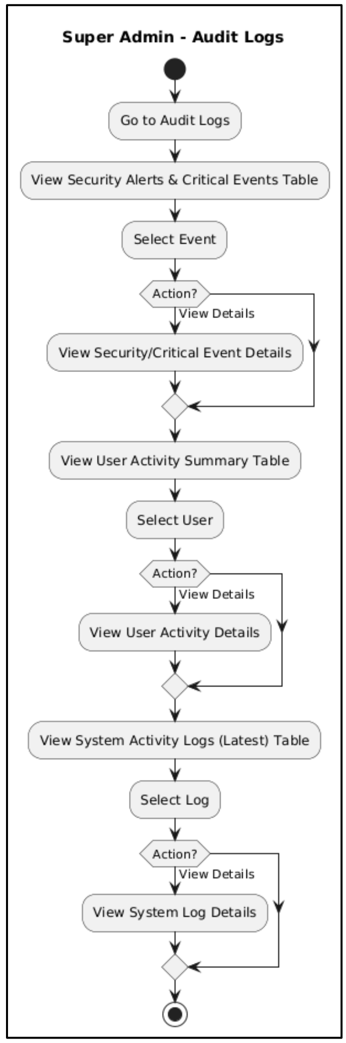


Figure 14. Super Admin - Audit Logs

The figure illustrates how the Super Admin can access audit logs. It begins with opening the Audit Logs tab, which displays tables for Security Alerts & Critical Events, User Activity Summary, and System Activity Logs (Latest). The Super Admin can select any entry to view its details. Additionally, the system allows sorting the logs by role, actions, or date range. All actions are reflected immediately, enabling the Super Admin to monitor system activities and security events efficiently.

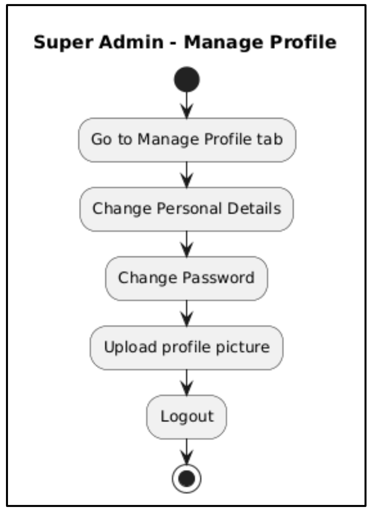


Figure 15. Super Admin - Manage Profile

The figure shows the process of managing the profile of Super Admin. It begins by clicking the 'Manage Profile' tab. The Super Admin can then change their personal details, change their password, upload a profile image, and finally log out of the system.

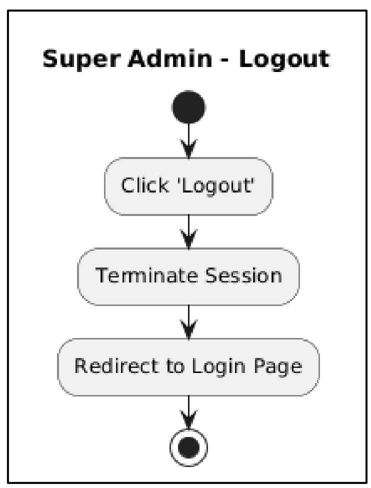


Figure 16. Super Admin - Logout

The figure presents the Super Admin Logout process. It begins with the Super Admin clicking the 'Logout' button. The system closes the session and redirect the super admin to the login page.

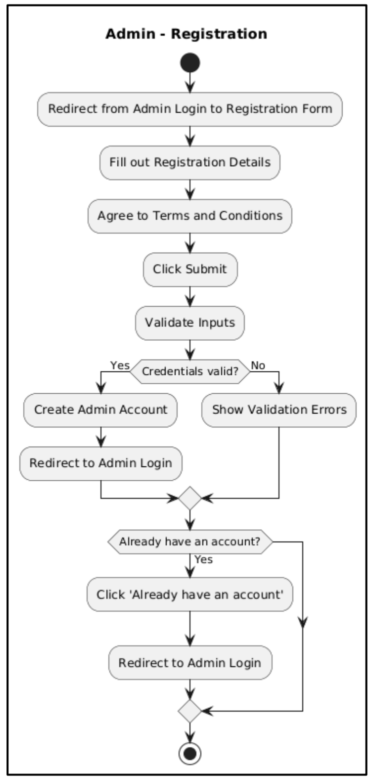


Figure 17. Admin - Registration

The figure indicates how to create a new admin account. It begins when the user is redirected from the admin login page to the admin registration form. The user is requested to provide a number of details, including an admin registration code, personal details (first name and last name), position and address from drop-down menus, contact number, email address, username, and password (with verification). The user is requested to accept terms and conditions before submitting the form. Upon submitting a form, the system validates the input fields; if valid, the admin account is created and the user is redirected back to the admin login page. Upon an error, it is displayed to the user so that he/she may correct it.

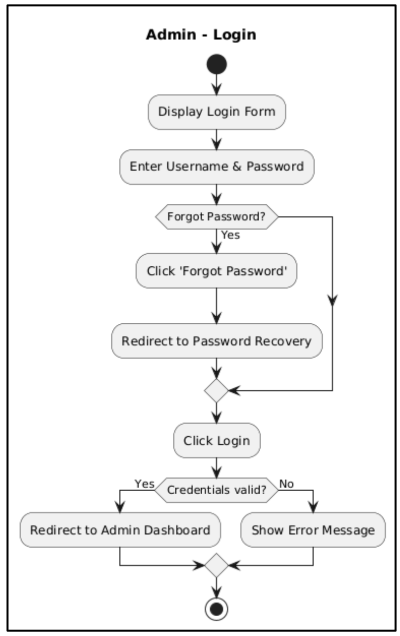


Figure 18. Admin - Login

The figure presents how to log in to an admin account. It starts by showing the login form and a register option. If the user clicks on "Register," user is taken to the register page. Otherwise, the user types in password and username, can click "Remember Me," and then click login. The system checks the details if correct, the user is taken to the admin dashboard; otherwise, an error message appears.

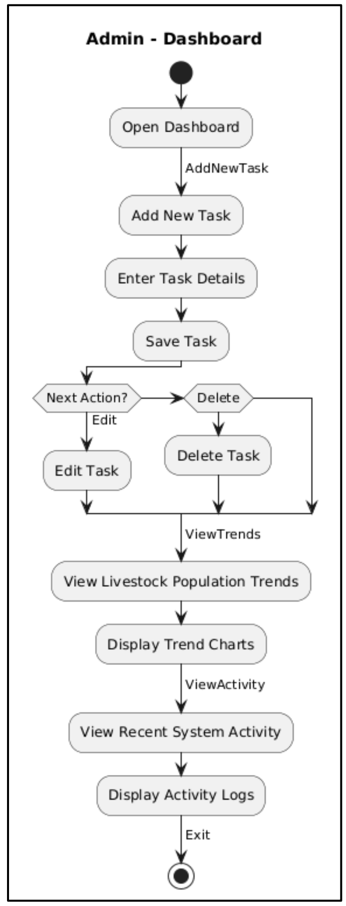


Figure 19. Admin - Dashboard

The figure illustrates how the Admin uses the dashboard. After logging in, the user can add a new task, view livestock population trends, or check recent system activity. When adding a task, the user enters the details and saves it, with options to edit or delete the task afterward. Viewing trends or system activity retrieves and displays the relevant data. The Admin can perform multiple actions in sequence before exiting, which ends the session and redirects back to the login page.

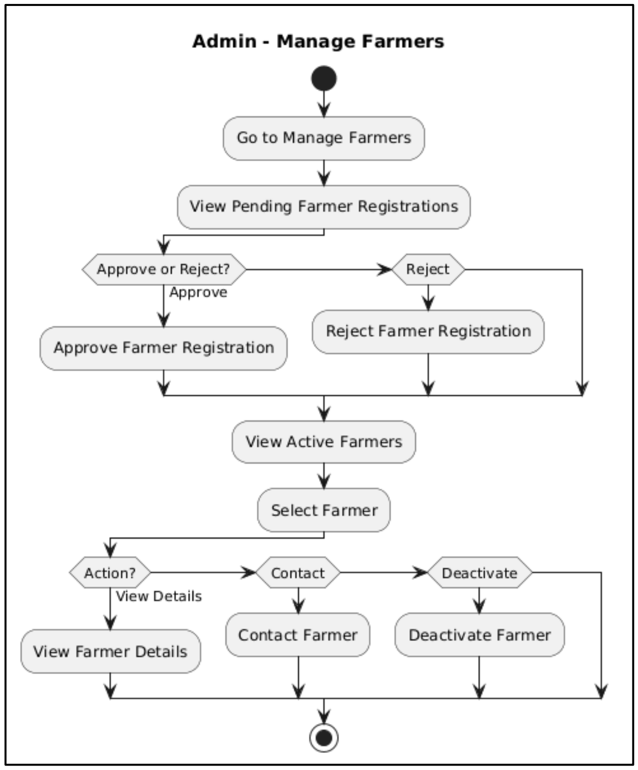


Figure 20. Admin - Manage Farmers

This figure indicates the procedures to an admin in handling farmers. It begins with the admin opening the "Manage Farmers" tab and presenting the farmer’s table. The admin can then view farmer details, change their status (approve or reject), and toggle their account status (active or inactive). Additionally, the admin can schedule an inspection using Calendar and has the option to delete a farmer, completing the process.

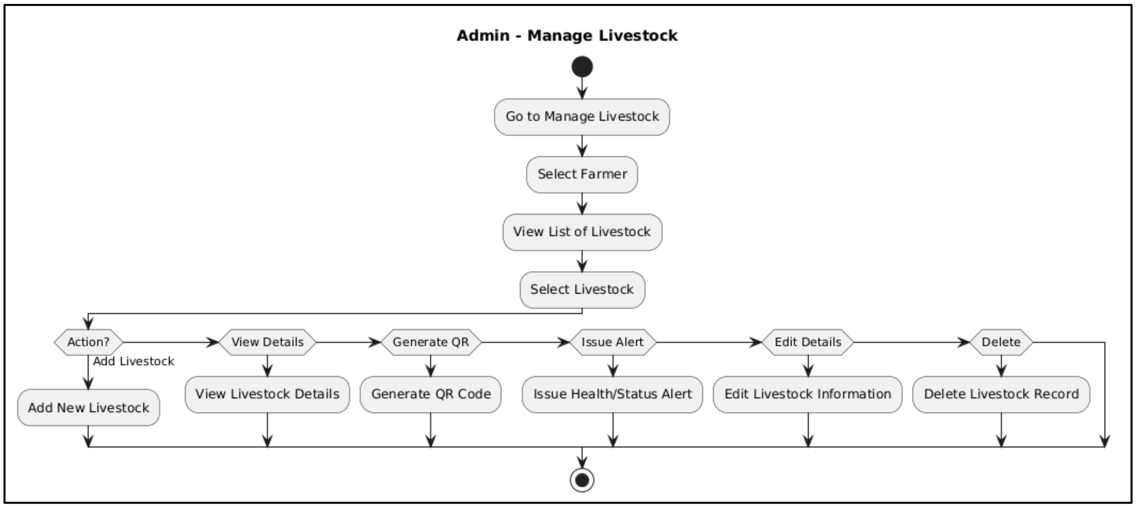


Figure 21. Admin - Manage Livestock

This figure shows the process where admin manage livestock record. It starts with accessing the livestock section, viewing farmers, and importing animals. Admins can then click a farmer to update livestock info such as ownership, birth details, breed, and images. Health records include observations, diagnoses, and treatments. The process ends with generating a QR code and issuing a record summary.

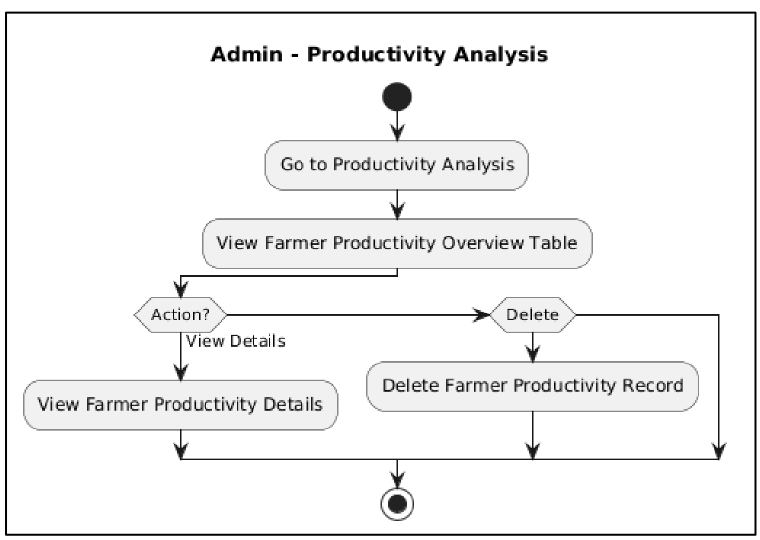


Figure 22. Admin - Manage Livestock

This figure illustrates the process for an admin to analyze farm productivity. It starts with opening the "Farm Productivity Analysis" tab. The admin then views the productivity analysis. Finally, the admin can generate a report in PNG, CSV, or PDF format to complete the process.

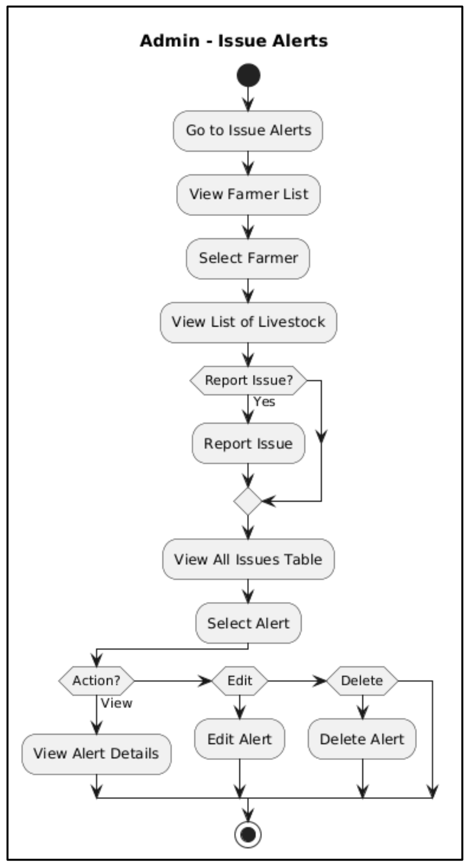


Figure 23. Admin – Issues Alerts

The figure shows the process for an admin to manage issued alerts. It starts with the admin opening the "Issued Alerts" tab. The system then displays a table of livestock alerts. From there, the admin can change the status of each alert to either resolved or unresolved, completing the process.

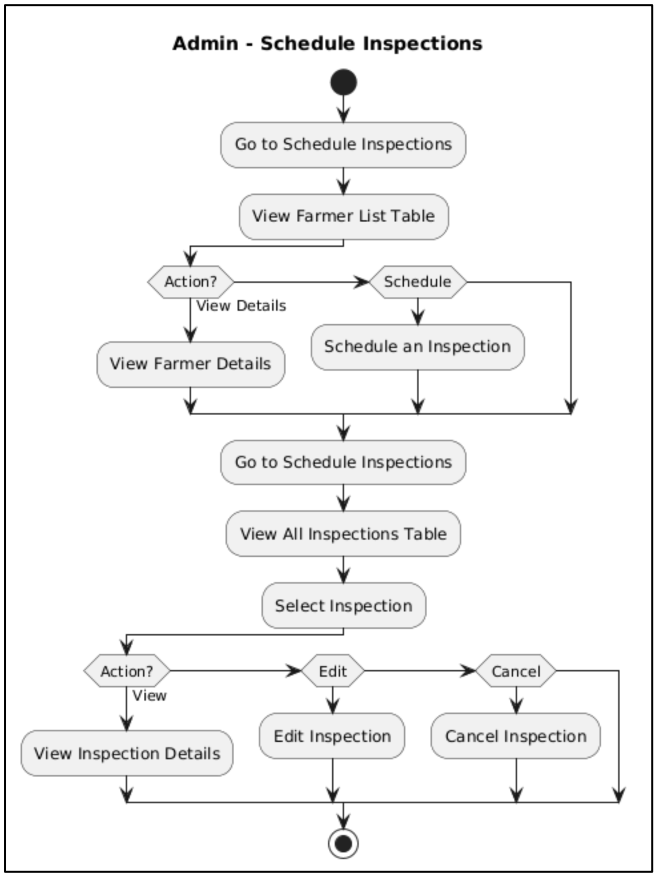


Figure 24. Admin – Schedule Inspections

The figure illustrates how the Admin manages farm inspections. It begins with opening the Schedule Inspections tab, which displays the Farmer List table. The Admin can select a farmer to view details and schedule an inspection. The Admin can also access the All Inspections table to select an existing inspection and perform actions such as viewing details, editing, or canceling the inspection. All updates are reflected immediately in the system, enabling the Admin to efficiently monitor and manage farm inspections.

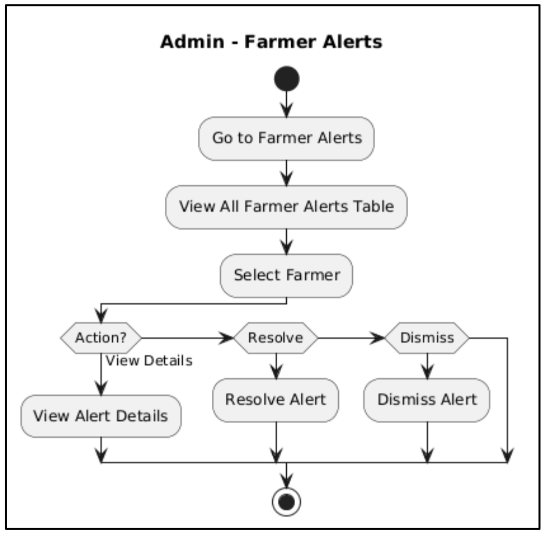


Figure 25. Admin – Farmer Alerts

The figure demonstrates how the Admin handles farmer alerts. Upon opening the Farmer Alerts tab, the system displays a table of all alerts submitted by farmers. The Admin can select any alert to review its details, mark it as resolved, or dismiss it if no further action is required. This process ensures that all farmer alerts are tracked and addressed promptly, maintaining smooth farm operations and timely communication.

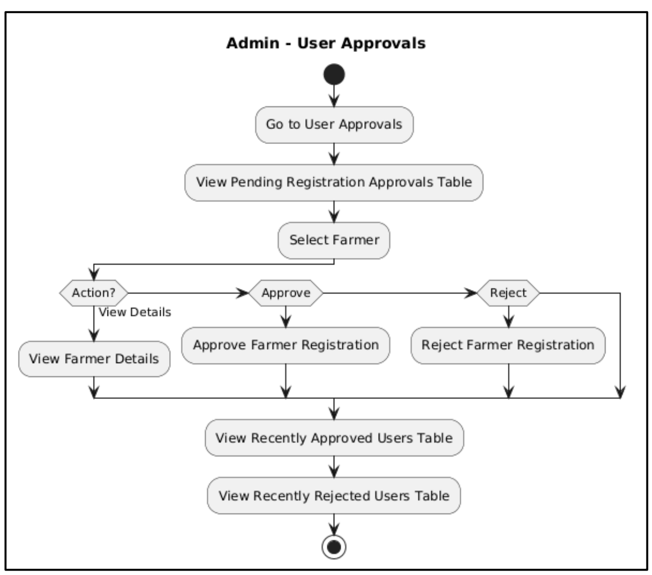


Figure 26. Admin – User Approvals

The figure presents how the Admin manages user registrations and approvals. Upon accessing the User Approvals tab, the system displays a table of pending registration requests. The Admin can select a user to view their details and either approve or reject the registration. This ensures that only verified users gain access while keeping track of past approval decisions.

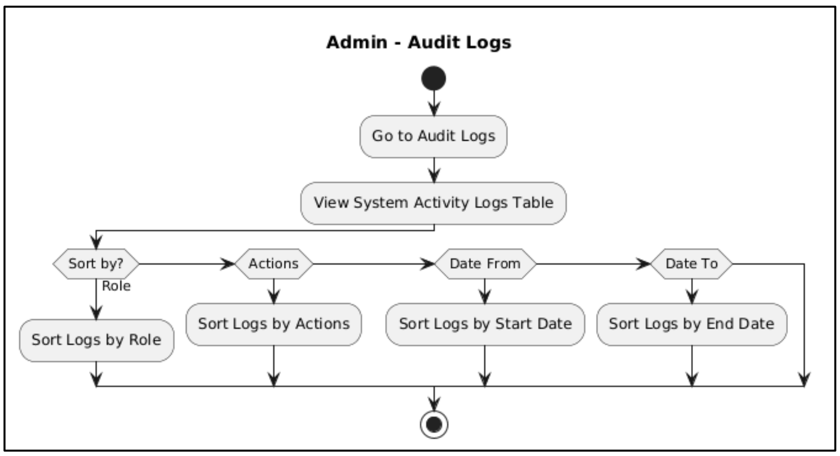


Figure 27. Admin – Audit Logs

The figure illustrates the process for an admin to access audit logs. The admin navigates to the "Audit Logs" section to view the activity history of farmers within the system.

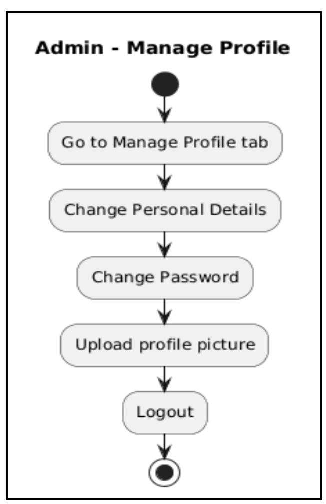


Figure 28. Admin – Manage Profile

The figure shows a step-by-step flow for an admin managing their profile. It starts with accessing the profile tab, followed by options to update things like the username, password, email, contact number, job position, and address. There's also an option to upload a profile picture. At the end, the admin can log out.

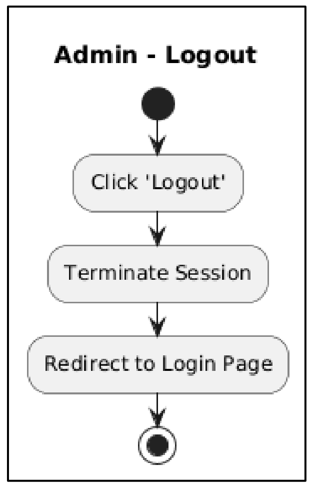


Figure 29. Admin – Logout

The figure displays the logout process for an administrator profile. It starts when the admin clicks the "Logout" button. The system then terminates the current session and redirects the admin to the login page, completing the logout process.

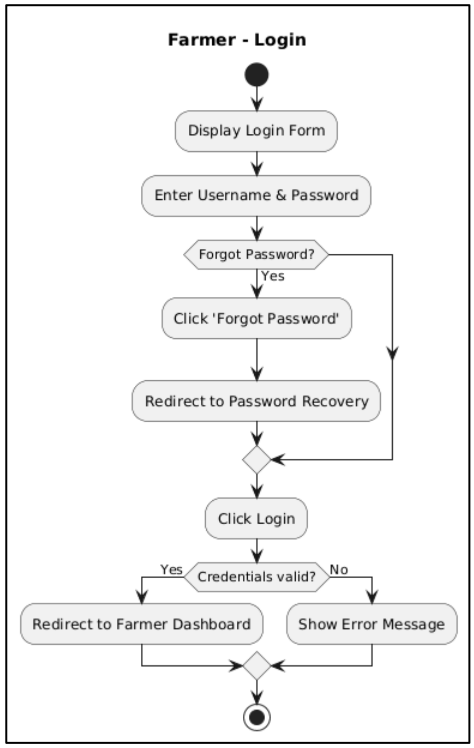


Figure 30. Farmer – Registration

The figure illustrates how the Farmer Registration is done in a system. It begins when a user is redirected from the farmer login page to the registration form. The user must fill in a number of fields, which include personal information such as name and contact information, farm information, and account information. After accepting the terms and conditions and submitting, the input is validated by the system. If all the fields are valid, the farmer account is registered, and the user is redirected to the login page. If there is an error, validation messages are given to the user.

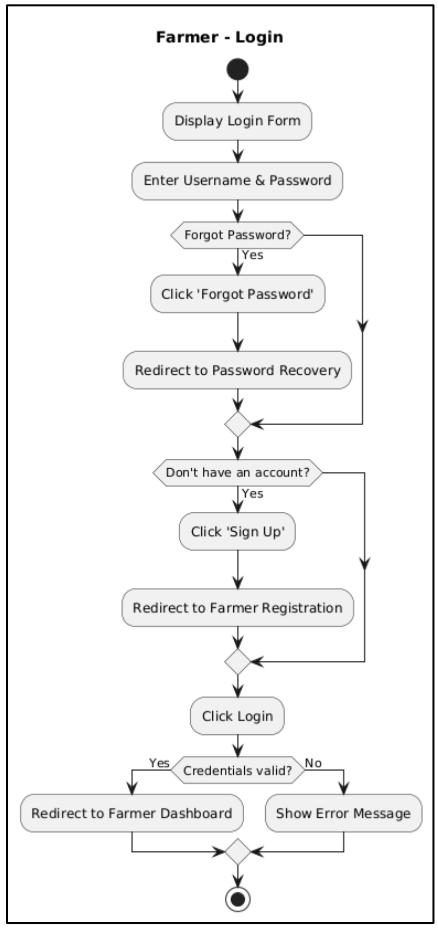


Figure 31. Farmer – Login

The figure depicts the Farmer Login process. It begins with the login form and has an option to "Register as Farmer." If the user chooses to register, it will redirect the user to the registration page. Otherwise, they proceed with entering their username and password. When the user submits the login button, the system verifies the user's credentials. If the login is successful, the user will be directed to the Farmer Dashboard; otherwise, an error message is shown.

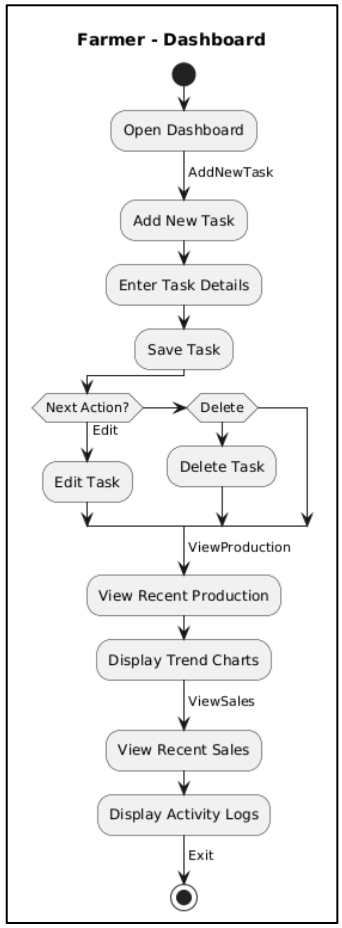


Figure 32. Farmer – Dashboard

The figure illustrates how the Farmer interacts with the dashboard. After logging in, the farmer is redirected to the Dashboard, which provides options to add new tasks, view recent production, view recent sales, and monitor overall farm activities. When adding a new task, the farmer enters the task details and saves it, with the option to edit or delete the task afterward. Viewing recent production or sales retrieves and displays the corresponding data and trend charts. The farmer can perform multiple actions sequentially before exiting, which ends the session and redirects back to the login page.

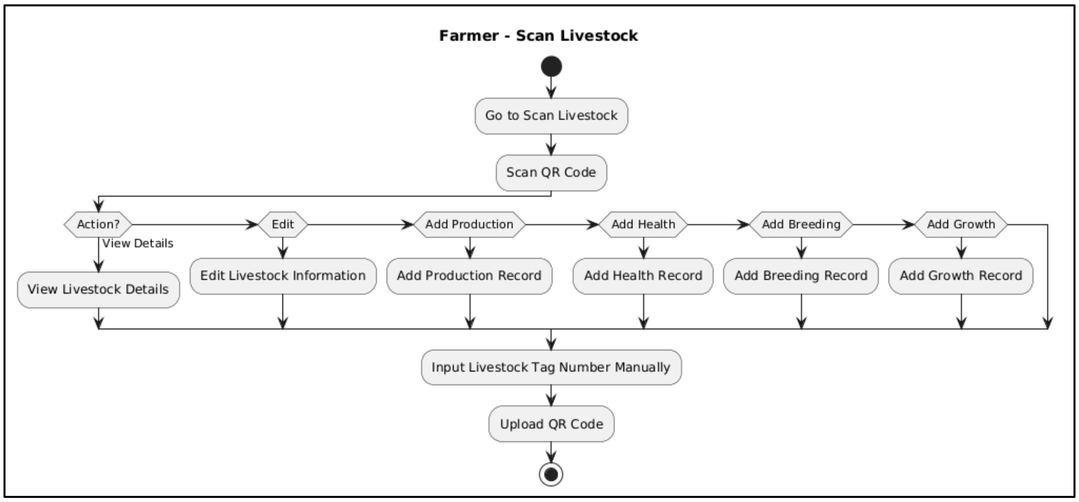


Figure 33. Farmer – Scan Livestock

The figure presents how the Farmer scans and manages livestock records. Upon accessing the Scan Livestock module, the farmer can either scan a livestock QR code, manually input the tag number, or upload a QR code image. After identifying the livestock, the farmer can view its details, edit information, or add records for production, health, breeding, and growth. All updates are reflected immediately in the system, ensuring accurate tracking and management of livestock data.

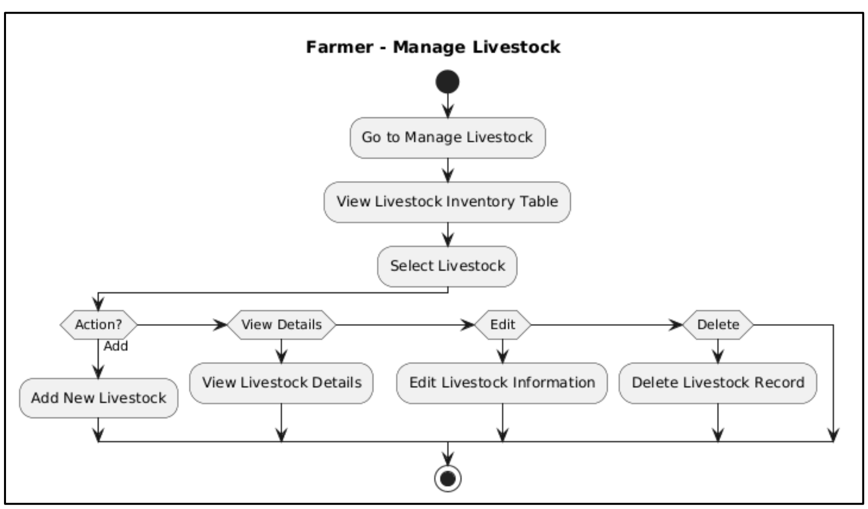


Figure 34. Farmer – Manage Livestock

The figure shows the process of how a farmer manage livestock. It starts with accessing the "Manage Livestock" tab, where the farmer can view, import, add, or delete livestock records. After selecting a specific animal, the farmer can update its growth record by entering data such as weight, height, heart girth, and body length. Additionally, calving and milk production details can be recorded, including calf ID, breed, milk output, and days in milk. Both growth and calving records can be reviewed on a quarterly basis.

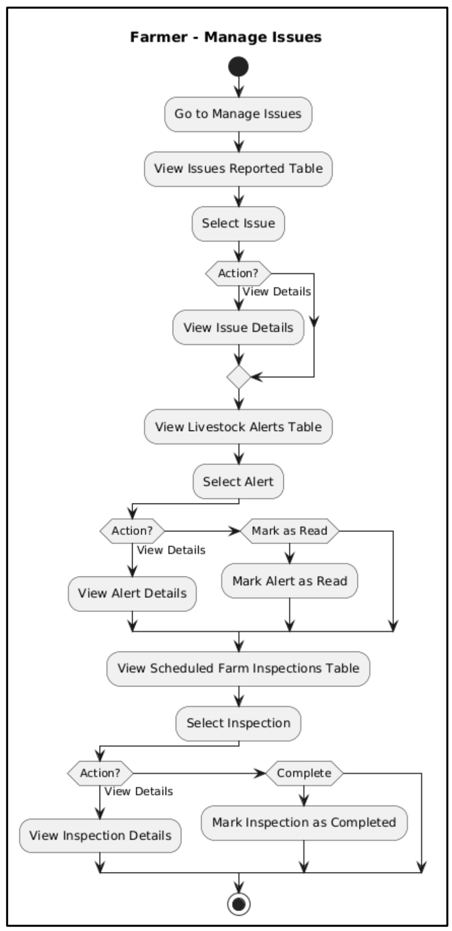


Figure 35. Farmer – Manage Issues

The figure illustrates how the Farmer manages reported issues. Upon accessing the Manage Issues module, the farmer can view tables for Issues Reported, Livestock Alerts, and Scheduled Farm Inspections. For Issues Reported, the farmer can select an entry to view its details. In Livestock Alerts, the farmer can view alert details and mark them as read. For Scheduled Farm Inspections, the farmer can view inspection details and mark them as complete.

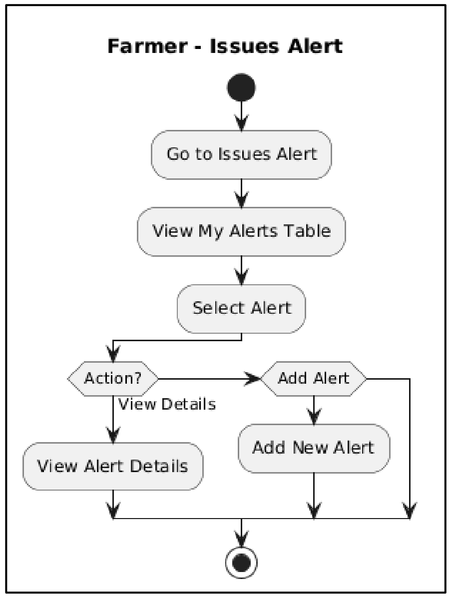


Figure 36. Farmer – Issues Alert

The figure shows the process of how farmer can issue an alert to the admin. It starts with opening the 'Issued Alerts' tab to view existing alerts related to the farmer's livestock. The farmer then accesses the 'Issue Alert to Admin' tab and proceeds to input the date, issue topic, and a description of the concern. Once all inputs are filled, the farmer can submit an alert to the admin for review and response.

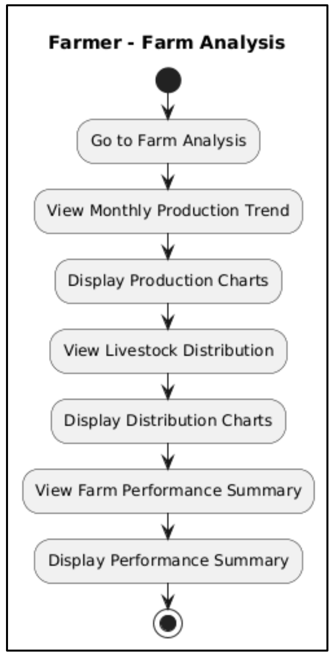


Figure 37. Farmer – Farm Analysis

The figure demonstrates how the Farmer monitors overall farm performance. Upon accessing the Farm Analysis module, the farmer can view visual summaries including Monthly Production Trends, Livestock Distribution, and Farm Performance Summary. Each view provides charts and tables that help the farmer identify trends, compare metrics, and make informed decisions regarding farm operations.

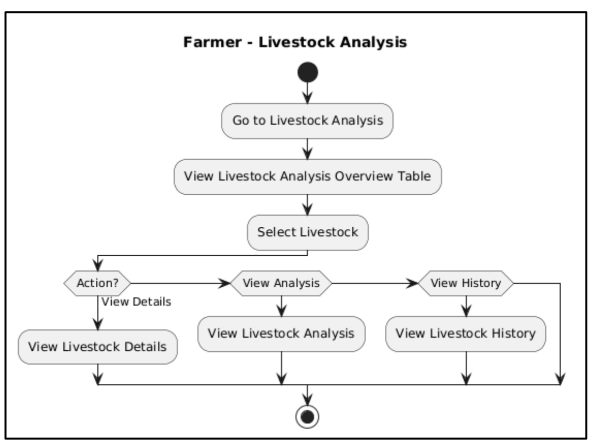


Figure 38. Farmer – Livestock Analysis

The figure depicts how the Farmer tracks individual livestock performance. In the Livestock Analysis module, the farmer can access the Livestock Analysis Overview table and select a specific animal to view detailed records. Available actions include viewing the livestock's history, production analysis, and other performance metrics. This allows the farmer to monitor health, productivity, and growth trends for each animal in the farm.

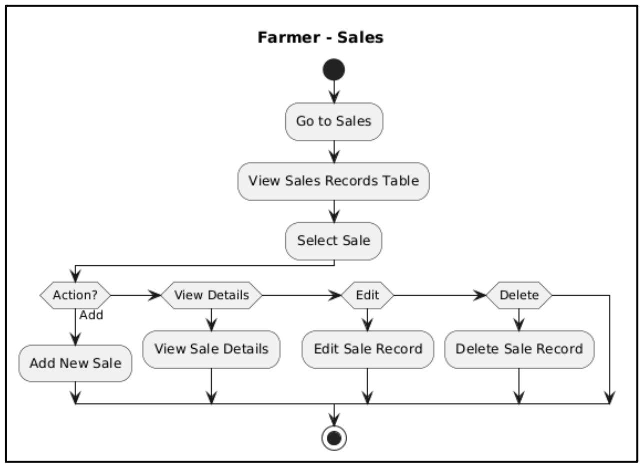


Figure 39. Farmer – Sales

The figure depicts how the Farmer manages sales records. In the Sales module, the farmer can view the Sales Records table, add new sales, or select an entry to view details, edit, or delete. This allows efficient tracking of farm product transactions.

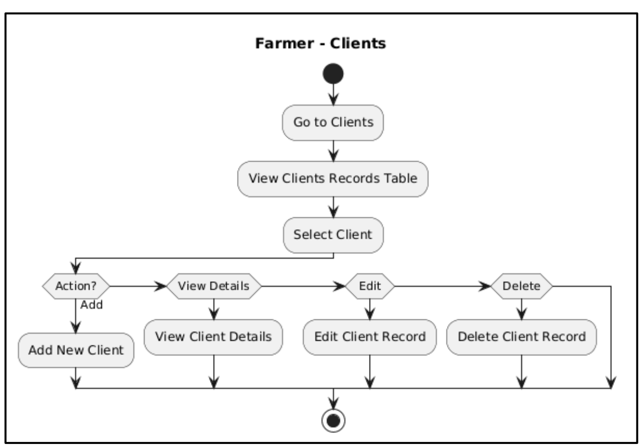


Figure 40. Farmer – Clients

The figure presents how the Farmer manages client information. The Clients module displays the Clients Records table, where the farmer can add new clients, view details, edit information, or remove clients from the list.

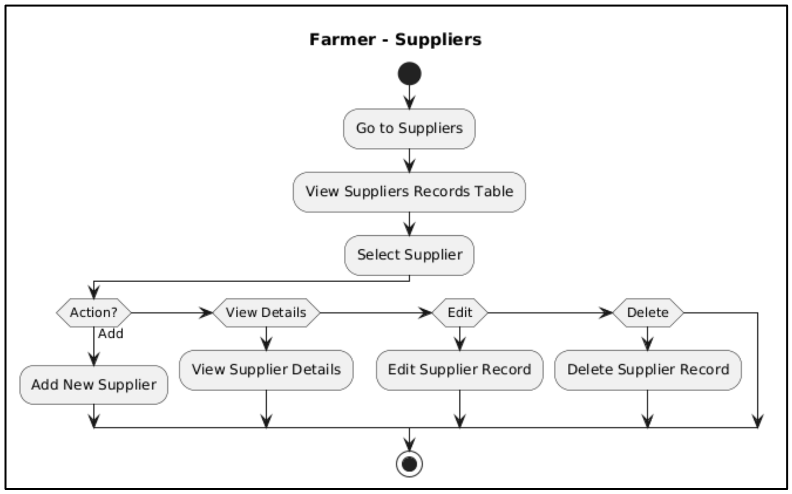


Figure 41. Farmer – Suppliers

The diagram illustrates how the Farmer handles supplier information. In the Suppliers module, the farmer can access the Suppliers Records table, add new suppliers, view details, edit information, or delete entries to maintain an updated supplier database.

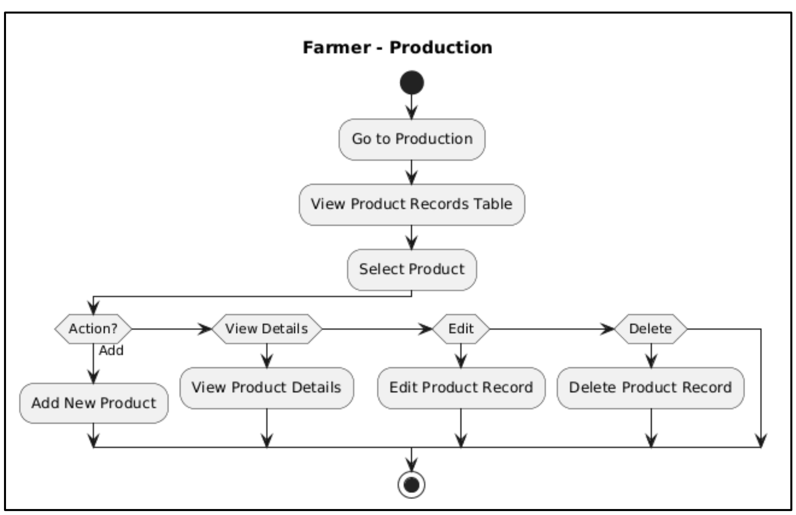


Figure 42. Farmer – Production

The diagram shows how the Farmer tracks farm production. The Production module displays the Product Records table, allowing the farmer to add new products, view details, edit, or delete existing entries, helping manage farm outputs effectively.

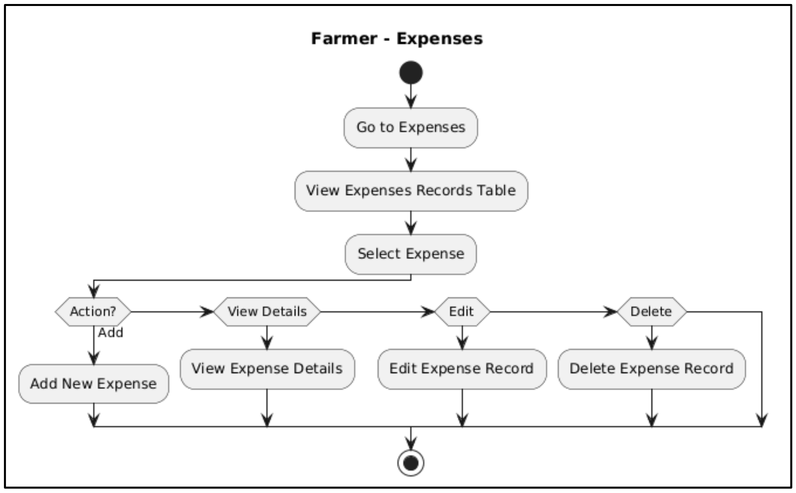


Figure 43. Farmer – Expenses

The figure depicts how the Farmer manages farm expenses. In the Expenses module, the farmer can access the Expenses Records table to add new expenses, view details, edit, or delete records, ensuring accurate financial tracking.

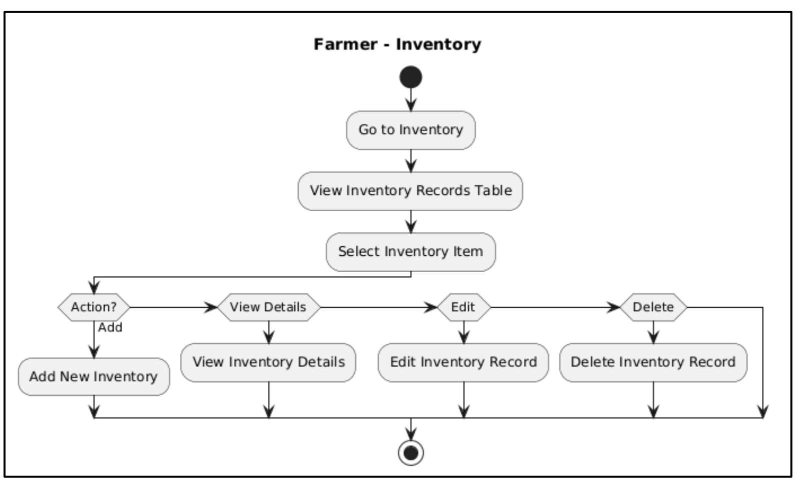


Figure 44. Farmer – Inventory

The figure presents how the Farmer oversees farm inventory. The Inventory module shows the Inventory Records table, where the farmer can add items, view details, edit, or delete records to maintain up-to-date inventory management.

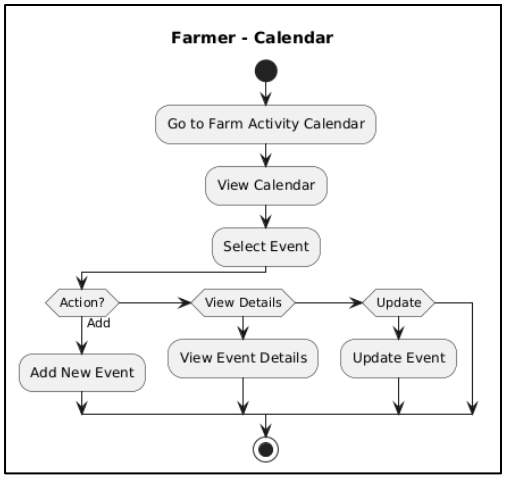


Figure 45. Farmer – Calendar

The figure illustrates how the Farmer manages farm activities using the calendar. The Farm Activity Calendar allows the farmer to add events, view details, and update scheduled tasks to organize farm operations efficiently.

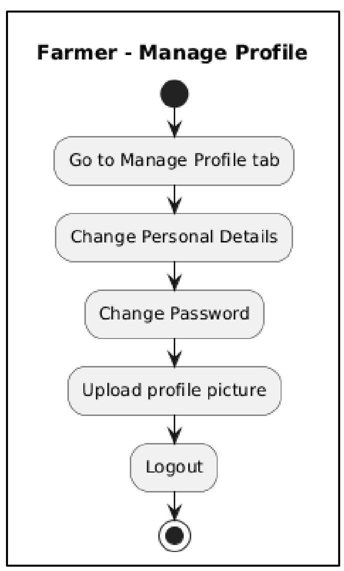


Figure 46. Farmer – Manage Profile

The figure shows how a farmer can manage their profile. It begins with opening the profile tab, then gives options to update the username, password, email, contact number, and address. The farmer can also upload a profile picture, and finally, log out when finished.

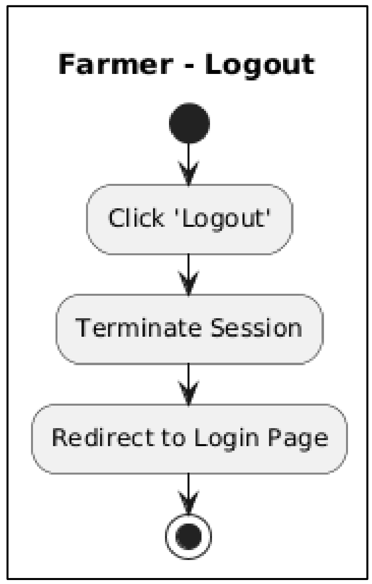


Figure 47. Farmer – Manage Profile

The figure shows how a farmer can manage their profile. It begins with opening the profile tab, then gives options to update the username, password, email, contact number, and address. The farmer can also upload a profile picture, and finally, log out when finished.

Sequence Diagram

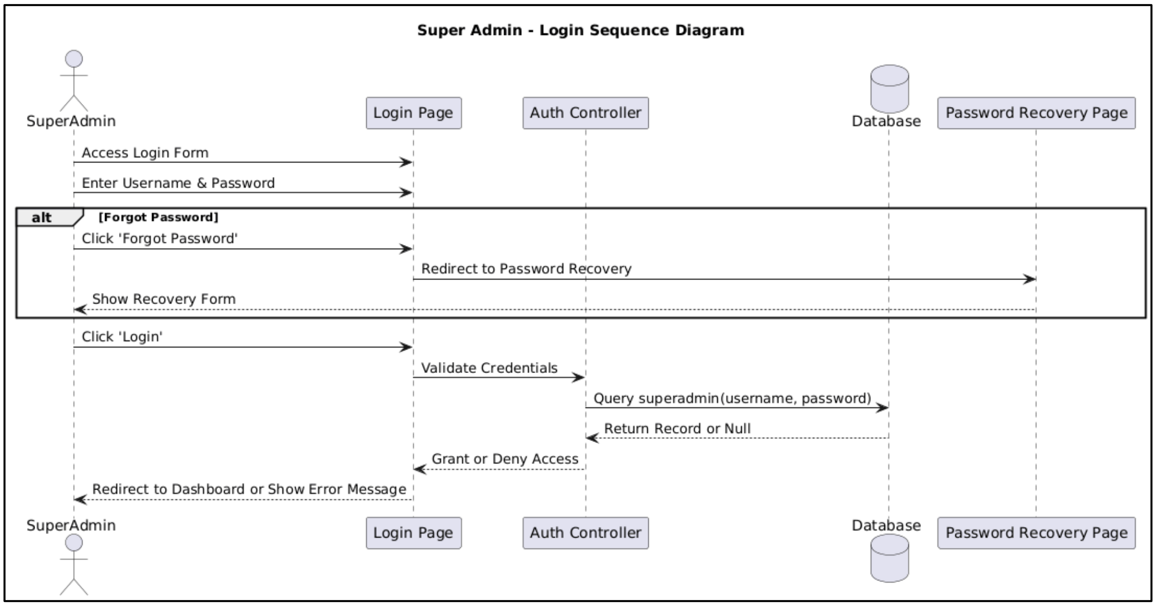


Figure 48. Super Admin – Login

The sequence diagram illustrates how a super admin logs in. It begins with the super admin visiting the login page and entering his username and password. Upon logging in, the system verifies the username and password with the database. Upon correct username and password, the system allows him in and displays the dashboard; otherwise, it displays an error message.

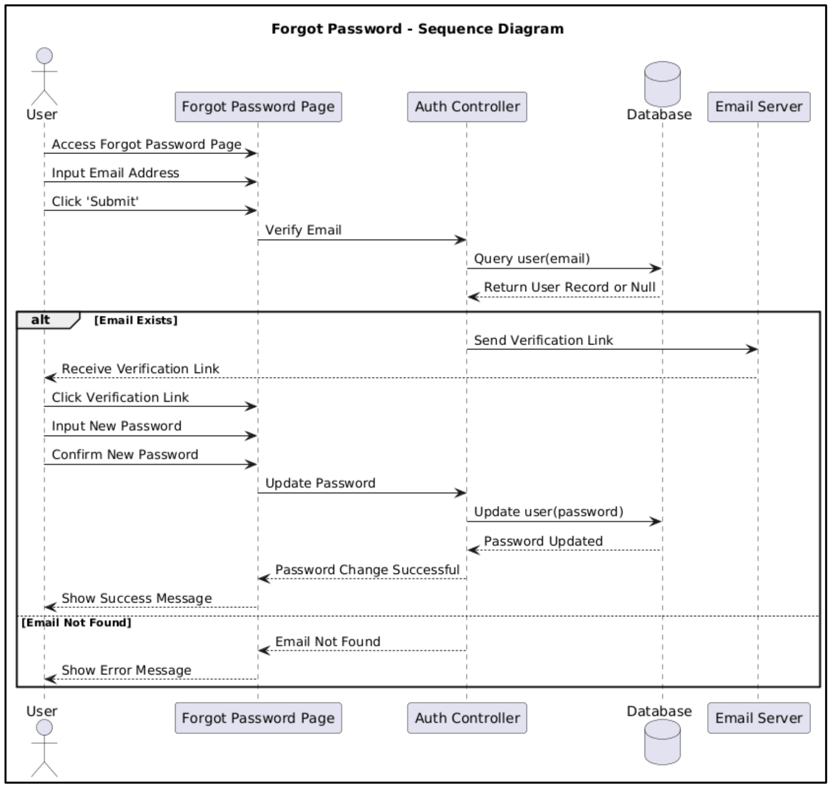


Figure 49. Forgot Password

The figure shows the workflow of the Forgot Password process. It begins with the user clicking “Forgot Password” and entering their email address. The system checks the email in the database. If the email exists, a verification link is sent, and the user can reset their password, which is then updated in the database. If the email does not exist, the system displays an “Email not found” message, ending the process.

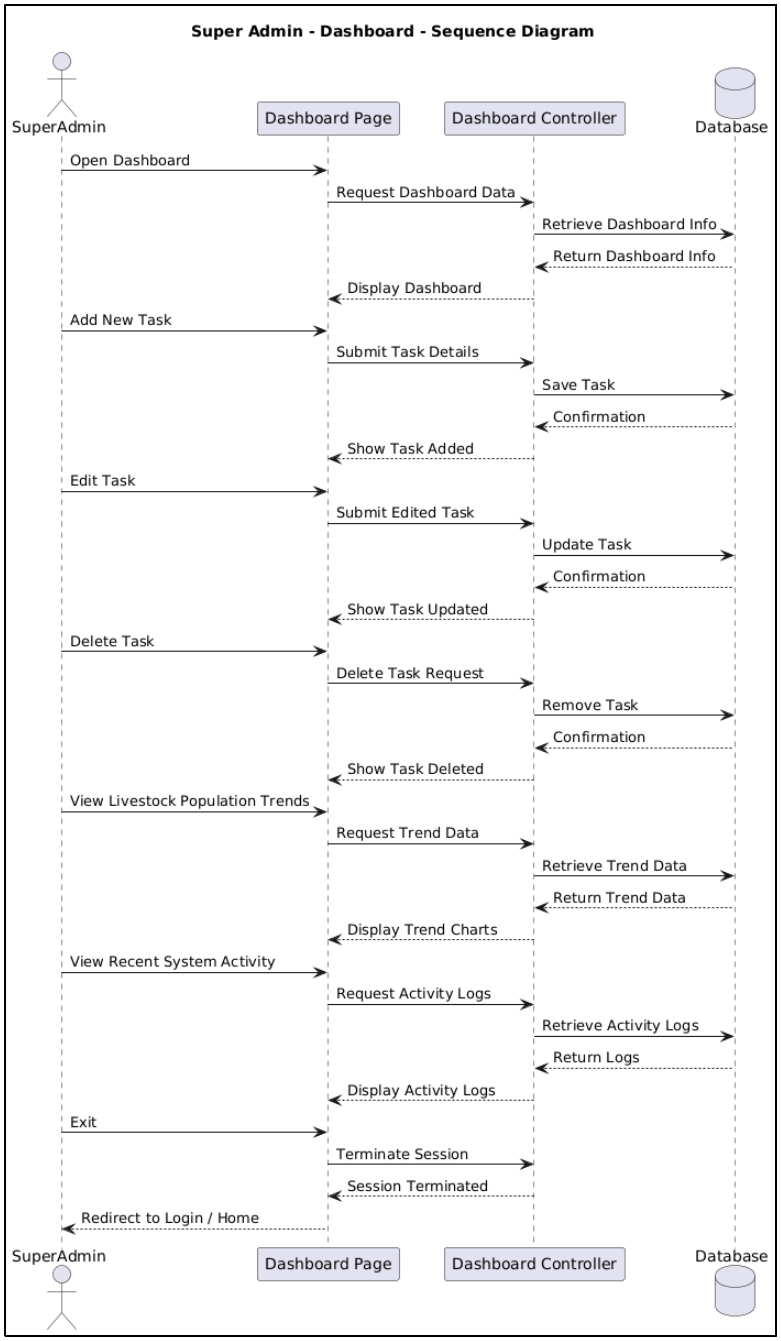


Figure 50. Super Admin – Dashboard

The sequence diagram shows how the Super Admin interacts with the dashboard. After accessing the dashboard interface, the Super Admin may perform actions such as adding a new task, viewing livestock population trends, or checking recent system activity.

For each selected action, the system retrieves the necessary data, processes the request, and returns the corresponding information or interface. The Super Admin may continue performing multiple actions until the session ends.

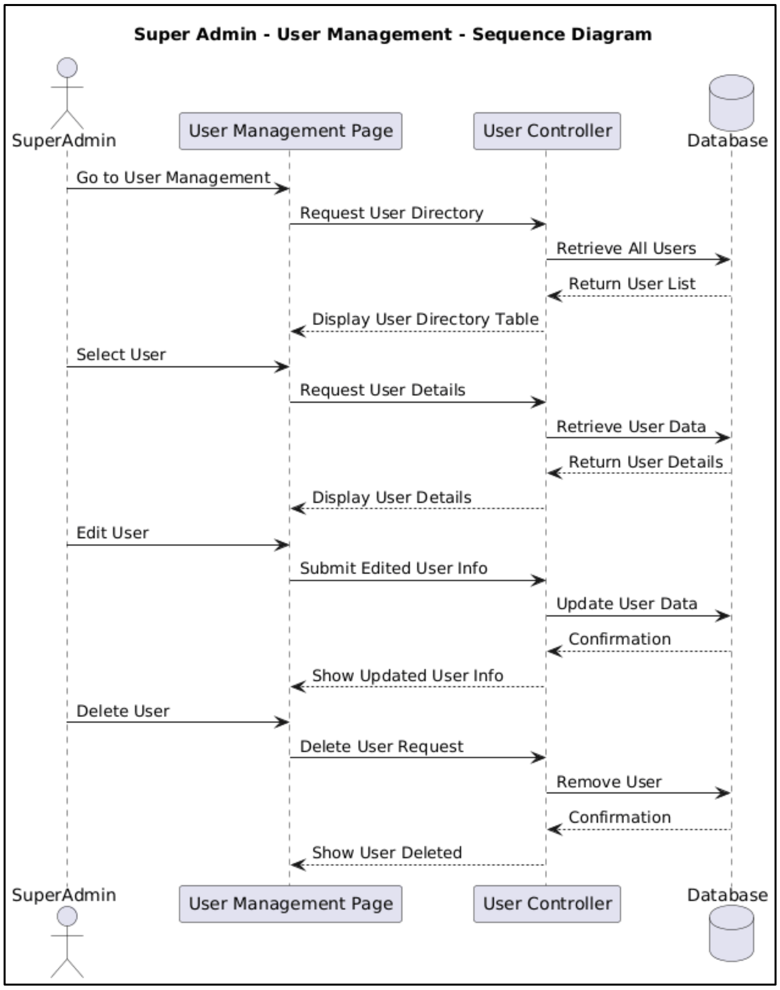


Figure 51. Super Admin – User Management

The sequence diagram illustrates how the Super Admin manages user accounts. After opening the User Management module, the Super Admin requests the list of users, and the system retrieves and displays the directory. The Super Admin may then choose an action such as viewing user details, editing information, or deleting an account. For each selected operation, the system processes the request and updates the records accordingly.

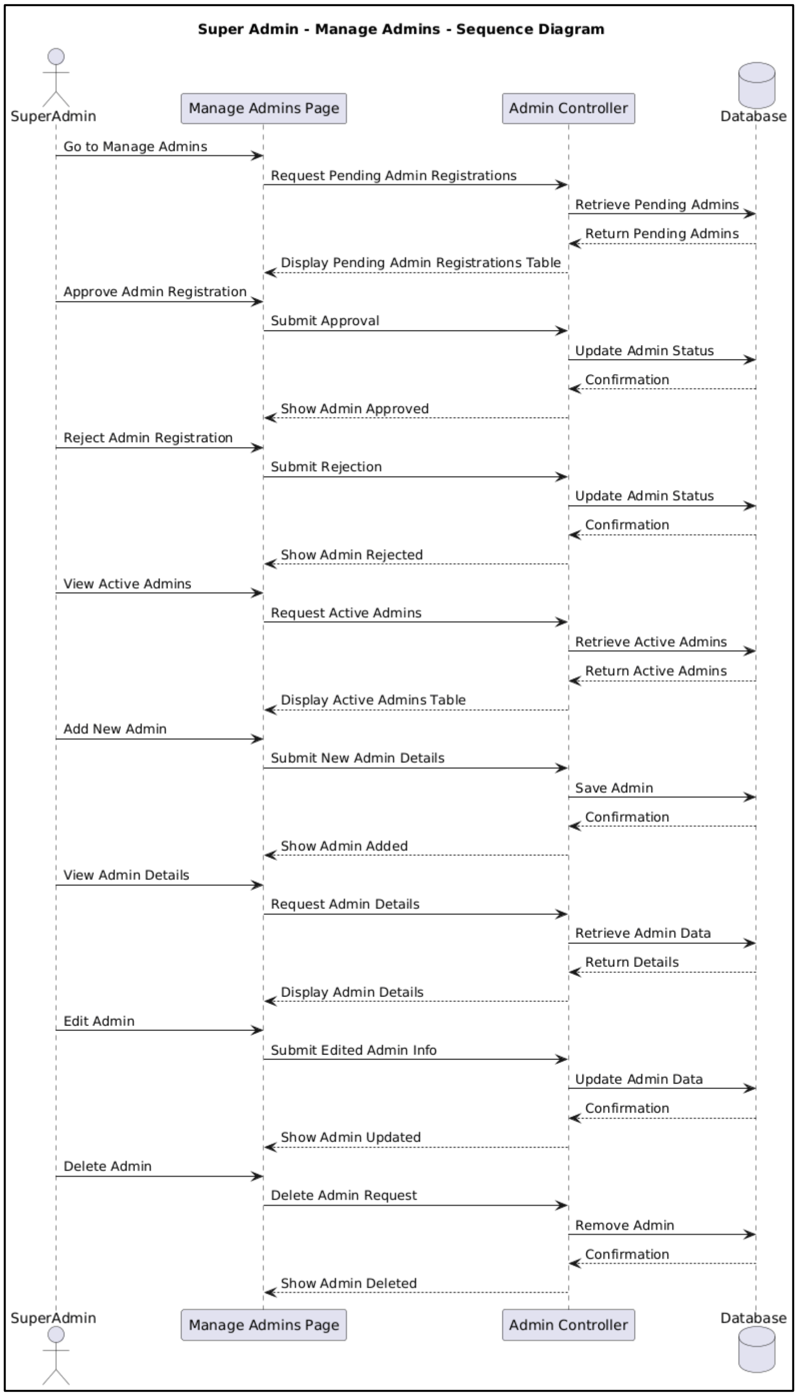


Figure 52. Super Admin – Manage Admins

The diagram shows the sequence diagram of a Super Admin managing other admin users. The process begins when the Super Admin clicks the "Manage Admins" tab, prompting the Dashboard UI to request the list of admins from the Admin Controller. The controller queries the database, and the results are displayed in a table. The Super Admin can view details, update statuses delete admins, or export the list in PNG, CSV, or PDF. Any changes trigger the controller to update the database and send confirmation, while export requests retrieve data and return the file.

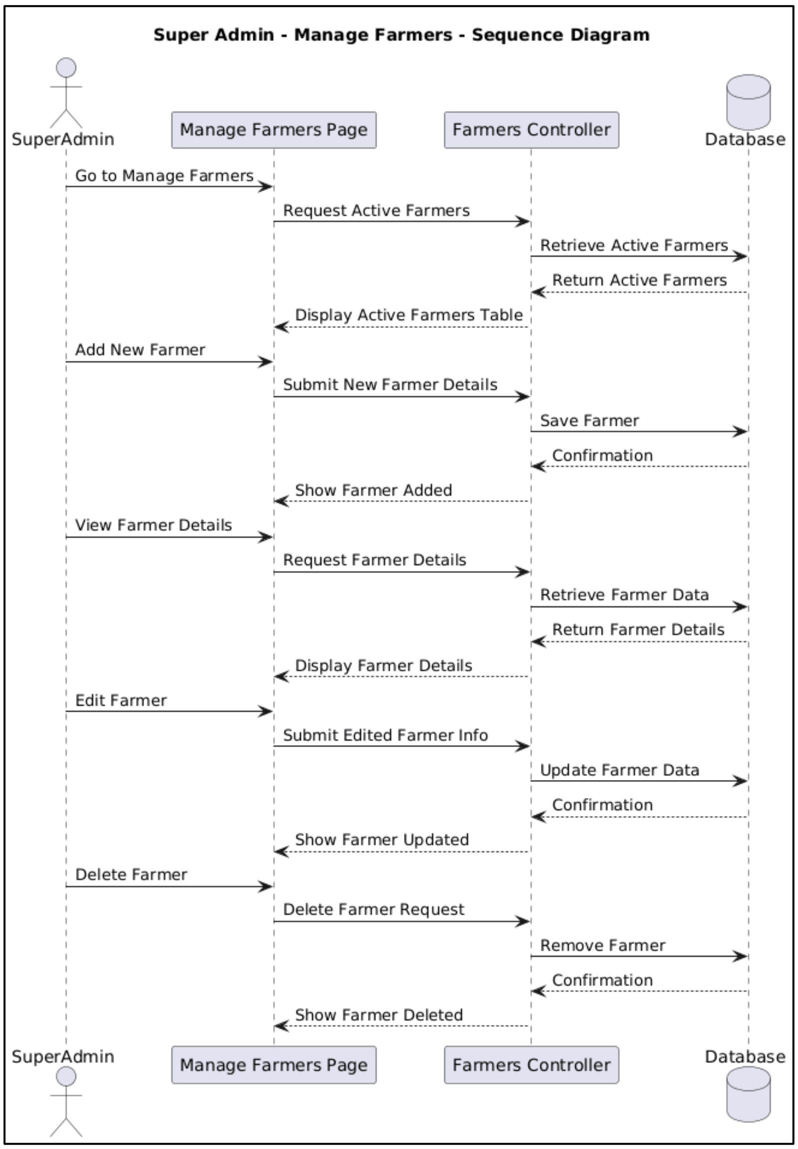


Figure 53. Super Admin – Manage Farmers

Figure 51 shows how a super admin manages farmer. When the super admin opens the Manage Farmers tab, the system retrieves all farmer data from the database. The Super Admin can view details, update statuses delete farmers, or export the list in PNG, CSV, or PDF.

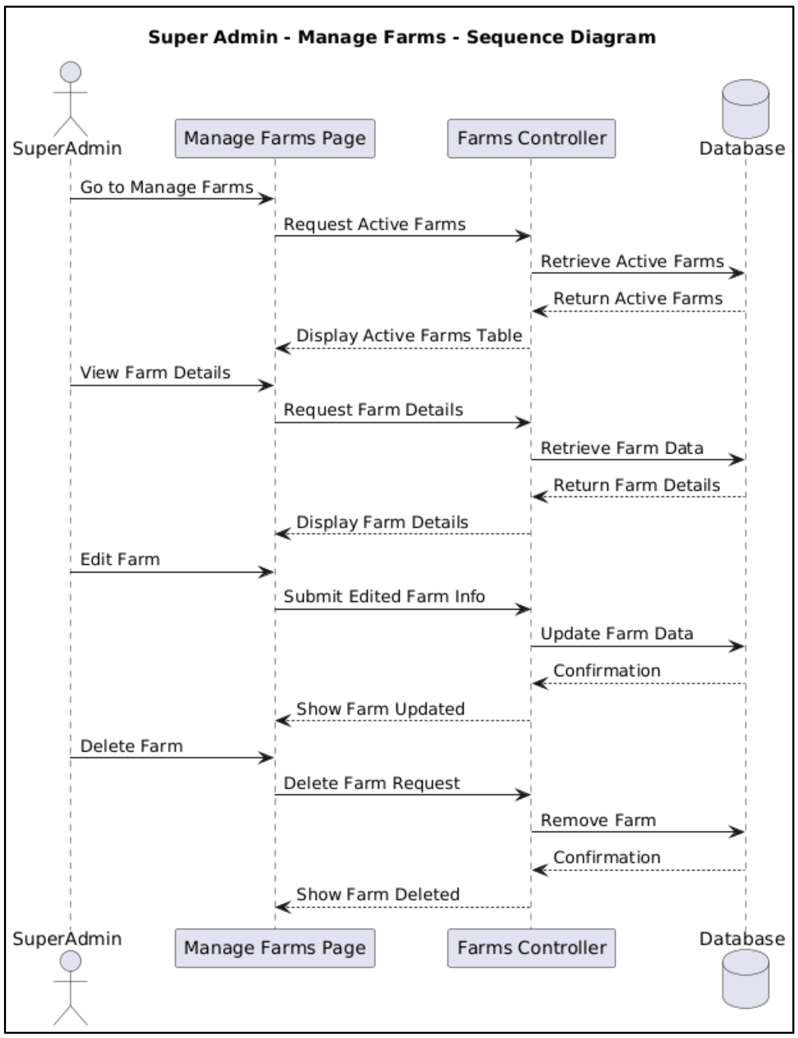


Figure 54. Super Admin – Manage Farms

The sequence diagram explains how a super admin manages farm records. When the admin opens the Manage Farms tab, the system fetches all farm data from the database. The admin can upload a CSV file with new farm details, which is then validated and inserted into the database. Once the import is successful, the system confirms it to the admin.

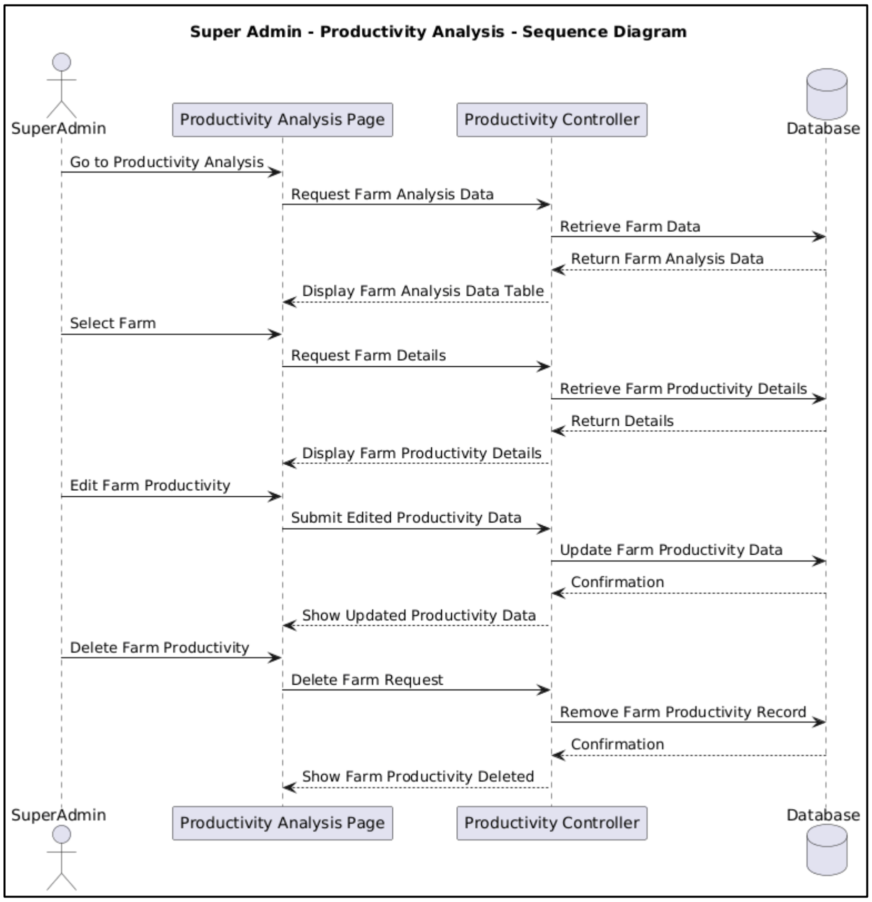


Figure 55. Super Admin – Productivity Analysis

The sequence diagram illustrates the sequence diagram for the Super Admin generating an overall productivity analysis. The process kicks off when the Super Admin selects the "Productivity Analysis" tab within the dashboard UI. After the analysis data comes back, it shows up on the screen for the Super Admin to view. Should the Super Admin decide to export the report whether as a PNG, CSV, or PDF a request is triggered to generate the report file. The system retrieves the necessary data from the database, and once the file is generated, it's returned and made available for download.

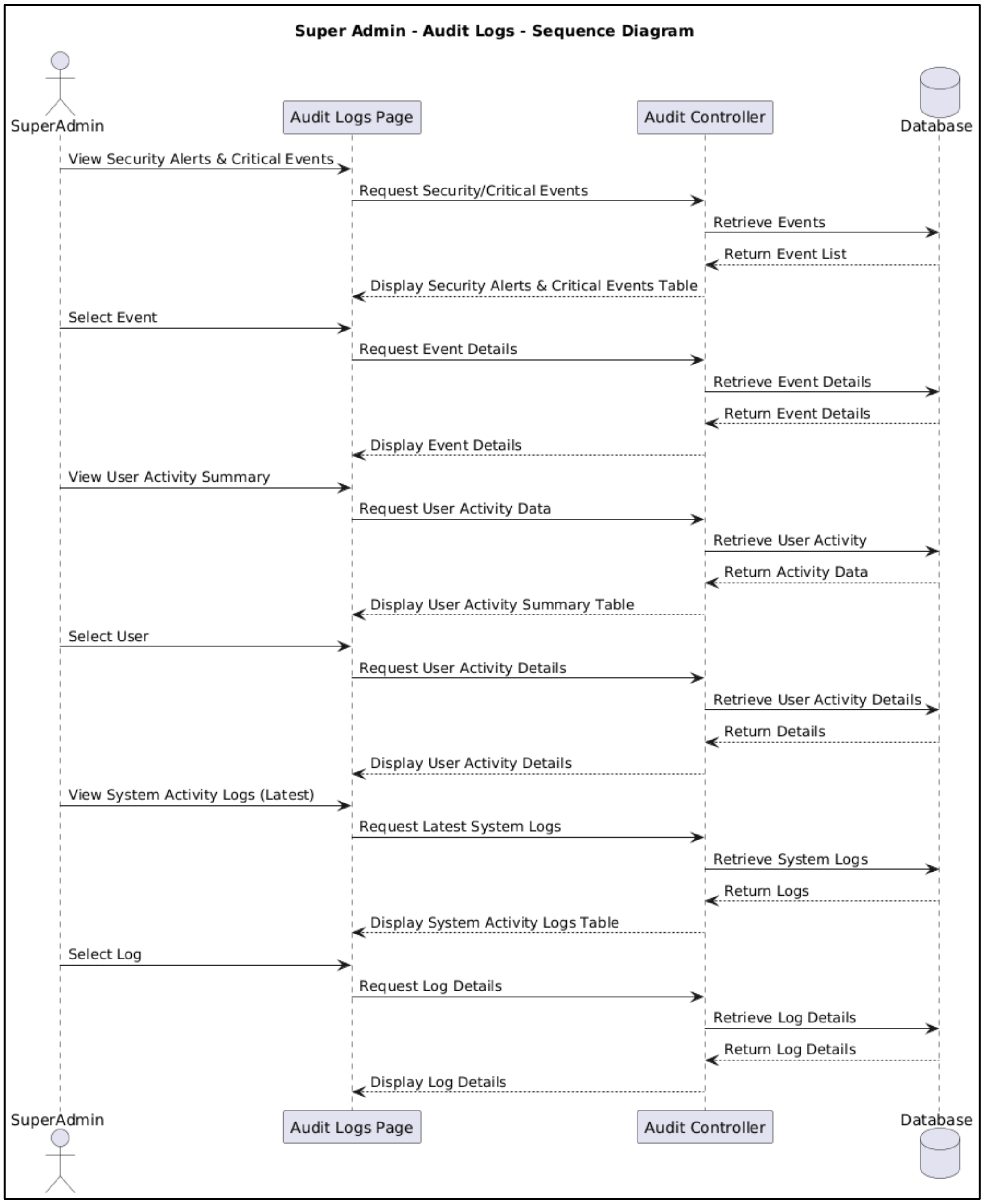


Figure 56. Super Admin – Audit Logs

The sequence diagram describes how a super admin can view and filter system audit logs. When the super admin opens the audit logs section, the system sends a request to retrieve all logs from the database and displays them in the user interface. If the super admin wants to narrow down the results, they can apply a filter (such as by admin or farmer). The system then sends a filtered query to the database, retrieves the relevant data, and updates the display to show only the filtered logs. This helps the super admin review specific actions or users efficiently.

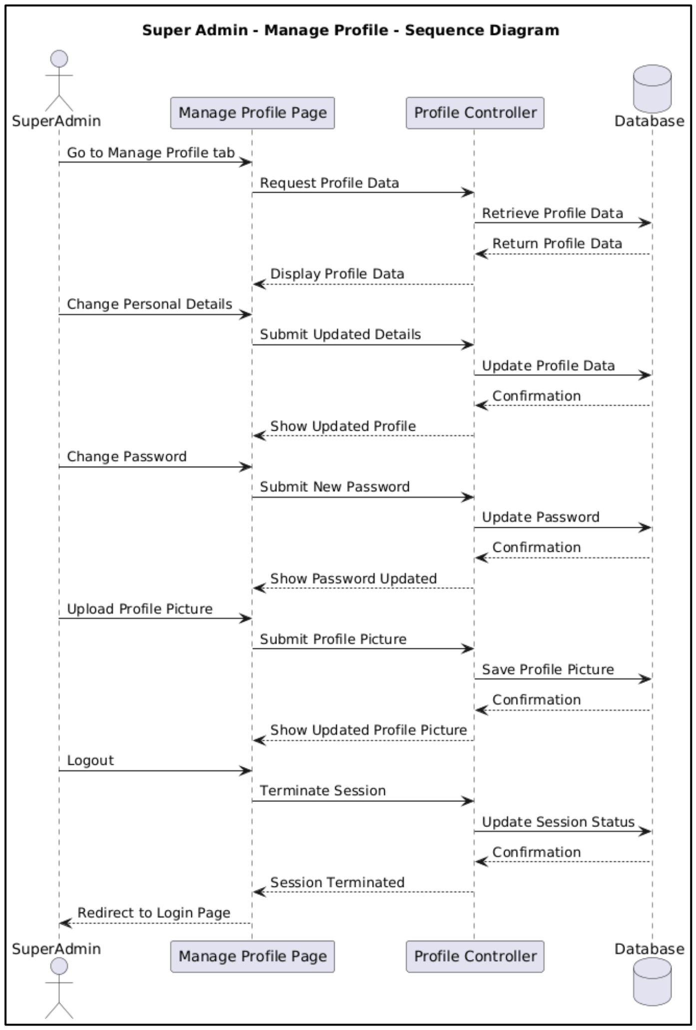


Figure 57. Super Admin – Manage Profile

The sequence diagram illustrates the process by which a super admin can manage their personal profile settings within the system. When the super admin opens the Manage Profile tab, the system sends a request to retrieve the profile data from the database and displays it in the user interface. The super admin can choose to change their username by submitting a new one, which is then updated in the database and confirmed. The admin also has the option to change their password, upload a new profile image, which is submitted and saved to the database, followed by a confirmation message. Finally, when the super admin decides to log out, a logout request is processed and a confirmation is displayed, completing the profile management process.

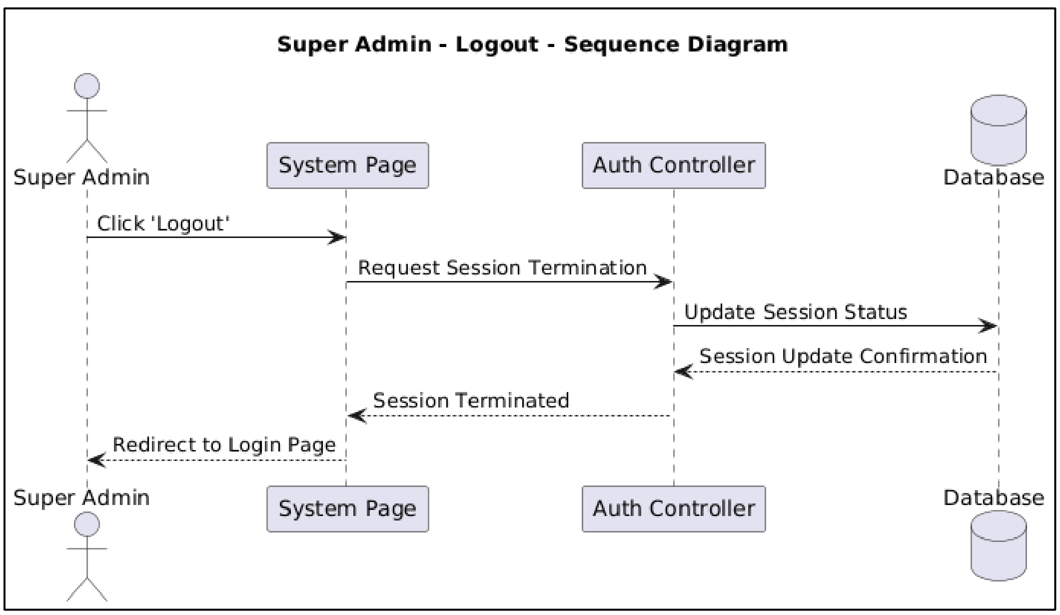


Figure 58. Super Admin – Logout

The sequence diagram shows the process of how to log out for Super Admin The process starts when the super admin clicks the 'Logout' button on the dashboard. This action prompts the System Page to instruct the Auth Controller to end the current session. Upon successfully ending the session, the system redirects the super admin back to the login page, completing the logout operation.

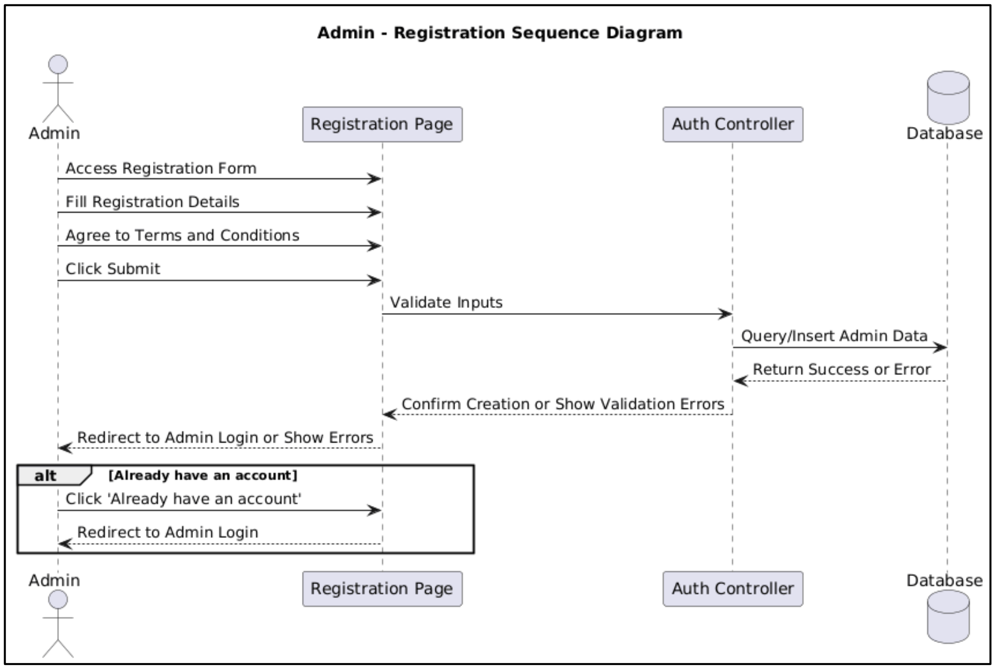


Figure 59. Admin – Registration

The sequence diagram illustrates the admin registration process. It begins when the admin clicks "Register as Admin." The system displays the registration form where the admin enters the required details, including the registration code, personal information, position, address, contact number, email, username, and password. After agreeing to the terms and conditions, the admin submits the form. The registration data is then sent to the controller, which validates the inputs and stores the information in the database. The system returns either a confirmation or an error message, which is displayed to the admin. If the admin already has an account, they may choose the "Already have an account" option to return to the login page instead of completing the registration.

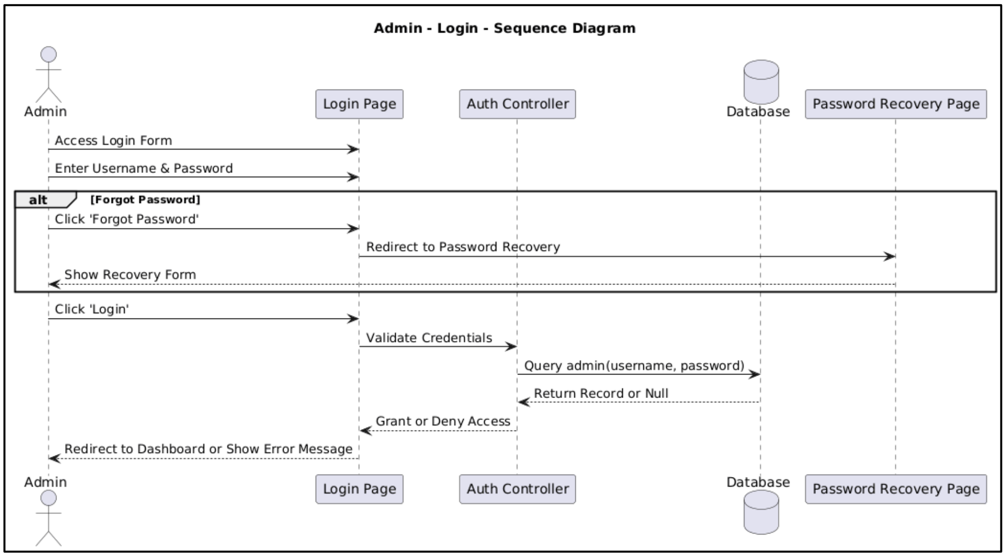


Figure 60. Admin – Login

The sequence diagram illustrates the login process for an admin. The process begins when the admin accesses the login page and enters their username and password. If the admin selects “Forgot Password,” the system redirects them to the password recovery process before continuing with any login attempt. When the admin clicks the login button, the system validates the credentials by querying the database. If the credentials are correct, access is granted and the dashboard is displayed. Otherwise, an error message is shown.

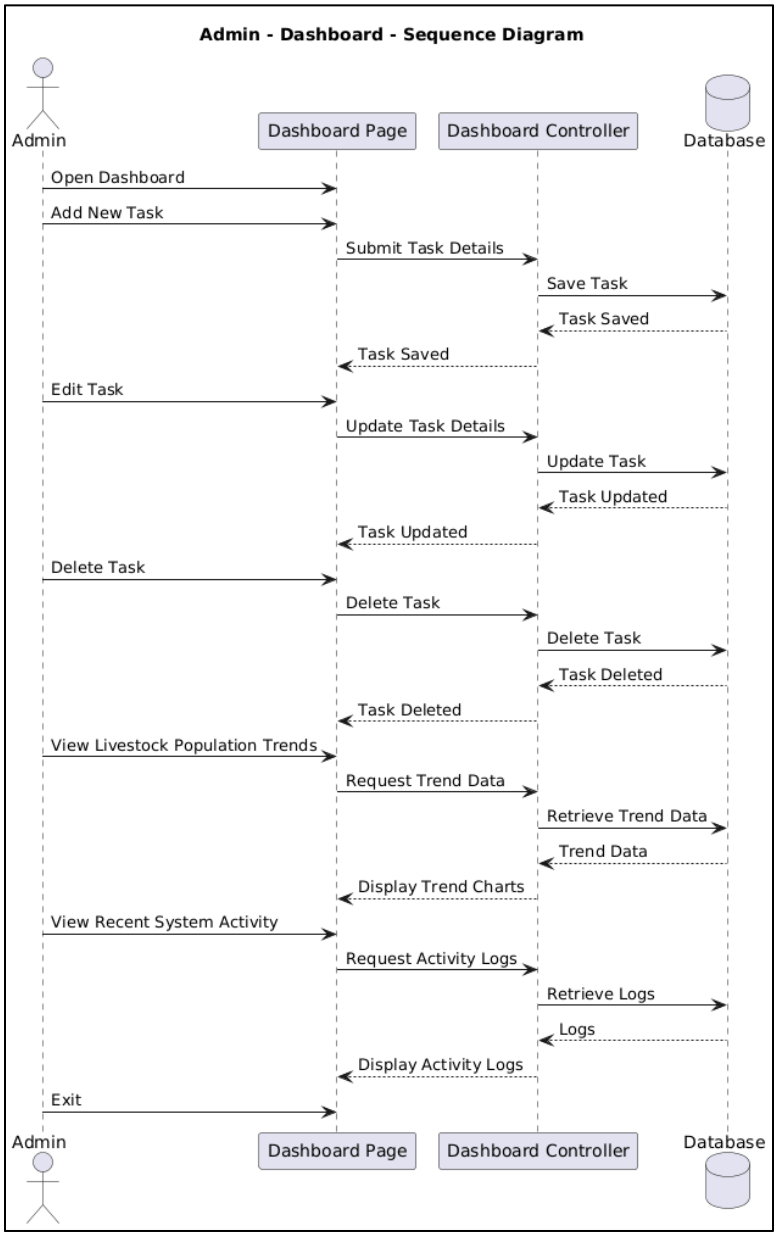


Figure 61. Admin – Dashboard

The sequence diagram illustrates how an admin interacts with the dashboard after logging in. Once the admin successfully accesses the system, the dashboard is displayed, providing options such as adding new tasks, viewing livestock population trends, and checking recent system activity. When the admin selects an action, the system retrieves and displays the corresponding data or form. The admin may perform multiple actions within the dashboard before choosing to exit, after which the system ends the session and returns to the login page.

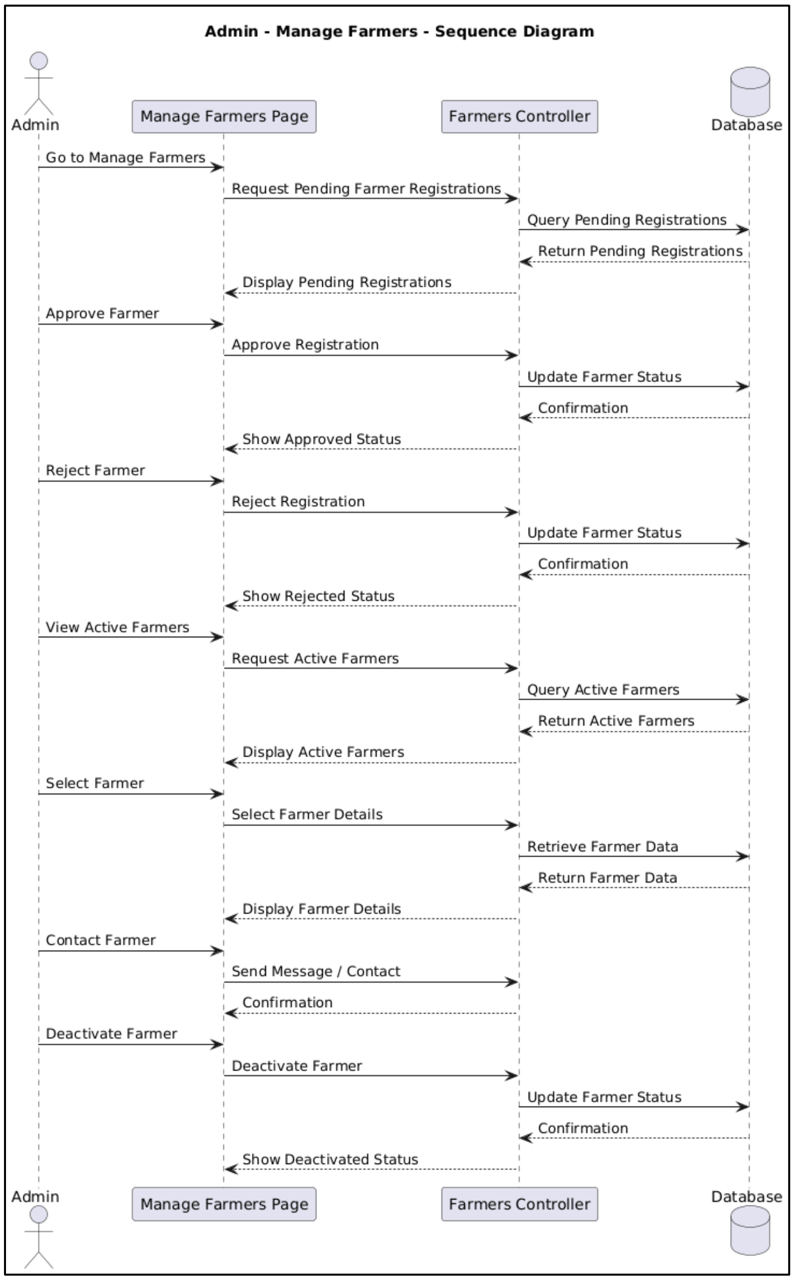


Figure 62. Admin – Manage Farmers

The sequence diagram shows how the admin manages farmers within the system. The process begins with the system retrieving and displaying the list of active farmers. From this interface, the admin view detailed information, edit existing records, or delete a farmer. Each selected action is sent to the Farmer Controller, which processes the request and updates or retrieves the necessary information from the database. The system then returns the corresponding confirmation or updated data to the admin.

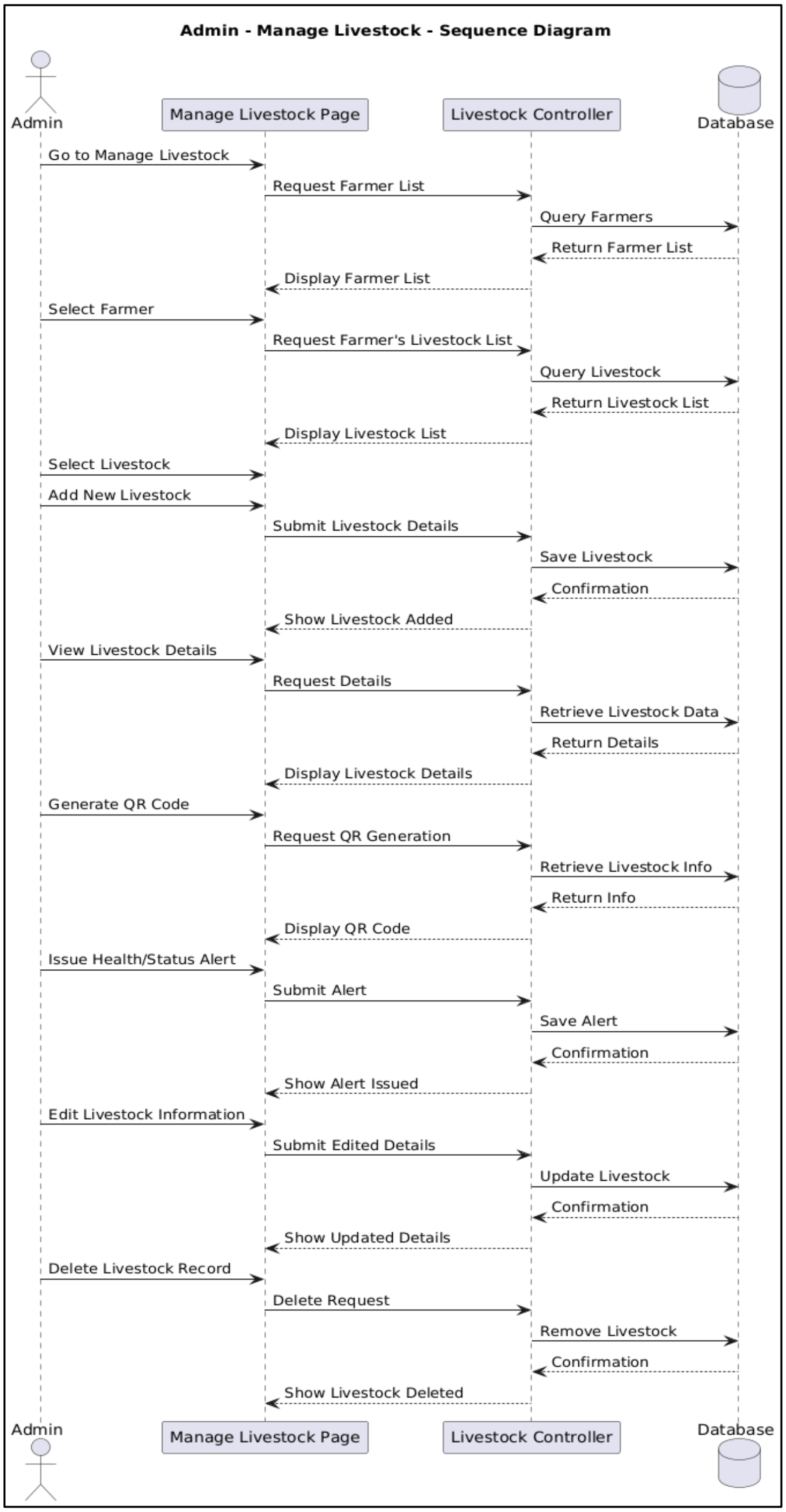


Figure 63. Admin – Manage Livestock

The sequence diagram illustrate the process of how an Admin manages livestock records. The admin starts by clicking the "Manage Livestock" tab, which retrieves a list of farmers. After selecting a farmer, the livestock data is displayed. The admin can then import CSV data, edit existing animal records, and add new records such as health, growth, calving/milk, and breeding/AI information. Additionally, the Admin can generate QR codes for livestock and issue alerts. Each action is processed through the system's controller and confirmed through the database.

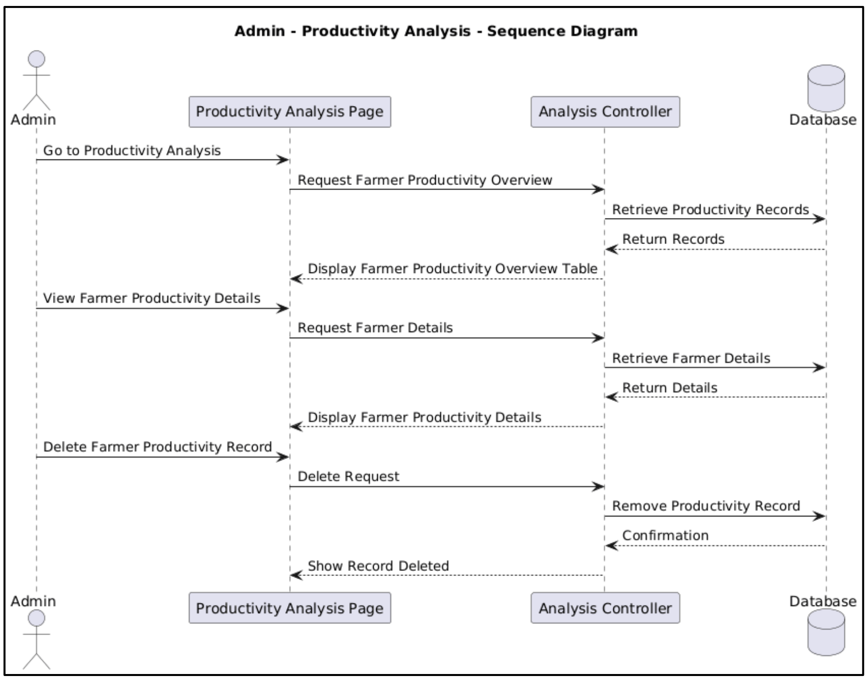


Figure 64. Admin – Productivity Analysis

The sequence diagram illustrates how an admin performs productivity analysis for farms. The process begins when the admin opens the Productivity Analysis tab, prompting the system to retrieve and display the list of farm productivity records. The admin may then select a specific farm to view detailed productivity analysis, which the Analysis Controller processes by requesting the necessary performance data from the database and returning the results for display. The admin may also choose to delete a productivity record, which is sent to the controller for removal from the database, followed by a confirmation returned to the admin.

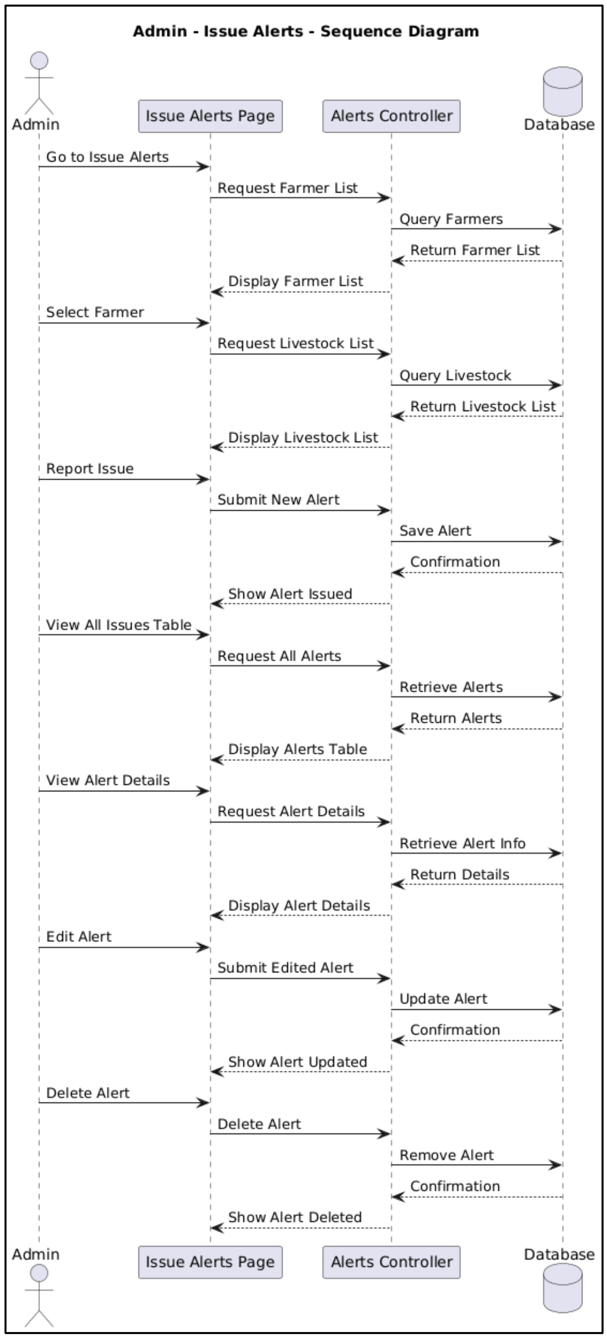


Figure 65. Admin – Issue Alert

The sequence diagram presents the process of an admin managing issued alerts. It begins when the admin opens the Issued Alerts tab. After the alerts are returned, the UI displays them in a table. When the admin updates an alert's status (e.g., resolved or not), the UI sends this change to the Alert Controller, which updates the alert record in the database. Once confirmed, the UI reflects the update.

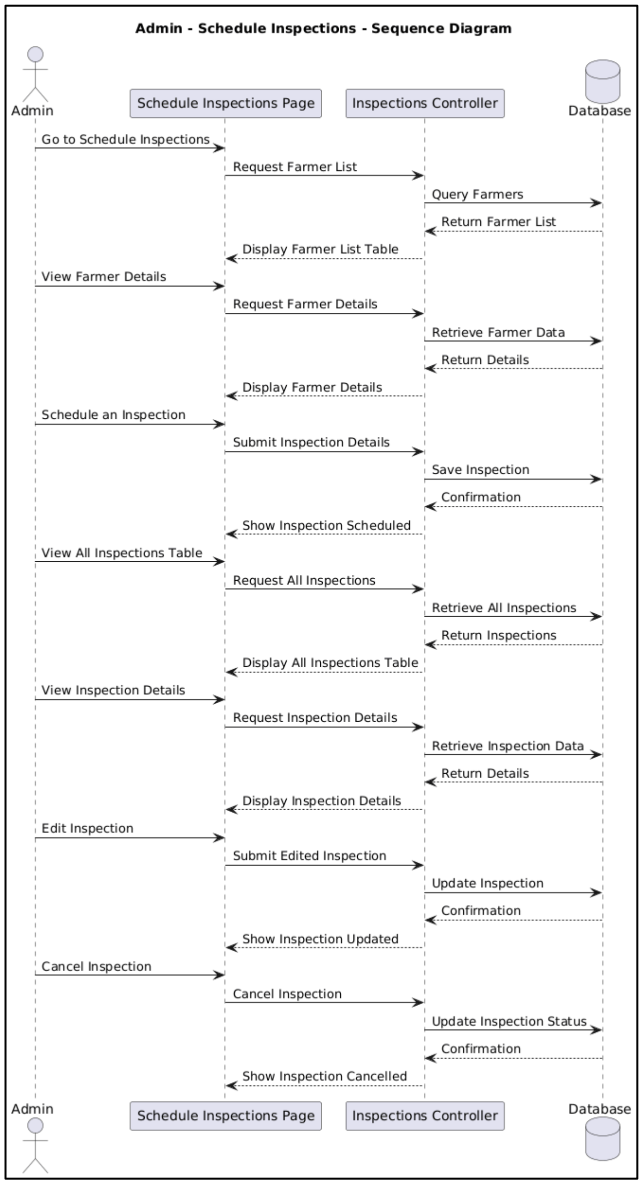


Figure 66. Admin – Schedule Inspections

The sequence diagram presents how an admin schedules farm inspection. It begins when the admin opens the Schedule Inspections tab, prompting the system to retrieve and display the list of upcoming and pending inspections. When the admin selects a specific farm or inspection entry, the system fetches and shows the corresponding details. The admin may then proceed to schedule a new inspection by entering the required information, which the controller validates and stores in the database.

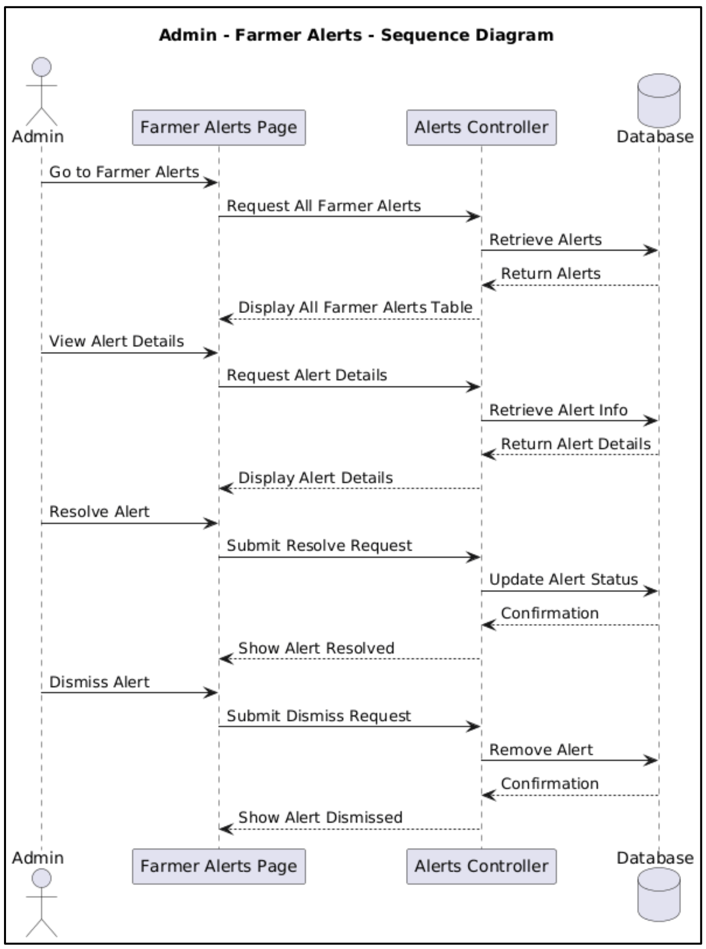


Figure 67. Admin – Farmer Alerts

The sequence diagram illustrates how an admin manages alerts related to farmers. The admin begins by accessing the Farmer Alerts tab, prompting the system to retrieve and display all active alerts. From the table, the admin can select an alert to view detailed information, resolve the issue, or dismiss it. Each action is processed through the Alerts Controller, which updates the database accordingly and returns a confirmation or updated status to the admin for display. This allows the admin to efficiently monitor and manage farmer-related alerts.

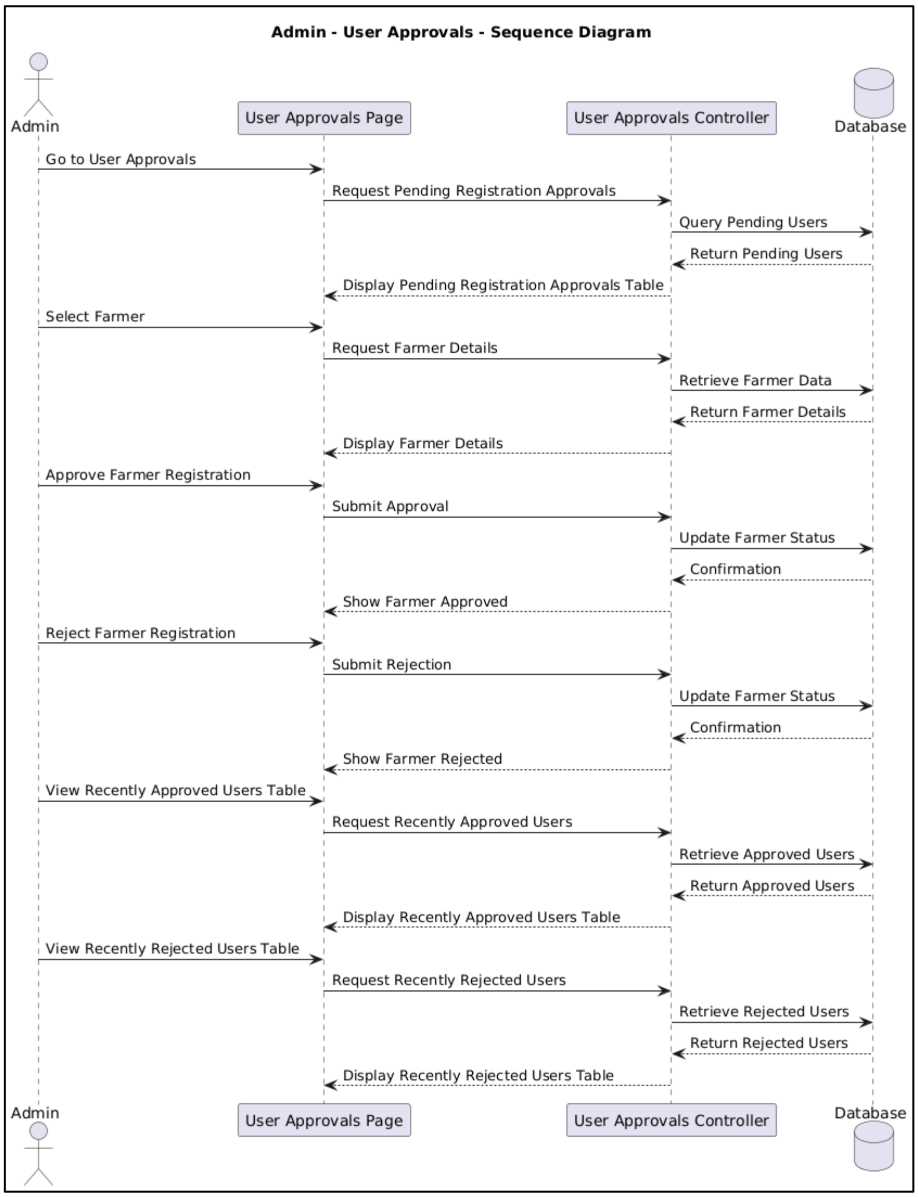


Figure 68. Admin – User Approvals

The sequence diagram illustrates how an admin handles user registration approval. The admin opens the User Approvals tab, which displays the pending registration table. The admin can select a user to view details, approve, or reject the registration, with each action processed by the User Controller and updated in the database. Additionally, the admin can review recently approved or rejected users, with the system retrieving and displaying the corresponding records for monitoring purposes.

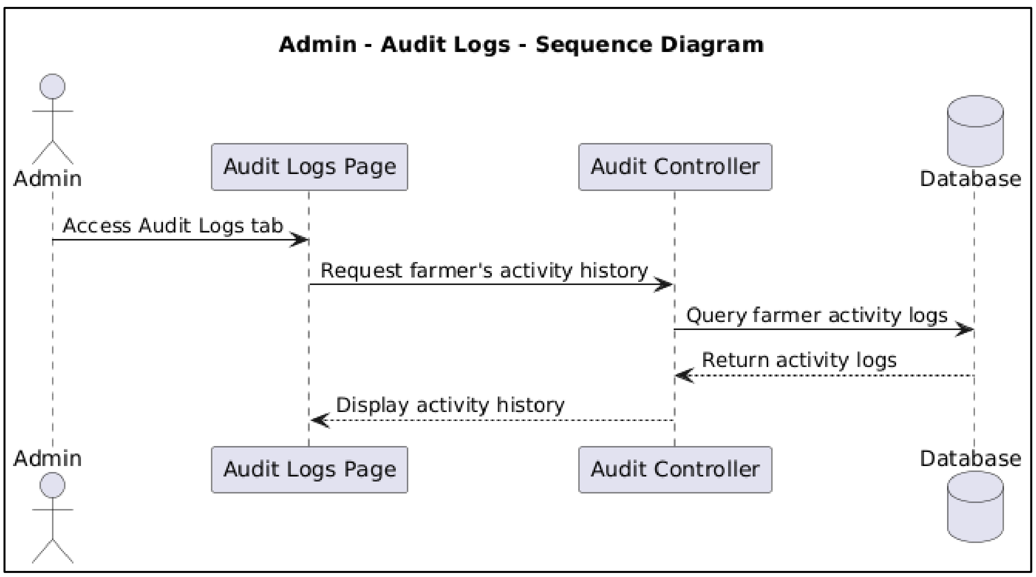


Figure 69. Admin – Audit Logs

The sequence diagram illustrates how an admin reviews system audit logs. Upon accessing the Audit Logs tab, the system retrieves and displays tables for Security Alerts & Critical Events, User Activity Summary, and Latest System Activity Logs. The admin can select any entry to view detailed information, with each request processed through the Audit Controller and fetched from the database. This allows the admin to monitor system activities and security events efficiently.

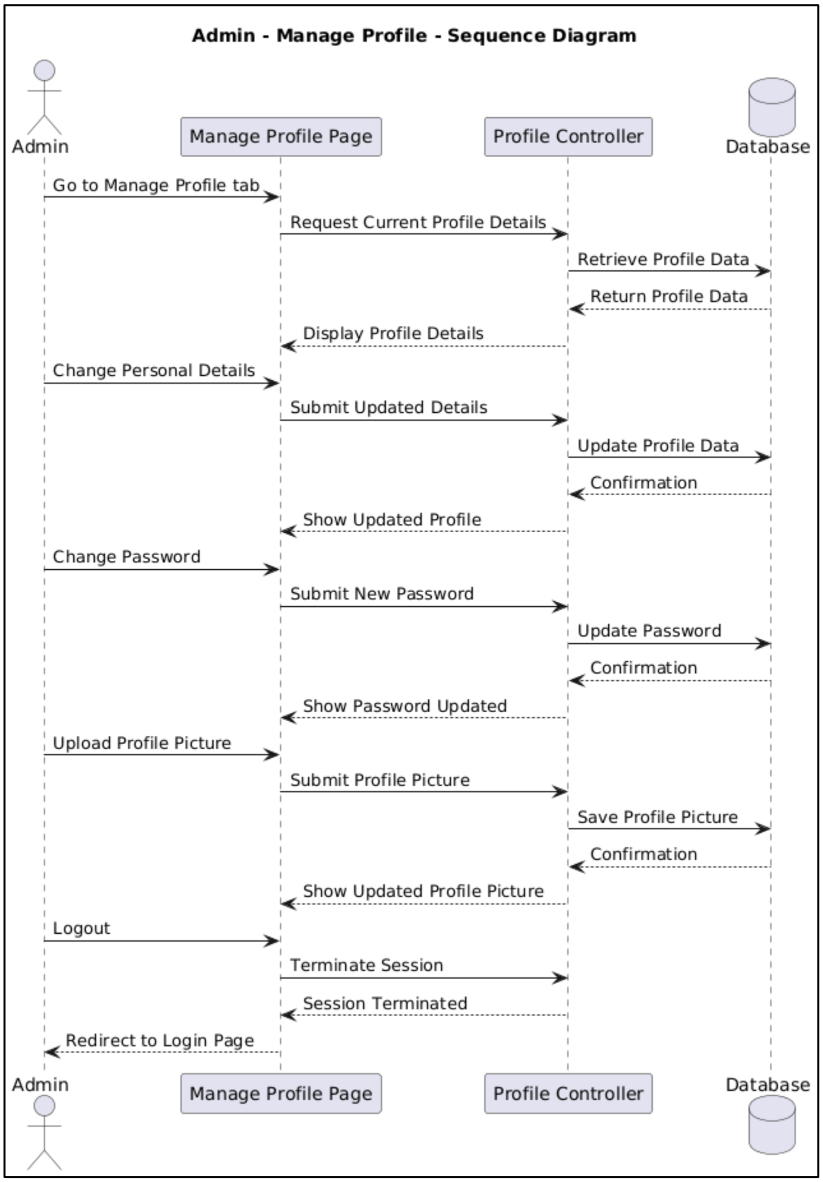


Figure 70. Admin – Manage Profile

The sequence shows the sequence of how Admin manages their profile. The process starts when the Admin click the "Manage Profile" tab, prompting the system to request and display the current profile data. The Admin can then update various details such as username, password, email, contact number, position, and address. Every change submitted to the system, which updates the corresponding data in the database. Additionally, the

Admin can upload a profile image and log out from the system. Each action is confirmed by the system to ensure successful updates.

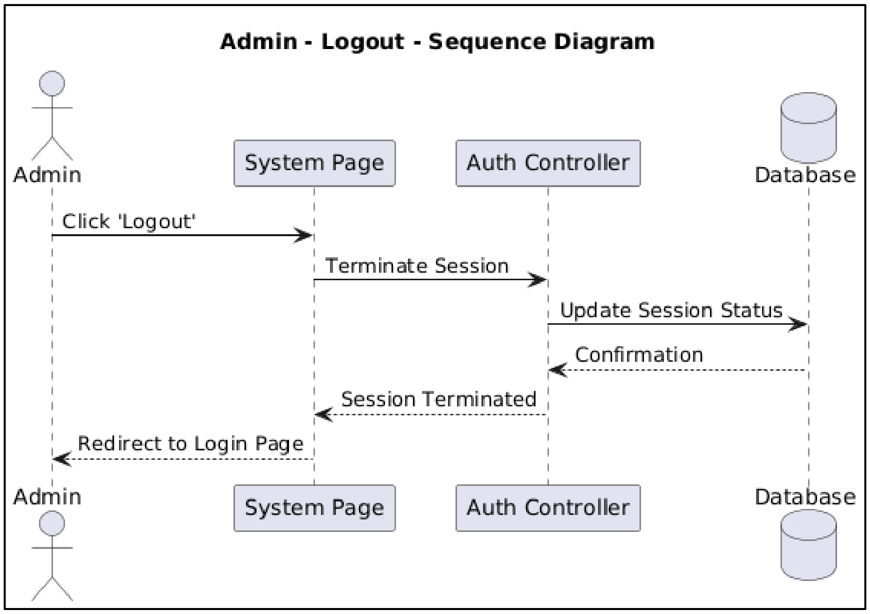


Figure 71. Admin – Logout

The sequence illustrates the logout process for an admin. The interaction starts when the admin clicks the logout button. The request is sent to the user interface (UI), which then ends the session. After the session is ended, the system redirects the admin to the login page.

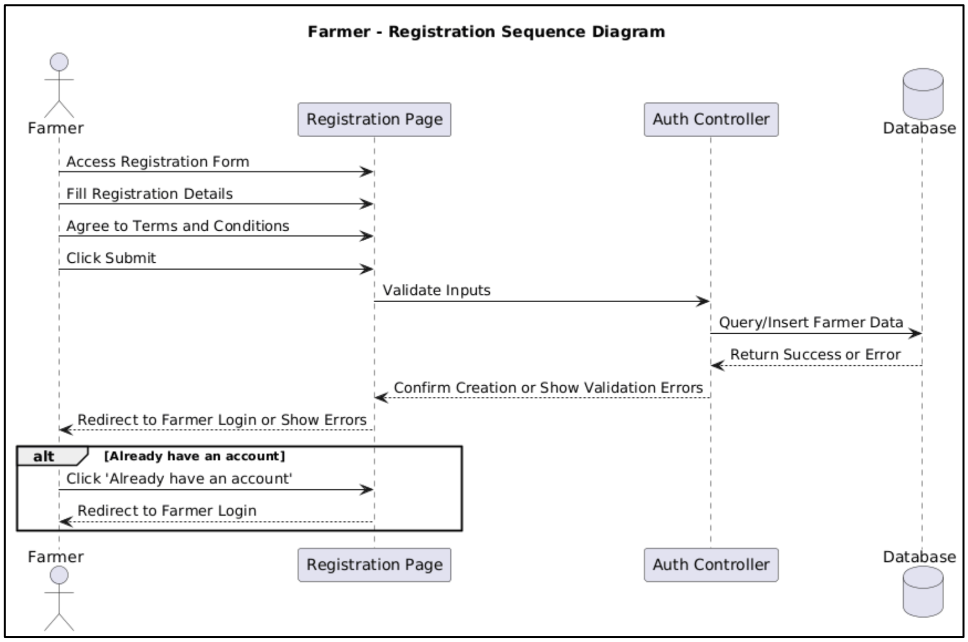


Figure 72. Farmer – Registration

The sequence diagram illustrates how a farmer registers an account in the system. The process begins when the farmer accesses the registration form and enters required details, including personal information, farm information, contact details, and login credentials. After agreeing to the terms and conditions, the farmer submits the form. The Registration Controller validates the inputs, stores the information in the database, and returns either a confirmation or an error message. If the farmer already has an account, they can select the “Already have an account” option to navigate back to the login page.

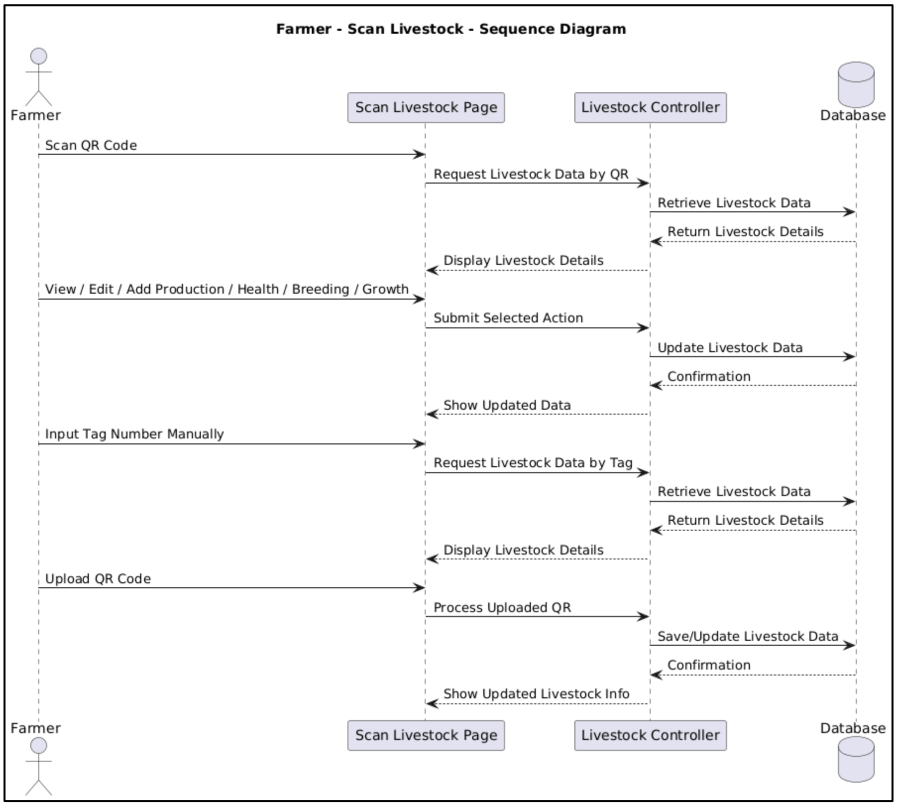


Figure 73. Farmer – Scan Qr

The sequence diagram illustrates how a farmer interacts with the system to manage livestock via QR codes. The process begins when the farmer scans a livestock QR code, which prompts the system to retrieve the livestock details. The farmer can then view detailed information, edit records, or add production, health, breeding, or growth data. Alternatively, the farmer may manually input the livestock tag number or upload a QR code. Each action is handled by the controller, processed in the database, and a confirmation or updated information is returned to the farmer for display.

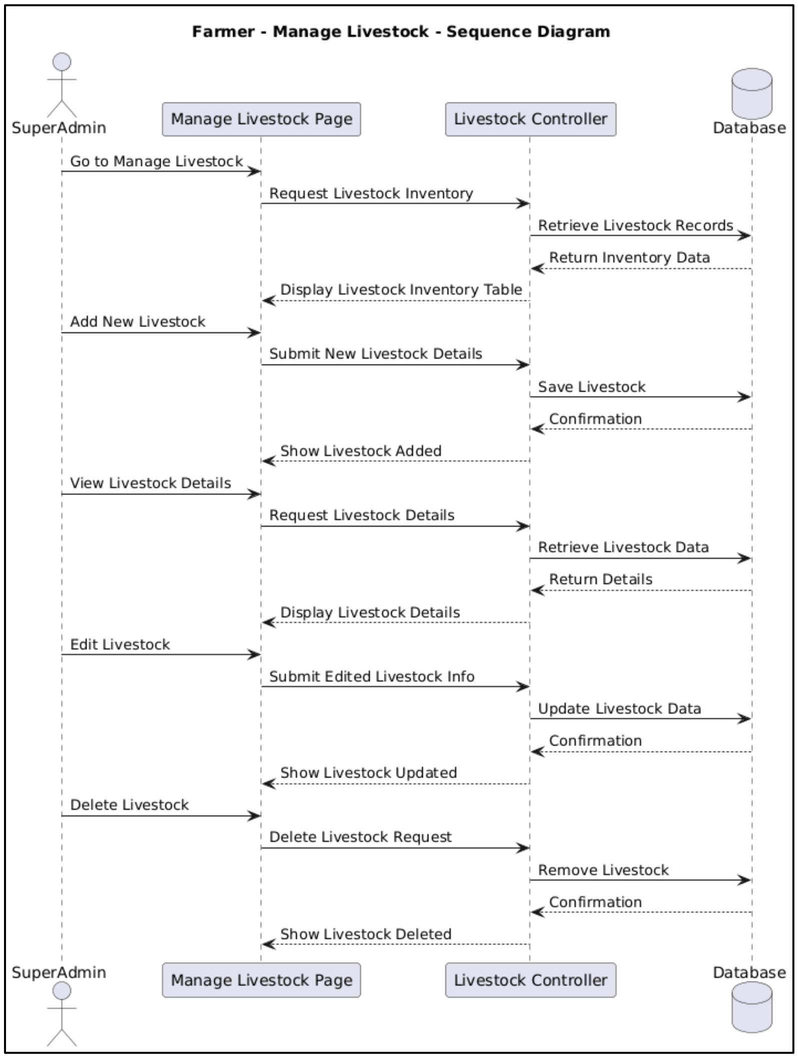


Figure 74. Farmer – Manage Livestock

The sequence diagram depicts how a farmer manages the livestock inventory. The process starts with the farmer accessing the Livestock Inventory table, which retrieves all existing livestock records. From this table, the farmer can add a new livestock record, view detailed information, edit existing records, or delete livestock entries. Each action is processed through the Livestock Controller and updated in the database, with the system confirming the changes or returning the requested information to the farmer

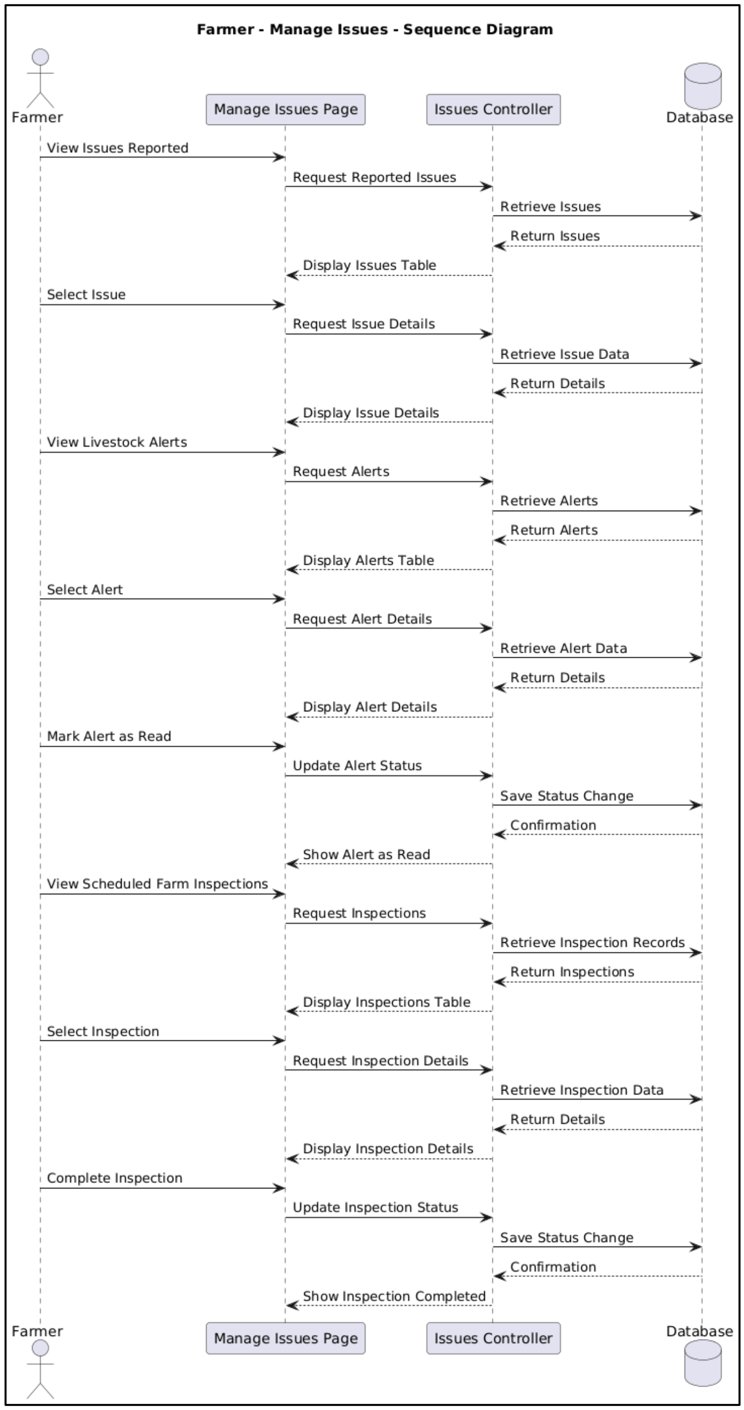


Figure 75. Farmer – Manage Issues

The sequence diagram illustrates how a farmer monitors and manages farm issues. The farmer begins by accessing tables for Reported Issues, Livestock Alerts, and

Scheduled Farm Inspections, each of which retrieves relevant records from the database. From these tables, the farmer can view details, mark alerts as read, or complete inspections. Each selected action is processed by the Issues Controller, updated in the database, and the system returns a confirmation or updated status to the farmer.

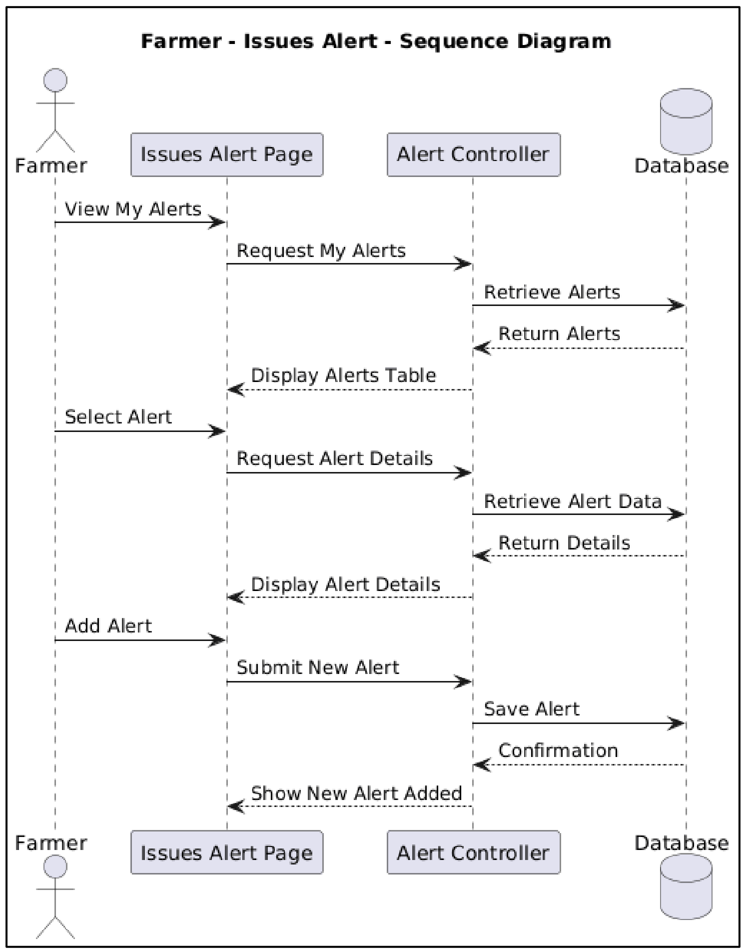


Figure 76. Farmer – Issues Alert

The sequence diagram shows how the farmer manages personal alerts. The farmer accesses the My Alerts table to either add a new alert or view the details of an existing alert. Each action is sent to the Alerts Controller, which processes the request, updates the database, and returns a confirmation or updated alert information to the farmer.

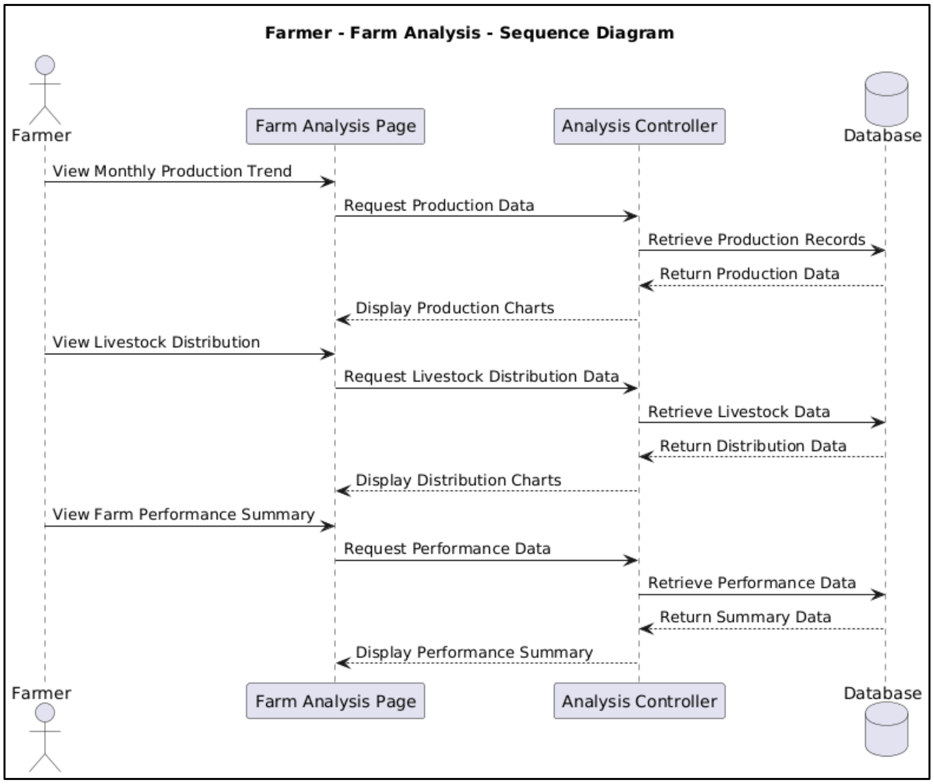


Figure 77. Farmer – Farm Analysis

The sequence diagram depicts how a farmer reviews overall farm performance. The farmer starts by opening the Farm Analysis tab, which retrieves records for Monthly Production Trends, Livestock Distribution, and Farm Performance Summary. The farmer may view detailed performance data for each category. Each request is handled by the Analysis Controller, which queries the database and returns the results to the farmer for display.

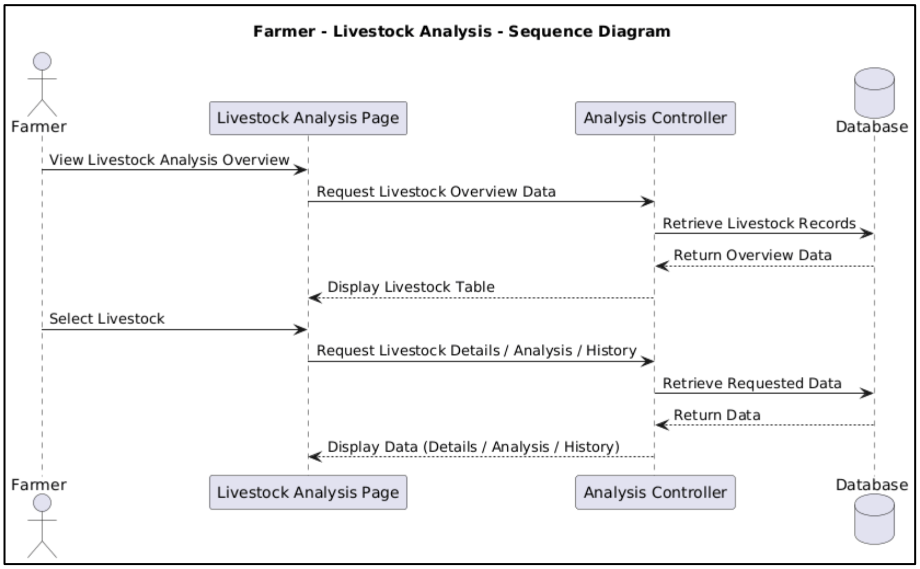


Figure 78. Farmer – Livestock Analysis

The sequence diagram illustrates how the farmer examines individual livestock performance. The farmer accesses the Livestock Analysis Overview table, selects a specific livestock, and can then view details, analyze performance, or review historical records. Each request is processed by the Analysis Controller and updated in the database, with the system returning the relevant data for display.

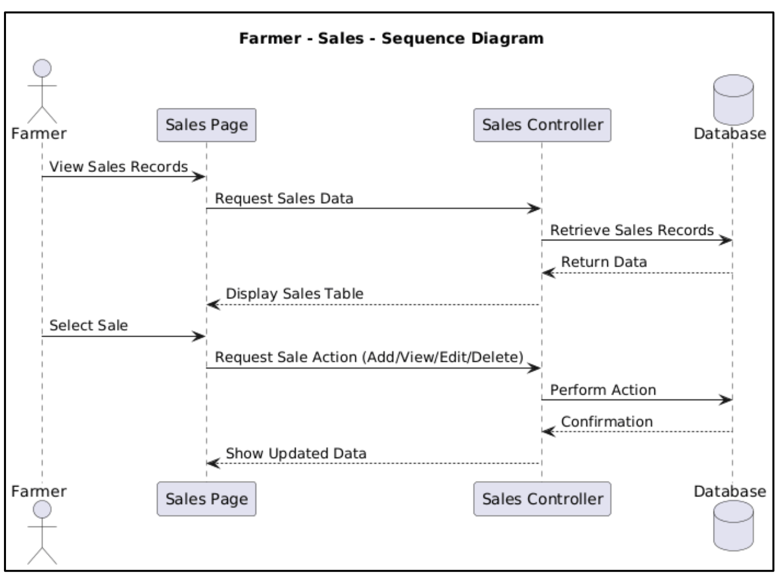


Figure 79. Farmer – Sales

The sequence diagram shows how a farmer manages sales records. The farmer opens the Sales Records table, which retrieves all existing sales data. The farmer can add new sales, view detailed information, edit records, or delete entries. Each action is processed by the Sales Controller, updated in the database, and confirmed back to the farmer.

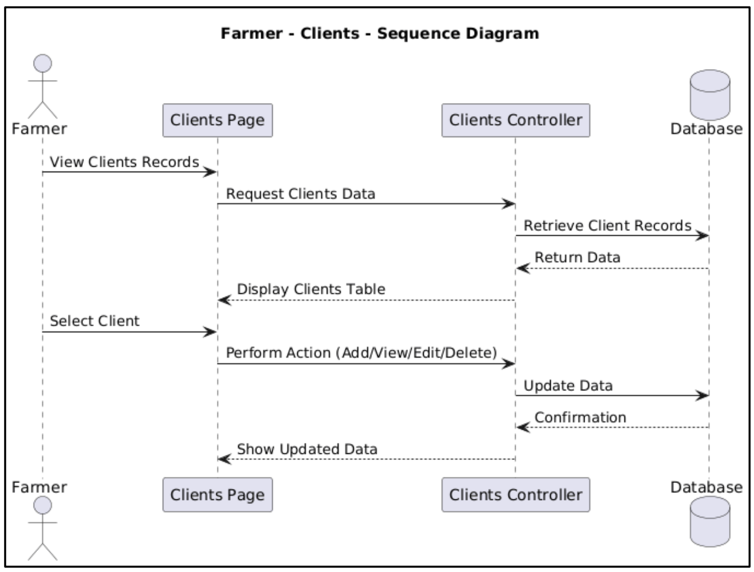


Figure 80. Farmer – Clients

The sequence diagram depicts how the farmer manages client information. Accessing the Clients Records table, the farmer can add new clients, view client details, edit existing records, or delete client entries. All actions are handled by the Clients Controller and synchronized with the database, with confirmations returned to the farmer.

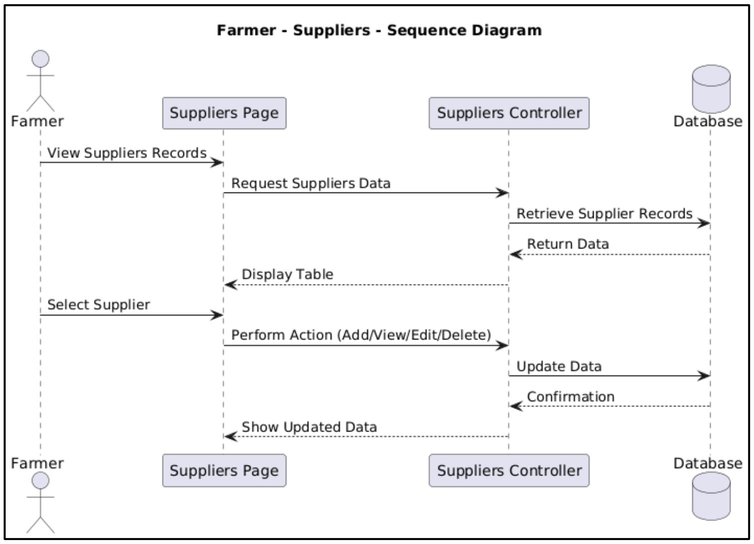


Figure 81. Farmer – Suppliers

The sequence diagram illustrates how the farmer manages supplier data. The farmer opens the Suppliers Records table and can add, view, edit, or delete supplier entries. Each request is handled by the Suppliers Controller, processed in the database, and the system returns confirmations or updated information.

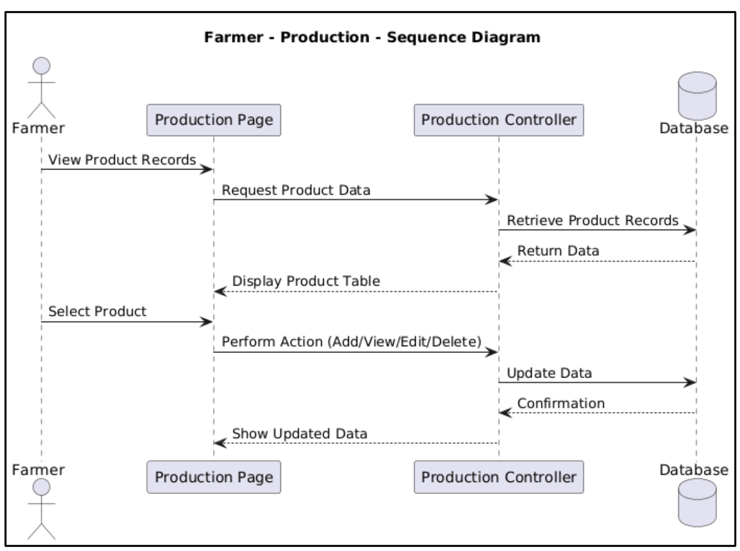


Figure 82. Farmer – Production

The sequence diagram shows how the farmer tracks farm production. The farmer accesses the Product Records table to add products, view details, edit entries, or delete records. Each action is processed by the Production Controller, updated in the database, and returned to the farmer for confirmation or display.

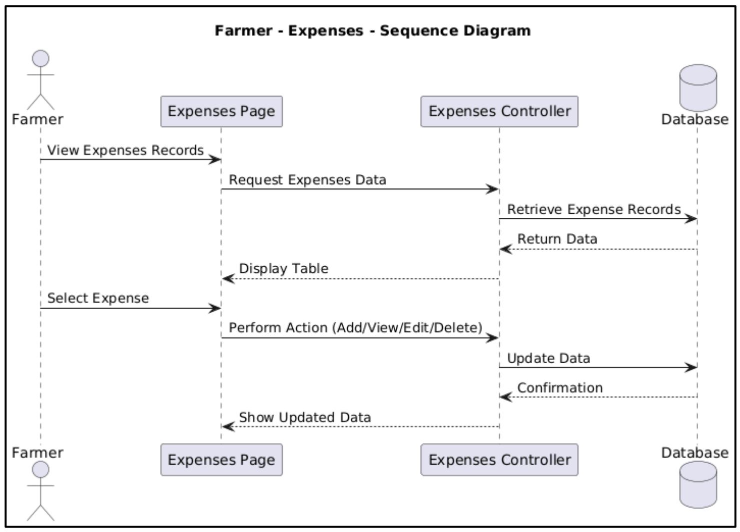


Figure 83. Farmer – Expenses

The sequence diagram depicts how the farmer manages expenses. The farmer opens the Expenses Records table to add new expenses, view detailed records, edit existing entries, or delete records. Each operation is processed by the Expenses Controller, updated in the database, and the system provides confirmation to the farmer.

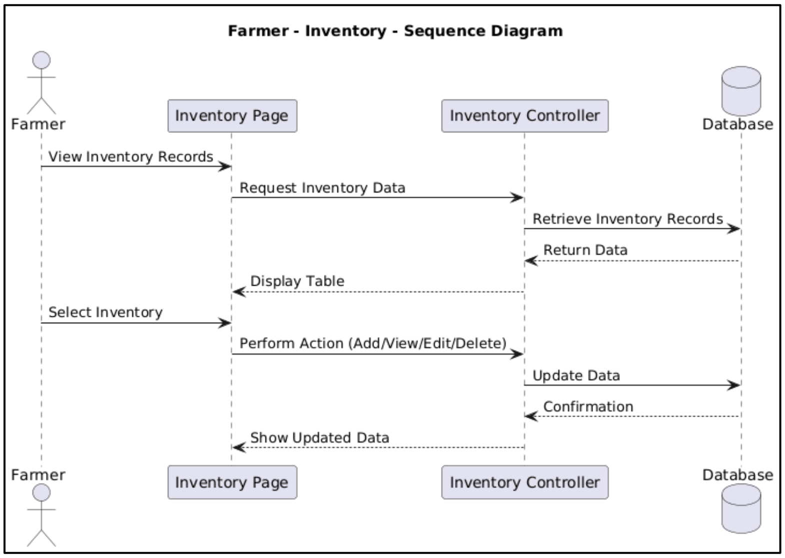


Figure 84. Farmer – Inventory

The sequence diagram illustrates how the farmer handles farm inventory. By accessing the Inventory Records table, the farmer can add items, view details, edit entries, or delete items. Each action is sent to the Inventory Controller, updated in the database, and confirmed back to the farmer.

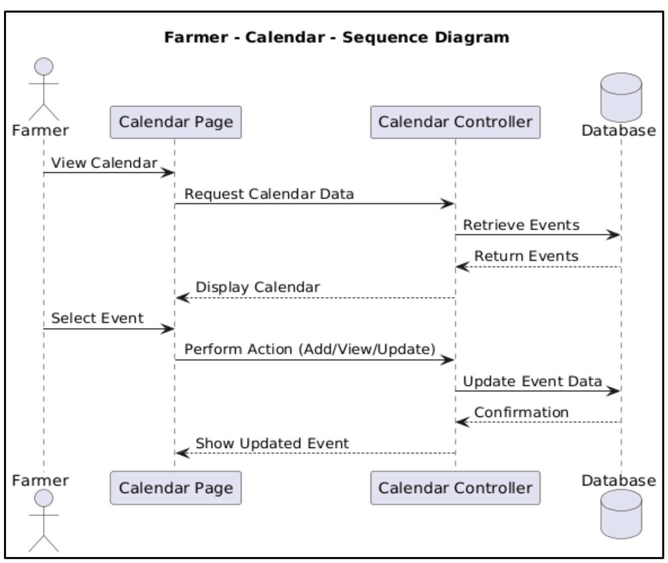


Figure 85. Farmer – Calendar

The sequence diagram shows how the farmer manages farm activities using the calendar. The farmer accesses the Farm Activity Calendar to add new events, view details of events, or update existing events. Each request is processed by the Calendar Controller, stored in the database, and returned to the farmer with confirmation.

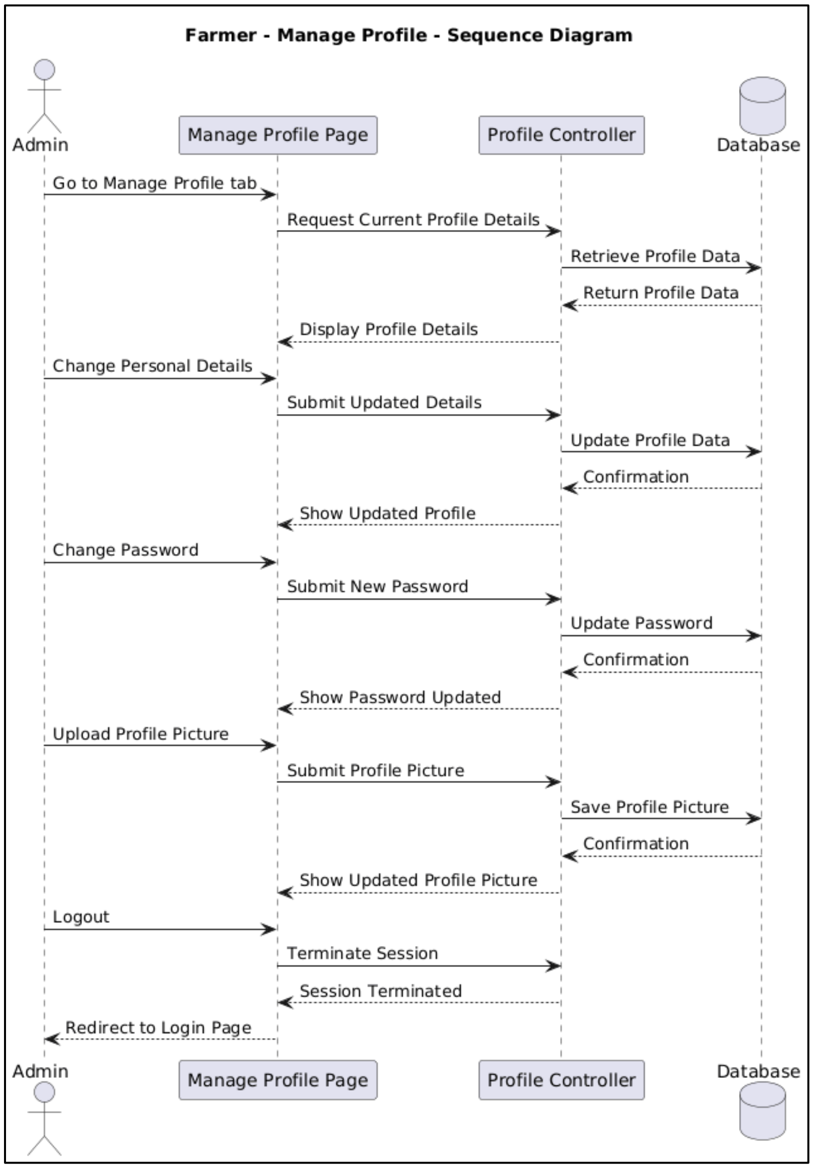


Figure 86. Farmer – Manage Profile

The sequence diagram illustrates how the farmer updates personal and account information. The farmer can change personal details, update the password, or upload a profile picture. Each action is processed by the Profile Controller, updated in the database, and confirmed back to the farmer.

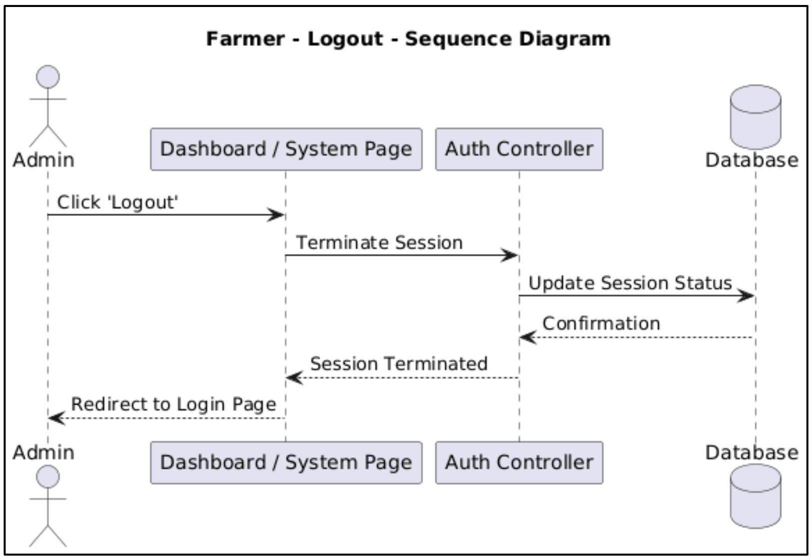


Figure 87. Farmer – Logout

The sequence diagram illustrates how the farmer updates personal and account information. The farmer can change personal details, update the password, or upload a profile picture. Each action is processed by the Profile Controller, updated in the database, and confirmed back to the farmer.

Class Diagram

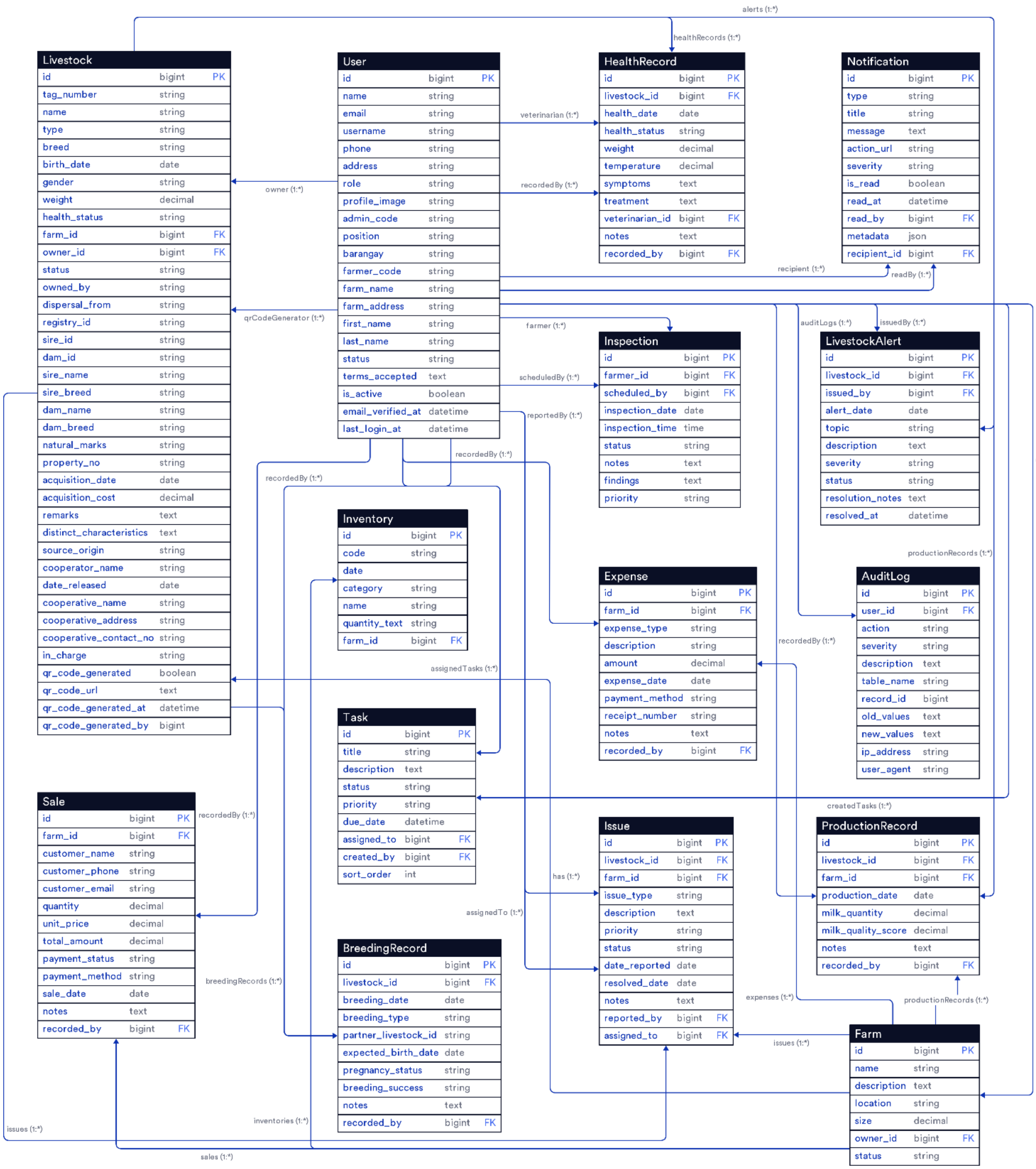


Figure 88. Class Diagram of LBDairy

The figure illustrates an integrated livestock and agricultural operations platform centered around the User entity, which manages multiple aspects of farm administration. The system tracks individual Livestock with detailed attributes including health status, breeding records, and genealogical information (sire/dam relationships), while maintaining associated HealthRecords for veterinary monitoring and Inspections for regulatory compliance. Users can manage their farm operations through connected entities like Farm (property details), Inventory (supplies and resources), and Tasks (work assignments), while the system facilitates Sales transactions and Expense tracking for financial management.

The platform includes a notification system that generates alerts for LivestockAlerts, Issues, and general farm activities, with all significant actions being logged in the AuditLog for accountability and traceability. ProductionRecords track output metrics like milk quantity and quality scores, while BreedingRecords manage reproduction cycles and genetic lineage, creating a complete end-to-end solution for modern farm operations that emphasizes data-driven decision-making, regulatory compliance, and operational efficiency across breeding, health management, production, and business aspects of agricultural enterprises.

Database Diagram

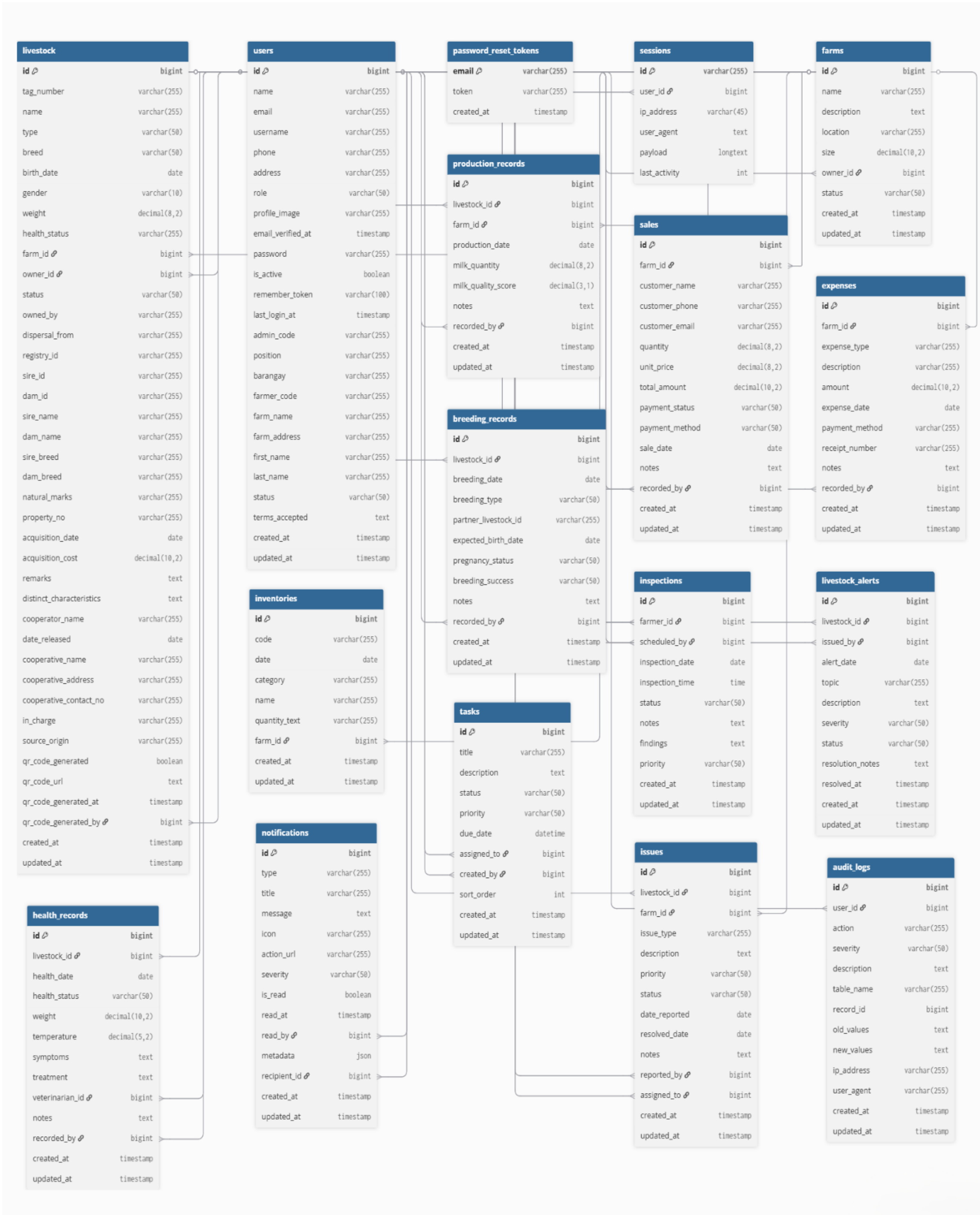


Figure 89. Database Diagram of LBDairy

The figure shows a livestock management system database schema with multiple interconnected tables organized around core entities. At the center are the users table, which manages all system users including farmers, administrators, and veterinarians with their personal information and roles, and the livestock table, which contains detailed records of individual animals including identification details, breeding information, health status, and cooperative data. The farms table connects livestock to their physical locations and ownership. Supporting these core entities are several operational tables: production_records tracks milk or other agricultural outputs with quality metrics; health_records maintain veterinary information including examinations, treatments, and vital signs; breeding_records documents reproduction activities and pregnancy tracking; sales manage customer transactions and revenue; expenses track farm expenditures and costs; and inventory catalogs farm supplies and resources.

The system also includes management and monitoring features through inspections for scheduled farm evaluations, livestock_alerts for important notifications about animal conditions, issues for problem tracking and resolution, and tasks for workflow coordination. Administrative support is provided by notifications for user communications, audit_logs for system activity tracking, sessions for user authentication management, and password_reset_tokens for secure account recovery, creating a complete enterprise-level solution for managing all aspects of livestock farming operations from animal care to financial management.

Deployment Diagram

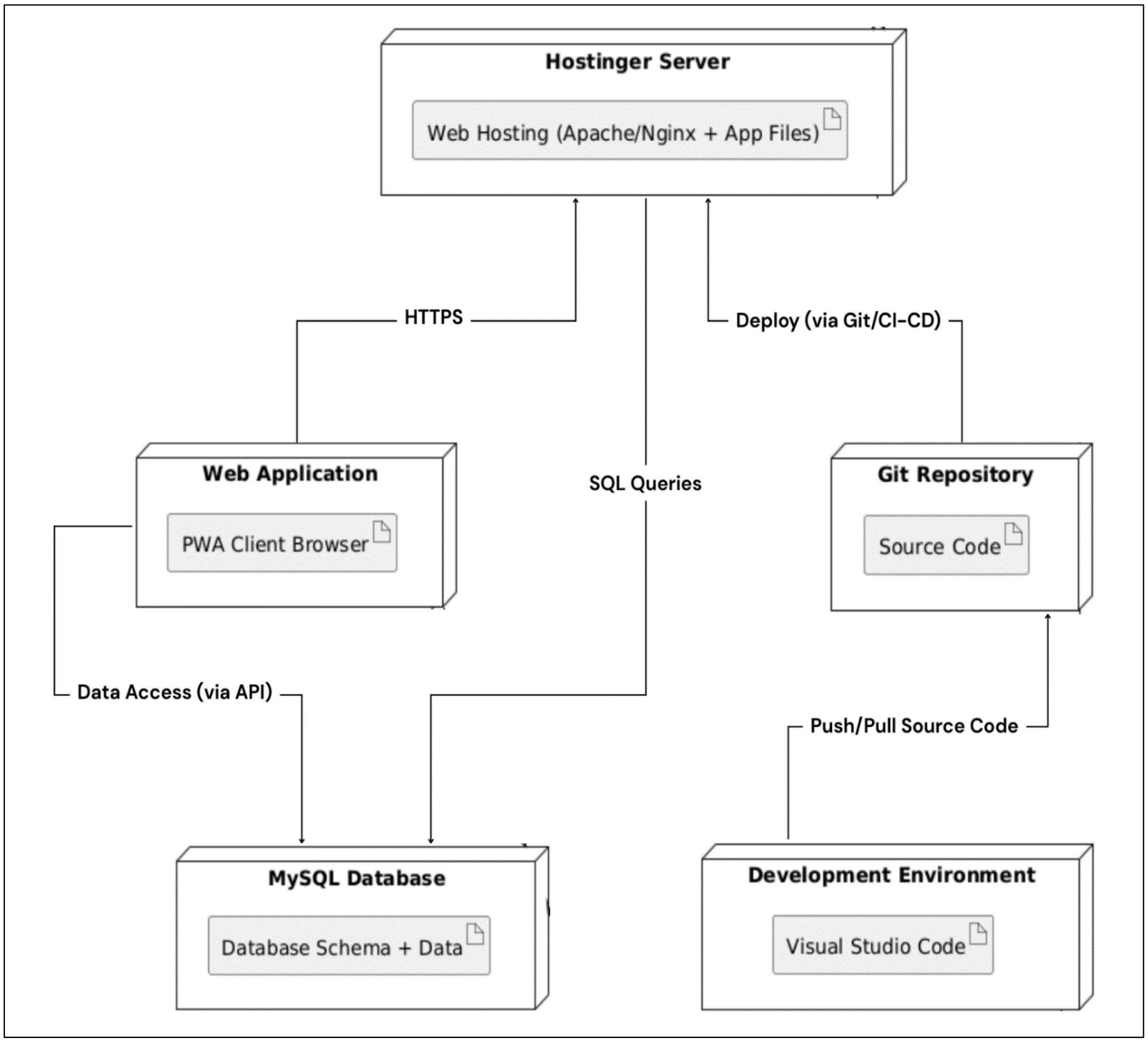


Figure 90. Deployment Diagram of LBDairy

The figure demonstrates the procedure of a web-based system implementing development, version control, hosting, database, and client interaction. The Development Environment uses Visual Studio Code for writing and editing code. The code is managed in a GitRepo, where the Source Code is stored for tracking changes and collaboration. Once development is finalized, the application is deployed to Hostinger, which serves as the Web Hosting provider. The system's data is stored in MySQL, which handles the Database functions. Users can access the application through a Web Application that runs in a PWA Client Browser, allowing for a responsive and accessible user experience. This structure provides a streamlined and connected environment from code development to end-user interaction.

System Development

The LBDAIRY system was developed using an Agile-Kanban methodology that was organized into five main sprints, each of which corresponded to a significant stage of the 12-week schedule. With this strategy, the team was able to provide features gradually while retaining the adaptability to adjust to the needs of stakeholders and evolving requirements. Sprint 1 of the project started with the establishment of the system's fundamental infrastructure. This involved backend programming, including creating the livestock records database structure, setting up API endpoints, and incorporating services for creating QR codes. In Sprint 2, frontend development and the deployment of Progressive Web Applications (PWAs) took over. The user interface was designed for desktop and mobile devices, integrating offline data synchronization using service workers and QR code scanning capabilities. The system's sophisticated productivity analysis tools were launched in Sprint 3, enabling data-driven insights into breeding cycles, milk yield, animal health, and herd performance as a whole. The goals of Sprint 4 were to consolidate the previously created components into a single system, enhance performance, and validate the entire process through comprehensive testing in a range of scenarios. Lastly, Sprint 5 concentrated on deployment preparation, which included production server configuration, end-user training, and documentation.

With well-defined phases from backlog to done, the Kanban board directed development progress during each sprint, guaranteeing systematic task management and adherence to work-in-process (WIP) constraints. Frequent standup meetings, sprint reviews, and retrospectives encouraged open communication and ongoing development among team members and stakeholders. A dependable, practical, and easy-to-use livestock management system that was customized to meet the operational requirements of the Lucban Municipal Agriculture Office was successfully delivered thanks to this methodical, sprint-driven process.

Development and Testing Procedure/System Testing

In the development and testing procedure of the LBDAIRY system, a structured and detailed approach was followed to ensure the quality, accuracy, and usability of the web-based application. At the start, the researchers collaborated closely with the Lucban Agriculture Office staff to design the system interface and core features in line with actual livestock management workflows and field conditions. After gathering the necessary requirements, a prototype was developed with key functionalities such as QR code tagging, real-time data entry, livestock profiles, and productivity tracking.

During the development phase, regular consultations and feedback sessions were held with agriculture officers and selected farmers to identify needed improvements and ensure the system remained user-friendly and practical. Once the initial development was completed, the researchers conducted a series of testing activities to assess the system's functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, flexibility, and data safety. Test results and user feedback were carefully recorded and used to enhance the system's design, responsiveness, and accuracy.

Furthermore, the researchers carried out security testing to ensure that all livestock records and user information were properly protected, especially when the system was used in offline mode or during field operations. This incremental and feedback-driven development and testing process allowed the LBDAIRY system to be continuously refined until it met the standards of reliability and effectiveness required for actual use in the Lucban Municipal Agriculture Office.

Description of Prototype

This section provides an overview of the LBDairy prototype, highlighting each page of the platform along with its mobile view.

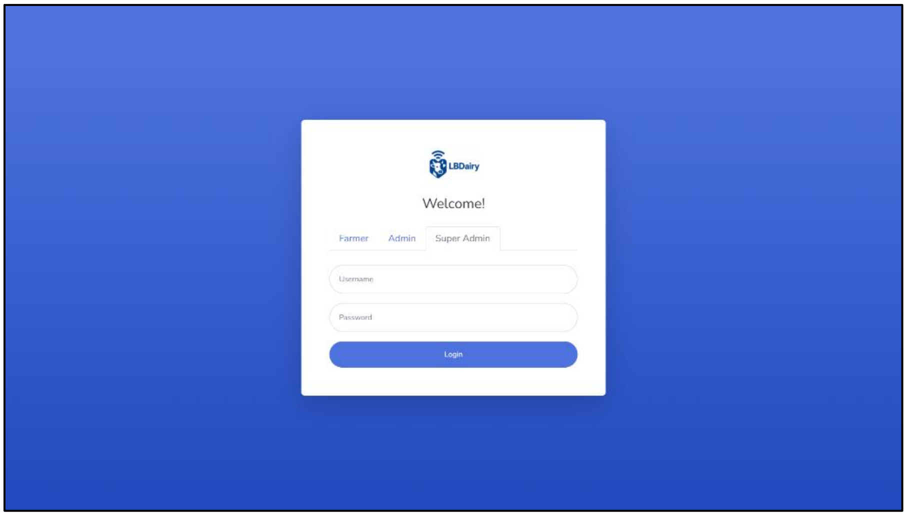


Figure 91. Log in Page for Super Admin

This login page is strictly for the super administrator who oversees the entire system infrastructure. It allows access to all admin and farmer data, settings, and high-level controls. No registration button is shown to maintain strict access control.

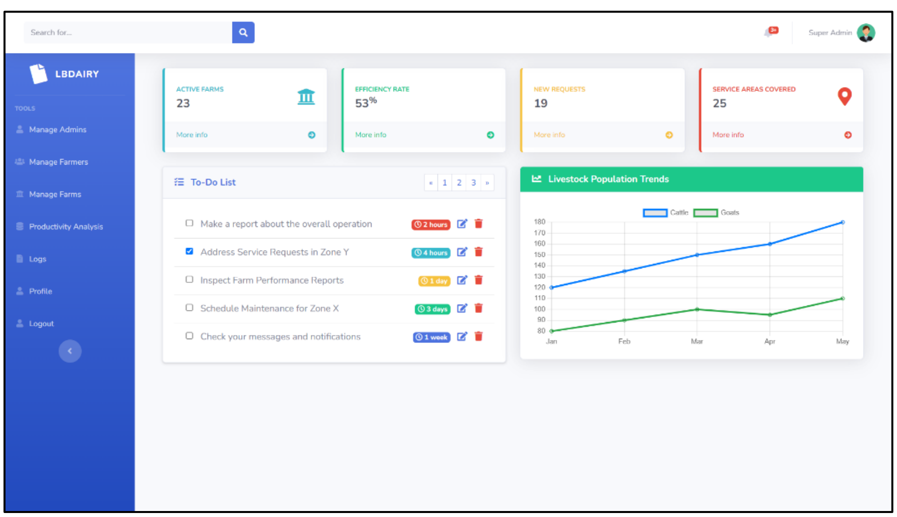


Figure 92. Dashboard Page for Super Admin

This shows an overview of the system's activity and metrics. It highlights farm performance, admin status, and user statistics. This allows the Super Admin to quickly navigate through key sections.

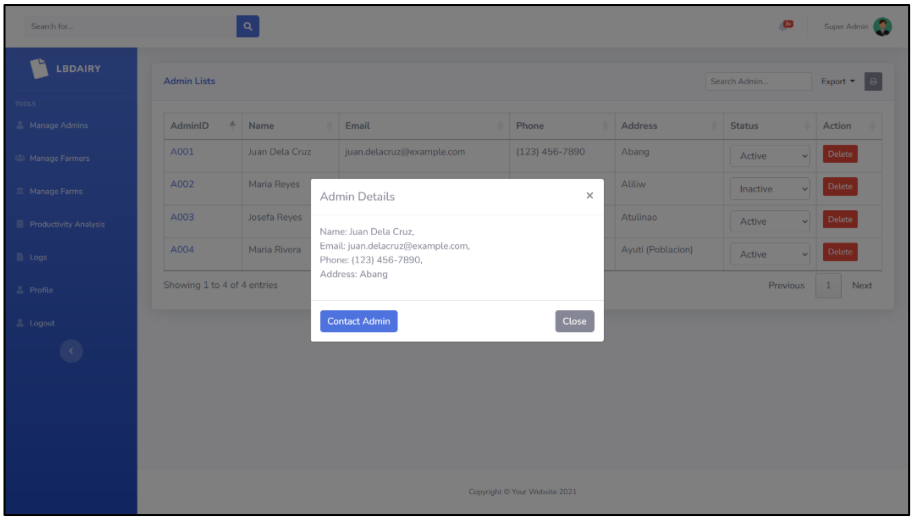


Figure 93. Manage Admin Page for Super Admin

This allows the Super Admin to view and manage all registered admin users. It provides options to add, edit, or remove admin accounts. This ensures full control over administrative roles in the system.

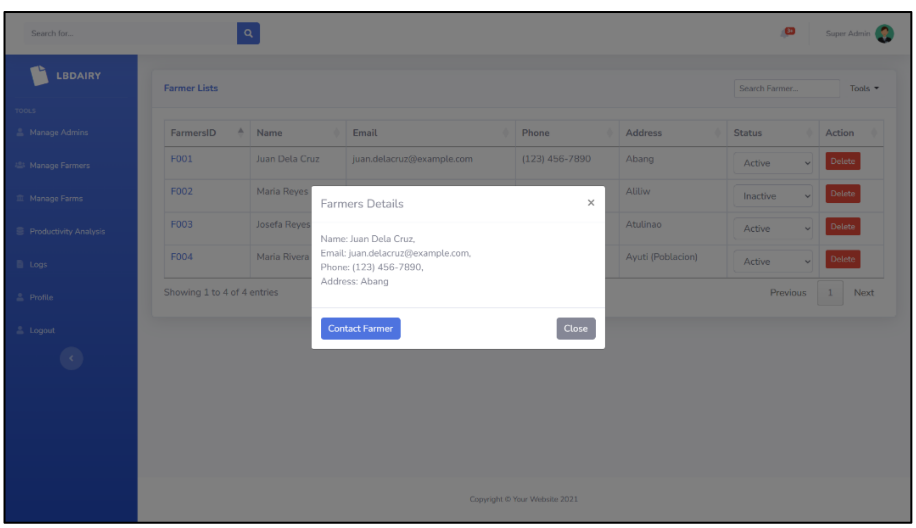


Figure 94. Manage Farmers Page for Super Admin

This shows the list of all registered farmers in the system. It allows the Super Admin to monitor and manage farmer details and access. This ensures that only verified farmers can use the platform. This page can also import a csv file, wherein it can directly add the data to the table.

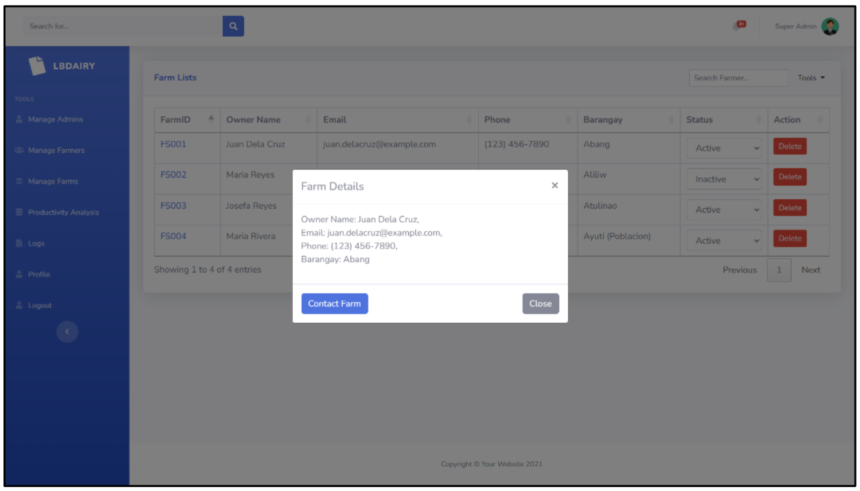


Figure 95. Manage Farm Page for Super Admin

This provides access to all farm records under the system. It shows farm names, owners, addresses, and registration status. This allows the Super Admin to oversee and validate active farms. This page can also import a csv file, wherein it can directly add the data to the table.

Figure 96. Productivity Analysis Page for Super Admin

This shows productivity charts such as milk output and livestock trends. It allows exporting of reports in CSV, PDF, or PNG formats. This helps in evaluating overall farm efficiency and performance.

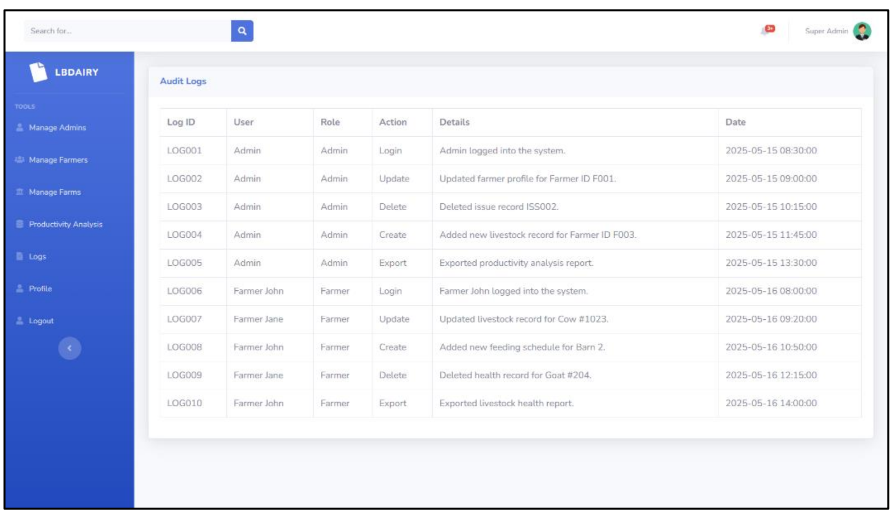


Figure 97. Audit Logs Page for Super Admin

This displays the system’s audit logs and recorded user activities. It allows the Super Admin to review actions performed across the platform for accountability and traceability. This ensures transparency, security, and effective monitoring of system usage.

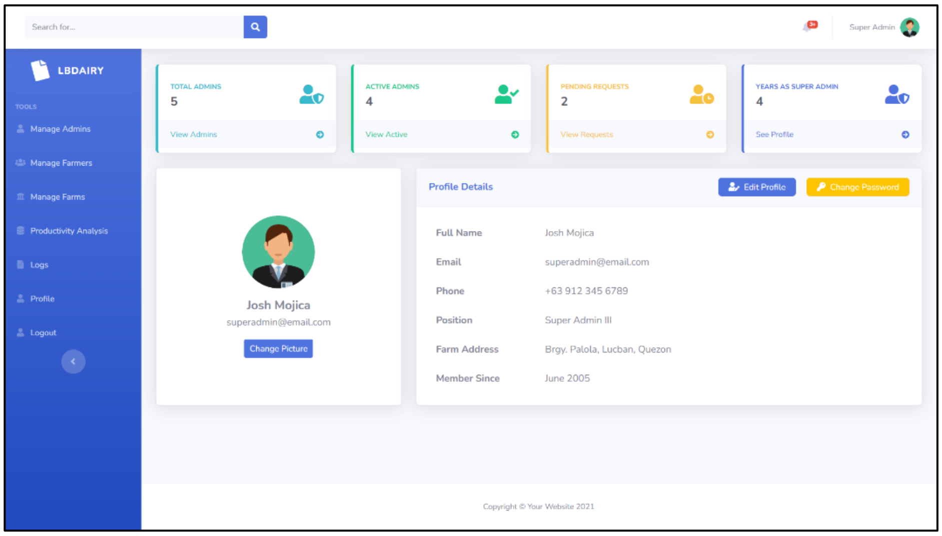


Figure 98. Profile Page for Super Admin

This displays the Super Admin's account information and profile details. It allows updating personal data like username and resetting the password. This ensures secure and personalized account management.

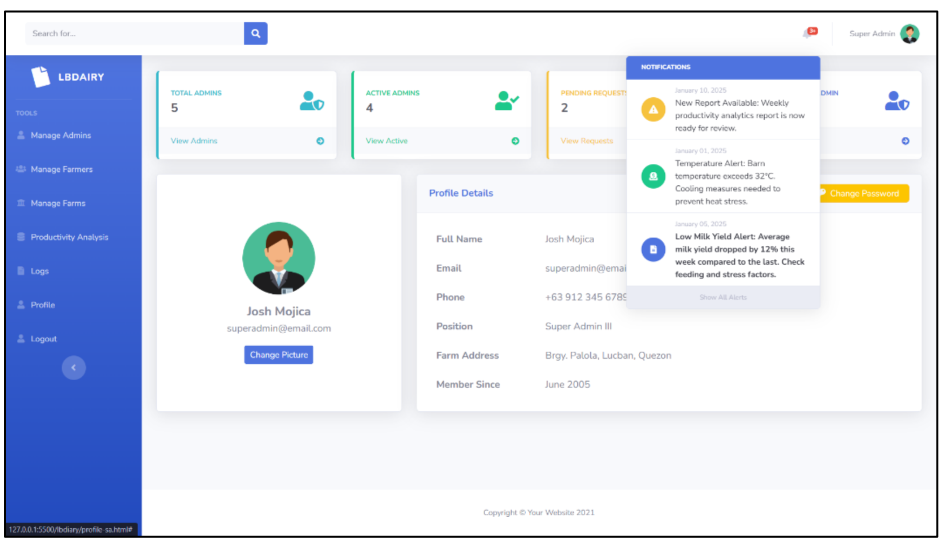


Figure 99. View Notification Page for Super Admin

This shows real-time alerts related to farmers, admins, and farms. It includes system updates, issue reports, and pending actions. This allows the Super Admin to stay informed and respond quickly.

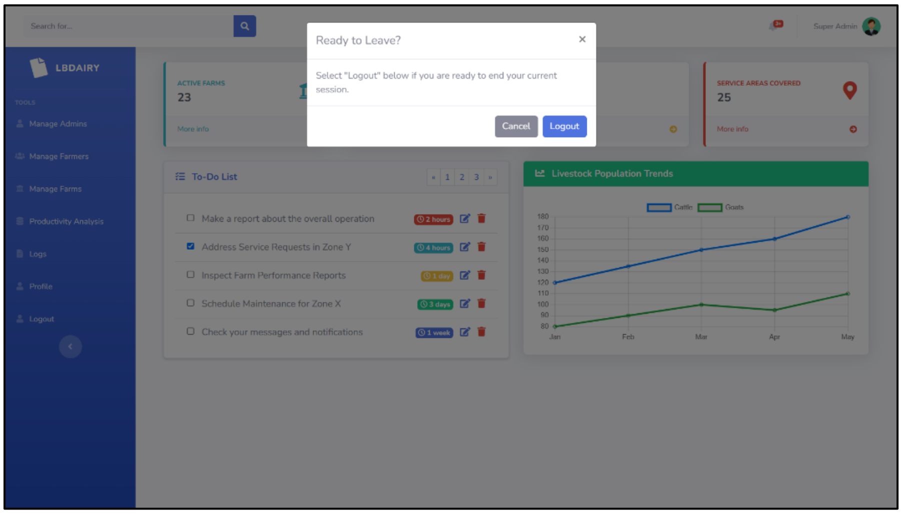


Figure 100. Logout Page for Super Admin

This allows the Super Admin to securely exit the platform. It ends the current session and redirects to the login page. This ensures account safety and prevents unauthorized access.

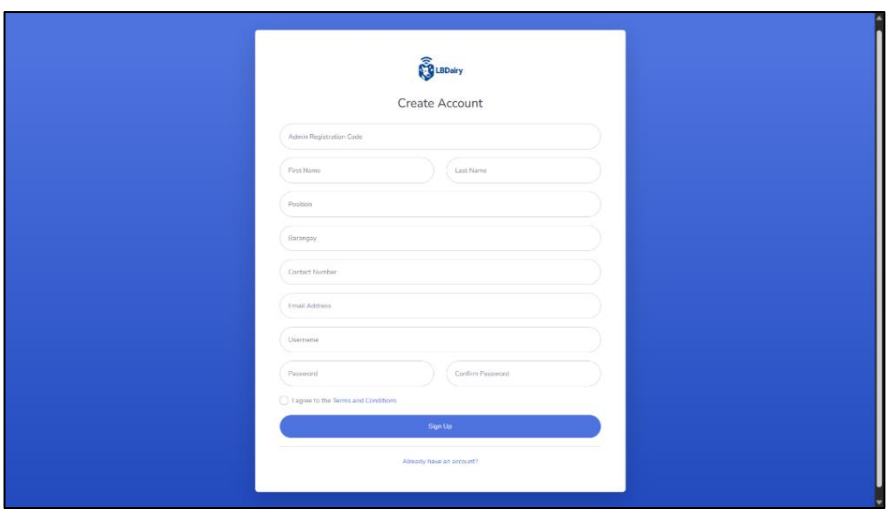


Figure 101. Register Page for Admin

This allows new admins to sign up using a valid admin registration code. It shows fields for identity, contact details, position, and system login information. This ensures secure registration and proper role assignment for administrative access.

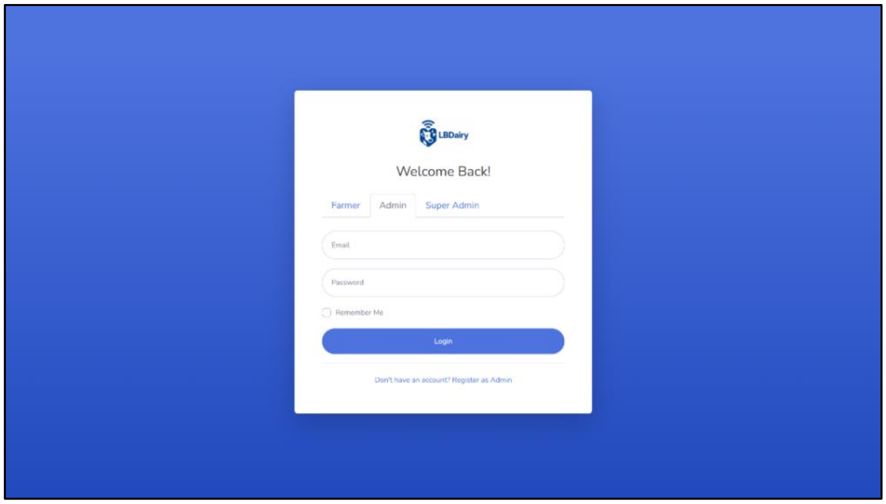


Figure 102. Login Page for Admin

This allows admins to log in up using a valid admin registration code. The form includes username, password, and a "Remember Me" checkbox for convenience. A registration option is available for new admins via the "Register as Admin" button.

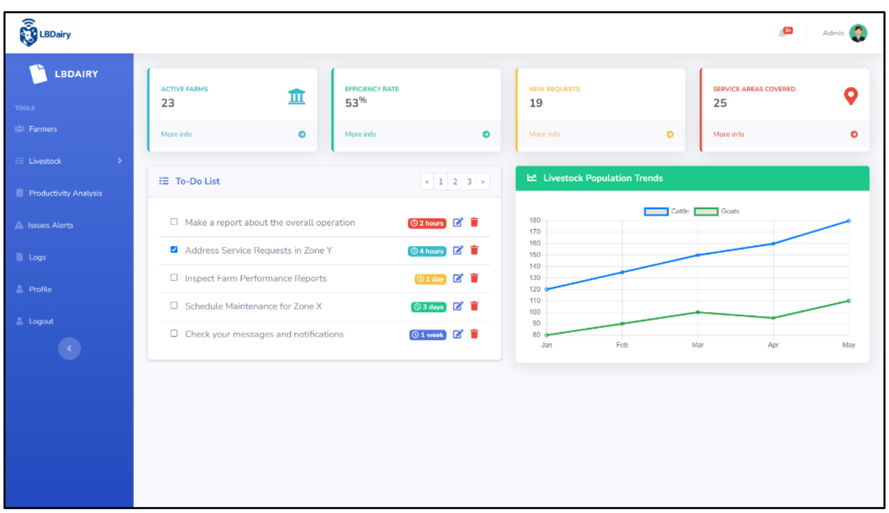


Figure 103. Dashboard Page for Admin

This displays the Admin’s dashboard with an overview of farm activities and system statistics. It allows monitoring of livestock records, farmer interactions, and operational metrics. This ensures efficient management, quick access to data, and streamlined administrative control.

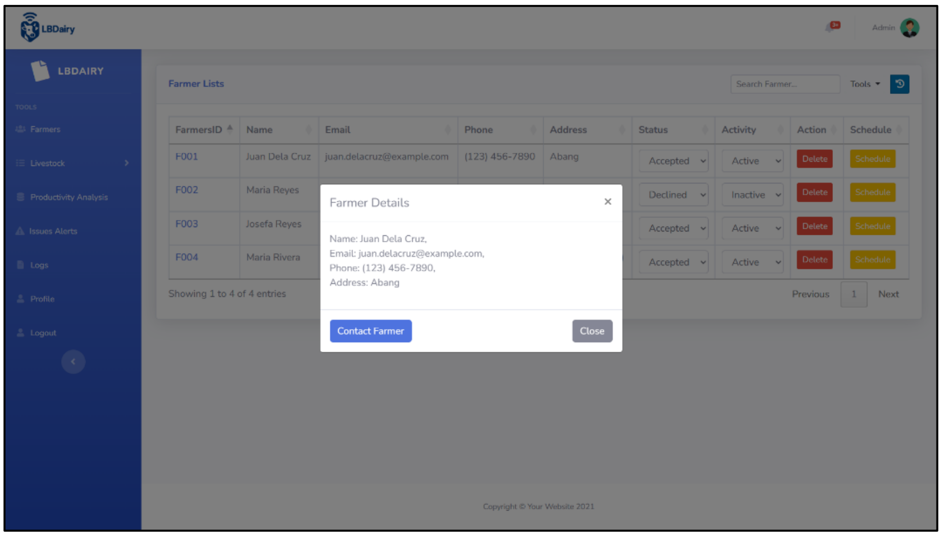


Figure 104. Manage Farmer Page for Admin

This allows the admin to view, add, and manage registered farmers. It shows farmer details such as contact, status, and farm association. This ensures proper oversight and user validation.

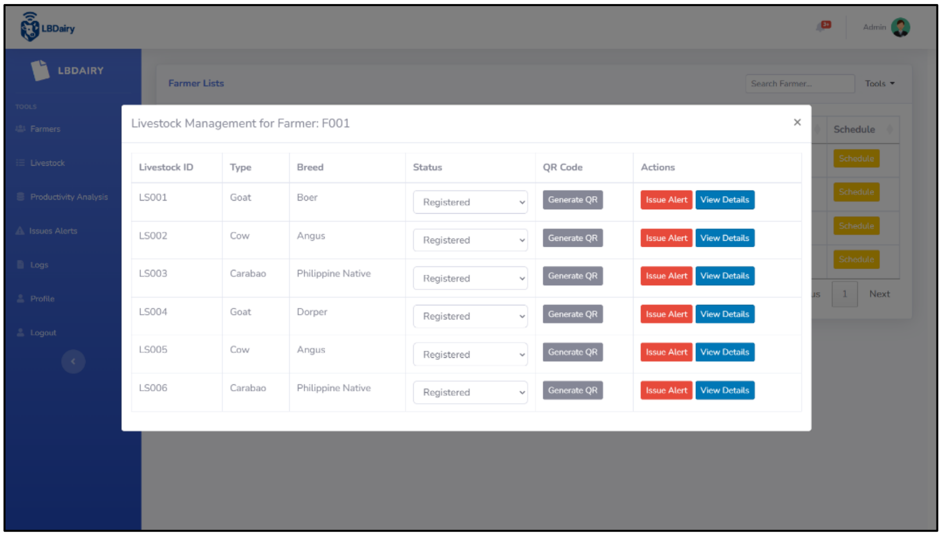


Figure 105. Manage Livestock Page for Admin

This allows users to view, edit, and monitor all livestock records under their assigned farms. It shows detailed information such as livestock type, status, registration ID, breed, health, and breeding data. This provides centralized control for livestock management, including QR generation, issue alerts, and productivity tracking.

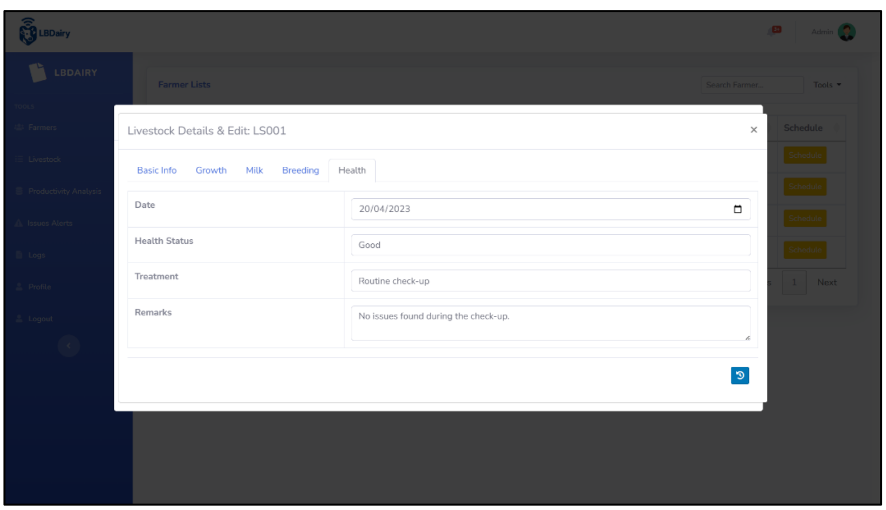


Figure 106. Health Record Page for Admin

This shows medical records for livestock including observations, diagnoses, and treatments. It allows the admin to log and edit health data per animal. This ensures continuous health monitoring and management.

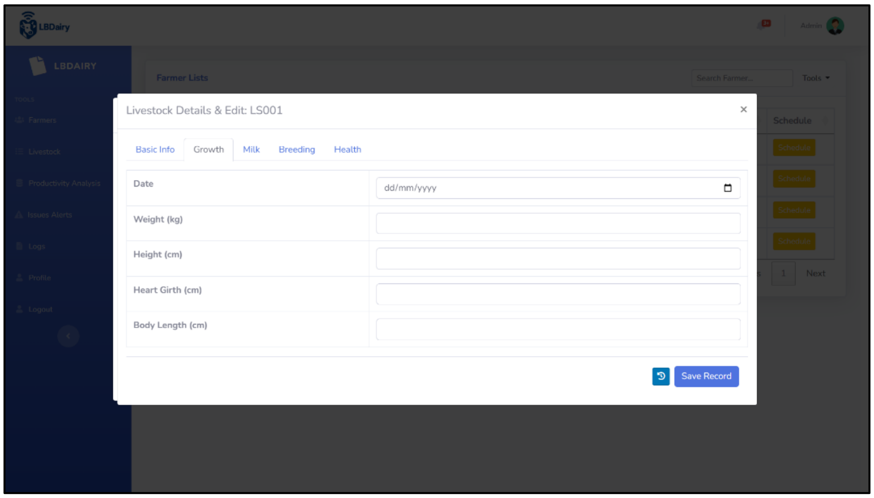


Figure 107. Growth Record Page for Admin

This provides input and tracking of livestock weight, height, and other growth metrics. It shows historical trends and performance per animal. This allows admins to assess growth progress and adjust care plans.

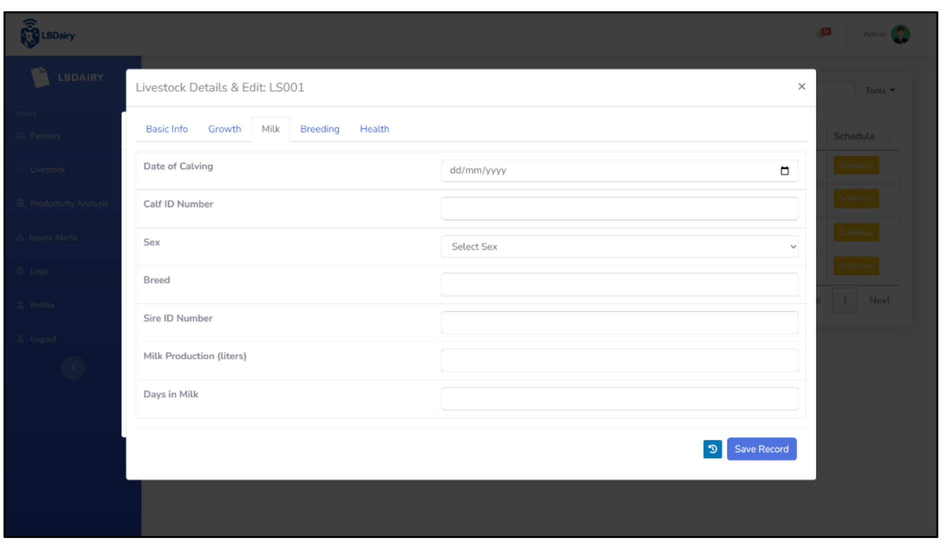


Figure 108. Calving and Milk Production Record Page for Admin

This shows milk yield data per livestock or farm. It allows the admin to input and compare production across dates or animals. This helps in evaluating productivity and identifying top-performing animals.

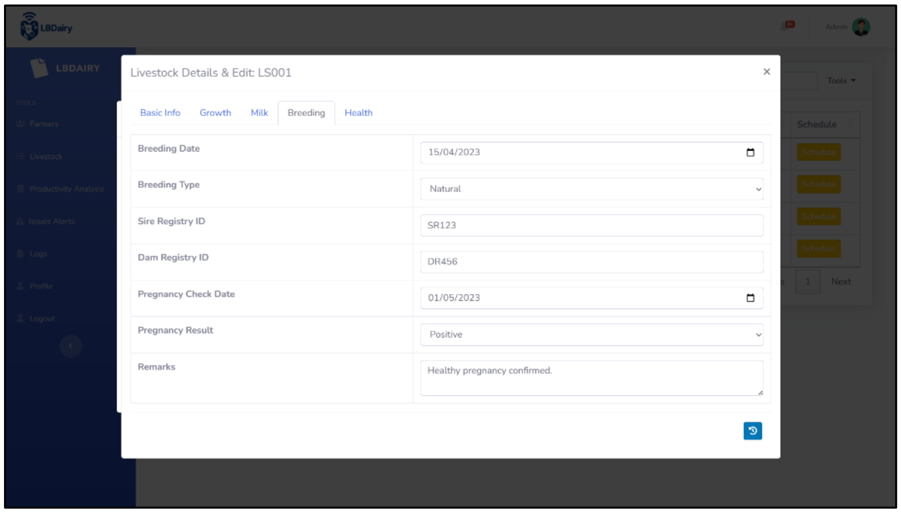


Figure 109. Breeding Record Page for Admin

This shows breeding history and reproductive records per livestock. It allows the admin to input service dates, calving data, and AI details. This supports tracking fertility performance and optimizing breeding strategies.

Figure 110. Manage Productivity Analysis Page for Admin

This shows productivity reports in visual and exportable formats. It allows analysis of the whole farm's data. This helps in strategic planning and performance evaluation.

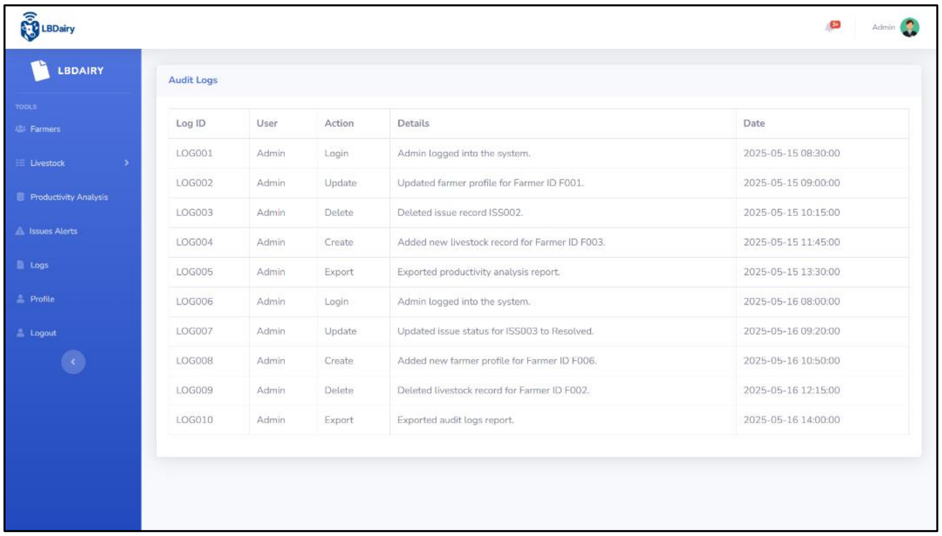


Figure 111. Audit Logs Page for Admin

This displays the system's audit logs and recorded user activities. It allows the Admin to review actions performed across the platform for accountability and traceability. This ensures transparency, security, and effective monitoring of system usage.

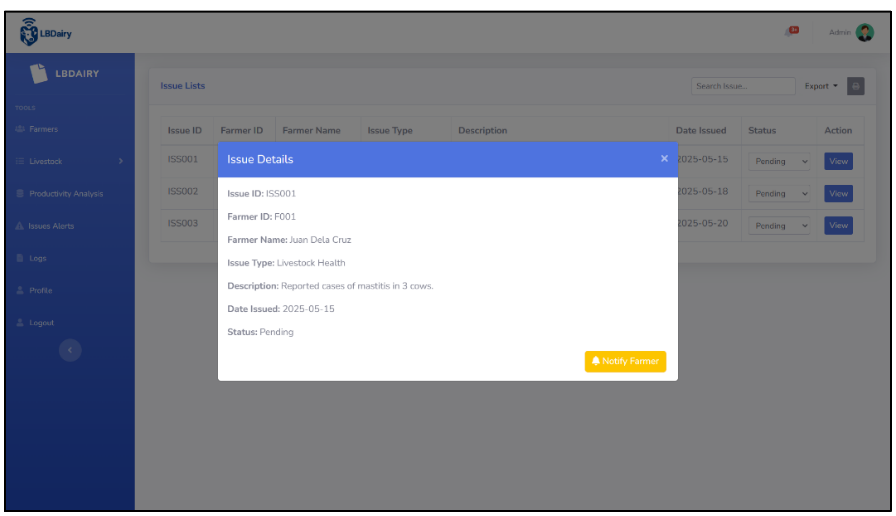


Figure 112. Manage Issues Page for Admin

This displays all reported issues concerning livestock or farm operations issued by the admin. It allows users to view, update the status, and send alerts or notifications to concerned farmers. This helps ensure timely communication and resolution of operational or animal-related concerns.

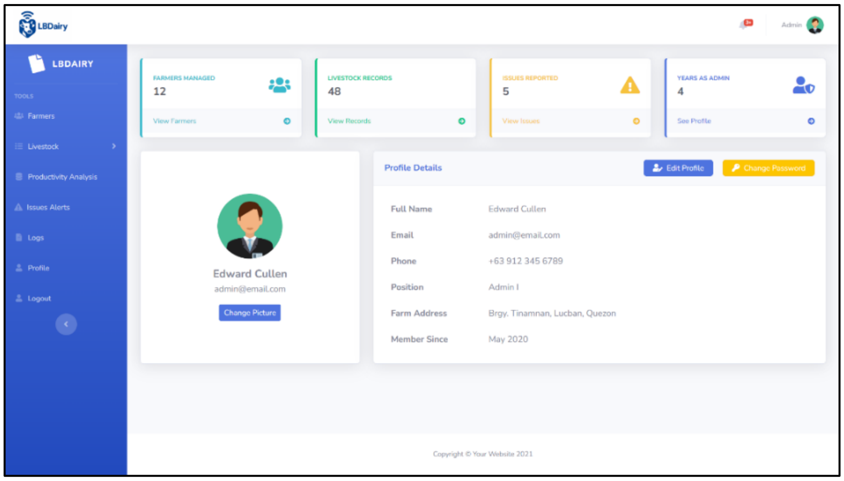


Figure 113. Manage Profile Page for Admin

This provides the admin's account settings and personal details. It allows profile updates and password changes. This ensures a secure and personalized user experience. It also allows the admin to change its profile picture.

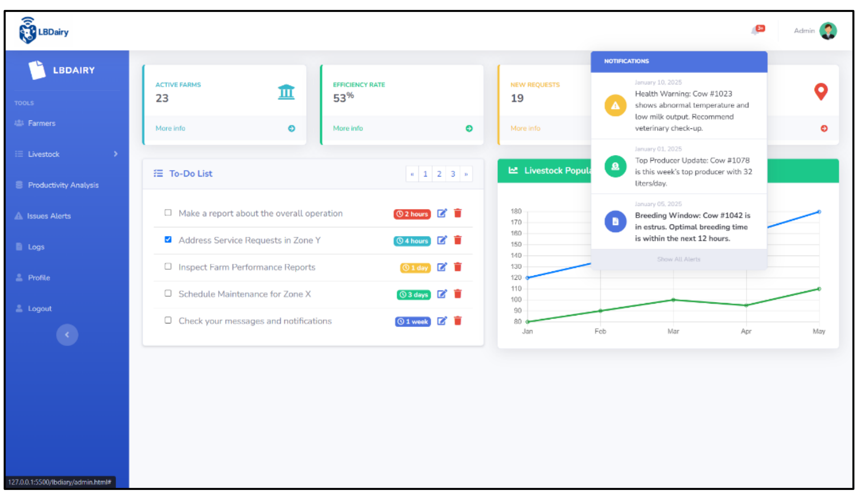


Figure 114. View Notification Page for Admin

This shows real-time alerts related to farmers, super admins, and farms. It includes system updates, issue reports, and pending actions. This allows the Admin to stay informed and respond quickly.

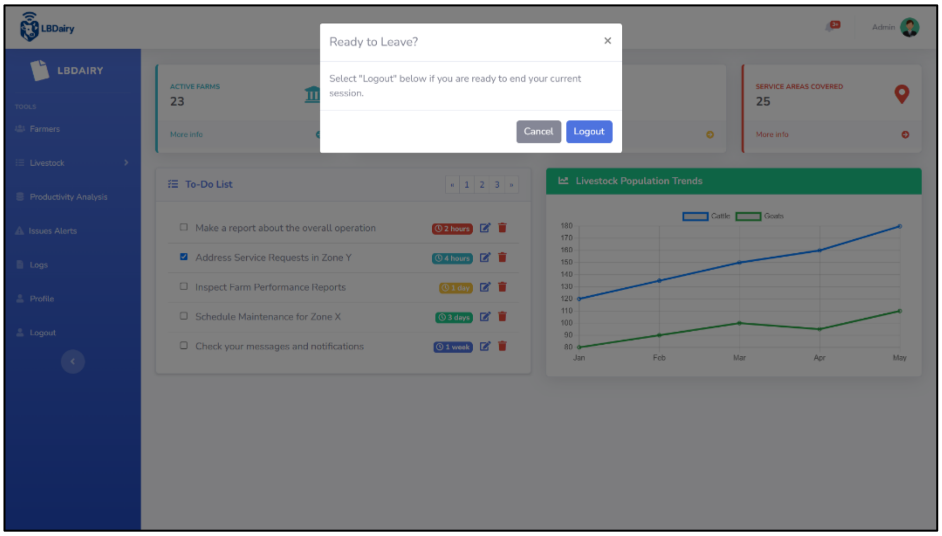


Figure 115. Logout Page for Admin

This allows the admin to securely exit the system. It ends the session and prevents unauthorized access. This ensures data protection and account security.

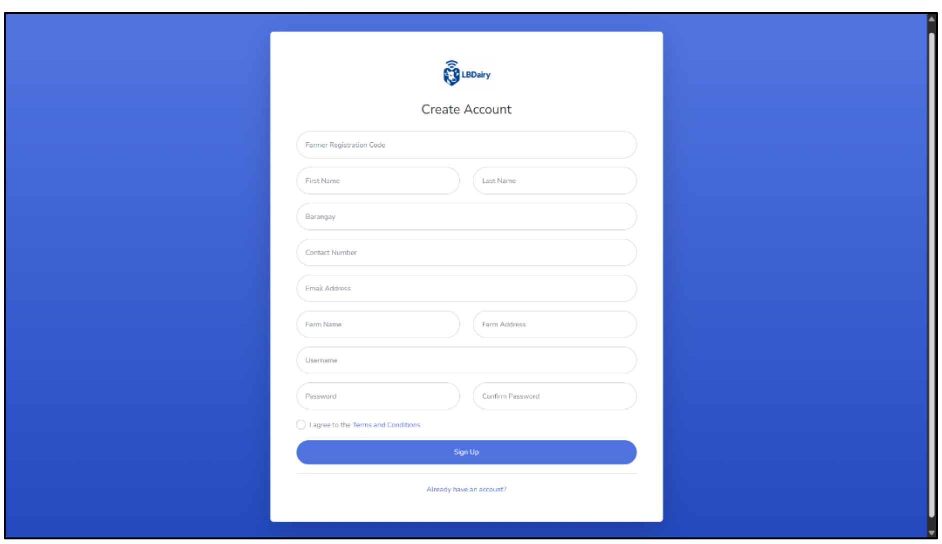


Figure 116. Register Page for Farmer

This allows farmers to create an account by providing personal, contact, and farm-related information. It shows input fields such as registration code, full name, address, farm name, and login credentials. This ensures only authorized and verified farmers can access the platform.

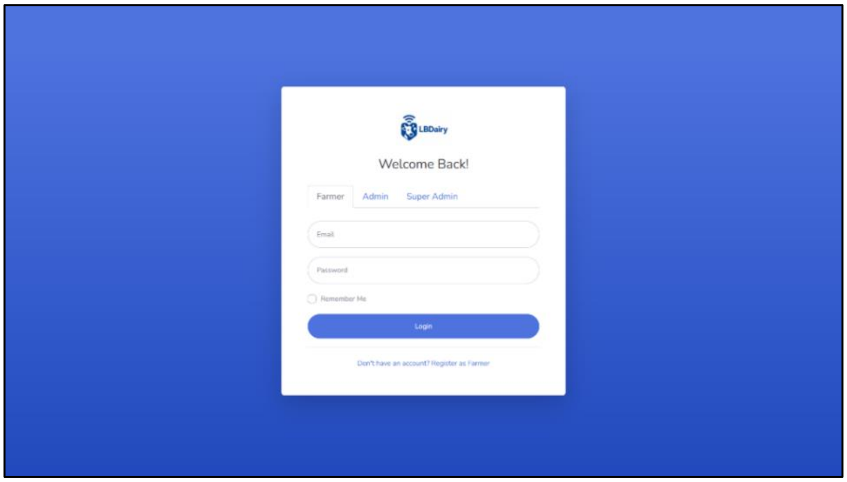


Figure 117. Login Page for Farmer

This allows registered farmers to securely access their accounts. It includes input fields for username, password, and a "Remember Me" option. The page also links to registration for new users.

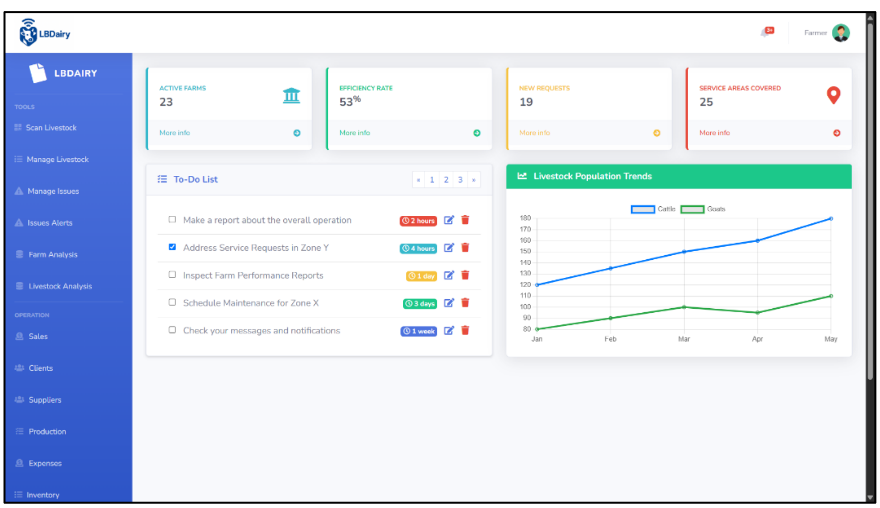


Figure 118. Dashboard Page for Farmer

This shows a quick overview of farm activities, alerts, and productivity metrics. It allows farmers to track performance and view key statistics in one glance. The dashboard serves as the central hub for farm management operations.

Figure 119. Scan Livestock Page for Farmer

This displays a live camera feed that allows the farmer to scan QR codes associated with individual livestock. Upon scanning, the system retrieves and displays the livestock's record for viewing or updating. This feature streamlines livestock management by enabling fast and accurate identification using QR codes.

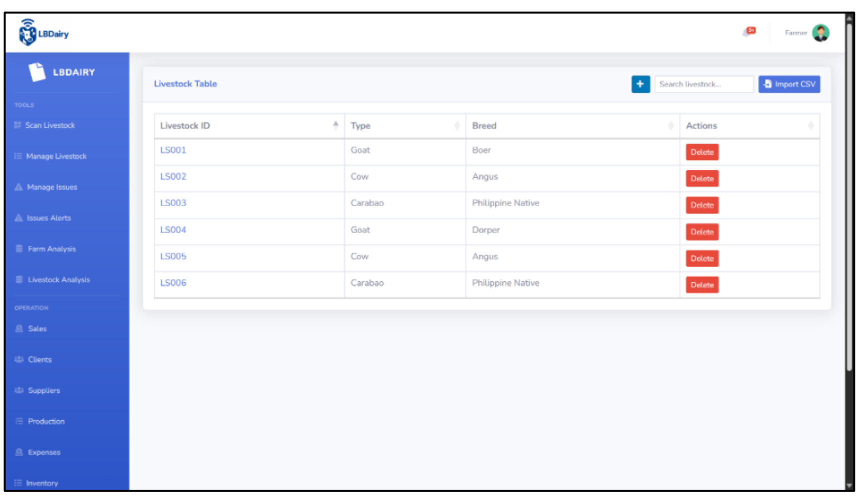


Figure 120. Manage Livestock Page for Farmer

This displays the list of livestock owned by the farmer. It allows the addition, updating, and viewing of individual animal records. This supports effective tracking of livestock details and history. This page can also import a csv file, wherein it can directly add the data to the table.

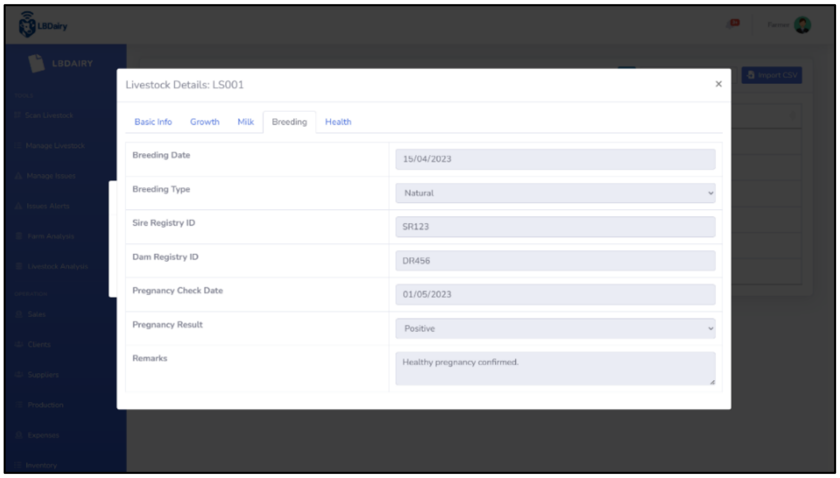


Figure 121. Livestock List Page for Farmer

This shows a structured list of all livestock with key details such as ID, breed, sex, and status. It helps in monitoring animal population and classification. Farmers can also perform actions like view, edit, or generate QR.

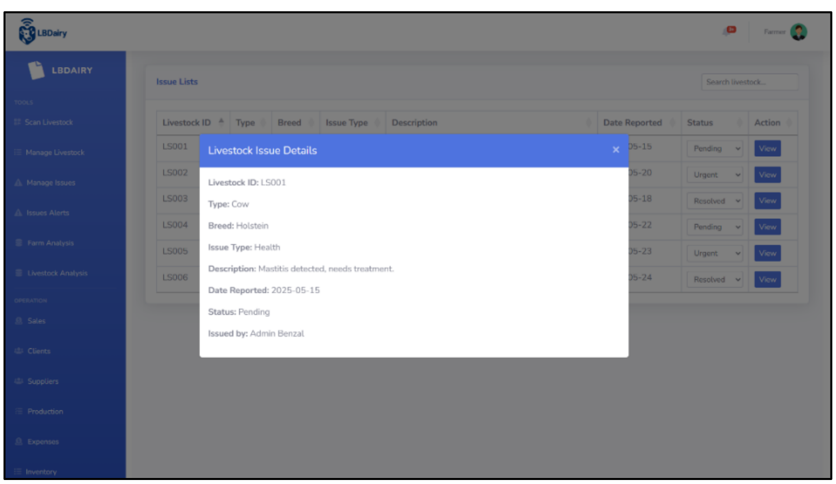


Figure 122. Manage Issues Page for Farmer

This shows alerts or problems reported regarding specific livestock. It allows farmers to acknowledge, respond to, or update issue statuses. Keeping track of issues improves animal welfare and farm operations.

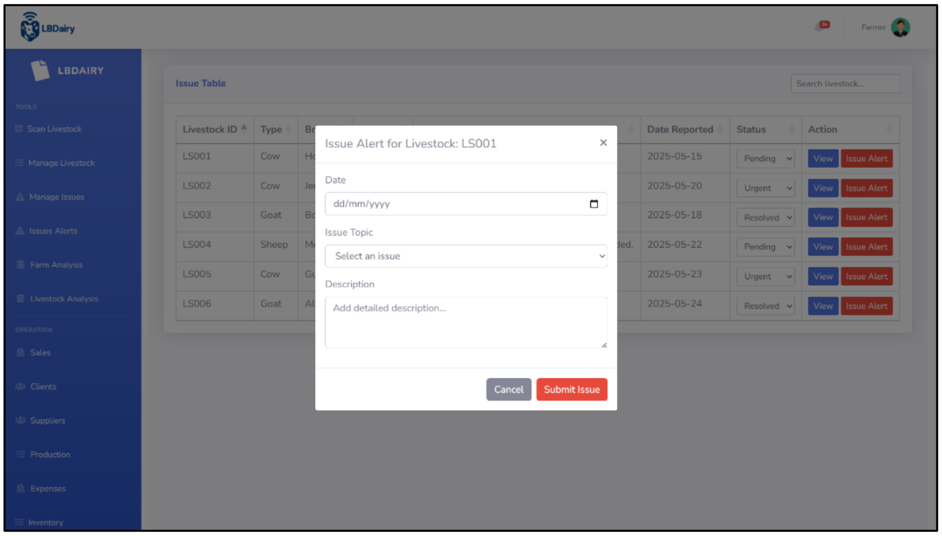


Figure 123. Issue Alert Page for Farmer

This allows farmers to report or respond to livestock-related concerns. Input fields for topic, date, description, and urgency help clarify the problem. The alert gets forwarded to the responsible admin for action.

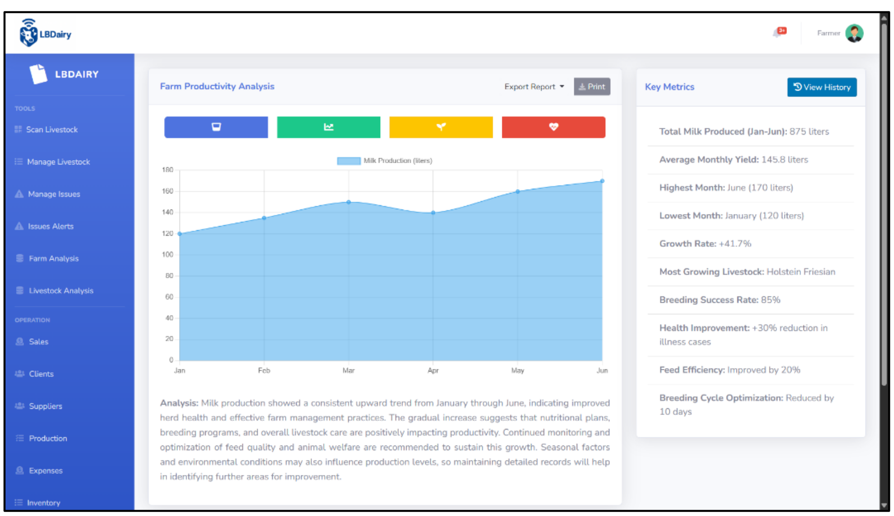


Figure 124. Farm Analysis Page for Farmer

This shows visual data on farm productivity and performance. It includes charts and trends for milk output, growth rates, and efficiency. Insights help farmers optimize strategies and improve outcomes through accessing the past data and analysis. This page also can import a csv file, wherein it can directly add the data to the table.

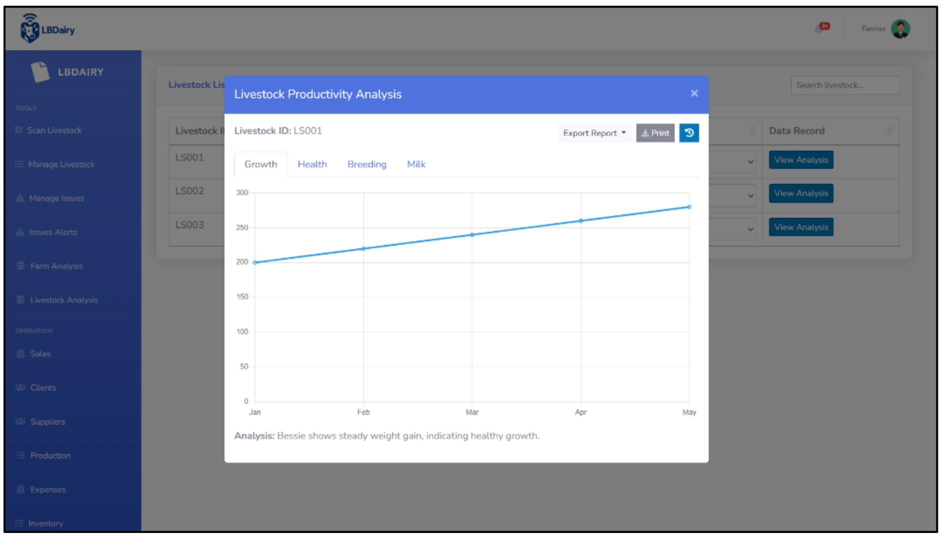


Figure 125. Livestock Analysis Page for Farmer

This visualizes data specifically for individual or grouped animals. It includes trends in health, breeding, and production. The analysis helps in making data-driven decisions for better livestock management. It also helps in decision-making thanks to the view history button, where farmers can access past data.

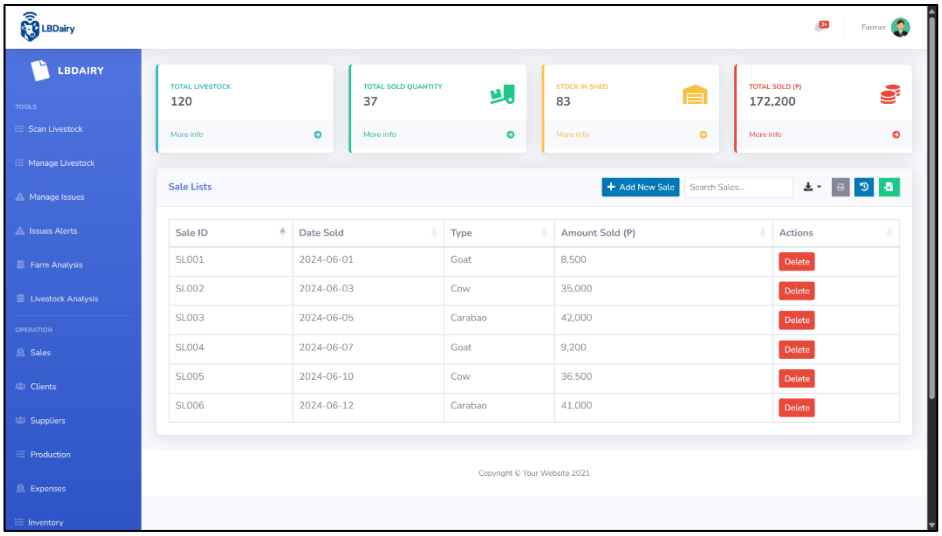


Figure 126. Sales Page Lists for Farmer

This tracks the sale of livestock, products, or dairy output. Farmers can input customer, quantity, price, and date. The page supports revenue tracking and report generation. This page can also import a csv file, wherein it can directly add the data to the table. Farmer can also access the past data of their sales through the view history button.

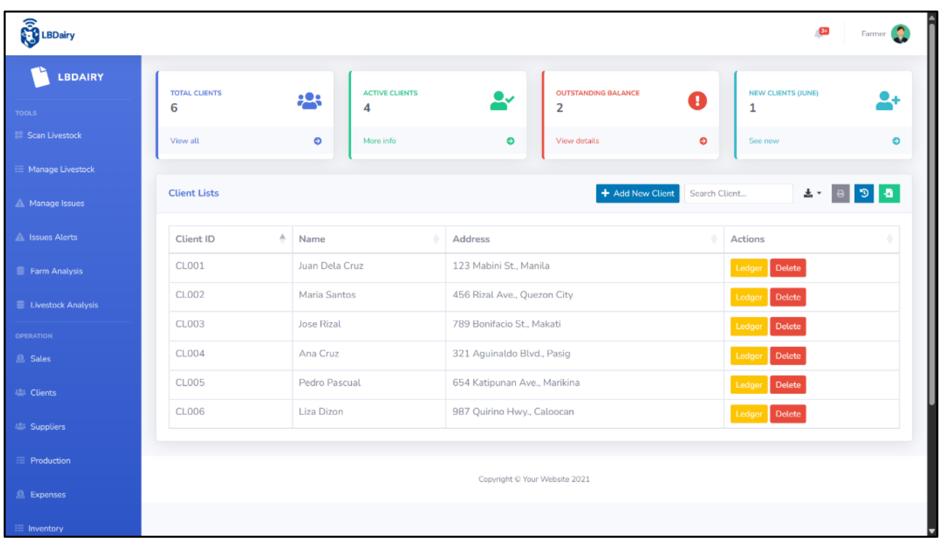


Figure 127. Clients Lists Page for Farmer

This manages client information related to sales or services. Farmers can store contact details, preferences, and transaction history. It helps build strong relationships and improves business tracking. Farmer can also access the past data of their clients through the view history button, they can also import a csv file.

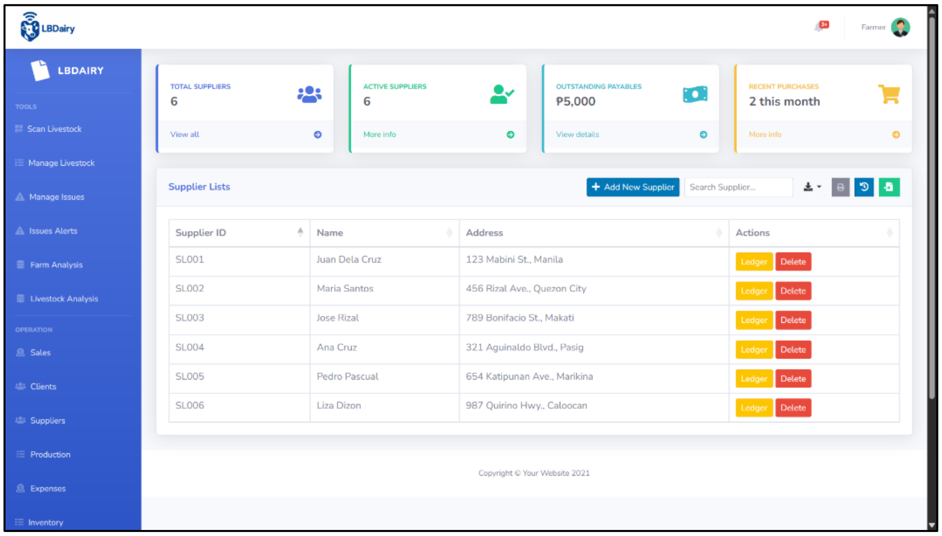


Figure 128. Supplier Lists Page for Farmer

This stores supplier data for feed, medicine, and farm resources. Farmers can monitor purchase records and contact details. Managing suppliers supports farm inventory and procurement efficiency. Farmer can also access the past data of their suppliers through the view history button, they can also import a csv file.

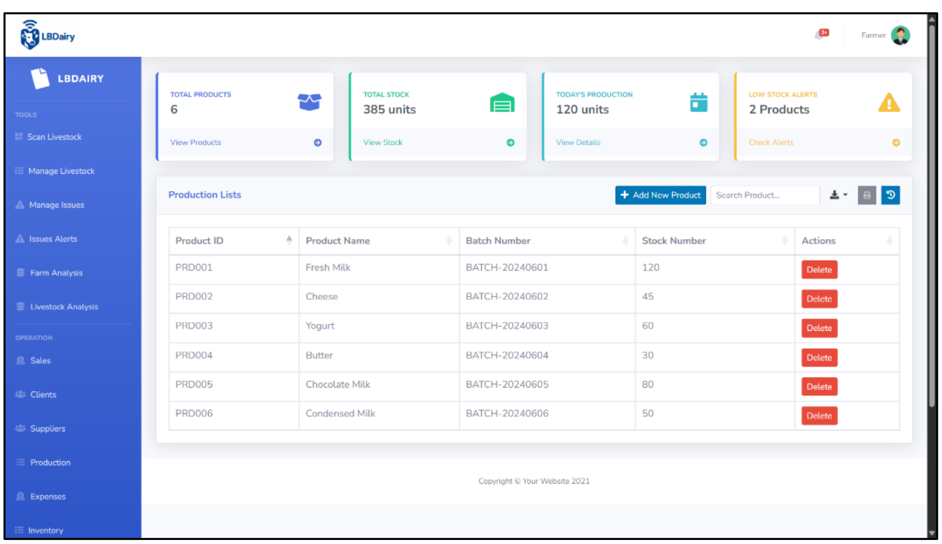


Figure 129. Production Lists Page for Farmer

This tracks overall dairy or meat production. Farmers can record quantity, type, and dates of production. The page ensures inventory is up to date and production is traceable. Farmer can also access the past data of their production through the view history button.

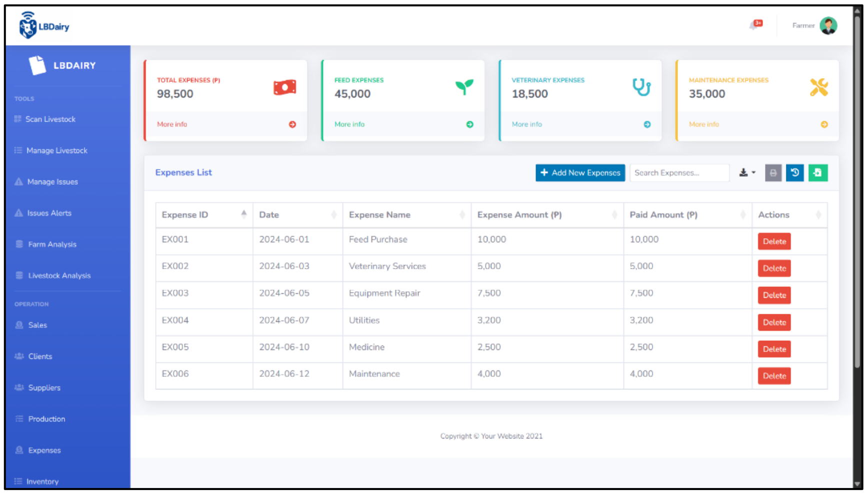


Figure 130. Expenses Lists Page for Farmer

This allows farmers to record financial outflows related to the farm. It includes fields for date, category, amount, and description. Keeping an expense log helps in budgeting and profit analysis. Farmer can also access the past data of their expenses through the view history button, they can also import a csv file.

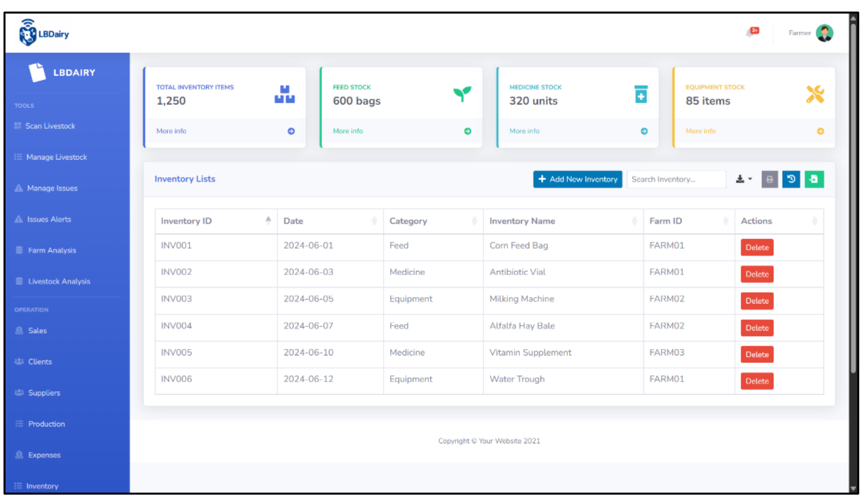


Figure 131. Inventory Lists Page for Farmer

This manages stock for feed, medicine, tools, and products. Farmers can track item quantity, reorder levels, and usage. Proper inventory management avoids shortage or overstock issues. Farmer can also access the past data of their inventory through the view history button, they can also import a csv file.

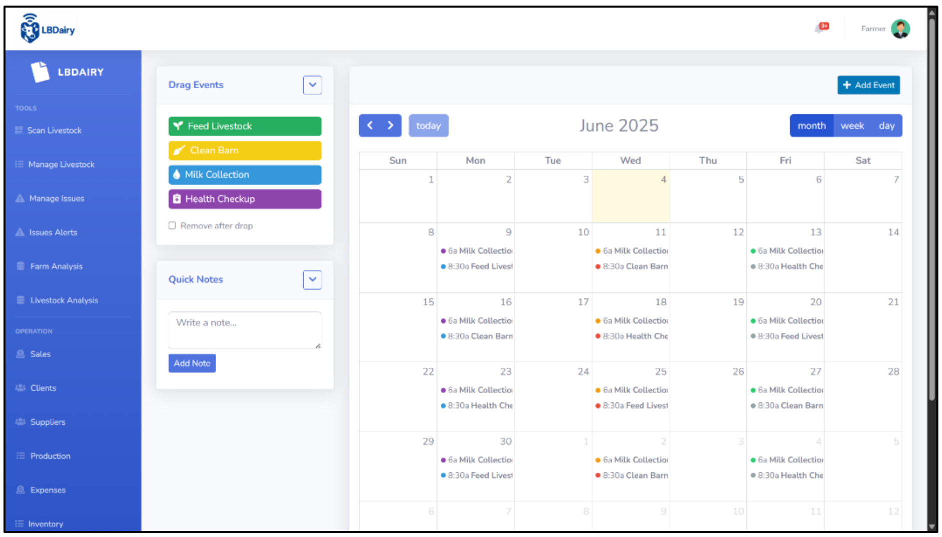


Figure 132. Calendar Page for Farmer

This shows scheduled inspections, vaccinations, and farm tasks. Farmers can add, edit, or remove events. The calendar ensures organized planning of daily farm operations.

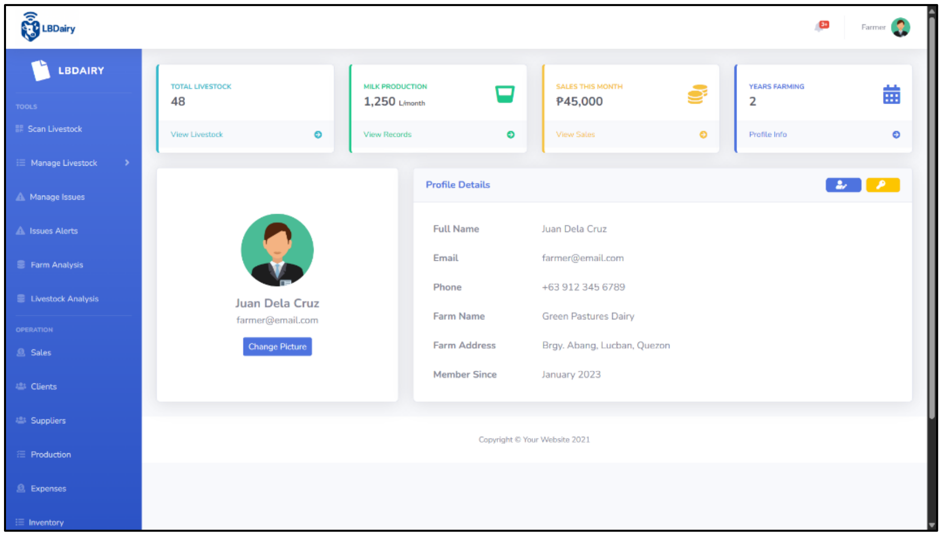


Figure 133. Manage Profile Page for Farmer

This allows farmers to update personal and farm-related details. It includes name, contact info, farm name, and login credentials. Keeping the profile up to date ensures accurate communication and access. Farmers can also change their personal data and profile picture.

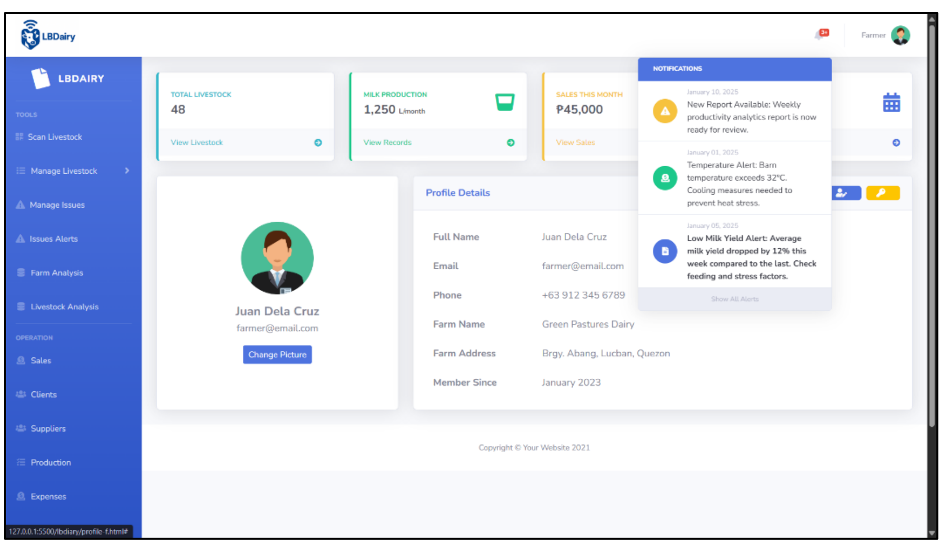


Figure 134. View Notification Page for Farmer

This shows alerts related to inspections, issues, or admin messages. Farmers are informed about important actions or reminders. Staying updated ensures responsive and timely management.

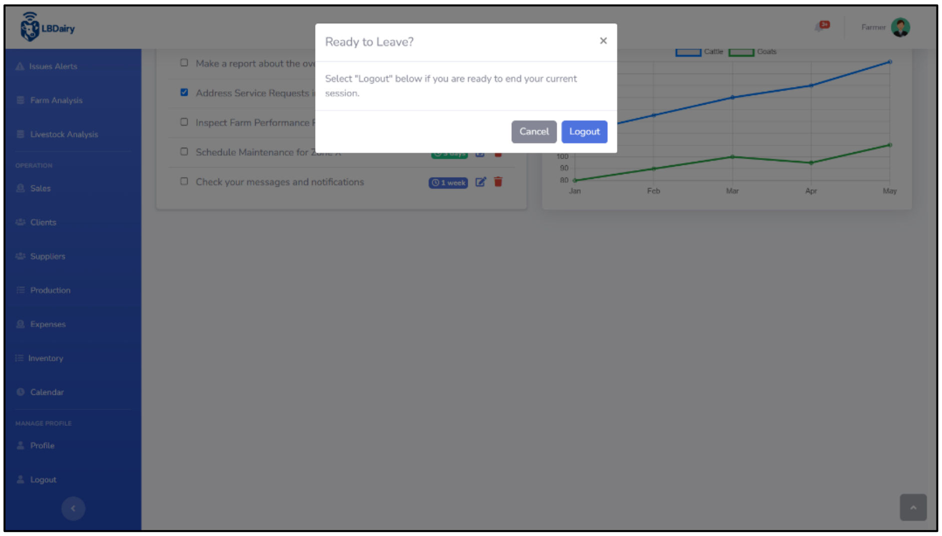


Figure 135. Logout Page for Farmer

This securely signs out the farmer from the system. It ensures privacy and protection of farm data. Logging out helps prevent unauthorized access.

Implementation Plan

The LBDAIRY system will be deployed at the Lucban Municipal Agriculture Office in Quezon Province after the final defense of the researchers. If the office agrees to use the system, the researchers will provide a complete package including the system files and a user manual. This manual is intended to guide the ICT personnel and livestock officers in managing the system, including basic troubleshooting and maintenance.

A formal turnover letter will be prepared to officially transfer ownership and responsibility of the system to the Lucban Agriculture Office. After this point, the researchers will no longer be responsible for future updates, maintenance, or user support. However, to ensure a smooth handover, the researchers will carry out a few important strategies during the implementation process, as outlined below:

STRATEGY	ACTIVITIES	PERSONS INVOLVED	DURATION
Approval from LGU and ICT Staff	Submission of formal request letter and approval process,	Municipal Agriculturist, ICT Staff, Researchers	1 Day
System Installation and User Manual Distribution	Installation of system on office computers and devices, and distribution of printed and digital manuals	Researchers, Agriculture Staff	1 Day
2-Day Training	Hands-on training on livestock registration, QR scanning, data entry, and report generation	Researchers, Livestock Technicians, ICT Staff	2 Days

Farmer Hands-on Training and Evaluation	Field training on scanning QR codes, updating livestock info, and understanding productivity records	Researchers, Livestock Technicians, Farmers	1 Day
IT Expert Evaluation	Field evaluation on system functionalities including QR code scanning, updating livestock records, and analyzing productivity dashboards	IT Experts, System Analysts, Evaluators	1 Day

Table 1. Implementation plan of the system LBDairy

This table outlines the structured timeline and key activities for implementing the LBDairy system. It includes task phases, assigned responsibilities, and expected completion dates. The plan ensures organized deployment and smooth transition into actual use.

Research Instrument

The researchers used a checklist-type questionnaire based on a 4-point Likert scale to gather data for the evaluation of the LBDAIRY system. This instrument included clear and direct statements that the respondents were asked to rate, with answer options ranging from “Acceptable” to “Unacceptable.” This method provided a structured way to assess the system’s effectiveness, usability, and overall quality, allowing the collected responses to be analyzed statistically. The data helped in identifying both the strengths and areas that may need improvement in the system.

The researchers dedicated time and effort in developing the questionnaire by ensuring that the questions were easy to understand and relevant to the goals of the study. The questionnaire was guided by the ISO 25010 standard, which focuses on key aspects of software quality. The statements were designed to reflect different system characteristics, including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, flexibility, and safety. These categories were carefully aligned with the objectives of the LBDAIRY system to ensure that the feedback collected would be meaningful and useful for evaluating its real-world performance.

Respondent of the Study

The respondents were selected based on their direct relevance to the study, their knowledge of livestock management, and through purposive sampling. This sampling method ensures that the data gathered is meaningful and useful for evaluating the effectiveness of the LBDAIRY web-based system using QR code tagging and productivity analysis. The study specifically targeted agriculture officers, ICT personnel, and local dairy farmers from the Lucban Municipal Agriculture Office. The researchers aimed to gather practical insights that are directly related to the actual implementation and day-to-day use of the system in dairy livestock monitoring and management within the rural agricultural setting.

Data Gathering Procedure

To conduct the data gathering for this study, a formal request letter was prepared and validated by the research adviser. This letter sought approval to conduct the study at the Lucban Municipal Agriculture Office and was addressed to the Municipal Agriculturist of Lucban, Quezon. After receiving approval, the researchers coordinated with the office personnel to proceed with the study and engage with agriculture staff and local dairy farmers.

The researchers dedicated time and effort to collaborate with the agriculture officers in creating questionnaires that were appropriate for the respondents and aligned with the objectives of the study. Purposive sampling of questions was applied, as the goal was to assess the system's effectiveness, usability, strengths, and areas for improvement. The questionnaire was validated by the research adviser, and after receiving approval, it was distributed to selected personnel and farmers affiliated with the Lucban Agriculture Office.

The study involved 40 respondents for data gathering: 10 IT experts, 10 municipal agriculture officials, and 20 farmers. These respondents were purposively selected to provide comprehensive insights from different perspectives - technical expertise from IT professionals, administrative and policy perspectives from municipal agriculture officials, and practical field experience from local farmers. Their responses provided useful insights for evaluating the actual performance and impact of the LBDAIRY system in the field.

Statistical Treatment

To statistically analyze the responses gathered from the respondents, the researchers used a 4-point Likert scale to measure their perception of the effectiveness and usability of the LBDAIRY system. The Likert scale ranged from 1 (Unacceptable) to 4 (Acceptable), where each number represented a level of agreement or satisfaction. This scale helped evaluate how well the system performed in different areas such as ease of use, accuracy, and usefulness in livestock monitoring.

To interpret the data, the researchers computed the weighted mean for each set of responses to summarize the overall level of performance and agreement. This helped determine which parts of the system were rated positively and which areas may need improvement.

The formula used:

$$WM = \frac{(4xA) + (3xSA) + (2xSU) + (1xU)}{N}$$

Where: WM = weighted mean

A = is the number of respondents who selected "Acceptable"

SA = is the number of respondents who selected "Slightly Acceptable"

SU = is the number of respondents who selected "Slightly Unacceptable”

U = is the number of respondents who selected "Unacceptable"

N = is the total number of responses

Likert-Scale	Likert-Scale Interval	Level of Agreement
4	3.25 – 4.00	Acceptable
3	2.50 – 3.24	Slightly Acceptable
2	1.75 – 2.49	Slightly Unacceptable
1	1.00 – 1.74	Unacceptable

Table 2. Likert Scale Interpretation for Statistical Analysis

This table presents the Likert scale used to quantify respondents’ perceptions and evaluations related to the LBDairy system. It serves as the basis for collecting measurable feedback, which will be statistically analyzed to assess the system’s effectiveness and user satisfaction.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents and explains the results from developing LBDAIRY: A Web-Based Dairy Livestock Monitoring and Management System Using QR Code Tagging with Productivity Analysis for the Lucban Municipal Agriculture Office. The findings are discussed in relation to the objectives stated in Chapter I. The system was designed to improve the monitoring of dairy livestock, track productivity, and organize records through a centralized online platform. It offers real-time access to animal information, updates on farm operations, and basic productivity data, which can help support more efficient and data-driven management of dairy farms.

Design and Development of the LBDairy Web App

The LBDAIRY system was designed with simplicity and functionality to ensure an intuitive and user-friendly experience. Each livestock is assigned a unique QR code tag for easy tracking and quick access to records such as health, feeding, and productivity data. The interface features organized modules for livestock records, inventory, financial management, and breeding activities, all accessible through a centralized dashboard. Built with Progressive Web App (PWA) standards, the system ensures accessibility across devices while maintaining data integrity, security, and ease of use.

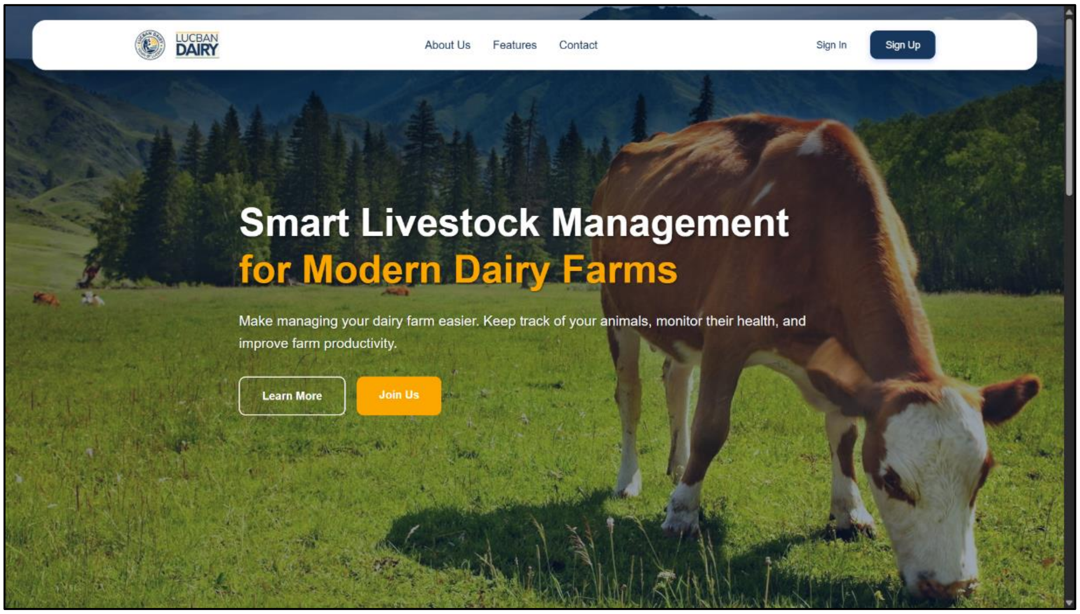


Figure 136. Landing Page

The figure demonstrates how a super admin interacts with the Landing Page. Upon opening the page, the system displays options to sign in, sign up, or explore features, support details, and company information. If the super admin is already logged in, the system automatically redirects them to the dashboard. This process provides a centralized access point for all users while guiding them to the appropriate system functionalities.

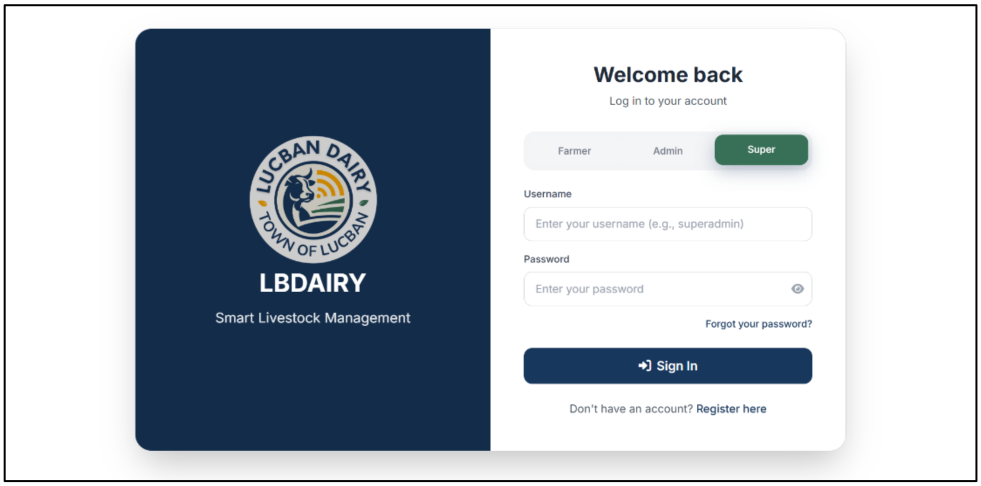


Figure 137. Login Page for Super Admin

The figure demonstrates how a super admin accesses the system through the Login page. The super admin can input their username and password, can also click the forgot password, and click the login button. Successful authentication grants access to the dashboard, while invalid credentials prompt the user to retry. This ensures secure access to the system based on user roles.

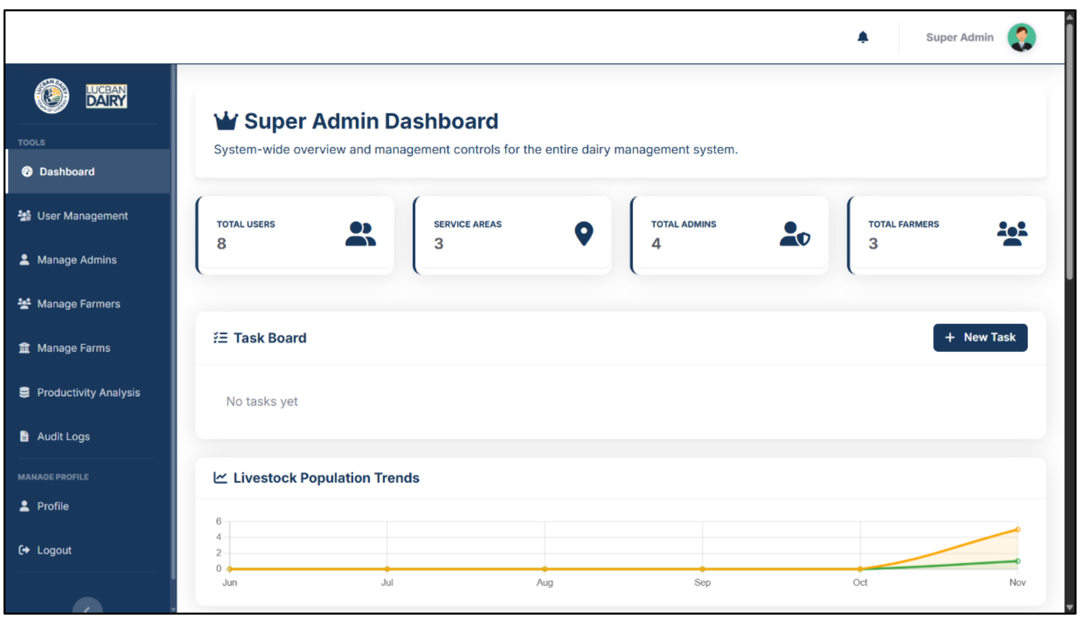


Figure 138. Dashboard Page for Super Admin

The figure demonstrates how super admin access their personalized Dashboard after login. The system displays modules and quick links relevant to the user's role, including tables, charts, notifications, and action buttons. super admin can navigate to different system functionalities directly from the dashboard, ensuring efficient workflow and quick access to important information.

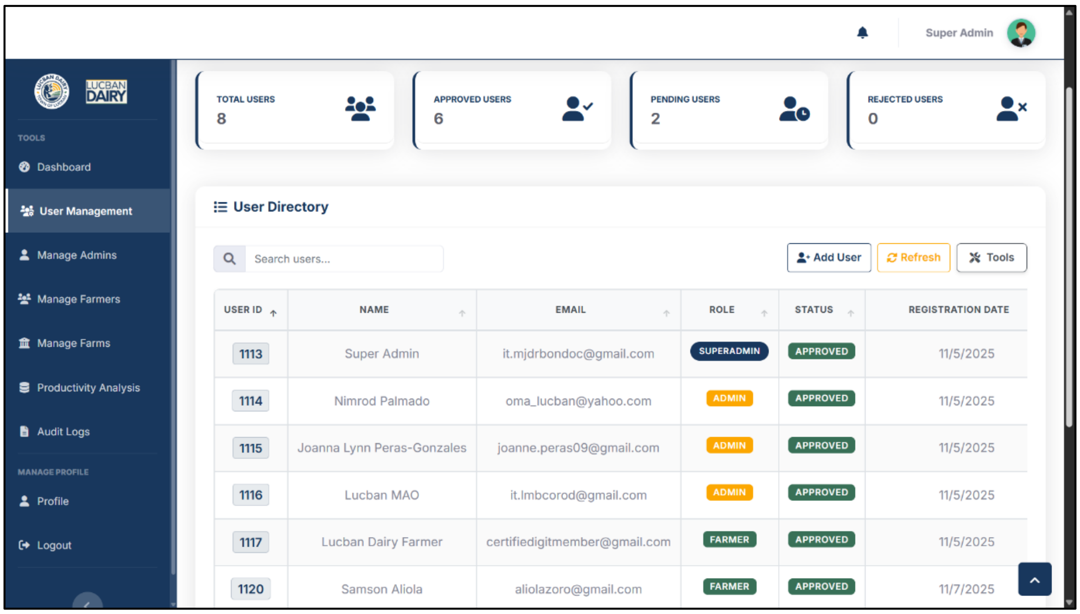


Figure 139. User Management Page for Super Admin

The figure demonstrates how the Super Admin manages users. Upon opening the User Management module, the system displays a table of all registered users, including admins and farmers. The Super Admin can view details, approve or decline registrations, activate or deactivate accounts, and delete users when necessary. This ensures proper control and oversight of all user accounts.

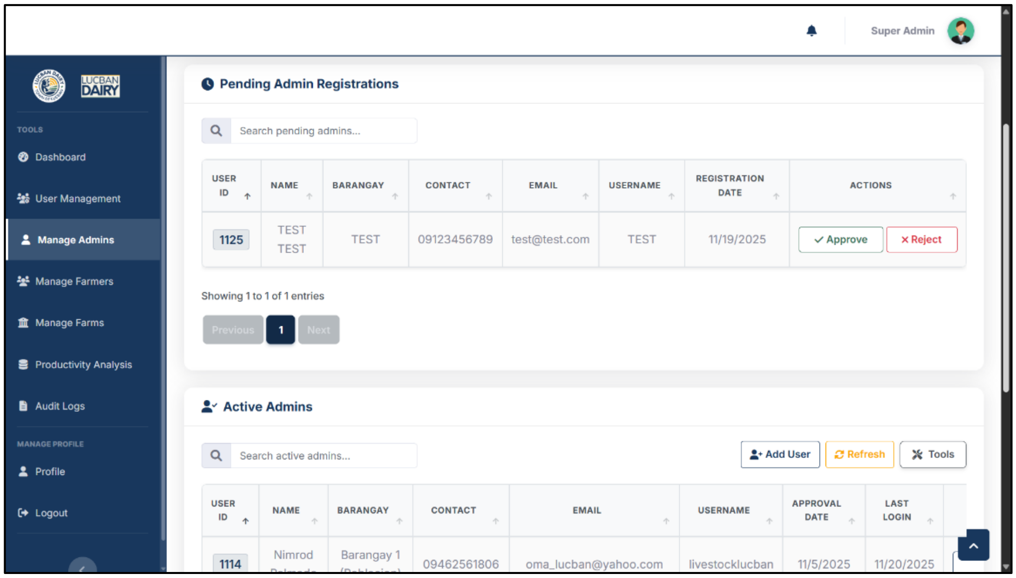


Figure 140. Manage Admins Page for Super Admin

The figure demonstrates how the Super Admin oversees system administrators. Upon opening the Manage Admins tab, the system displays a table of all registered admins. The Super Admin can review their details, approve or decline registration requests. This ensures that administrative privileges are carefully monitored and controlled.

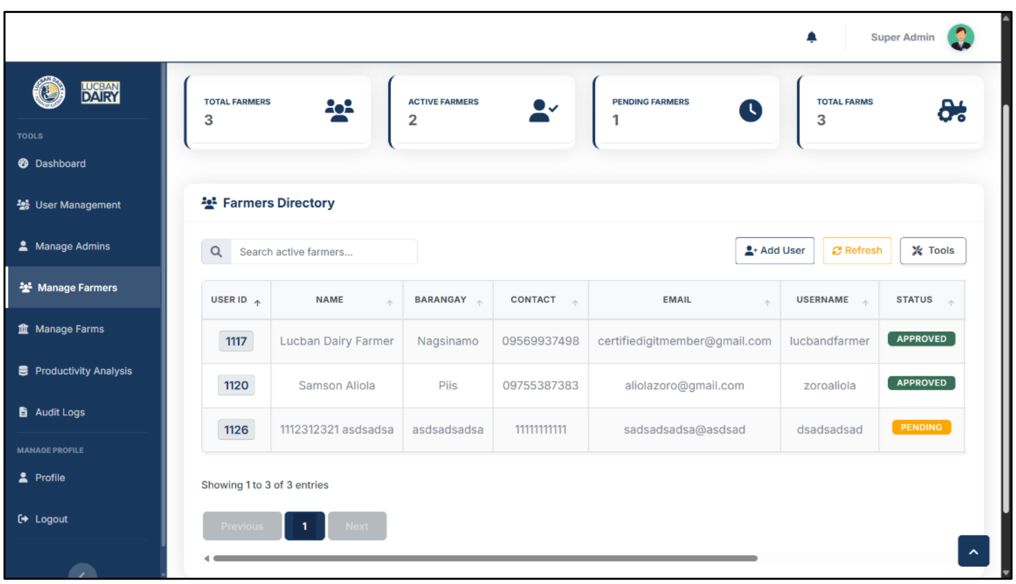


Figure 141. Manage Farmers Page for Super Admin

The figure demonstrates how the Super Admin monitors farmer accounts. Upon opening the Manage Farmers module, the system displays all registered farmers in a table format. The Super Admin can review farmer details, manage registration statuses, activate or deactivate accounts, import farmer data via CSV, and generate reports. This process ensures accurate oversight and proper record-keeping of all farmers in the system.

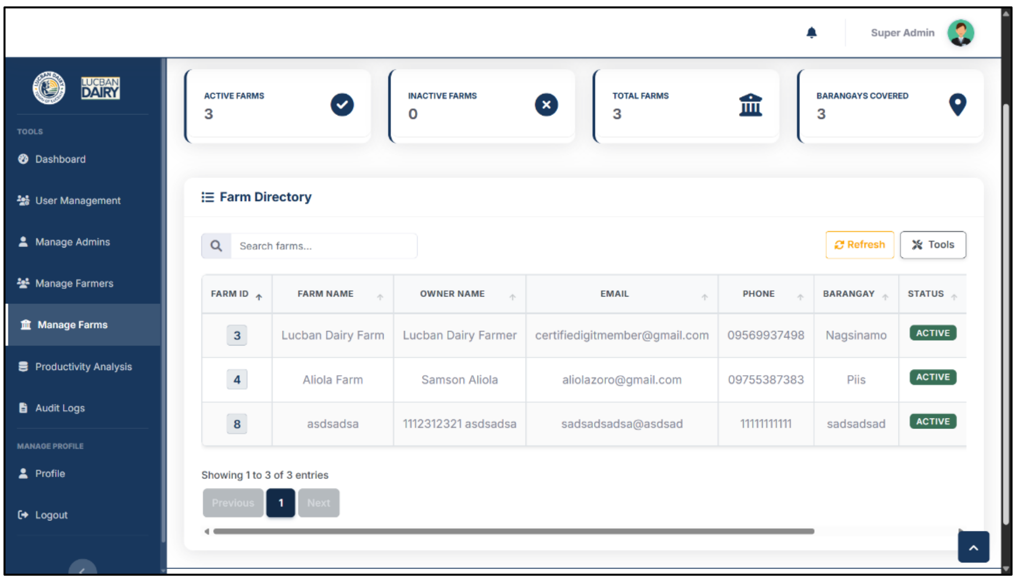


Figure 142. Manage Farms Page for Super Admin

The figure demonstrates how the Super Admin manages farms. Upon opening the Manage Farms module, the system displays a list of registered farms. The Super Admin can review farm details, import farm data via CSV, and generate reports in PNG, CSV, or PDF formats. This ensures that farm data is systematically maintained and easily accessible.

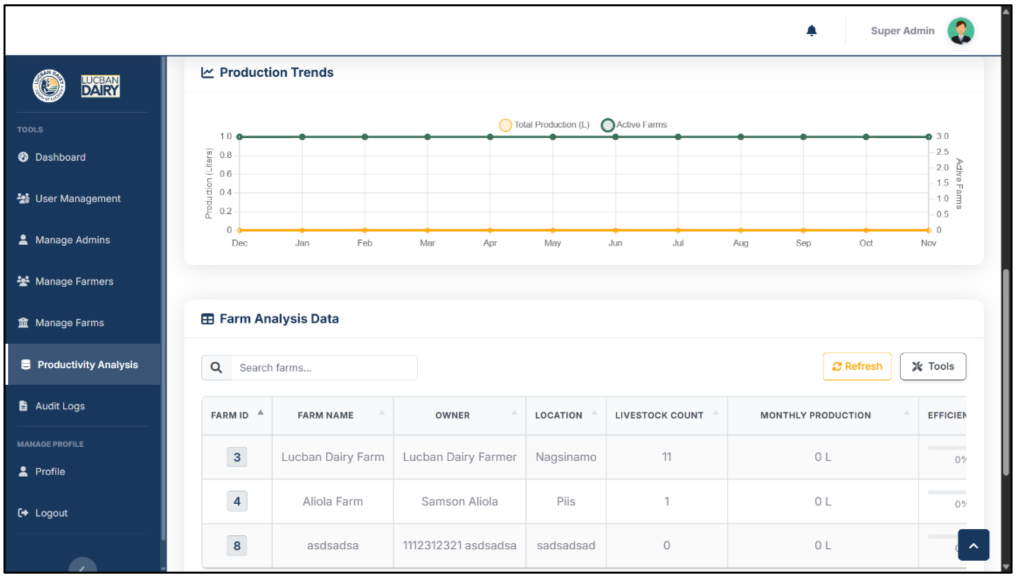


Figure 143. Productivity Analysis Page for Super Admin

The figure demonstrates how the Super Admin reviews overall system productivity. Upon opening the Productivity Analysis module, the system displays aggregated productivity data across all farms and farmers. This allows the Super Admin to monitor system-wide performance and make informed administrative decisions.

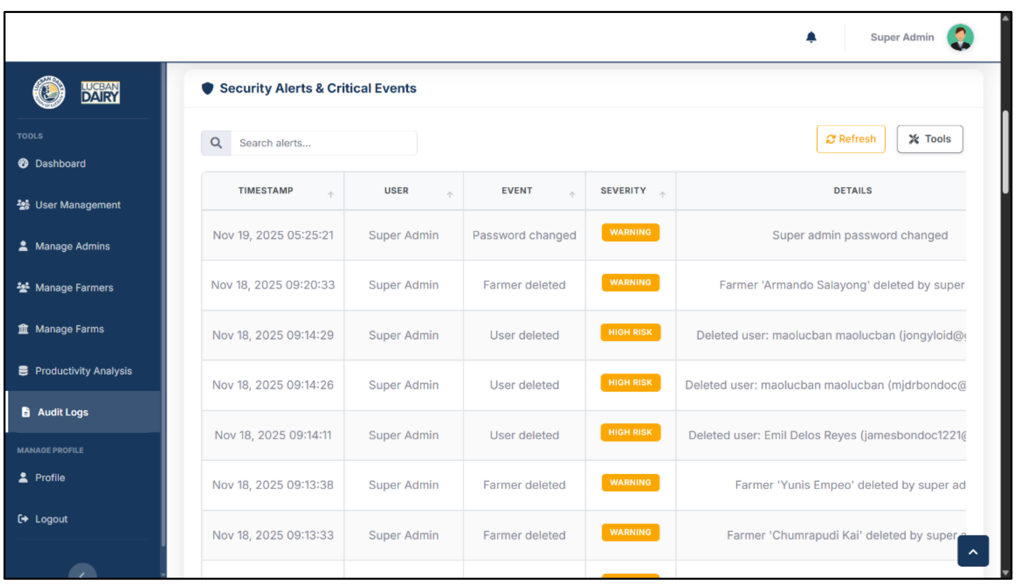


Figure 144. Audit Logs Page for Super Admin

The figure demonstrates how the Super Admin tracks system activities. Upon opening the Audit Logs module, the system displays a chronological record of actions performed by admins and farmers, including edits, deletions, and system interactions. This ensures transparency, accountability, and the ability to trace any activity within the system.

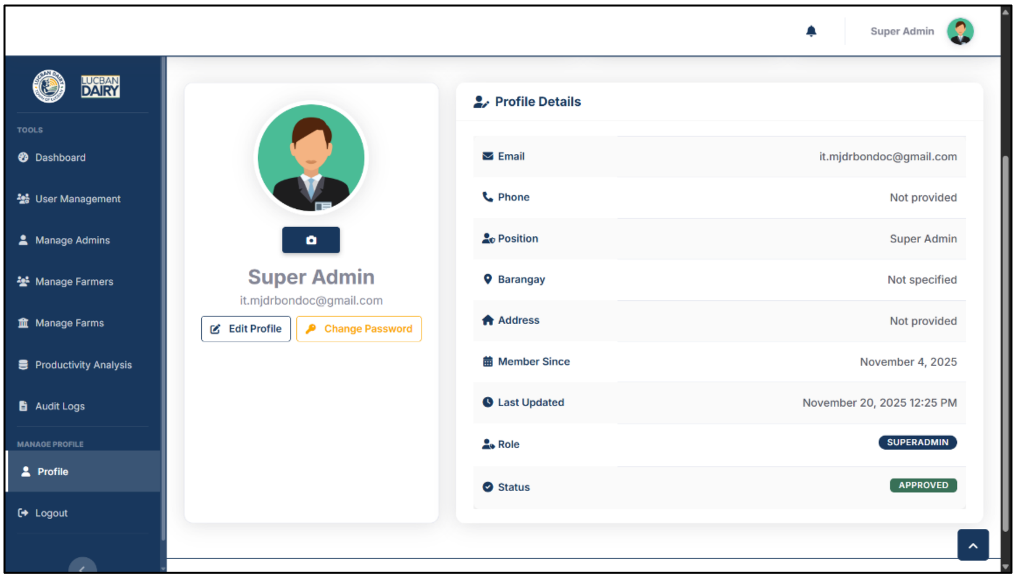


Figure 145. Manage Profile Page for Super Admin

The figure demonstrates how the Super Admin updates personal information. Upon opening the Manage Profile module, the system allows the Super Admin to edit username, password, email, contact information, and upload a profile picture. This ensures that the Super Admin's account details are up-to-date and secure.

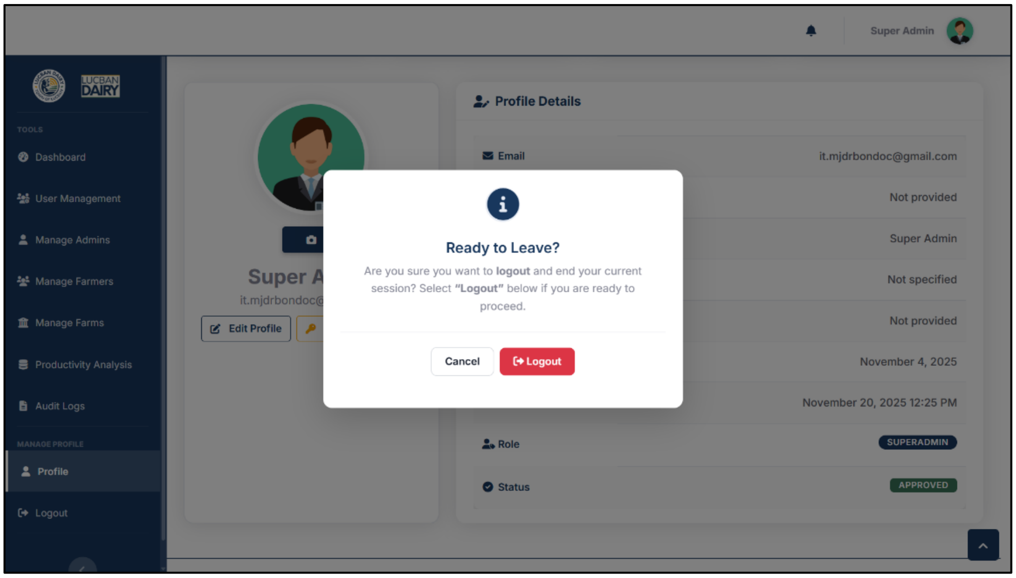


Figure 146. Logout Page for Super Admin

The figure demonstrates how the Super Admin securely exits the system. Upon clicking the Logout button, the system terminates the session and redirects to the landing page. This ensures proper session management and maintains the security of the administrative account.

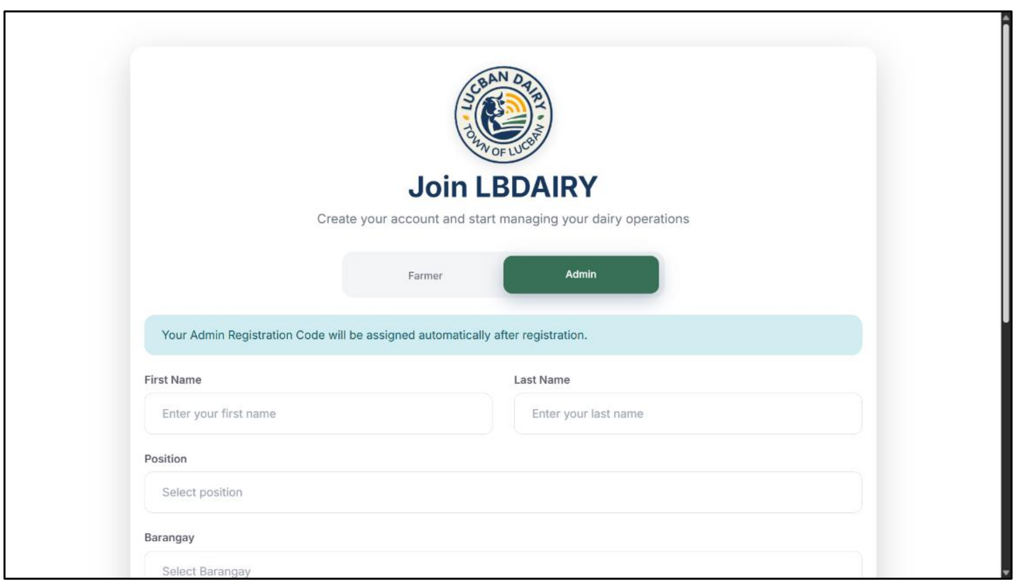


Figure 147. Registration Page for Admin

The figure demonstrates how the Admin registers a new account. Upon opening the Admin Registration page, the system prompts the user to input the registration code, personal information, position, username, and password, and to accept the terms and conditions. Successful registration allows the Admin to access the system, ensuring that only authorized personnel can create accounts.

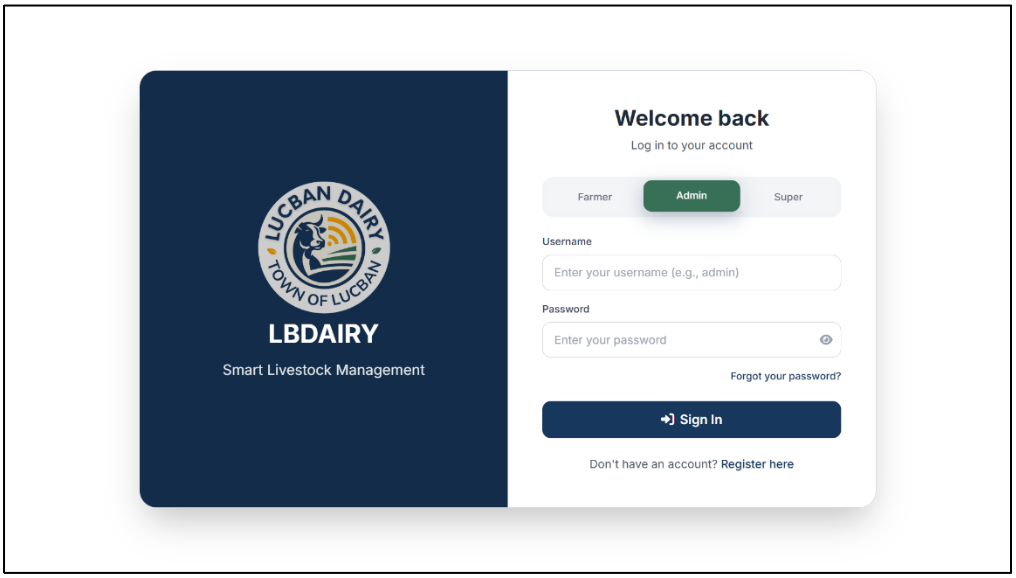


Figure 148. Login Page for Admin

The figure demonstrates how the Admin accesses the system through the Login page. The Admin enters their username and password, optionally selects the forgot password, and clicks the login button. Successful authentication redirects the Admin to the Dashboard, while incorrect credentials prompt a retry. This ensures secure access for administrative tasks.

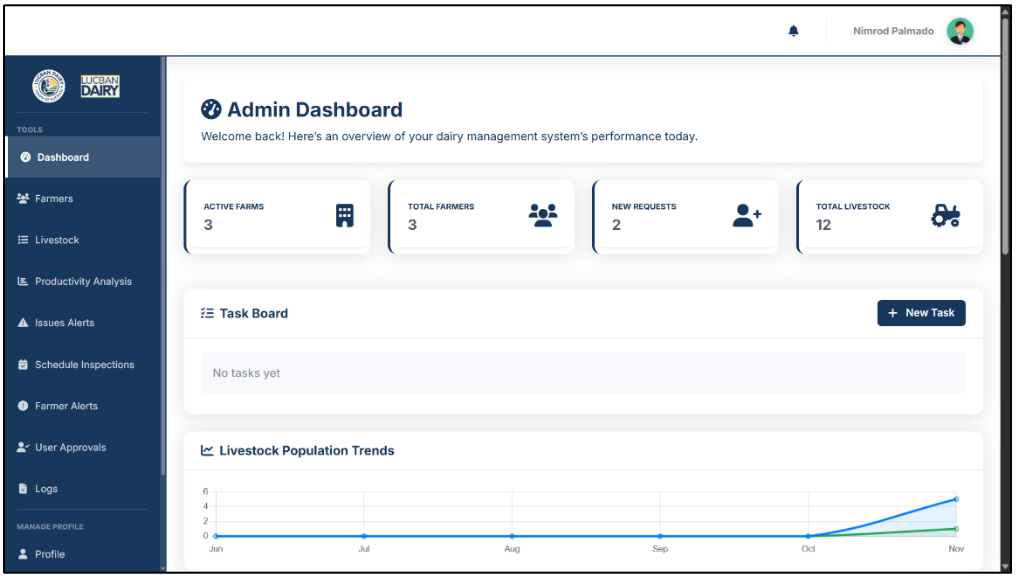


Figure 149. Dashboard Page for Admin

The figure demonstrates how the Admin uses the Dashboard to access system functionalities. Upon login, the system displays modules such as Manage Farmers, Manage Livestock, Productivity Analysis, Issues Alerts, and others The Dashboard provides a centralized interface for efficient management of farm operations.

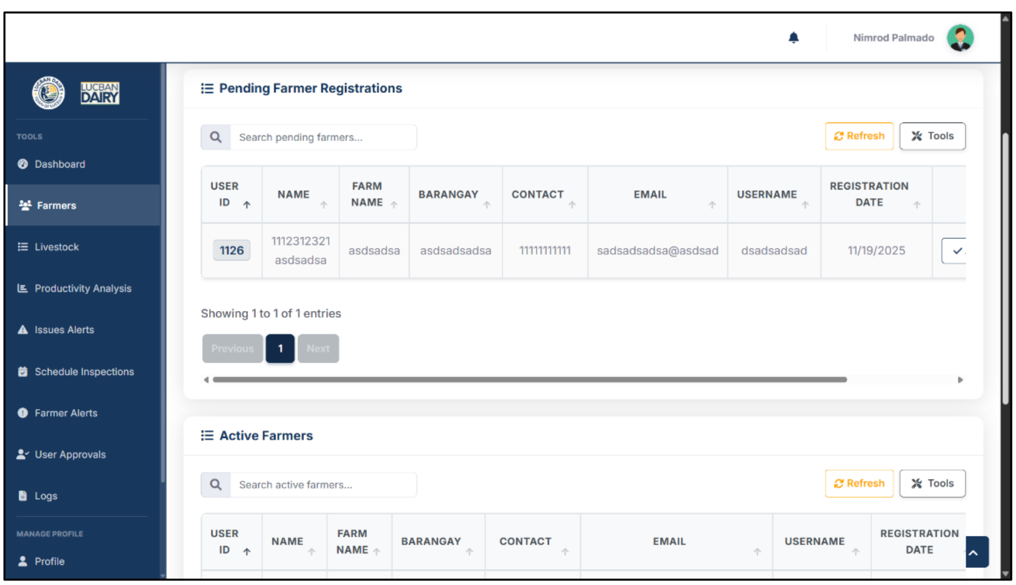


Figure 150. Manage Farmer Page for Admin

The figure demonstrates how the Admin oversees farmer accounts. Upon opening the Manage Farmer module, the system displays a table of registered farmers. The Admin can view details, approve or decline registration requests, activate or deactivate accounts, import farmer data via CSV, schedule inspections, and generate reports. This ensures proper monitoring and management of all farmers under their supervision.

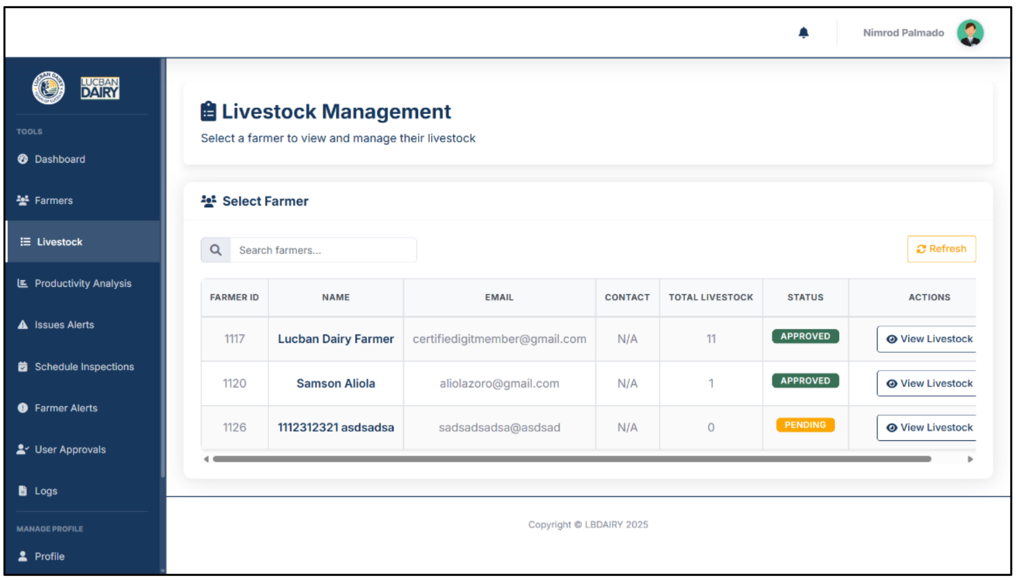


Figure 151. Manage Livestock Page for Admin

The figure demonstrates how the Admin manages livestock records. Upon accessing the Manage Livestock module, the system displays livestock tables linked to each farmer. The Admin can add new livestock, edit details such as growth, health, breeding, calving, and milk production records, generate QR codes, and issue alerts. This ensures accurate tracking and proper care of livestock.

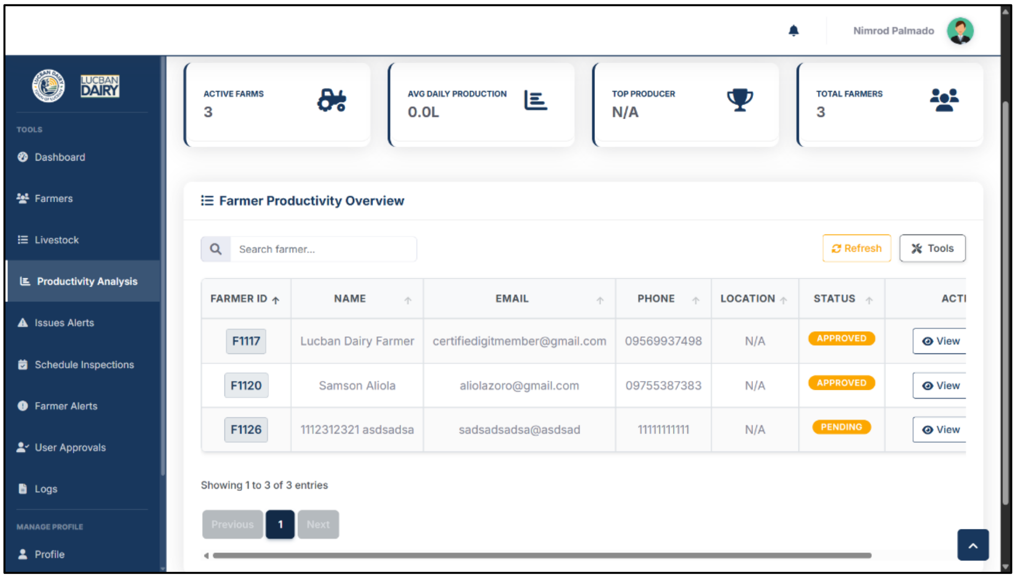


Figure 152. Productivity Analysis Page for Admin

The figure demonstrates how the Admin monitors farm and livestock productivity. Upon opening the Productivity Analysis module, the system displays data per farm or per livestock using charts and tables. The Admin can generate reports in PNG, CSV, or PDF formats, allowing informed decisions for improving productivity.

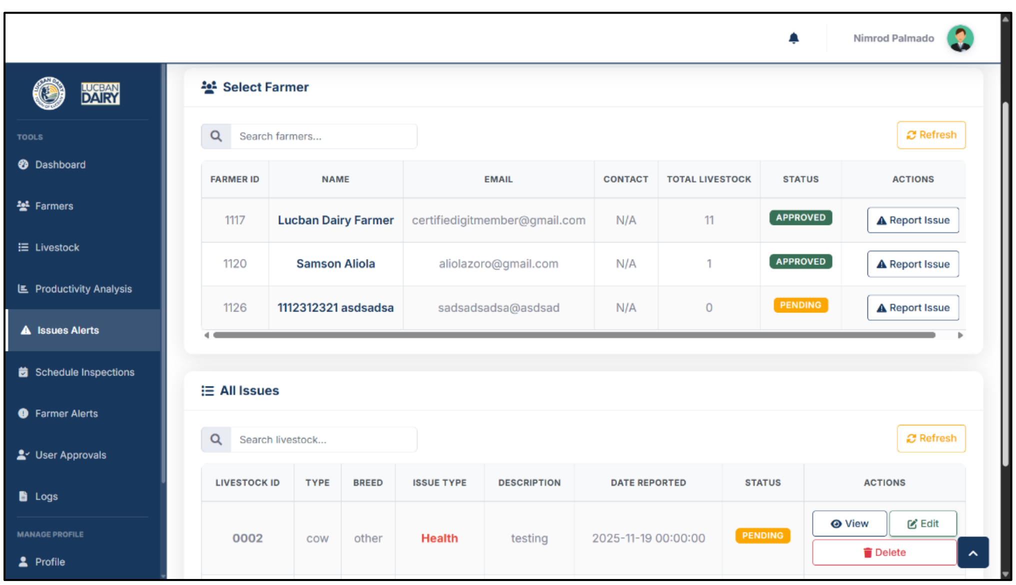


Figure 153. Issues Alerts Page for Admin

The figure demonstrates how the Admin manages alerts related to livestock issues. Upon opening the Issues Alert module, the system displays a table of all issued alerts. The Admin can review details, mark issues as resolved, or escalate them if necessary. This ensures timely response to livestock or farm concerns.

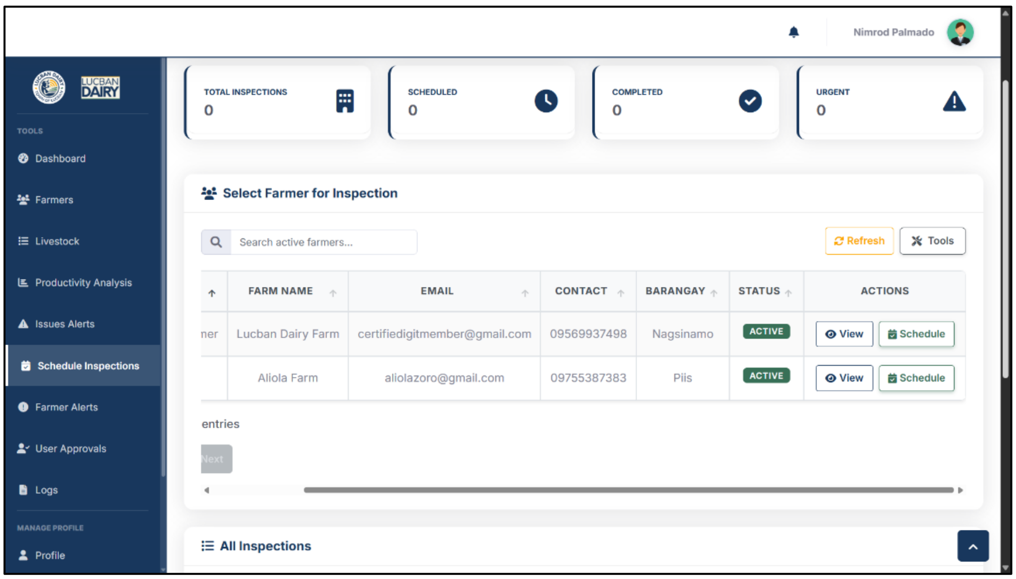


Figure 154. Schedule Inspections Page for Admin

The figure demonstrates how the Admin schedules farm inspections. Upon accessing the Schedule Inspections module, the system allows the Admin to assign inspection dates for individual farmers. Scheduled inspections are reflected in the calendar, ensuring proper monitoring and timely farm management.

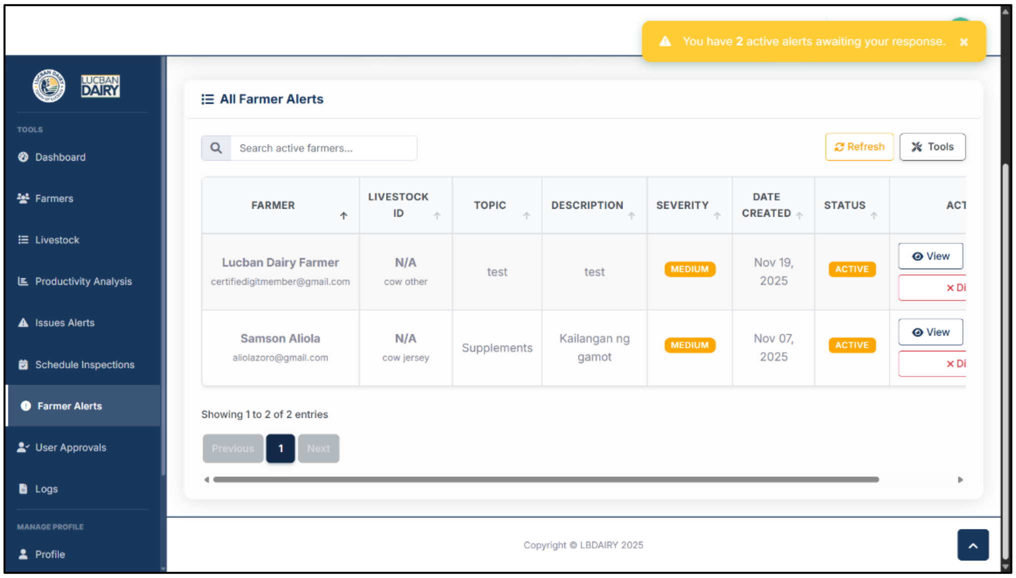


Figure 155. Farmer Alerts Page for Admin

The figure demonstrates how the Admin handles alerts submitted by farmers. Upon opening the Farmer Alerts module, the system displays a table of all alerts submitted. The Admin can review details, mark them as resolved, or dismiss unnecessary alerts. This ensures effective communication and prompt action on farmer concerns.

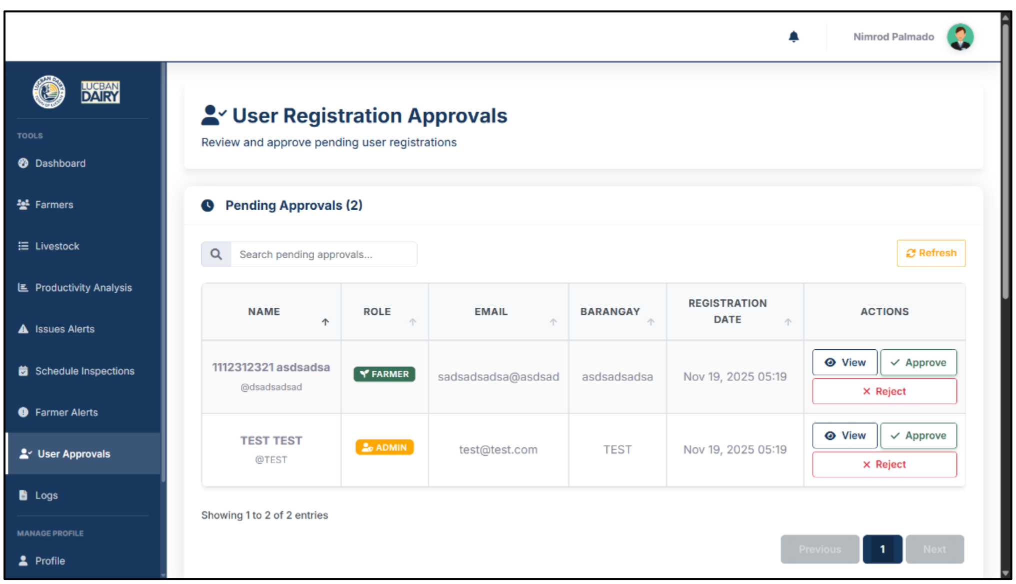


Figure 156. User Approval Page for Admin

The figure demonstrates how the Admin approves or declines new user registrations. Upon opening the User Approvals module, the system lists pending registration requests. The Admin can review user details and decide whether to accept or decline their access to the system. This maintains control over who can use the platform.

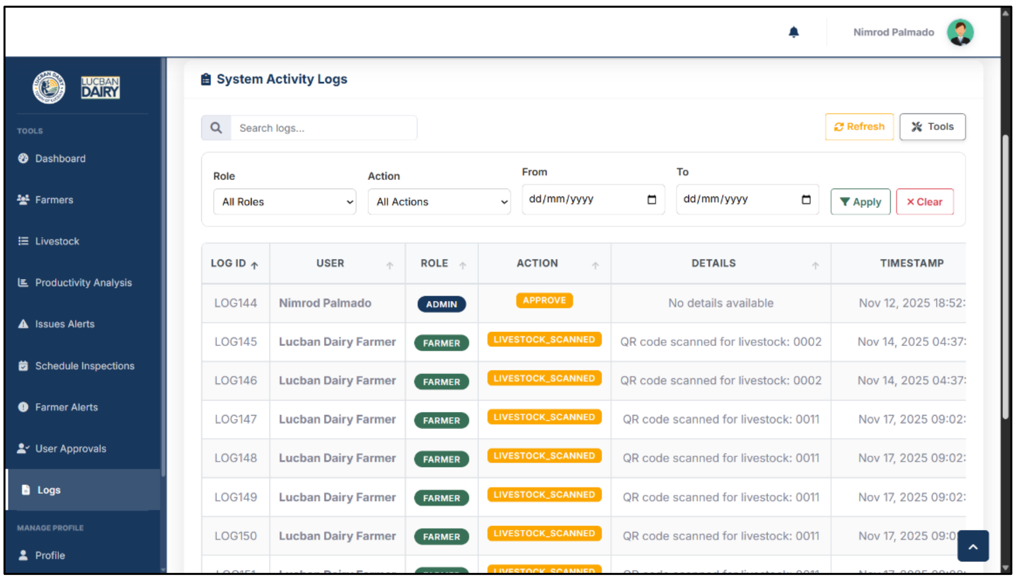


Figure 157. Audit Logs Page for Admin

The figure demonstrates how the Admin monitors system activity. Upon opening the Audit Logs module, the system displays a chronological record of actions performed by farmers and other users under the Admin's supervision. This ensures accountability, transparency, and the ability to trace activities.

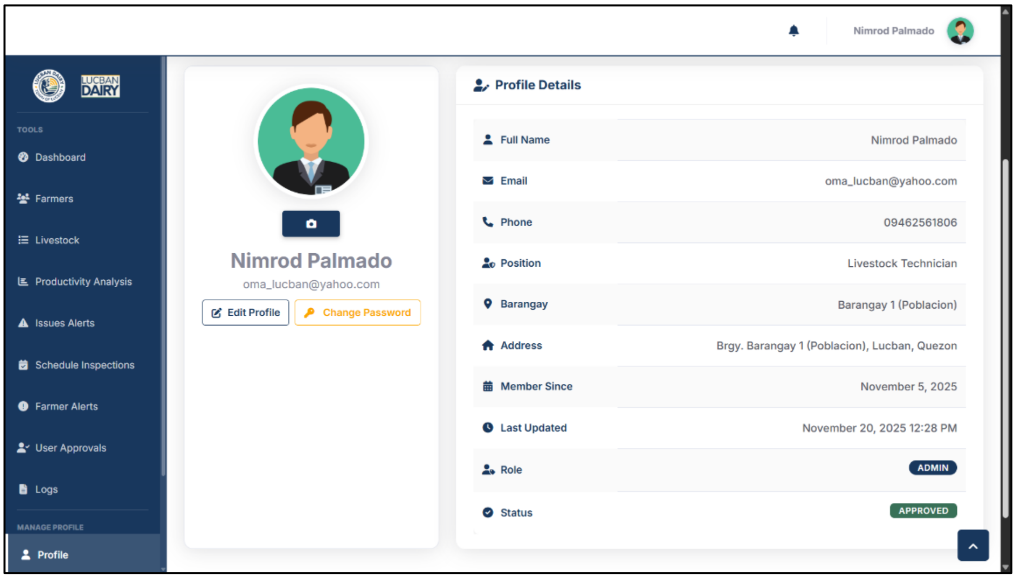


Figure 158. Manage Profile Page for Admin

The figure demonstrates how the Admin updates their account information. Upon opening the Manage Profile module, the system allows editing of username, password, email, contact number, address, and position, and uploading of a profile picture. This ensures that account details remain current and secure.

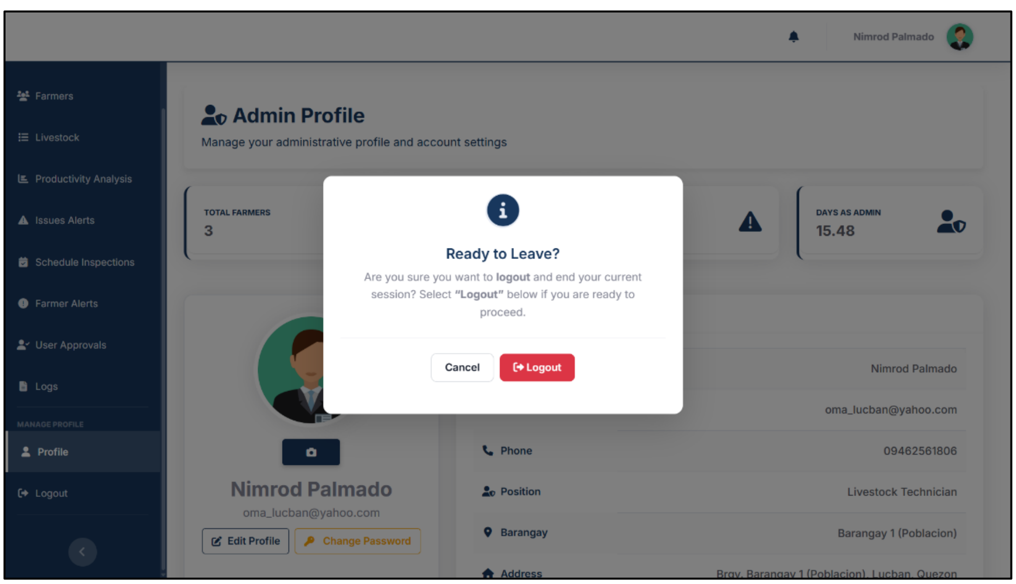


Figure 159. Logout Page for Admin

The figure demonstrates how the Admin securely exits the system. Upon clicking the Logout button, the system terminates the session and redirects to the landing page. This ensures the protection of sensitive farm and user data.

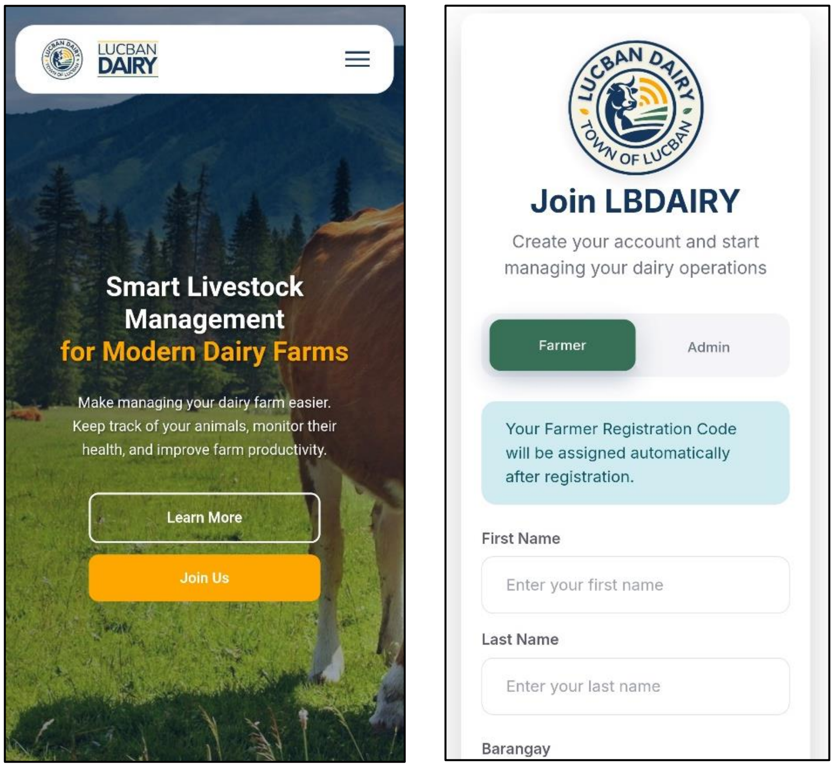


Figure 160. Registration Page for Farmer

The figure demonstrates how the Farmer registers a new account. Upon opening the Registration page, the system prompts the user to input the farmer registration code, personal information, farm details, username, password, and to accept the terms and conditions. Successful registration allows the Farmer to access the system and manage farm and livestock records.

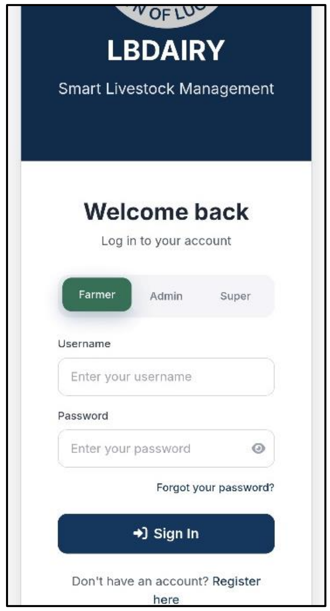


Figure 161. Login Page for Farmer

The figure demonstrates how the Farmer accesses the system through the Login page. The Farmer enters their username and password, optionally selects the "Remember Me" checkbox, and clicks the login button. Successful authentication redirects the Farmer to the Dashboard, ensuring secure access to farm management functionalities.

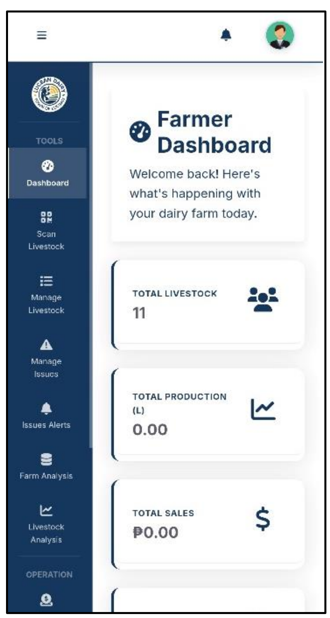


Figure 162. Dashboard Page for Farmer

The figure demonstrates how the Farmer uses the Dashboard to access system modules. Upon login, the system displays quick links to Scan Livestock, Manage Livestock, Manage Issues, Farm and Livestock Analysis, Sales, Clients, Suppliers, Production, Expenses, Inventory, Calendar, Profile settings, and Logout. The Dashboard provides a centralized view for efficient farm and livestock management.

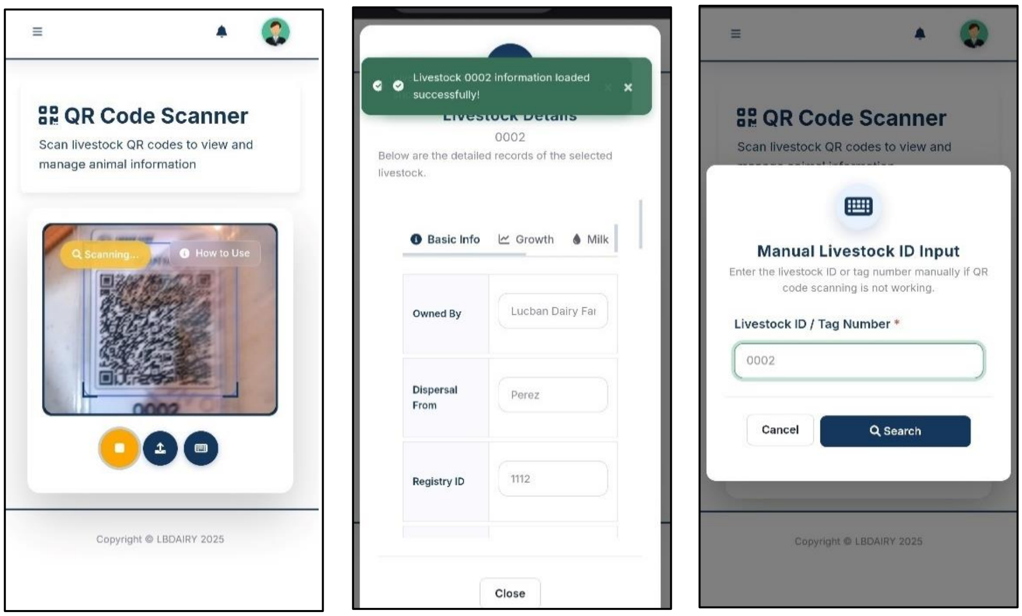


Figure 163. Scan Livestock Page for Farmer

The figure demonstrates how the Farmer scans livestock QR codes. Upon opening the Scan Livestock module, the system allows the Farmer to upload or scan a QR code, which provides direct access to the corresponding livestock's record. This ensures quick retrieval of livestock information for monitoring and management.

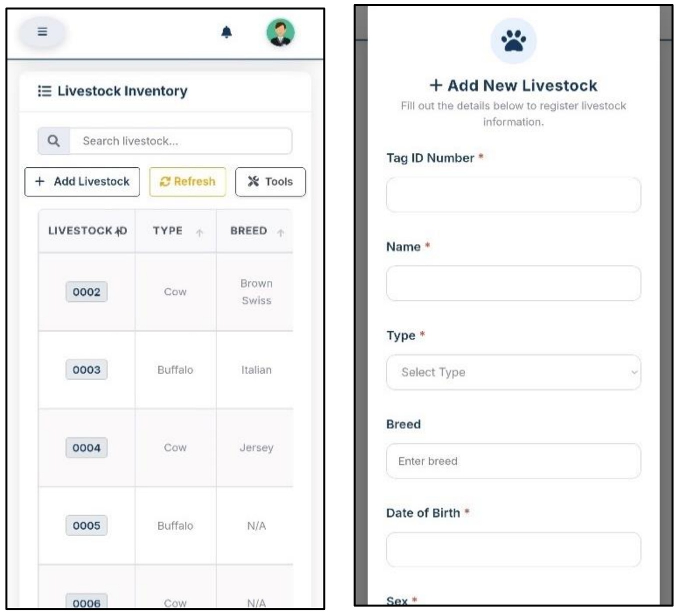


Figure 164. Manage Livestock Page for Farmer

The figure demonstrates how the Farmer manages livestock records. Upon opening the Manage Livestock module, the system displays a table of all livestock. The Farmer can add new livestock, delete records, and edit growth or calving and milk production sections. This ensures proper tracking of individual animal productivity.

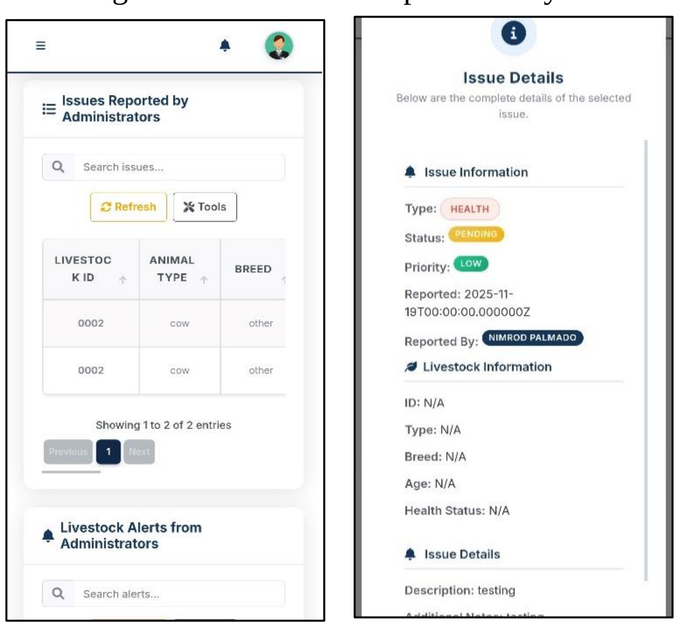


Figure 165. Manage Issues Page for Farmer

The figure demonstrates how the Farmer monitors livestock-related issues. Upon opening the Manage Issues module, the system displays a table of livestock that have issues or alerts issued. The Farmer can review and address these issues to ensure proper animal care.

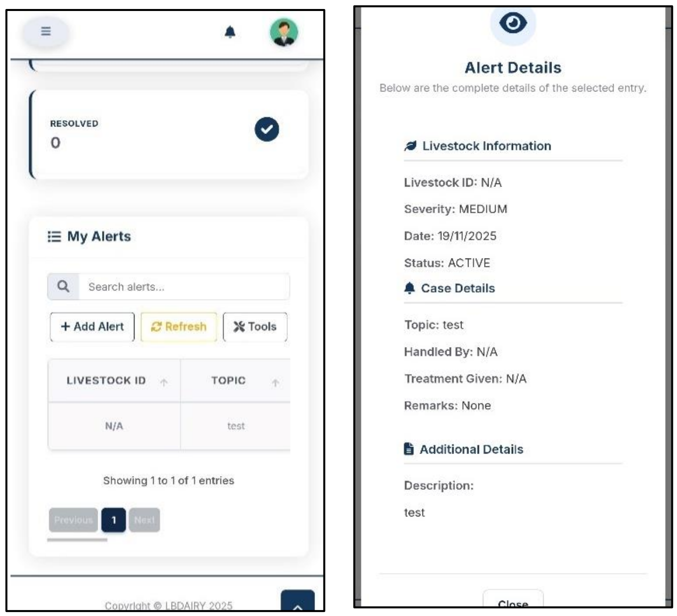


Figure 166. Issues Alerts Page for Farmer

The figure demonstrates how the Farmer submits alerts to the Admin. Upon opening the Issues Alert module, the system allows the Farmer to input the date, issue topic, and description, which are sent to the Admin for review and action. This ensures effective communication and timely resolution of farm or livestock concerns.

Figure 167 Farm Analysis Page for Farmer

The figure demonstrates how the Farmer reviews overall farm productivity. Upon opening the Farm Analysis module, the system displays charts and tables summarizing farm performance, including livestock productivity and output. The Farmer can generate reports in PNG, CSV, or PDF formats to monitor farm progress.

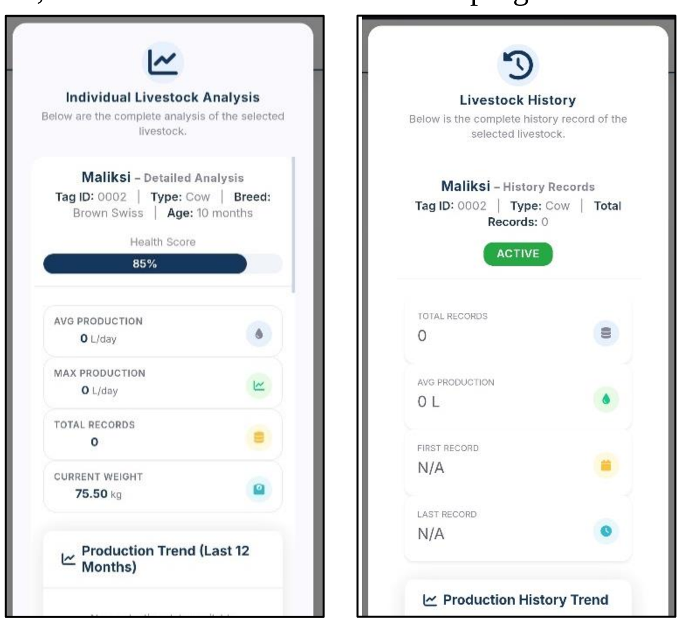


Figure 168. Livestock Analysis Page for Farmer

The figure demonstrates how the Farmer reviews individual livestock productivity. Upon opening the Livestock Analysis module, the system displays growth, calving, and milk production data for each animal. The Farmer can generate reports and monitor monthly progress to make informed management decisions.

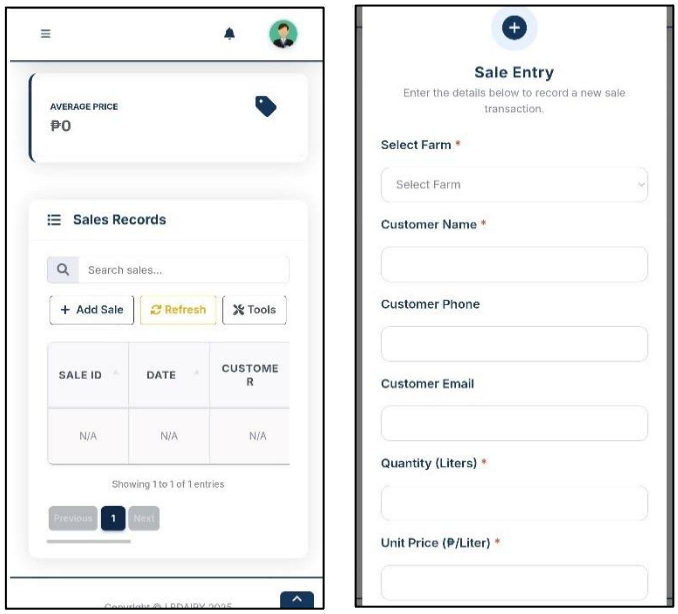


Figure 169. Sales Page for Farmer

The figure demonstrates how the Farmer manages sales records. Upon opening the Sales module, the system displays sales data, including sale ID, date, and total sold amount. The Farmer can export CSV data, view history quarterly, and generate sales reports. This ensures accurate tracking of farm income.

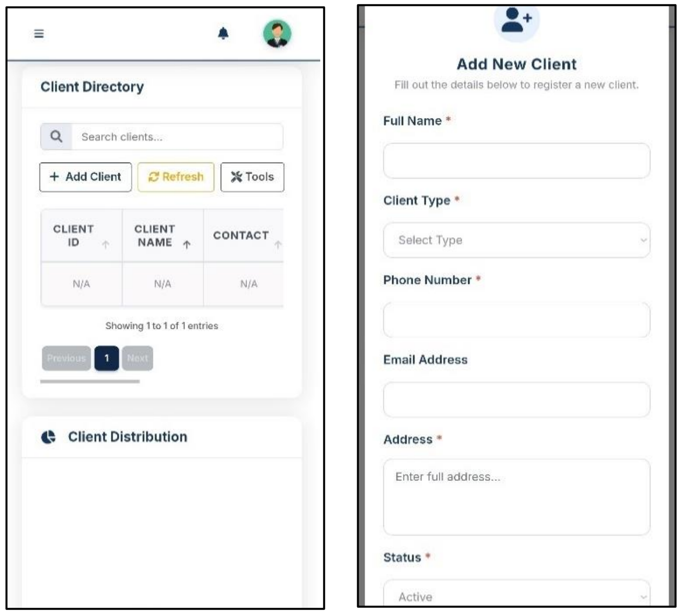


Figure 170. Clients Page for Farmer

The figure demonstrates how the Farmer manages client records. Upon opening the Clients module, the system displays client information, including ID, name, and address. The Farmer can import client data, and access the client ledger for payment tracking. This ensures proper management of customer relationships.

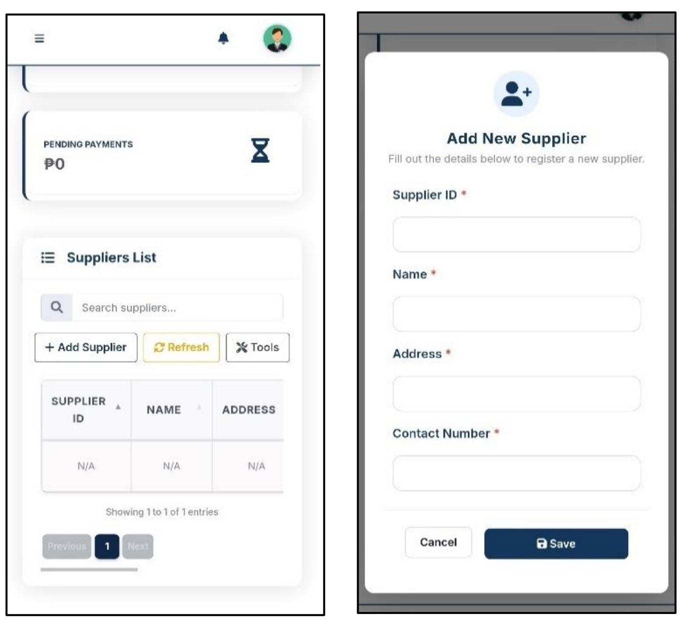


Figure 171. Suppliers Page for Farmer

The figure demonstrates how the Farmer manages supplier information. Upon opening the Suppliers module, the system displays supplier data, including ID, name, and address. The Farmer can import data, view purchase history, and access supplier ledgers for monitoring payables and payments. This ensures proper supply chain management.

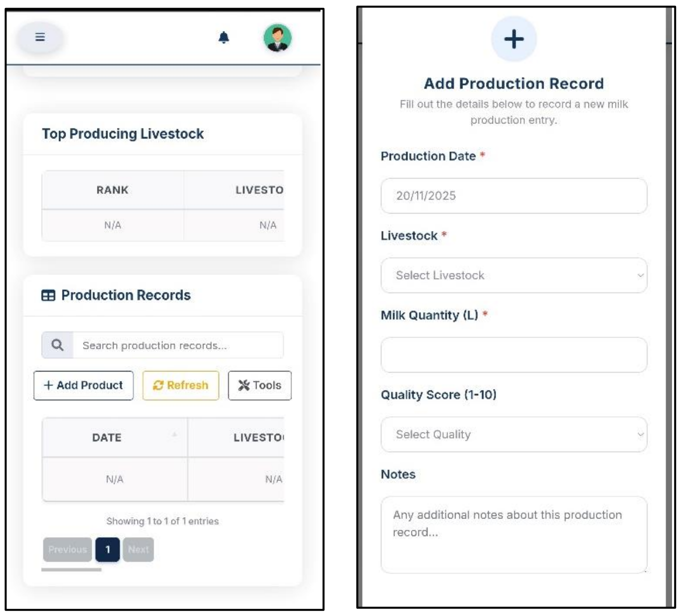


Figure 172. Production Page for Farmer

The figure demonstrates how the Farmer tracks farm production. Upon opening the Production module, the system displays product details such as ID, name, batch, and stock levels. The Farmer can view quarterly history and generate production reports to monitor outputs effectively.

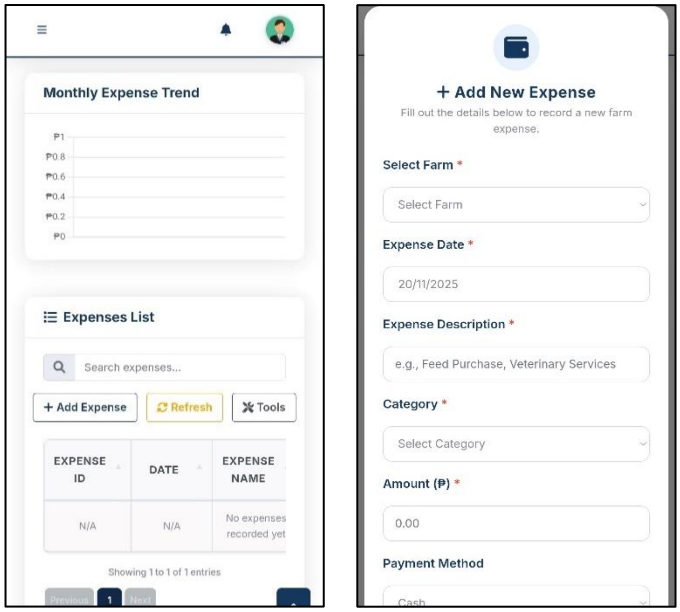


Figure 173. Expenses Page for Farmer

The figure demonstrates how the Farmer manages farm expenses. Upon opening the Expenses module, the system displays expense records, including date, name, and amount. The Farmer can import CSV data, view quarterly history, and generate expense reports to ensure proper financial tracking.

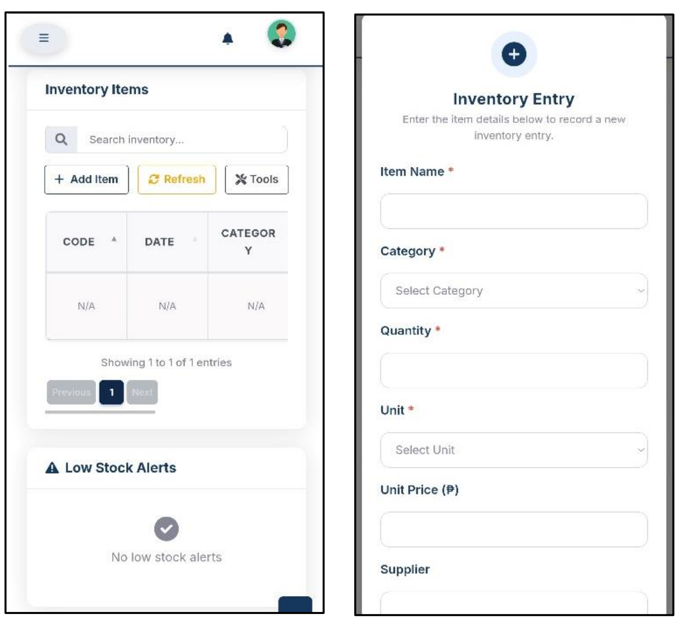


Figure 174. Inventory Page for Farmer

The figure demonstrates how the Farmer oversees farm inventory. Upon opening the Inventory module, the system displays all inventory items, including ID, category, farm ID, and stock details. The Farmer can import data, view quarterly history, and generate inventory reports in multiple formats. This ensures effective resource management.

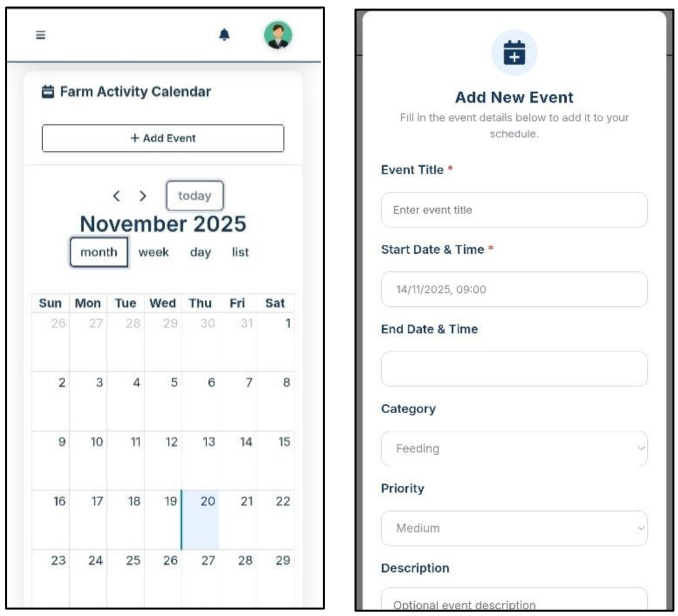


Figure 175. Calendar Page for Farmer

The figure demonstrates how the Farmer views scheduled activities. Upon opening the Calendar module, the system displays inspection schedules and other events. The Farmer can track upcoming inspections and manage farm activities efficiently.

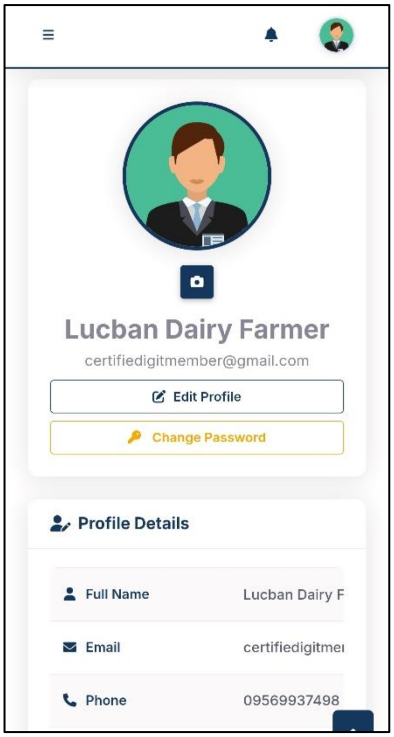


Figure 176. Manage Profile Page for Farmer

The figure demonstrates how the Farmer views scheduled activities. Upon opening the Calendar module, the system displays inspection schedules and other events. The Farmer can track upcoming inspections and manage farm activities efficiently.

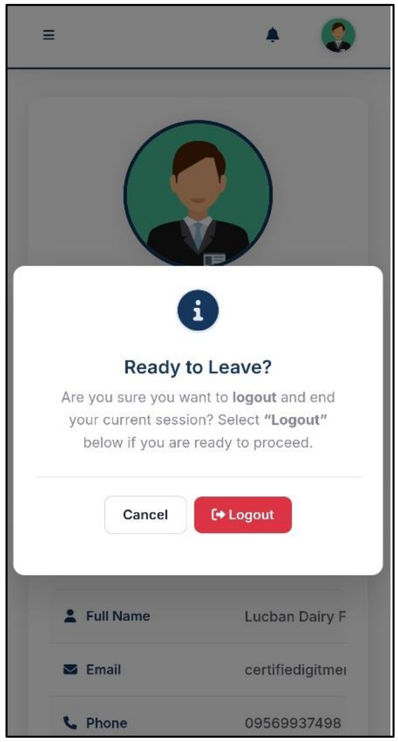


Figure 177. Logout Page for Farmer

The figure demonstrates how the Farmer securely exits the system. Upon clicking the Logout button, the system terminates the session and redirects to the Landing Page. This ensures the protection of sensitive farm and livestock data.

User Acceptance Evaluation Survey Results and Interpretation

The researchers developed LBDAIRY: A Web-Based Dairy Livestock Monitoring and Management System Using QR Code Tagging with Productivity Analysis for the Lucban Municipal Agriculture Office. The system aims to streamline dairy livestock management by providing modules for animal monitoring, productivity tracking, breeding records, inventory, and financial management through an accessible and data-driven web platform.

This chapter presents the results of the system evaluation conducted using the ISO 25010 software quality standard. The evaluation focused on the following criteria: Performance Sustainability, Performance Efficiency, Compatibility, Interaction Capability, Reliability, Security, and Graphical User Interface. A total of 40 respondents participated in the evaluation, composed of 10 IT experts and 30 End-users from the Lucban Municipal Agriculture Office and Lucban Dairy Association. The respondents were selected through purposive sampling to assess the system's functionality, usability, and overall performance. Data were gathered using an unstructured survey questionnaire after participants tested the LBDAIRY system. The summarized results are presented in tabular form, showing the average ratings across the evaluated sub-characteristics.

End-User

Table 3: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Functional Suitability.

Statement	Mean Score	Interpretation/ Category
1. The system provides features I need to monitor and manage dairy livestock.	3.93	Acceptable
2. The QR code tagging correctly identifies and track each animal.	3.73	Acceptable
3. The productivity reports give accurate and reliable result.	3.73	Acceptable
4. The system has enough functions to support the work of the Lucban Agriculture Office	3.7	Acceptable
5. The analysis tools help in making better farm decisions.	3.83	Acceptable
Average Weighted Mean	**3.78**	**Acceptable**

The system's functional suitability was assessed to determine how well it supports users in accomplishing tasks related to dairy livestock monitoring and management. It achieved an average weighted mean of 3.78, which is interpreted as acceptable, indicating that the system provides the necessary features for effective use.

Users scored the system 3.93 for providing features needed to monitor and manage livestock. QR code tagging for animal identification scored 3.73, while productivity reports received 3.73, reflecting accurate and reliable results. The system's overall functions to support office operations scored 3.70, and analysis tools for farm decision-making scored 3.83, demonstrating that users can complete tasks efficiently.

These results suggest that the system provides adequate functional suitability, supporting QMII (2024) and Rebeś & Rebeś (2025), who note that functional suitability includes completeness, correctness, and appropriateness of features in meeting user needs.

Table 4: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Performance Efficiency.

Statement	Mean Score	Interpretation/ Category
1. The system loads quickly and responds without delays.	3.60	Acceptable
2. The QR code scanning feature works fast and accurately.	3.63	Acceptable
3. The system stays fast even when I enter multiple data.	3.50	Acceptable
4. The system works well and stays fast on different devices.	3.70	Acceptable
5. The system provides real - time updates without noticeable delay.	3.63	Acceptable
Average Weighted Mean	**3.61**	**Acceptable**

The system's performance efficiency was evaluated to determine how well it executes tasks and uses resources. It achieved an average weighted mean of 3.61, interpreted as acceptable, indicating that the system operates efficiently under normal conditions.

Users rated the system 3.60 for speed and responsiveness, 3.63 for QR code scanning accuracy, and 3.50 for handling multiple data entries. Performance on different devices scored 3.70, and real-time updates scored 3.63, showing consistent and reliable operations.

These results align with ISO/IEC 25010 (2024) and Panduwiyasa et al. (2023), which emphasize that performance efficiency involves timely task execution, proper resource use, and responsiveness, contributing to user satisfaction.

Table 5: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Compatibility.

Statement	Mean Score	Interpretation/ Category
1. The system works properly on different devices such as phones, tablet and computers.	3.57	Acceptable
2. The system runs smoothly in different web browsers without errors.	3.53	Acceptable
3. I can easily share data from this system in formats I can use.	3.73	Acceptable
4. The system works well alongside other applications running in the background.	3.57	Acceptable
5. The system integrates well with device cameras for QR code scanning.	3.63	Acceptable
Average Weighted Mean	**3.61**	**Acceptable**

The system's compatibility was evaluated to determine how well it operates across different devices, browsers, and applications. It achieved an average weighted mean of 3.61, which is interpreted as acceptable, indicating that it can function alongside other tools and platforms without major issues.

Users rated the system 3.57 for working properly on various devices, including phones, tablets, and computers, and 3.53 for running smoothly on different web browsers without errors. Data sharing received a higher score of 3.73, showing that users can easily export and use information in desired formats. The system's ability to coexist with other applications running in the background scored 3.57, while integration with device cameras for QR code scanning scored 3.63, reflecting its adaptability to hardware features.

These results suggest that the system provides adequate compatibility, supporting the ISO/IEC 25010 standard (2024), which emphasizes both co-existence and interoperability, and aligning with findings by Britton (2021), who notes that compatible systems ensure smooth operations across diverse environments and prevent interference between software applications.

Table 6: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Interaction Capability.

Statement	Mean Score	Interpretation/ Category
1. The system is easy to understand and use.	3.70	Acceptable
2. The menus, buttons, and icons are clear and easy to follow.	3.63	Acceptable
3. The system allows me to finish tasks without confusion.	3.23	Acceptable
4. The system provides clear messages / notifications after I take an action.	3.77	Acceptable
Average Weighted Mean	**3.58**	**Acceptable**

End-users assessed how effectively they could interact with the system through its interface. The system achieved an average weighted mean of 3.58, which is interpreted as acceptable, indicating that users can perform tasks with minimal difficulty and understand system operations.

The system scored 3.70 for ease of understanding and use, showing that users can navigate the platform without confusion. The clarity of menus, buttons, and icons received a score of 3.63, reflecting an intuitive interface. Completing tasks without errors scored 3.23, indicating that while generally user-friendly, there may be minor areas for improvement in workflow guidance. Notifications and feedback after actions scored 3.77, showing that the system communicates results and updates clearly to the users.

These results suggest that the system provides adequate interaction capability, supporting the ISO/IEC 25010 standard (2024), which highlights learnability, operability, and user engagement as key aspects. The findings also align with Fukuzumi et al. (2022), who emphasize that effective interaction capabilities improve user experience and reduce errors during system use.

Table 7: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Reliability.

Statement	Mean Score	Interpretation/ Category
1. The system works consistently without frequent crashes or downtime.	3.67	Acceptable
2. The system remains available whenever it is needed.	3.60	Acceptable
3. The system can quickly recover and keep livestock records after an interruption or problem like power or internet loss.	3.53	Acceptable
4. The system functions well without issue over a long period.	3.37	Acceptable
Average Weighted Mean	**3.54**	**Acceptable**

The reliability of the system was assessed to determine its ability to consistently perform tasks and maintain stable operations under normal and unexpected conditions. The system achieved an average weighted mean of 3.54, which is interpreted as acceptable, indicating that users can rely on it to support dairy livestock monitoring and management effectively.

End-users rated the system 3.67 for working without frequent crashes, reflecting its overall stability. Availability whenever needed scored 3.60, showing that users can access the system whenever required. The ability to quickly recover and maintain livestock records after interruptions, such as power or internet outages, scored 3.53, demonstrating practical resilience. Long-term performance received a score of 3.37, indicating consistent functionality over extended periods of use.

These results suggest that the system provides adequate reliability, supporting the findings of Pratama and Mutiara (2021), who highlight that reliability encompasses availability, fault tolerance, and recoverability. Ensuring these factors contributes to uninterrupted operations and is particularly important in environments where timely access to accurate data is critical, such as in agriculture and livestock management.

Table 8: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Security.

Statement	Mean Score	Interpretation/ Category
1. User accounts are well-protected through secure login credentials (username and password).	3.77	Acceptable
2. The information entered remains correct and accurate upon returning.	3.60	Acceptable
3. The system requires proper login authentication before granting access to any information.	3.63	Acceptable
4. The system maintains a complete history of all user actions for accountability.	3.67	Acceptable
5. Farm data is kept safe through regular automated backups.	3.73	Acceptable
Average Weighted Mean	**3.68**	**Acceptable**

The security of the system was evaluated to determine how well it protects user data, ensures authentication, and maintains accountability. The system achieved an average weighted mean of 3.68, which is interpreted as acceptable, indicating that users feel confident about the safety and integrity of their information.

End-users rated the system 3.77 for securing user accounts with proper login credentials, reflecting effective access control. The accuracy of stored information received a score of 3.60, showing that data remains correct when revisited. Login authentication scored 3.63, demonstrating that only authorized users can access the system. Maintaining a complete history of user actions scored 3.67, supporting accountability, while automated backups of farm data scored 3.73, ensuring that information is safeguarded against accidental loss or system failures.

These results suggest that the system provides adequate security, aligning with Naqvi et al. (2025), who emphasize that confidentiality, integrity, and accountability are key to protecting software systems.

Table 9: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Maintainability.

Statement	Mean Score	Interpretation/ Category
1. The system continues to work after update.	3.80	Acceptable
2. The system displays a message whenever an error occurs.	3.60	Acceptable
3. Problems reported to support are addressed with timely updates and assistance.	3.63	Acceptable
4. Error messages provided by the system are easy to understand and helpful.	3.80	Acceptable
Average Weighted Mean	**3.71**	**Acceptable**

The maintainability of the system was assessed to determine how easily it can be updated, corrected, and supported over time. The system achieved an average weighted mean of 3.71, which is interpreted as acceptable, indicating that users can rely on it to remain functional and manageable during its operational life.

End-users scored the system 3.80 for continuing to work properly after updates, reflecting effective modifiability. The display of messages during errors scored 3.60, showing that the system helps users identify issues. Timely assistance and updates for reported problems received a score of 3.63, demonstrating responsive support. Error messages were rated 3.80, indicating that they are clear, understandable, and helpful for resolving issues.

These results suggest that the system provides adequate maintainability, supporting Naqvi et al. (2025) and Mena and Santorum (2021), who highlight that maintainability includes testability, modifiability, analyzability, and clarity in error handling. Proper maintainability ensures minimal disruption during updates and contributes to long-term system reliability and user satisfaction.

Table 10: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Flexibility.

Statement	Mean Score	Interpretation/ Category
1. The system provide access at any time and from any location.	3.60	Acceptable
2. I am able to access it only when connected to the internet.	3.57	Acceptable
3. The system functions properly in different browsers.	3.83	Acceptable
4. Different types of farm records (health, breeding, production) can be easily added, viewed, and managed.	3.83	Acceptable
Average Weighted Mean	**3.71**	**Acceptable**

The flexibility of the system was evaluated to determine how well it adapts to different usage conditions, devices, and user needs. The system achieved an average weighted mean of 3.71, which is interpreted as acceptable, indicating that it can adjust to varying operational environments and support diverse user tasks effectively.

Users scored the system 3.60 for providing access at any time and location, showing that it supports remote usage. Access dependent on internet connection scored 3.57, reflecting moderate reliance on connectivity. The system scored 3.83 for functioning properly across different web browsers, and 3.83 for the ability to easily add, view, and manage various farm records, demonstrating adaptability and usability across multiple tasks.

These results suggest that the system provides adequate flexibility, supporting the findings of ISO/IEC 25010 (2024) and Loesch (2023), which describe flexibility as the system's ability to adapt to changing conditions, usage contexts, and user requirements. This capability ensures continuity in operations and enhances overall user satisfaction by allowing the system to meet diverse farming management needs.

Table 11: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Safety.

Statement	Mean Score	Interpretation/ Category
1. The system maintains a complete audit trail of all actions performed by farmers.	3.8	Acceptable
2. The system protects information from being corrupted.	3.77	Acceptable
3. The system gives clear alerts or warnings when user makes a mistake or has done something unsafe.	3.7	Acceptable
4. The system prevents loss of important farm data.	3.8	Acceptable
5. Regular automated backups ensure that livestock records can be recovered if needed.	3.77	Acceptable
Average Weighted Mean	**3.77**	**Acceptable**

The system's safety was evaluated to determine how effectively it prevents data loss, protects information integrity, and alerts users to potential risks. It achieved an average weighted mean of 3.77, which is interpreted as acceptable, indicating that users can rely on the system to maintain secure and safe operations.

End-users rated the system 3.80 for maintaining a complete audit trail of all actions, ensuring traceability and accountability. Protection against data corruption scored 3.77, while clear alerts for unsafe actions received 3.70, reflecting proactive guidance for error prevention. Preventing loss of important farm data scored 3.80, and automated backups scored 3.77, showing that the system can recover records if needed.

These results suggest that the system provides adequate safety, supporting ISO/IEC 25010:2023 (2023) and ITEH Standards (2024), which emphasize operational constraints, fail-safe mechanisms, and hazard warnings as key elements of software safety. Ensuring these safety features reduces risks, safeguards critical farm information, and enhances user confidence in daily operations.

Table 12. Overall Quality Standard Result for End-User of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office.

QUALITY STANDARDS	MEAN	INTERPRETATION
1. Functional Suitability	3.78	Acceptable
2. Performance Efficiency	3.61	Acceptable
3. Compatibility	3.61	Acceptable
4. Interaction Capability	3.58	Acceptable
5. Reliability	3.64	Acceptable
6. Security	3.68	Acceptable
7. Maintainability	3.71	Acceptable
8. Flexibility	3.71	Acceptable
9. Safety	3.77	Acceptable
Average Weighted Mean	**3.67**	**Acceptable**

The evaluation of LBDAIRY in terms of ISO/IEC 25010 quality standards shows that the system performs at an acceptable level across all measured characteristics, with scores ranging from 3.58 to 3.78. This indicates that end-users find the system reliable, functional, and suitable for managing dairy livestock efficiently.

In terms of Functional Suitability (3.78), the system provides the core features necessary for monitoring and managing livestock. Users confirmed that tasks such as tracking animals via QR codes, generating productivity reports, and analyzing farm data can be completed accurately and effectively (QMII, 2024).

The system’s Performance Efficiency scored 3.61, showing that operations are carried out swiftly, with minimal delays, even when handling multiple entries or interacting with different devices. This efficiency ensures that users can work continuously without experiencing slowdowns or interruptions (Panduwiyasa et al., 2023).

Compatibility (3.61) reflects the system’s ability to function smoothly across different browsers, devices, and alongside other applications. Users reported that the system integrates well with device features, such as cameras for QR code scanning, and shares data in usable formats without conflicts.

For Interaction Capability (3.58), the interface was found to be user-friendly, with clear menus, buttons, and notifications. These features allow users to navigate the system and complete tasks with minimal effort, reducing the likelihood of errors (Fukuzumi et al., 2022).

The Reliability score of 3.64 highlights consistent system performance and the ability to recover quickly from interruptions, such as power or internet issues, ensuring that critical farm data remains accessible and intact.

Security achieved 3.68, indicating that the system safeguards user accounts, maintains accurate records, and performs regular backups to prevent data loss. Proper authentication and monitoring enhance confidence in system operations (Naqvi et al., 2025).

With a score of 3.71, Maintainability shows that updates and corrections can be made without introducing new errors. The system’s modular design and informative error messages simplify maintenance and support continuous improvement (Mena & Santorum, 2021).

Flexibility (3.71) demonstrates that LBDAIRY can adapt to different operational conditions and environments, including various browsers and devices, without compromising functionality.

Finally, Safety scored 3.77, showing that the system proactively prevents unsafe actions, secures data, and provides reliable backups, supporting confidence in everyday use (ISO/IEC 25010, 2024).

Overall, the results confirm that LBDAIRY delivers a well-rounded, user-centered system that supports the Lucban Agriculture Office in achieving efficient and safe livestock monitoring and management. The consistent acceptability across all quality characteristics indicates a balance of functionality, performance, and user experience, fulfilling the standards set by ISO/IEC 25010.

IT Expert

Table 13: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Functional Sustainability.

Statement	Mean Score	Interpretation/ Category
1. The system provides all necessary functions need for monitoring and management as expected.	3.70	Acceptable
2. The QR code scanning and tagging features ensures accurate livestock identification across different devices.	3.80	Acceptable
3. The system generates reports with accurate data aggregation and correct calculations across different datasets.	3.70	Acceptable
4. The system maintains functional accuracy when handling large datasets or multiple users at the same time.	3.70	Acceptable
5. The system properly validates livestock data to avoid error and missing records.	3.80	Acceptable
Average Weighted Mean	**3.74**	**Acceptable**

This means it was assessed based on how functional the system is in supporting end-users in accomplishing tasks related to dairy livestock monitoring and management. It recorded an average weighted mean of 3.74, interpreted as acceptable, meaning the system adequately delivered the functions that are necessary in relation to reliable livestock data handling and operational sustainability.

Users rated the system 3.70 for providing all essential functions needed for monitoring and management, reflecting acceptable functional completeness. The QR code scanning and tagging feature received a higher score of 3.80, suggesting that users are satisfied with the accuracy of the identification process and its functionality across devices, demonstrating strong functional correctness. Similarly, the system's report-generation capability-scoring 3.70-was viewed as sufficiently accurate in aggregating data and producing correct calculations. The ability of the system to maintain accuracy when processing large datasets or multiple users also received a score of 3.70, while the validation of livestock data earned 3.80, indicating that users can trust the system in terms of the prevention of errors and missing information.

These results together indicate that the system provides acceptable functional sustainability, as would be expected under ISO/IEC 25010, emphasizing functional suitability. The system is functionally complete, with the right features, as described by QMII (2024) and Perforce Software (2021); functionally correct, presenting the outputs accurately; and functionally appropriate, enabling users to perform their tasks efficiently. This addresses the specific emphasis by Rebeś and Rebeś (2025) that a functionally suitable system should include the necessary features, be correct in providing results, and appropriately conduct the purpose for which it was designed. In this regard, the system supports efficient livestock monitoring and contributes to operational efficiency within agriculture offices, where accuracy and ease of use are paramount.

Table 14: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Performance Efficiency.

Statement	Mean Score	Interpretation/ Category
1. Page loads, data entry, and report generation complete within defined response time thresholds under normal conditions.	3.70	Acceptable
2. The QR code scanning feature works fast and accurately.	3.80	Acceptable
3. The system maintains stable performance during simultaneous access by multiple users.	3.80	Acceptable
4. Does database queries and transactions execute with minimal delay.	3.80	Acceptable
5. The system efficiently manages server and client-side resources (CPU, memory, storage).	3.70	Acceptable
Average Weighted Mean	**3.76**	**Acceptable**

The system had an average weighted mean of 3.76, interpreted as acceptable, meaning the system operates reliably within the time and resource limits expected. Page loading, data entry, and report generation scored 3.70, indicating the timely response of the system within reasonable time under normal usage. QR code scanning, stable performance during access by multiple users, and handling database queries all received 3.80, indicating fast processing with almost no delay, even when many users operate at the same time. Resource management also scored 3.70, meaning the system uses CPU, memory, and storage efficiently.

Generally, the results indicated that the system meets the key aspects of Performance Efficiency as defined by ISO 25010: time behavior, resource utilization, and capacity. In other words, this means that the system can handle operational demands without performance degradation, hence meeting the responsive and resource-efficient criteria for agricultural monitoring software put forward by the same standard.

Table 15: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Compatibility.

Statement	Mean Score	Interpretation/ Category
1. The system fully functional on both desktop and mobile devices.	3.90	Acceptable
2. The system run consistently across major web browser.	3.80	Acceptable
3. The system can share or exchange data with other tools or systems used by the Agriculture Office.	3.80	Acceptable
4. The system co-exists with other applications running on the same device without performance issues.	3.90	Acceptable
5. The system integrates well with device cameras for QR code scanning.	3.80	Acceptable
Average Weighted Mean	**3.84**	**Acceptable**

The weighted mean obtained by the system was 3.84, interpreted as acceptable, indicating that it works well on different devices, browsers, and other software installed in the Agriculture Office. The rating given to the system for working properly both on desktop and mobile devices was 3.90, proving very adaptable across platforms. Its ability to run consistently on major web browsers and to integrate with device cameras for QR code scanning both scored 3.80, reflecting stable and reliable cross-environment performance.

It also scored 3.80 regarding sharing or exchanging data with other tools used by the office, showing good interoperability. Its score of 3.90 demonstrates that it coexists well with other applications on the same device without performance issues, which means effective resource sharing with minimal interference.

These results have demonstrated that the system meets the definition of Compatibility under ISO 25010, which emphasizes interoperability and co-existence. This means the system can interact with other applications without any hitch and work in shared environments without causing delays in conflicts of any kind, thus supporting Britton (2021) and Peters & Aggrey (2020), who point out the prime importance of seamless integration within modern and interconnected software environments.

Table 16: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Interaction Capability.

Statement	Mean Score	Interpretation/ Category
1. The system's interface follows usability design standards to ensure intuitive interaction for different user roles.	3.50	Acceptable
2. The menus, buttons, and icons implemented with consistent design patterns and properly labeled for functional clarity across all modules.	3.50	Acceptable
3. The system implements accessibility standards such as keyboard navigation, screen reader compatibility, and sufficient color contrast.	3.60	Acceptable
4. Does workflows optimized to reduce redundant interactions, and is task efficiency measured through interaction design metrics	3.80	Acceptable
5. Are feedback mechanisms designed with technical clarity, consistency, and proper error-handling protocols?	3.80	Acceptable
Average Weighted Mean	**3.64**	**Acceptable**

The interaction capability of the system is considered acceptable because the end-users assessed it and gave an average weighted mean of 3.64, meaning that it will be easy for users to interact with the interface and accomplish tasks with relatively minimal effort. Both usability design and clarity of menu, buttons, and icons in the interface scored 3.50, indicating that the system provides intuitive and recognizable elements that support learnability and self-descriptiveness. The accessibility features of keyboard navigation and proper contrast were rated 3.60, reflecting compliance with inclusivity requirements.

Workflow efficiency and the execution of tasks scored 3.80, reflecting good operability with low risk for user error. Feedback mechanisms scored 3.80, indicating that the system provides clear prompts and responses to support user assistance and error protection.

These findings indicate that the system ensures a very good level of interaction ability, which is in conformance with ISO/IEC 25010:2024 and ITEH standards, emphasizing operability, learnability, user engagement, and inclusivity as integral parts of interactive quality. The results also confirm Fukuzumi et al. (2022), who point out that better interaction design minimizes users' errors and enhances general user experiences by guaranteeing that interfaces are identifiable, self-descriptive, and supportive of seamless task execution.

Table 17: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Reliability.

Statement	Mean Score	Interpretation/ Category
1. The system works consistently without frequent crashes or downtime.	3.80	Acceptable
2. The system remains available whenever it is needed.	3.60	Acceptable
3. The system has proper fault tolerance mechanisms to continue functioning during minor failures.	3.70	Acceptable
4. Is there redundancy or backup functionality to protect livestock records and productivity data.	3.70	Acceptable
5. The logs and monitoring tools in place to track system failures, crashes, or availability issues.	3.60	Acceptable
Average Weighted Mean	**3.68**	**Acceptable**

The ISO 25010 reliability comes into play in how well the system sustains continuous operation under various conditions. Consequently, with a weighted mean of 3.68, which is interpreted as acceptable, findings indicated that indeed the system executes intended functions reliably and sustains agricultural operations without some kind of disruption.

The end-users evaluated the system to function without frequent crashes (3.80) and be accessible whenever required (3.60) to signify strong availability, one of the central aspects of reliability under ISO 25010. It also demonstrated sufficient fault tolerance, with a rating of 3.70, indicating that the system would remain functioning even when small issues were detected, while it received an identical rating for backup mechanisms that facilitate the preservation of records of livestock and their productivity. In addition, the logs and monitoring features (3.60) support recoverability by providing the system with the ability to keep track of failures and deal with them accordingly.

These findings indicate that the system offers reliable performance commensurate with the ISO 25010 criteria on reliability, as it is resilient during operational occurrences without data corruption or loss of function.

Table 18: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Security.

Statement	Mean Score	Interpretation/ Category
1. Does the system use encryption (in-transit and at-rest) to protect sensitive livestock and user data?	3.70	Acceptable
2. The access control mechanisms implemented to restrict data visibility and actions based on user roles.	3.90	Acceptable
3. Does the system enforce secure authentication mechanisms before granting access?	3.70	Acceptable
4. Does the system verify authenticity of users and devices before allowing access to sensitive functions?	3.70	Acceptable
5. Is there protection against brute force or repeated failed login attempts.	3.50	Acceptable
Average Weighted Mean	**3.70**	**Acceptable**

It was assessed regarding how well the system protects sensitive data, authenticates user identities, and prevents unauthorized access. The weighted mean average of 3.70 is interpreted as acceptable, thus indicating that the end-users consider the system sufficiently secure for both livestock and user information.

Users rated encryption at 3.70 and access control mechanisms at 3.90, showing strong endorsement of confidentiality, a key ISO 25010 security sub-characteristic. Authentication measures were at 3.70, and verification of user identity before accessing sensitive functions was also at 3.70. Protection against brute-force attempts was at 3.50, demonstrating basic safeguards that support accountability and resistance to misuse.

The results show that the system is sufficiently secure according to ISO/IEC 25010, meeting important criteria such as confidentiality and accountability. This corroborates the view that secure design practices in low-code/no-code environments play a critical role in avoiding security vulnerabilities and maintaining user trust.

Table 19: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Maintainability.

Statement	Mean Score	Interpretation/ Category
1. Is the system documentation sufficient for future developers to maintain it?	3.90	Acceptable
2. Can bug fixes and feature updates be deployed without affecting other modules or causing downtime.	3.70	Acceptable
3. The system design support scalability for future feature expansions without requiring major rework.	3.80	Acceptable
4. Are dependencies documented and manageable to avoid compatibility issues during updates.	3.70	Acceptable
5. Is version control properly implemented to track changes and support collaborative development.	3.70	Acceptable
Average Weighted Mean	**3.76**	**Acceptable**

The maintainability of the system was considered in terms of the degree to which it could be updated, extended, and supported over its lifetime. With an average weighted mean of 3.76, which is interpreted to be acceptable, the results indicate that the system is manageable for future development and ongoing improvements.

A high rating for the adequacy of the documentation by end-users was 3.90, reflecting strong analyzability since well-documented code helps a developer understand or diagnose an issue quickly. Effective modifiability, another important sub-characteristic in ISO 25010, modular design, was demonstrated by the system's scalability for expansion in new features 3.80 and the ability to deploy bug fixes and updates without taking the system down (3.70). Properly managed dependencies supported testability with 3.70, and proper version control helped in maintaining organized collaborative development with 3.70.

The results indicate the system is sufficiently maintainable, consistent with the ISO/IEC 25010 model. This supports the findings by Naqvi et al. (2025) and Mena and Santorum (2021), where they state that high maintainability—through analyzability, modifiability, testability, and structured design—ensures long-term reliability, less disruption during updates, and continued productivity of the developers.

Table 20: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Flexibility.

Statement	Mean Score	Interpretation/ Category
1. Can the system adapt to changes in livestock processes without major rework?	3.80	Acceptable
2. Are modules designed to be independent so changes in one do not break others.	3.70	Acceptable
3. The system allow integration with future tools, databases, or APIs.	3.80	Acceptable
4. Can new features or roles be added easily without disrupting existing functions.	3.80	Acceptable
Average Weighted Mean	**3.78**	**Acceptable**

The system's flexibility was examined to ascertain how well it would adapt to changing processes, integration demands, and future functional needs. With an overall weighted mean of 3.78 interpreted as acceptable, it showed that the system could indeed cope with any change in the workflows of livestock management with minimal perturbation.

The end-users strongly rated the system for stability related to changes in the processes around livestock, with an average rating of 3.80; this suggests that it is very responsive in the case of changed operational needs. The system modules being independent scored 3.70, facilitating modularity such that changes in one feature do not affect others negatively. Integration into any future tools, databases, or APIs scored 3.80, which means it's ready for scaling and also directly meets the ISO 25010 sub-characteristic scalability, which intends that performance should be maintained as workloads or integrations increase. It is easy to add new functions or roles, which got 3.80 ratings and shows that the system would evolve seamlessly without affecting existing functions.

Results indicate that the system is sufficiently flexible, as stated in the revised ISO/IEC 25010 standard. This supports Loesch (2023) and other scholars who have pinpointed that flexibility, through adaptability, modularity, and scalability, acts as the backbone for developing resilient and future-ready software that will be able to support the evolution of requirements and operational needs over time.

Table 21: The Level of Acceptability of the End-Users of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of its Safety.

Statement	Mean Score	Interpretation/ Category
1. The transaction controls and access logs in place to prevent unauthorized or accidental record changes.	3.60	Acceptable
2. Are input validations and data checks implemented to prevent unsafe or incorrect entries.	3.50	Acceptable
3. The alert and warning mechanisms correctly implemented and logged for auditing unsafe actions.	3.70	Acceptable
4. The system enforces user role restrictions to prevent accidental or unsafe operations by unauthorized user.	4.00	Acceptable
5. Are backup and recovery procedures implemented and tested to ensure data integrity under failures	3.70	Acceptable
Average Weighted Mean	**3.70**	**Acceptable**

Results on the safety of the system show how well it prevents unsafe operations, maintains data integrity, and minimizes risks that could compromise livestock records or system functionality. With an average weighted mean of 3.70, which is interpreted as acceptable, the results showed that the system has sufficient safeguards to maintain safety and reliability for daily operations.

Users rated the enforcement of user role restrictions highest at 4.00, showing that there are strong operational constraints to prevent unauthorized or unsafe actions. Alert and warning mechanisms were rated with 3.70, as access logs received 3.60, supporting risk identification and hazard warning to notify users of imminent threats and being able to trace actions if some issues arise. Input validation with 3.50 and the existence of backup and recovery procedures with 3.70 contribute to fail-safe mechanisms that help in sustaining the accuracy of data and recovering during system failures.

These results indicate that the system provides acceptable safety in line with the updated ISO/IEC 25010:2023 model. This is in support of guidelines by ITEH Standards 2024 and Naqvi et al. 2025, which emphasize the importance of proactive risk prevention, robust warnings, and safe integration, especially in low-code/no-code development environments where hidden complexities increase the potential for safety oversights.

Table 22. Overall Quality Standard Result for End-User of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office.

QUALITY STANDARDS	MEAN	INTERPRETATION
1. Functional Suitability	3.74	Acceptable
2. Performance Efficiency	3.76	Acceptable
3. Compatibility	3.84	Acceptable
4. Interaction Capability	3.64	Acceptable
5. Reliability	3.68	Acceptable
6. Security	3.70	Acceptable
7. Maintainability	3.76	Acceptable
8. Flexibility	3.78	Acceptable
9. Safety	3.70	Acceptable
Average Weighted Mean	**3.73**	**Acceptable**

The overall assessment of LBDAIRY against the ISO/IEC 25010 software quality model, the system has reached an acceptable level in all nine quality characteristics, an average weighted mean of 3.73. That means the system is functionally reliable, efficient, and secure, and end-users believe it would support them in performing their tasks related to livestock management.

Functional Suitability (3.74) reflects that the system provides the essential features needed for monitoring livestock and processing farm data, consistent with ISO 25010's emphasis on delivering complete, correct, and appropriate functionality. Performance Efficiency (3.76) demonstrates that operations of the system-from scanning QR codes up to retrieving records-run within reasonable time and resource limits. Compatibility (3.84), the highest-rated characteristic, reveals strong interoperability and coexistence with a variety of browsers, devices, and external tools.

Interaction Capability: 3.64-the interface would allow for effective user interaction through clarity of menus, ease of navigation, and guidance through relevant prompts. Reliability: 3.68-the system is stable in its performance and bounces back readily in case of interruptions to make the necessary farm information continually available to the operator. Security: 3.70-the system ensures protection against data loss through provisions for authentication, access control, and monitoring mechanisms.

Maintainability at 3.76 points to how updates, modifications, and debugging can be done without major disruption, thus supporting ISO 25010 in terms of modularity, analyzability, and testability. Flexibility at 3.78 shows the response of a system toward the continuous evolution of processes, integration with future tools, and scalability of operations. Safety has a rating of 3.70 for proactive protection against unsafe actions, data corruption, and operational failures.

Overall, the system meets the ISO/IEC 25010 quality standards at an acceptable level. This supports the literature characterization of the model as an intensive framework for assessing technical performance and user-centered quality, as seen by Temkar & Bhaskar, 2021, and Britton, 2021. Due to their consistent nature in all characteristics, LBDAIRY delivers a well-balanced and reliable solution for the Lucban Agriculture Office, where efficient, secure, and adaptive management of livestock can be supported.

Deployment and Implementation Result

This section presents the deployment and implementation results of LBDAIRY: A Web Based Dairy Livestock Monitoring and Management System Using QR Code Tagging with Productivity Analysis. The system was developed to improve livestock monitoring, record management, and productivity tracking through a centralized digital platform.

The deployment process took two weeks. During the first week, the researchers visited the Lucban Municipal Agriculture Office (LGU) and local farmers to test the system in real world conditions, ensuring that all features such as QR code scanning, record updates, and productivity tracking worked as intended. Adjustments were made to address initial issues, including data loading delays and interface improvements.

The second week focused on demonstrations for stakeholders and IT experts. The system was tested on various devices to verify performance, usability, and compatibility. Feedback collected from both end users and experts was used to refine the interface, enhance functionality, and ensure that the system meets the practical needs of farmers and municipal staff.

Table 23: Testing Procedure & Result

TYPE OF TESTING	DESCRIPTION	RESULTS
Functional Testing	Ensure that all the features of the LBDAIRY system such as QR code scanning, adding and updating livestock records, accessing productivity data, generating reports, and managing user accounts are working properly as intended.	All system features functioned as intended. QR code scanning successfully retrieved livestock records, productivity data and reports were accurately generated, and user account management worked without issues. Minor interface adjustments were noted for better clarity.
Performance Testing	Evaluate the system's processing speed when loading livestock information, generating productivity insights, and handling database transactions to determine its efficiency and reliability.	The system processed livestock records, productivity insights, and report generation efficiently. Average load times were under 3 seconds, and database queries were handled smoothly without delays, confirming reliable performance under typical usage conditions.
Usability Testing	Gather feedback from 40 respondents regarding the usability of the system, particularly in terms of navigation, interface design, and overall ease of use.	Users rated the system highly for usability. Navigation was intuitive, the interface was clear, and most users were able to complete tasks efficiently. Some respondents suggested minor improvements.
Compatibility	Testing Ensure that the application is compatible with various Android devices and screen resolutions.	The system functioned properly across different Android smartphones, OS, and tablets, adapting layouts correctly to different screen sizes. No significant display or functionality issues were observed.

During testing, users responded positively to LBDAIRY, noting its ease of use and the accuracy of livestock monitoring and productivity tracking. Some users experienced slight delays when accessing large datasets or working in areas with poor connectivity, which led to optimizations that improved performance and responsiveness. An in-app user guide was also suggested to help first-time users navigate the system more easily.

The system is designed to function smoothly in farm offices, municipal agriculture offices, and field environments. Its intuitive interface allows users with minimal technical experience to efficiently manage livestock records, track productivity, and generate reports. LBDAIRY's flexible architecture also allows for future upgrades, such as adding new analytics features or expanding monitoring to other types of livestock.

Stakeholders, including municipal staff, farmers, and field technicians, participated throughout the implementation phase. Their feedback was used to refine the interface and features, ensuring the system meets their needs. Demonstrations and tutorial sessions were provided to familiarize users with the platform and its workflows.

Implementation Requirements

Table 24. Implementation Requirements

REQUIREMENT TYPE	DETAILS
Hardware Requirements	The system requires a desktop with Windows 10+, Intel Core i5, 8GB RAM, and 256GB SSD for administration and testing; mobile devices with Android 10+, 3GB RAM, 2GB free storage, and Full HD display for field use; and a developer laptop with Windows 11, Ryzen 5 or Intel i5, 8GB RAM, 512GB SSD, dedicated GPU, and 15.6” Full HD display.
Software Requirements	Visual Code Studio for development, MySQL for database management, and Chart.js with HTML5 for QR generation and scanning.
User Requirements	Access to a user manual or guide and devices that meet the recommended hardware specifications to ensure smooth usage of the LBDAIRY system.
Demo Requirements	A live demonstration session to help stakeholders understand the features and workflows.

The table presents the essential requirements for implementing the LBDAIRY system. It specifies the necessary hardware, including desktop computers for administration, mobile devices for field use, and laptops for development, each meeting the recommended specifications to ensure stable performance. The software requirements include Visual Code Studio for development, MySQL for database management, and HTML5-Qr Code for generating and scanning QR codes. A live demonstration or built-in tutorial is also recommended to help stakeholders understand the system’s features, workflows, and basic troubleshooting procedure.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the findings of the study in relation to the research objectives outlined at the outset. It includes a detailed analysis and interpretation of the data collected from the testing and evaluation of the developed mobile application. The results, together with the study's objectives and research questions, serve as the foundation for drawing conclusions. Additionally, the chapter discusses the implications of these findings and offers recommendations that align with the study's purpose and derived conclusions.

Summary

The study entitled *"LBDAIRY: A Web-Based Dairy Livestock Monitoring and Management System Using QR Code Tagging with Productivity Analysis for the Lucban Agriculture Office"* was developed to provide a reliable and user-friendly tool for monitoring and managing dairy livestock. LBDAIRY integrates QR code tagging for animal identification, generates productivity reports, and assists in farm decision-making. The study focuses on the system's design, implementation, and evaluation of functionality, usability, and overall effectiveness.

The researchers employed a developmental research design to guide the creation of LBDAIRY. This approach supported the systematic development and structuring of the system, helping the researchers determine the technical requirements and specifications needed for successful implementation. It also facilitated engagement with end-users, enabling effective data collection and evaluation.

Various methods were used to gather and analyze information, including observations, interviews, and library/online research. Field visits to local farms provided insight into current livestock management practices, while discussions with staff from the Lucban Agriculture Office identified operational requirements and challenges. Literature and online research helped identify best practices for livestock monitoring and productivity analysis. Guidance from the researchers' adviser and co-adviser provided continuous support during the development process.

An iterative Agile-Kanban methodology was applied to systematically develop and refine LBDAIRY, allowing the researchers to integrate user feedback continuously and make informed design decisions, thereby improving the system's usability, functionality, and adaptability. This approach provided the flexibility to accommodate changing requirements and ensured that the system remained aligned with the needs of the end-users, ultimately enhancing the effectiveness and efficiency of the dairy livestock monitoring and management processes.

For the evaluation of usability, functionality, and acceptability, the researchers used a questionnaire survey aligned with ISO/IEC 25010, covering quality characteristics such as functional suitability, performance efficiency, compatibility, interaction capability, reliability, security, maintainability, flexibility, and safety. Each characteristic was assessed through multiple questions, with responses categorized as acceptable, slightly acceptable, slightly unacceptable, or unacceptable. Face-to-face demonstrations confirmed that LBDAIRY is operational, effective, and capable of meeting both technical specifications and end-user requirements.

Specifically, this project aims to:

1. Design and develop LBDAIRY, which will be capable of:
    a. Providing real-time access to insights on livestock status, farming operations, and output progress via a centralized online dashboard.
    b. Employing QR code identification to assign unique tags to dairy animals for streamlined tracking and data access.
    c. Facilitating supply management by monitoring inventories of feed, veterinary supplies, and farming tools.
    d. Maintaining detailed financial logs to track expenditures, earnings, and farm-related financial activities.
    e. Including performance analysis tools to measure milk yield, weight, and growth over time.
    f. Tracking reproduction and breeding of livestock within the herd.
    g. Supporting multiple platforms via PWA standards for use on mobile, tablet, and desktop devices.
    h. Implementing protective measures for data integrity and confidentiality to ensure secure access.

2. Evaluate the LBDAIRY system for compliance with ISO 25010 standards in terms of:
    1. Functional Suitability
    2. Performance Efficiency
    3. Compatibility
    4. Interaction Capability
    5. Reliability
    6. Security
    7. Maintainability
    8. Flexibility
    9. Safety
3. To prepare a deployment plan for LBDAIRY, ensuring successful implementation and effective utilization by the Lucban Municipal Agriculture Office through system deployment, user training, and continuous monitoring.

Findings

The study revealed several significant findings from the testing and evaluation of the LBDAIRY web-based system. LBDAIRY effectively provides a comprehensive platform for managing and monitoring dairy livestock. Key features include QR code-based livestock identification, centralized dashboards for real-time farm insights, productivity tracking, financial and inventory management, and reproductive monitoring. Users noted that the interface is intuitive, user-friendly, and efficient for overseeing farm operations. Minor visual and alignment adjustments were identified and addressed to enhance usability and overall user experience.

Assessment of the system based on ISO 25010 software quality standards demonstrated satisfactory performance across all measured characteristics. IT experts rated functional suitability (3.74), performance efficiency (3.76), compatibility (3.84), interaction capability (3.64), reliability (3.68), security (3.70), maintainability (3.76), flexibility (3.78), and safety (3.70) as Acceptable. End-users similarly rated all characteristics as Acceptable. The overall Average Weighted Mean of 3.73 indicates that both experts and users found LBDAIRY to be functional, reliable, secure, and capable of meeting operational requirements.

The deployment of LBDAIRY followed a structured implementation plan. This included verification of hardware and software requirements, cross-platform testing, and guided support for administrators and end-users. Feedback from stakeholders emphasized the need for continuous monitoring, training, and updates to ensure sustained system effectiveness and improved adoption.

Overall, the findings demonstrate that LBDAIRY successfully supports the Lucban Municipal Agriculture Office in streamlining livestock management, enhancing operational efficiency, and providing a secure and user-friendly platform. Continuous evaluation and stakeholder feedback are recommended to maintain high system performance and further improve usability.

Conclusions

The challenges faced by the Lucban Municipal Agriculture Office and local dairy farmers included manual record-keeping and outdated techniques in the monitoring of livestock. By integrating gathered data into modern web technologies, the researchers developed LBDAIRY, a web-based system for the monitoring and management of livestock through the use of QR code tagging and productivity analysis tools. This centralized system, accordingly, will provide a format for systematically recording, in a manner accessible to its users, animal health and milk production, breeding records, inventories, and farm financial activities.

In the development process, the researchers focused on creating a user-friendly interface by ensuring that the system works well in every device format because of its PWA structure. Through continuous testing, feedback from actual end-users, and expert evaluations, the proponents were able to refine the system's interface, responsiveness, and functionality. Based on the overall result of the ISO/IEC 25010 evaluation, LBDAIRY is acceptable in all key characteristics of quality software, proving to be reliable and suitable for supporting dairy livestock management operations.

In particular, the researchers come up with the following:

1. LBDAIRY hence facilitates dairy animal management through providing features such as QR code animal identification, productivity tracking, and maintaining records digitally. These also enable a user to track the status of the animals or livestock effectively.
2. It integrated web technologies with PWA standards, ensuring compatibility across a multitude of different devices, such as mobile phones, tablets, and desktop computers, allowing farmers and agricultural staff to access updated livestock data from anywhere and at any time.
3. The ISO/IEC 25010 evaluation results establish that the system is at acceptable standards in terms of functional suitability, performance efficiency, reliability, security, maintainability, and usability as expressed by end-users and IT experts. Such findings indicate that the system supports real-world livestock monitoring operations.
4. LBDAIRY was successfully deployed and met the requirements gathered from Lucban Municipal Agriculture Office and dairy farmers. The features, put together with a clean interface, secure data handling, and organized information flow, prove that this system can substantially enhance farm management, decision-making, and productivity. Evaluation results also prove that LBDAIRY

offers a reliable and practical method for shifting from manual to digital livestock monitoring.

Recommendations

Based on the results of the study, the evaluation rating, and the overall performance of the LBDAIRY system, the researchers recognize the potential of the platform to further enhance livestock management in Lucban and other agricultural communities. While the system has achieved its goals and exhibited reasonable levels of software quality, there are also several enhancements and extensions that could be made in order to improve the efficiency, accessibility, and long-term use of this testing method.

The researchers propose several recommendations:

1. Implement offline-first or enhanced offline mode, especially in areas where internet connectivity is poor or erratic. The system should be able to record data even if there is no internet connectivity, and it should also automatically sync when the internet is back up.
2. Provide continuous training and capacity-building programs among farmers, agricultural staff, and future users. Training shall cover digital literacy, the navigation system, data interpretation, and best practices to maximize the features of the system.

3. Develop additional layers of security, such as multi-factor authentication, encrypted backups, and role-based permissions, to better secure sensitive livestock data and meet standards for digital security.
4. Enable livestock photo uploads for better identification and accuracy. This feature adds a visual layer to support QR codes and records, helping farmers verify animals, prevent mix-ups, and create more detailed livestock profiles.
5. Future research and usability testing should be conducted, investigating new functionalities, improving the user experience, and aligning the system to emerging agricultural technologies and industry needs. Continuous assessment will ensure that LBDAIRY is adaptable, relevant, and effective over time.

References Cited

Abiri, R., Rizan, N., Balasundram, S. K., Shahbazi, A. B., & Abdul-Hamid, H. (2023). Application of digital technologies for ensuring agricultural productivity. Heliyon, 9(12), e22601. https://doi.org/10.1016/j.heliyon.2023.e22601

Abdullah, A., Khan, M., & Srivastava, R. (2015). Flexibility: a key factor to testability. International Journal of Software Engineering & Applications, 6(1), 89–99. https://doi.org/10.5121/ijsea.2015.6108

Akash, N., Hoque, M., Mondal, S., & Adusumilli, S. (2021). Sustainable livestock production and food security. In Elsevier eBooks (pp. 71–90). https://doi.org/10.1016/b978-0-12-822265-2.00011-9

Ajagekar, R., Ajara, K., Corresponding, R., & Ajagekar. (2022). QR CODES AND USEFUL APPS FOR ACADEMIC LIBRARIES. *International Journal of Advance and Applied Research*. https://doi.org/10.5281/zenodo.7188156

Al Dallal, H. R. H., & Al Mukhtar, W. N. M. (2023). A QR code used for personal information based on a multi-layer encryption system. International Journal of Interactive Mobile Technologies (iJIM), 17(9), 44–56. https://doi.org/10.3991/ijim.v17i09.38777

Alhari, M. I., Lubis, M., & Budiman, F. (2022, November 1). Information System Management of Palm Agriculture using Laravel Framework. IEEE Xplore. https://doi.org/10.1109/ICIMCIS56303.2022.10017918

Ali, S., Grover, C., & Chaudhary, R. (2023). Progressive Web Apps (PWAs)-Alternate to mobile and web. In P. Dutta, S. Chakrabarti, A. Bhattacharya, S. Dutta, & V. Piuri (Eds.), Emerging technologies in data mining and information security (Lecture Notes in Networks and Systems, Vol. 491, pp. 613–625). Springer. https://doi.org/10.1007/978-981-19-4193-1_55

Alvarez, M. T. S., & Cañete, D. C. (2022). Awareness of Green Technologies among Dairy MSMEs in Cagayan Valley an Administrative Region in the Philippines. Universal Journal of Agricultural Research, 10(2), 156–169. https://doi.org/10.13189/ujar.2022.100207

Arogundade, O., Sakpere, A., Misra, S., Alonge, C., Garg, L., Abayomi-Alli, A., & Bello, O. (2022). A Web-Based Instant Messaging System for Effective Communication Among Organic Farmers and Researchers. Information Systems and Management Science, 291–300. https://doi.org/10.1007/978-3-031-13150-9_25

Aryo Bhagaskoro, Muhammad Al Makky, & Huda, H. (2025). Development of a Laravel-Based Backend Application Server to Support Farm Animal Information Management at Sein Farm Bandung City. 1–6. https://doi.org/10.1109/icadeis65852.2025.10933316

Atheequlla, G. A., Vasanthi, C., Mahadevaiah, C., Dhananjaya, M. V., & Ramya, H. R. (2024). Leveraging quick response (QR) Codes for horticultural information access stakeholder perspective. Journal of Horticultural Sciences, 19(1). https://doi.org/10.24154/jhs.v19i1.2914

Alders, R. G., Campbell, A., Costa, R., Guèye, E. F., Hoque, M. A., Perezgrovas-Garza, R., Rota, A., & Wingett, K. (2021b). Livestock across the world: diverse animal species with complex roles in human societies and ecosystem services. Animal Frontiers, 11(5), 20–29. https://doi.org/10.1093/af/vfab047

Banta, J. V. C., Nghia, P. T., Thai, V. D., Thuy, N. T., Huynh, V. N., & Van Huan, N. (2025). HerdHero: A livestock management system with descriptive analytics. In P. T. Nghia, V. D. Thai, N. T. Thuy, V. N. Huynh, & N. Van Huan (Eds.), Advances in information and communication technology. ICTA 2024 (Vol. 1205, pp. 1115–1125). Springer. https://doi.org/10.1007/978-3-031-80943-9_88

Basir, M. S., Buckmaster, D., Raturi, A., & Zhang, Y. (2024). From pen and paper to digital precision: a comprehensive review of on-farm recordkeeping. Precision Agriculture, 25(5), 2643–2682. https://doi.org/10.1007/s11119-024-10172-7

Bodnar, J. (2025). ISO 25010 Quality Model tutorial: Definition, characteristics, and applications | ZetCode. https://zetcode.com/terms-testing/iso-25010/

Briones, R. M., & Espineli, I. B. (2022). Towards Competitive Livestock, Poultry, and Dairy Industries: Consolidated Benchmarking Study. https://hdl.handle.net/10419/284557

Britt, J., Cushman, R., Dechow, C., Dobson, H., Humblot, P., Hutjens, M., Jones, G., Mitloehner, F., Ruegg, P., Sheldon, I., & Stevenson, J. (2021). Review: Perspective on high-performing dairy cows and herds. Animal, 15, 100298. https://doi.org/10.1016/j.animal.2021.100298

Britton, J. (2021). What is ISO 25010? Perforce Software. https://www.perforce.com/blog/qac/what-is-iso-25010#what

Budiyanto, S., Silalahi, L. M., Silaban, F. A., Simanjuntak, I. U. V., Rochendi, A. D., & Darusalam, U. (2021). Integration Of Lifting Pump Monitoring System Using ESP32 And Hostinger With Internet Of Things Based. 2021 3rd International

Conference on Research and Academic Community Services (ICRACOS), 225–229. https://doi.org/10.1109/icracos53680.2021.9701989

Budyanto, A. R., & Mujahed, B. A., Singh, J., & Saqib, A. (2023). Integrated farming system: Trends, advantages and constraints - A review. RASSA Journal of Science for Society, 5(2and3), 65–69. https://doi.org/10.5958/2583-3715.2023.00011.4

Canlas, R. B., Piad, K. C., & Lagman, A. C. (2021). An ISO/IEC 25010 based software qualityassessment of a faculty research productivity monitoring and prediction system. ResearchGate, 2. https://doi.org/10.1145/3512576.3512619

Chakraborty, S., & Chakraborty, D. (2025). Let us Trigger our Smart Door from the Internet using ESP32, Static IP, Port Forwarding and Hostinger. ResearchGate, 11(3), 1-06. https://www.researchgate.net/publication/389804361_Let_us_Trigger_our_Smart_Door_from_the_Internet_using_ESP32_Static_IP_Port_Forwarding_and_Hostinger/references

Cordeiro, A. F. R., Silva, L. F., & OliveiraJr, E. (2022). Maintainability Metrics for PLA evaluation based on ISO/IEC 25010. In Springer eBooks (pp. 193–218). https://doi.org/10.1007/978-3-031-18556-4_9

Cui, H., Hanafi, M., Fazlil Ilahi, W. F., Zamri, M. A. S., Shafie, S. M., & Mashohor, S. (2022). The effect of smart fertigation systems on chilli grown in a greenhouse for urban farming. Irrigation and Drainage. https://doi.org/10.1002/ird.2709

Cuenca-Enrique, C., Garcia, J. G., Perez, J. R., & Fernandez, M. (2024). Progressive Web Apps: An optimal solution for rural communities in developing countries? In A. Rocha, H. Adeli, G. Dzemyda, F. Moreira, & V. Colla (Eds.), Information Systems and Technologies. WorldCIST 2023. Lecture Notes in Networks and Systems (Vol. 801, pp. 429–438). Springer. https://doi.org/10.1007/978-3-031-45648-0_35

Dadios, E. P., Vicerra, R. R., Lauguico, S., Bandala, A., Concepcion, R., II, & Sybingco, E. (2022). Automation and control for adaptive management system of urban agriculture using computational intelligence. In IntechOpen eBooks. https://doi.org/10.5772/intechopen.102775

Dineva, K., & Atanasova, T. (2022). Cloud data-driven intelligent monitoring system for interactive smart farming. Sensors, 22(17), 6566. https://doi.org/10.3390/s22176566

Domingo, S. N., Rosellon, M. A. D., Lorenzo, P. J. M., & Manejar, A. J. A. (2022). Domestic benchmarking of the Philippine livestock, dairy, and poultry industries (https://pidswebs.pids.gov.ph/CDN/document/pidsdps2219.pdf

Džermeikaitė, K., Bačėninaitė, D., & Antanaitis, R. (2023). Innovations in cattle farming: Application of innovative technologies and sensors in the diagnosis of diseases. Animals, 13(5), 780. https://doi.org/10.3390/ani13050780

Eduardo, C., Avelar, T. A., Ilda, Luiz, A., Campos, F., & Barbari, M. (2025). Development and Validation of Data Acquisition System for Real-Time Thermal Environment Monitoring in Animal Facilities. AgriEngineering, 7(2), 45–45. https://doi.org/10.3390/agriengineering7020045

Elshan, E., Siemon, D., Bruhin, O., Kedziora, D., & Schmidt, N. (2024). Unveiling challenges and opportunities in low code development Platforms: A StackOverflow analysis. https://scholarspace.manoa.hawaii.edu/items/8b6d2573-fca0-4280-bea8-a5a56f449525

Erickson, B., & Fausti, S. W. (2021). The role of precision agriculture in food security. Agronomy Journal, 113(6), 4455–4462. https://doi.org/10.1002/agj2.20919

Fabiyi, S. D., Ren, J., Han, Y., Zhu, Q., & Barclay, D. (2022). Mobile platform for livestock monitoring and inspection. 2022 3rd International Informatics and Software Engineering Conference (IISEC), 1-6. https://doi.org/10.1109/IISEC56263.2022.9998297

Fauzan, R., Krisnahati, I., Nurwibowo, B. D., & Wibowo, D. A. (2022). A Systematic Literature Review on Progressive Web Application Practice and Challenges. IPTEK the Journal for Technology and Science, 33(1), 43. https://doi.org/10.12962/j20882033.v33i1.13904

Freitas, E., & Cabrera, V. (2024). Short communication: Dairy VictoryTM Platform: A Novel Benchmarking Platform to Empower Economic Decisions on Dairy Farms. JDS Communications. https://doi.org/10.3168/jdsc.2024-0617

Friedman, N., Tan, Z., Haskins, M. N., Ju, W., Bailey, D., & Longchamps, L. (2024). Understanding farmers' data collection practices on Small-to-Medium Farms for the design of future farm management information systems. Proceedings of the ACM on Human-Computer Interaction, 8(CSCW1), 1–28. https://doi.org/10.1145/3637416

Fukuzumi, S., Geis, T., & Earthy, J. (2022). What Is the Difference between Usability in ISO 25000 and ISO/IEC 9241-11? Ceur-ws. https://ceur-ws.org/Vol-3356/paper-03.pdf

Gabato, A. J., Vendivil, J., Sison, B. A., Botangen, K. A., Del Rosario, N. D., & SanZtiago, K. (2024). Development of an RFID-based record management web portal for goats towards precision livestock farming. In 2024 IEEE International Conference on

Computing (ICOCO) (pp. 479–484). IEEE. https://doi.org/10.1109/ICOCO62848.2024.10928232

Gerges, M., & Elgalb, A. (2024). Comprehensive Comparative Analysis of Mobile Apps Development Approaches. Journal of Artificial Intelligence General Science (JAIGS) ISSN:3006-4023, 6(1), 430–437. https://doi.org/10.60087/jaigs.v6i1.269

Geopard. (2023, May 27). Precision livestock farming: technologies, benefits, and risks. GeoPard - Precision Agriculture Mapping Software. https://geopard.tech/blog/precision-livestock-farming-technologies-benefits-and-risks/

Giua, C., Materia, V. C., & Camanzi, L. (2020). Management information system adoption at the farm level: evidence from the literature. British Food Journal, 123(3), 884–909. https://doi.org/10.1108/bfj-05-2020-0420

Green, J. L., Manski, S. E., Hansen, T. A., & Broatch, J. E. (2022). Descriptive statistics. In Elsevier eBooks (pp. 723–733). https://doi.org/10.1016/b978-0-12-818630-5.10083-1

Hansbhanvi, A. N., Atmanand Gauns, Mulla Aizaz Muzawar, Pai, R., & Shaikh, S. S. (2024, June 20). Cellular IoT Enabled Smart Farm Management System. https://doi.org/10.13140/RG.2.2.10273.21604

Hendry, H., Irwan, I., Supiyandi, S., Fachri, B., & Harahap, R. R. (2024, November 3). Construction of web-based livestock Farmer Group information system. Hendry | PROSIDING SEMINAR NASIONAL FAKULTAS TEKNIK DAN ILMU KOMPUTER UNIVERSITAS DHARMAWANGSA. https://proceeding.dharmawangsa.ac.id/index.php/PFTIK/article/view/387

Hidayat, M. R., Saeppani, A. S. A., & Sofiyan, Y. S. Y. (2024, December 29). WEBSITE BASED AGRICULTURAL CONSULTATION INFORMATION SYSTEM DESIGN USING PROGRESSIVE WEB APP. https://ejournal.jurnalist.org/index.php/jureti/article/view/35

Hussain, M. A., K. Sree Varsha, K. Krishnamraju, K. Lavanya, & B. Chakradhar. (2022). QR-Based Ticket Verification and Parking System. Algorithms for Intelligent Systems, 123–130. https://doi.org/10.1007/978-981-19-1484-3_14

Imasha Bandara, Simpson, O., & Sun, Y. (2024). Optimizing Efficiency Using a Low-Cost RFID-Based Inventory Management System. https://doi.org/10.1109/iwcmc61514.2024.10592581

Jain, V., Jain, Y., Dhingra, H., Saini, D., Taplamacioglu, M. C., & Saka, M. U. S. T. A. F. A. (2021). A systematic literature review on qr code detection and pre-processing. International Journal on Technical and Physical Problems of Engineering, 13(1), 111-119

Kassahun, A., Bloo, R., Catal, C., & Mishra, A. (2022). Dairy Farm Management Information Systems. Electronics, 11(2), 239. https://doi.org/10.3390/electronics11020239

K., E., B., F., M.N., M., B., D., & I.S., M. (2021). Poultry Farm Management Information System (A Case Study of Biyinzika Poultry International Limited). British Journal of Computer, Networking and Information Technology, 4(2), 42–79. https://doi.org/10.52589/bjcnit-i1qimwrr

Keibach, E., & Shayesteh, H. (2022). BIM for Landscape Design Improving Climate Adaptation Planning: The Evaluation of Software Tools Based on the ISO 25010 Standard. Applied Sciences, 12(2), 739. https://doi.org/10.3390/app12020739

Kikitamara, S., Mujahidah, I., & Rizky, P. N. M. (2024). Development of digital livestock monitoring in Sambilawang Village, Serang, Banten. E3S Web of Conferences, 475, 02008. EDP Sciences. https://doi.org/10.1051/e3sconf/202447502008

Kofler, J., Suntinger, M., Mayerhofer, M., Linke, K., Maurer, L., Hund, A., Fiedler, A., Duda, J., & Egger-Danner, C. (2022). Benchmarking based on regularly recorded Claw health data of Austrian dairy cattle for implementation in the Cattle Data Network (RDV). Animals, 12(7), 808. https://doi.org/10.3390/ani12070808

Kusnadi, E., Yanitasari, Y., & Supriyadi, S. (2021). Implementation of knowledge management system in cattle farming. ILKOM Jurnal Ilmiah, 13(1), 36–44. https://doi.org/10.33096/ilkom.v13i1.785.35-44

Kumar Shwetabhand, & Ambhaikar, A. (2024). Development of a Low-Cost Livestock Sorting Information Management System Leveraging Deep Learning, AI, and IoT Technologies. BIO Web of Conferences, 82(1). https://doi.org/10.1051/bioconf/20248205019

Laksmi, N. D. N. D. I., Candrawati, N. D. P. M. A., Budaya, N. I. G. B. A., Yanti, N. N. P. Y. P., Merdana, N. I. M., & Mogi, N. I. K. A. (2025). Enhancing Smart Farming Management in the Bali Cattle Breeding Center, Sobangan, Bali, Indonesia, through "SIDEWI" Electronic Data Information System. Journal of Computer Science and Technology Studies, 7(1), 74–81. https://doi.org/10.32996/jcsts.2025.7.1.6

Liu, Q., & Wu, J. (2024). Agricultural & Forestry Economics and Management, 7(2). https://doi.org/10.23977/agrfem.2024.070203

Loesch, H. (2023) ISO 25010 is changing soon - ZEISS Digital Innovation Blog. Digital Innovation Blog. https://blogs.zeiss.com/digital-innovation/en/iso-25010-is-changing-soon/

Loresco, M. M., Poblete, J. B., Guadayo, G. F., Sandro, J. M., Lualhati, C. V., & Sevilla, C. C. (2022, July 5). HERD PROFILE, MILK PRODUCTION AND FEEDING VARIABLES OF DAIRY CATTLE FARMS FROM SELECTED REGIONS IN THE PHILIPPINES. Loresco | Philippine Journal of Veterinary and Animal Sciences. https://www.pjvas.org/index.php/pjvas/article/view/280

Malapane, T. A., & Ndlovu, N. (2024). Assessing the Reliability of Likert Scale Statements in an E-Commerce Quantitative Study: A Cronbach Alpha Analysis Using SPSS Statistics. 90–95. https://doi.org/10.1109/sieds61124.2024.10534753

Malik, M. A., Mustapha, M. F., Sobri, N. M., Razak, N. F. A., Zaidi, M. N. M., Shukri, A. A., & Sham, M. A. L. Z. (2021). Optimal Reliability and Validity of Measurement Model in Confirmatory Factor Analysis: Different Likert Point Scale Experiment. https://doi.org/10.37134/jcit.vol11.9.2021

Martinez, C., Bilderback, D., Eckelkamp, E., Pepper, H., & Cross, T. (2021). Dairy balance sheet and profitability benchmarks. University of Tennessee Extension. https://doi.org/10.22004/ag.econ.309397

Mat. (2025, May 4). Out now: IFCN Dairy Report 2024: Improved global milk production growth and recovery in demand in 2023. IFCN Dairy Research Network. https://ifcndairy.org/improved-global-milk-production-growth-recovery-in-demand-in-2023

Melzer, M., Bellingrath-Kimura, S., & Gandorfer, M. (2023). Commercial farm management information systems - A demand-oriented analysis of functions in practical use. Smart Agricultural Technology, 4, 100203. https://doi.org/10.1016/j.atech.2023.100203

Mena, D., & Santorum, M. (2020). Maintainability and portability evaluation of the REACT Native Framework applying the ISO/IEC 25010. In Advances in intelligent systems and computing (pp. 429–439). https://doi.org/10.1007/978-3-030-59194-6_35

Miguel, J. A. (2023, October 24). Dairy product demand seen rising. The Manila Times. https://www.manilatimes.net/2023/10/25/business/top-business/dairy-product-demand-seen-rising/1916329.

Mohamed, E. S., Belal, A., Abd-Elmabod, S. K., El-Shirbeny, M. A., Gad, A., & Zahran, M. B. (2021). Smart farming for improving agricultural management. The Egyptian Journal of Remote Sensing and Space Science, 24(3), 971–981. https://doi.org/10.1016/j.ejrs.2021.08.007

Monaem, R. a. a. E., & Aljarousha, H. (2023). The Effectiveness of QR code Technology in Developing Digital Game Programming Skills in the Programming Curriculum and Motivation Towards Digital Transformation Among Fifth Grade Students. *An-Najah University Journal for Research - B (Humanities)*, *38*(2), 371–402. https://doi.org/10.35552/0247.38.2.2154

Monteiro, A., Santos, S., & Gonçalves, P. (2021). Precision agriculture for crop and livestock farming—Brief review. Animals, 11(8), 2345. https://doi.org/10.3390/ani11082345

Mujahed, B. A., Singh, J., & Saqib, A. (2023). Integrated farming system: Trends, advantages and constraints - A review. RASSA Journal of Science for Society, 5(2and3), 65–69. https://doi.org/10.5958/2583-3715.2023.00011.4

Muoneke, O. B., Okere, K. I., & Nwaeze, C. N. (2022). Agriculture, globalization, and ecological footprint: the role of agriculture beyond the tipping point in the Philippines. Environmental Science and Pollution Research, 29(36), 54652–54676. https://doi.org/10.1007/s11356-022-19720-y

Naqvi, B., Kedziora, D., Zhang, L., & Oyedeji, S. (2025). Quality of Low-Code/No-Code development platforms through the lens of ISO 25010:2023. Computer, 58(3), 30–40. https://doi.org/10.1109/mc.2024.3493192

Neethirajan, S., & Kemp, B. (2021). Digital livestock farming. Sensing and Bio-Sensing Research, 32, 100408. https://doi.org/10.1016/j.sbsr.2021.100408

Nurfiryal Awatif Mahadi, & Nayef Alduais. (2024). Development of a Web-Based Pet Welfare Community. Applied Information Technology and Computer Science, 5(2), 633–652. https://doi.org/10.30880/aitcs.2024.05.02.034

Orden, E. A., Del Rosario, N. A., Veluz, E. V., Orden, M. E. M., Crisostomo, J. C. A., Dela Cruz, J. M., & Del Rosario, L. L. M. (2021). Farm characteristics, management practices and production performance of smallholder goat farms in Central Luzon, Philippines. Livestock Research for Rural Development, 33(11). http://www.ijat-aatsea.com/past_v19_n4.html

Orihuela, A. (2021). Review: Management of livestock behavior to improve welfare and production. Animal, 15(Suppl 1), 100290. https://doi.org/10.1016/j.animal.2021.100290

Ortega, A. D. S., Mujitaba, M. A., Xayalath, S., Gutierrez, W., Soriano, A. C., & Szabó, C. (2021). Perspectives of the livestock sector in the Philippines: A review. Acta Agraria Debreceniensis, 1, 175–188. https://doi.org/10.34101/actaagrar/1/9101

Pandey, H. O., & Upadhyay, D. (2021). Global livestock production systems: Classification, status, and future trends. In Elsevier eBooks (pp. 47–70). https://doi.org/10.1016/b978-0-12-822265-2.00017-x

Palacpac, E. P., Valiente, E. M., Jacang, R. T., & Manito, M. T. M. (2022b). Adoption scores for buffalo-based technologies in the Philippines as influenced by socio-economic, technological, communication, and institutional factors. Buffalo Bulletin, 41(1), 105. https://doi.org/10.56825/bufbu.2022.4114043

Panduwiyasa, H., Febrian, Y. Y., Saputra, M., & Azzahra, Z. F. (2023). Performance evaluation of ERP based to ISO/IEC 25010:2011 quality model (a case study). AIP Conference Proceedings, 2693, 020001. https://doi.org/10.1063/5.0174711

Philippine Statistics Authority (PSA). (2023). https://psa.gov.ph/content/dairy-situation-report-january-march-2023

Pratama, A. A., & Mutiara, A. B. (2021). Software Quality Analysis for Halodoc Application using ISO 25010:2011. International Journal of Advanced Computer Science and Applications, 12(8). https://doi.org/10.14569/ijacsa.2021.0120844

Poulopoulou, I., Zanon, T., Alrhmoun, M., Katzenberger, K., Holighaus, L., & Gauly, M. (2023). Development of a benchmarking tool to assess the welfare of dairy cattle on small-scale farms. Journal of Dairy Science, 106(9), 6464–6475. https://doi.org/10.3168/jds.2022-22592

Rama Chandra Charan, S. (2022). Asynchronous Data Processing with Machine Learning: Progressive Web Applications for Seamless Offline Functionality. International Journal of Science and Research (IJSR), 11(9), 1288–1296. https://doi.org/10.21275/sr220912120313

Ramsbottom, G., Läpple, D., & Pierce, K. (2020). Financial benchmarking on dairy farms: Exploring the relationship between frequency of use and farm performance. Journal of Dairy Science, 104(3), 3169–3180. https://doi.org/10.3168/jds.2020-18843

Rangayasami, A., & Kannan, K. (2022). Information and Advanced Technology Applied at Agriculture and Livestock Development. In Agro-biodiversity and Agri-ecosystem Management (pp. 323-339). Singapore: Springer Nature Singapore.

Rebeś, P., & Rebeś, P. (2025). Software Quality Standards—How and Why we applied ISO 25010 | Monterail. Monterail. https://www.monterail.com/blog/software-qa-standards-iso-25010

Rochim, R. V., Rahmatulloh, A., El-Akbar, R. R., & Rizal, R. (2023). Performance comparison of response time native, mobile and progressive web application technology. Innovation in Research of Informatics (INNOVATICS), 5(1). https://doi.org/10.37058/innovatics.v5i1.7045

Rokeman, N. R. M. (2024). Likert measurement scale in education and social sciences: explored and explained. EDUCATUM Journal of Social Sciences, 10(1), 77-88. https://doi.org/10.37134/ejoss.vol10.1.7.2024

Rosli, N. A. S., & Zin, N. A. M. (2025). *The development of QR-code preschooler dismissal management system using Laravel framework*. Applied Information Technology and Computer Science, 6(1), 2056–2075. https://doi.org/10.30880/aitcs.2025.06.01.114

Saban, M., Bekkour, M., Amdaouch, I., El Gueri, J., Ait Ahmed, B., Chaari, M. Z., Ruiz-Alzola, J., Rosado-Muñoz, A., & Aghzout, O. (2023). A Smart Agricultural System Based on PLC and a Cloud Computing Web Application Using LoRa and LoRaWan. Sensors, 23(5), 2725. https://doi.org/10.3390/s23052725

Samson Damilola Fabiyi, Ren, J., Han, Y., Zhu, Q., & Barclay, D. (2022). Mobile Platform for Livestock Monitoring and Inspection. White Rose Research Online (University of Leeds), 1–6. https://doi.org/10.1109/iisec56263.2022.9998297

Senate of the Philippines. (2024, August 12). Senate okays bill to revitalize livestock, poultry, dairy industry [Press release]. https://web.senate.gov.ph/press_release/2024/0812_prib2.asp

Serd, C. J. J. G.-. (2024, July 11). Dairy – Industry Strategic Science and Technology Plans (ISPs) platform. https://ispweb.pcaarrd.dost.gov.ph/dairy/

Siddiqi, R., Singh, S., Zuck, L., & Kanich, C. (2023). *Tracking, But Make It Offline: The Privacy Implications of Scanning QR Codes Found in the World*. https://par.nsf.gov/servlets/purl/10420113

Simitzis, P., Tzanidakis, C., Tzamaloukas, O., & Sossidou, E. (2021). Contribution of precision livestock farming systems to the improvement of welfare status and productivity of dairy animals. Dairy, 3(1), 12–28. https://doi.org/10.3390/dairy3010002.

StrategyHelix. (2024, October 17). Thailand Milk Market 2024. https://strategyh.com/report/milk-market-in-thailand/

Solutions - South-South Galaxy. (2024, August 7). South-South Galaxy. https://southsouth-galaxy.org/solutions/detail/addressing-the-philippine-dairy-sector-challenges/

Syed Mohammad Kamruzzaman, Fahim, M., Rahman, L. M., Ahmed, T., & Pavel, M. I. (2022). Sense-IT: An Aquaculture-Specific Autonomous Data Acquisition and Monitoring System. 2022 International Electronics Symposium (IES). https://doi.org/10.1109/IES55876.2022.9888275

Taer, A. N., & Taer, E. C. (2025). Harnessing precision and innovation: A systematic review of precision livestock farming and IoT technologies in the Philippines. Ceylon Journal of Science, 54(1), 53–64. https://doi.org/10.4038/cjs.v54i1.8405

Tambunan, R. A. (2023). UI/UX Design Web-Based Livestock Sale Using Design Thinking to Rapid Prototyping. International Journal of Multidisciplinary Research and Analysis, 06(03). https://doi.org/10.47191/ijmra/v6-i3-03

Temkar, R., & Bhaskar, A. (2021). Quality assurance of IoT based home automation application using modified ISO/IEC 25010. International Journal of Engineering Trends and Technology (IJETT). https://doi.org/10.14445/22315381/IJETT-V69I2P213

Turaja, K. I., Guillermo, L. J., Maghirang, M. A., Tenorio, K. C., Salazar, B., & Del Barrio, A. (2024). The Philippine Dairy Industry: Status, key influences, benchmarks, and Strategies for improvement. Transactions of the National Academy of Science and Technology, 46(2024), 1–31. https://doi.org/10.57043/transnastphl.2024.541

U.S. Department of Agriculture (USDA). (2023). Dairy outlook. USDA Global Agricultural Information Network. Retrieved from https://www.fas.usda.gov

Verónica Isabel Martínez-Cepeda, Moreira, P., Borja, L., Luis Armando Ortiz-Delgado, & Ricardo, D. (2024). ESPE Security: Mobile and Web Application to Manage Community Emergency Alerts. International Journal of Interactive Mobile Technologies, 18(05), 77–90. https://doi.org/10.3991/ijim.v18i05.46781

Vijay Panwar. (2024). Web Evolution to Revolution: Navigating the Future of Web Application Development. International Journal of Computer Trends and Technology, 72(2), 34–40. https://doi.org/10.14445/22312803/ijctt-v72i2p107

Vlaicu, P. A., Gras, M. A., Untea, A. E., Lefter, N. A., & Rotar, M. C. (2024). Advancing Livestock Technology: Intelligent systemization for enhanced productivity, welfare, and sustainability. AgriEngineering, 6(2), 1479–1496. https://doi.org/10.3390/agriengineering6020084

Vučetić, S., Vulović, M., Radosavljević, D., Milić, P., Lekić, J., & Milosavljević, B. (n.d.). Open Data Visualization by Using Javascript Libraries. https://infoteh.etf.ues.rs.ba/zbornik/2023/radovi/VRT-1-2.pdf

Vezzali, E., Bolelli, F., Santi, S., & Grana, C. (2025). State-of-the-art review and benchmarking of barcode localization methods. Engineering Applications of Artificial Intelligence, 147, 110259. https://doi.org/10.1016/j.engappai.2025.110259

Wang, B., & Qi, J. (2022). Research on the Intelligent Cloud Animal Husbandry Platform. Mathematical Problems in Engineering, 2022, e4940511. https://doi.org/10.1155/2022/4940511

Wang, B., Zhao, Q., Zeng, D., Yao, Y., Hu, C., & Luo, N. (2025). Design and Development of a Local-First Collaborative 3D WebGIS Application for Mapping. ISPRS International Journal of Geo-Information, 14(4), 166–166. https://doi.org/10.3390/ijgi14040166

Wiranut Thannithi, Payungsuk Intawicha, Phuwitsorn Phuwisaranakom, & Sureeporn Saengwong. (2024). Design and evaluation of a mobile application for enhancing farm management and performance assessment in fattening beef cattle. Journal of Advanced Veterinary and Animal Research, 0, 1–1. https://doi.org/10.5455/javar.2024.k766

Yeong, D. J., Panduru, K., & Walsh, J. (2024). Smart agriculture: Software platform for telematics monitoring in farm machinery. In 2024 35th Irish Signals and Systems Conference (ISSC) (pp. 1–6). IEEE. https://doi.org/10.1109/ISSC61953.2024.10602840

Yanis, M., Muzakir Zainal, Riza Aulia PUTRA, & Andri Yadi Paembonan. (2023). INTEGRATION OF QR-CODE AND WEB-BASED APPLICATIONS FOR DEVELOPING DIGITAL TOURISM IN IBOIH VILLAGE, INDONESIA AS A LESSON LEARNED MEDIA ON THE VOLCANIC ISLAND. Geojournal of Tourism and Geosites, 47(2), 499–507. https://doi.org/10.30892/gtg.47217-1049

Zheng, H., Zhang, T., Fang, C., Zeng, J., & Yang, X. (2021). Design and implementation of Poultry Farming Information Management System based on cloud database. Animals, 11(3), 900. https://doi.org/10.3390/ani11030900

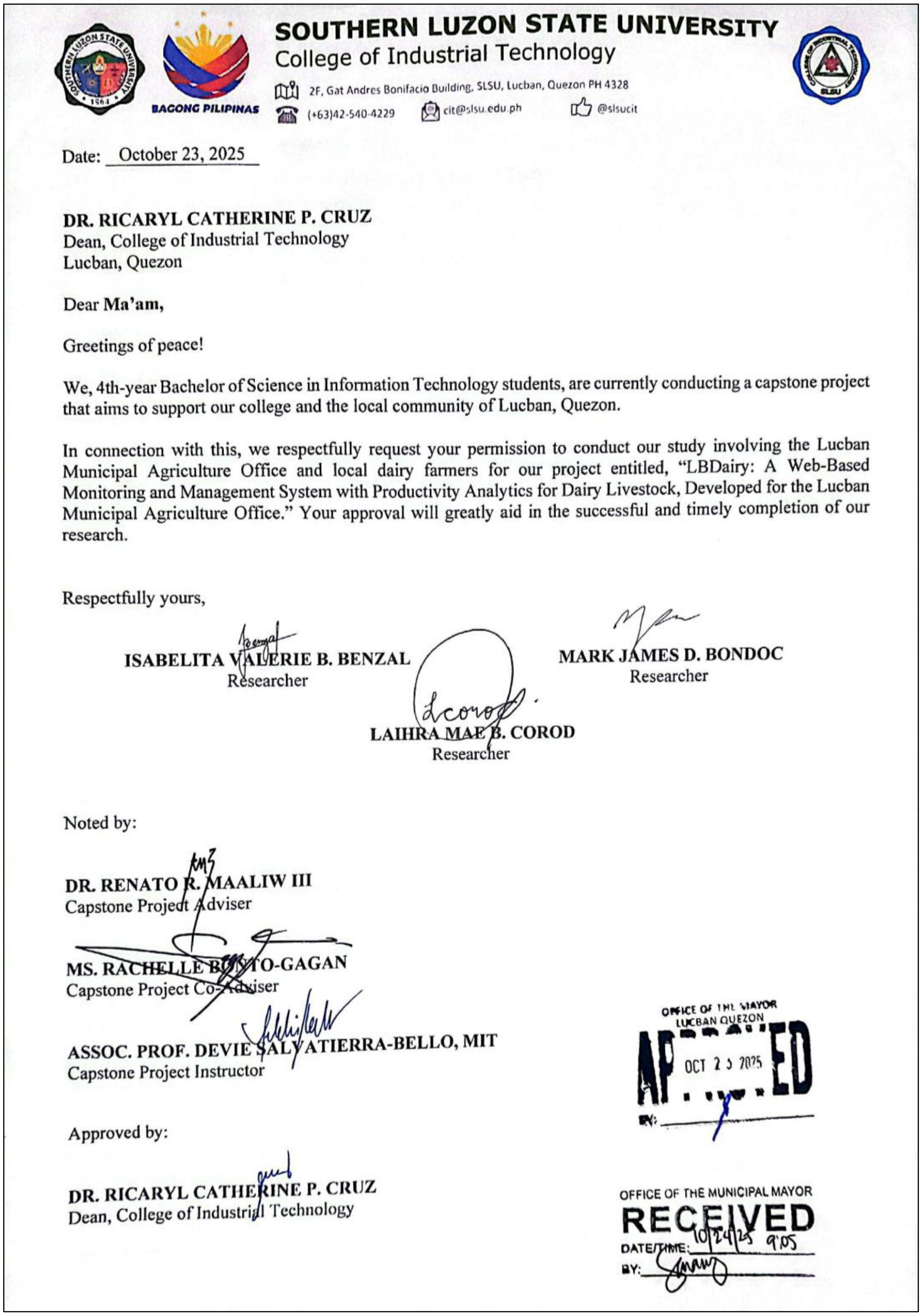
Zhifeng, B. (2021). Research on Visualization Method and Application of Government Statistical Data. https://doi.org/10.23977/jsoce.2021.030315

Zhou, J., & Kong, Z. (2022). Research on the design of interactive games of Intangible Cultural Heritage based on HTML5. In *IntechOpen eBooks*. https://doi.org/10.5772/intechopen.106611

APPENDICES

APPENDIX A

Letter Approved by the Dean to Conduct the Study



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College of Industrial Technology
2F, Gat Andres Bonifacio Building, SLSU, Lucban, Quezon PH 4328
(+63)42-540-4229 cit@slsu.edu.ph @slsucit

Date: October 23, 2025

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology
Lucban, Quezon

Dear **Ma'am,**

Greetings of peace!

We, 4th-year Bachelor of Science in Information Technology students, are currently conducting a capstone project that aims to support our college and the local community of Lucban, Quezon.

In connection with this, we respectfully request your permission to conduct our study involving the Lucban Municipal Agriculture Office and local dairy farmers for our project entitled, "LBDairy: A Web-Based Monitoring and Management System with Productivity Analytics for Dairy Livestock, Developed for the Lucban Municipal Agriculture Office." Your approval will greatly aid in the successful and timely completion of our research.

Respectfully yours,

ISABELITA VALERIE B. BENZAL
Researcher

MARK JAMES D. BONDOC
Researcher

LAIHRA MAE B. COROD
Researcher

Noted by:

DR. RENATO R. MAALIW III
Capstone Project Adviser

MS. RACHELLE BUSTO-GAGAN
Capstone Project Co-Adviser

ASSOC. PROF. DEVIE SALVATIERRA-BELLO, MIT
Capstone Project Instructor

Approved by:

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology

OFFICE OF THE MAYOR
LUCBAN QUEZON
APPROVED
OCT 2 3 2025
BY:

OFFICE OF THE MUNICIPAL MAYOR
RECEIVED
DATE/TIME: 10/24/25 9:05
BY:

APPENDIX B

Adviser Approval Letter

SOUTHERN LUZON STATE UNIVERSITY
College of Industrial Technology
BAGONG PILIPINAS
2F, Gat Andres Bonifacio Building, SLSU, Lucban, Quezon PH 4328
(+63)42-540-4229 cit@slsu.edu.ph @slsucit

REQUEST FOR A RESEARCH ADVISER

Date: May 22, 2025

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology

Dear Madam:

May I request the services of Dr./Prof DR. RENATO R. MAALIW III
(Name of Adviser)
as my adviser on my research entitled "Lbdairy: A Web-Based Dairy Livestock Monitoring and Management System Using Qr Code Tagging with Productivity Analysis for Lucban Agriculture Office".

Very truly yours,

Isabelita Valerie B. Benzal   Mark James D. Bondoc   Laihra Mae B. Corod

Noted:

ASSO. PROF. DEVIE S. BELLO
Research Instructor

Recommending Approval:

ASSO. PROF. DEVIE S. BELLO
Program Chair

1st Endorsement
COLLEGE OF INDUSTRIAL TECHNOLOGY

Respectfully forwarded to DR. RICARYL CATHERINE P. CRUZ seeking response on the
(College Dean)
above request of Isabelita Valerie B. Benzal, Mark James D. Bondoc, and Laihra Mae B. Corod
(Name of Student)

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology

Return Endorsement

Respectfully returned to the College of Industrial Technology office indicating ____________ for the following reason: ____________
(Acceptance or Non-Acceptance)
____________.

DR. RENATO R. MAALIW III
Research Adviser
(Signature over Printed Name)

APPENDIX C

Co-Adviser Approval Letter

SOUTHERN LUZON STATE UNIVERSITY
College of Industrial Technology
2F, Gat Andres Bonifacio Building, SLSU, Lucban, Quezon PH 4328
(+63)42-540-4229 cit@slsu.edu.ph @slsucit

BAGONG PILIPINAS

REQUEST FOR A RESEARCH CO-ADVISER

Date: May 22, 2025

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology

Dear Madam:

May I request the services of Dr./Prof MS. RACHELLE BONTO-GAGAN
(Name of Co-Adviser)
as my adviser on my research entitled "Lbdairy: A Web-Based Dairy Livestock Monitoring and Management System Using Qr Code Tagging with Productivity Analysis for Lucban Agriculture Office".

Very truly yours,

Isabelita Valerie B. Benzal   Mark James D. Bondoc   Laihra Mae B. Corod

Noted:

ASSO. PROF. DEVIE S. BELLO
Research Instructor

Recommending Approval:

ASSO. PROF. DEVIE S. BELLO
Program Chair

1st Endorsement
COLLEGE OF INDUSTRIAL TECHNOLOGY

Respectfully forwarded to DR. RICARYL CATHERINE P. CRUZ seeking response on the
(College Dean)
above request of Isabelita Valerie B. Benzal, Mark James D. Bondoc, and Laihra Mae B. Corod
(Name of Student)

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology

Return Endorsement

Respectfully returned to the College of Industrial Technology office indicating
__________________ for the following reason: __________________
(Acceptance or Non-Acceptance)
________________________.

MS. RACHELLE BONTO-GAGAN
Research Co-Adviser
(Signature over Printed Name)

APPENDIX D

Client Approval Letter

SOUTHERN LUZON STATE UNIVERSITY
College of Industrial Technology
2F, Gat Andres Bonifacio Building, SLSU, Lucban, Quezon PH 4328
(+63)42-540-4229 cit@slsu.edu.ph @slsucit

BAGONG PILIPINAS

DATE : October 23, 2025

TO : **HON. AGUSTIN M. VILLAVERDE**
Municipal Mayor
Lucban, Quezon

THRU : **MS. JOANNA LYNN P. GONZALES**
OIC – Municipal Agriculturist
MAO Lucban, Quezon

SUBJECT : Request for Permission to Conduct a Research

Dear Sir/Madam:

Greetings of Peace!

We are third-year students enrolled in the Bachelor of Science in Information Technology program at Southern Luzon State University. As part of our academic requirement for the completion of our capstone project, we are conducting a study entitled "LBDairy: A Web-Based Monitoring and Management System with Productivity Analytics for Dairy Livestock, Developed for the Lucban Municipal Agriculture Office."

In connection with this, we respectfully request your permission to conduct research activities related to our project. We hope to be granted the opportunity to administer surveys and interviews within your office and among local dairy farmers to gather essential data for our study. The information we aim to collect will serve as a crucial foundation in developing a web-based system designed to assist the Lucban Municipal Agriculture Office in monitoring and managing dairy livestock more efficiently through digital tools and productivity analysis. We would also like to request access to any relevant materials, records, or information that your office may be able to provide, which could serve as valuable references for our research. Please be assured that all data gathered will be treated with the highest level of confidentiality and used solely for academic purposes. Your kind support and cooperation will greatly contribute to the successful completion of our project and the improvement of livestock management practices within the municipality.

Thank you for your time and consideration. We look forward to your response and the opportunity to discuss this matter further at your convenience.

Respectfully yours,

ISABELITA VALERIE B. BENZAL
Researcher

MARK JAMES D. BONDOC
Researcher

LAIHRA MAE B. COROD
Researcher

Noted by:

DR. RENATO R. MAALIW III
Capstone Project Adviser

MS. RACHELLE BONTO-GAGAN
Capstone Project Co-Adviser

ASSOC. PROF. DEVIE SALVATIERRA-BELLO, MIT
Capstone Project Instructor

DR. RICARYL CATHERINE P. CRUZ
Dean, College of Industrial Technology

Approved by:

HON. AGUSTIN M. VILLAVERDE
Municipal Mayor, Lucban, Quezon

OFFICE OF THE MUNICIPAL MAYOR
RECEIVED
DATE/TIME: 10/24/25 9:05
BY:

OFFICE OF THE MAYOR
LUCBAN QUEZON
APPROVED
OCT 24 2025
BY:

APPENDIX E

Letter to the Respondents

Republic of the Philippines
Southern Luzon State University
COLLEGE OF INDUSTRIAL TECHNOLOGY
Lucban, Quezon

Dear Respondents,

Good day! We are the BS Information Technology students from Southern Luzon State University, Lucban, Quezon, are currently conducting our capstone project entitled **"LBDAIRY: A WEB-BASED DAIRY LIVESTOCK MONITORING AND MANAGEMENT SYSTEM USING QR CODE TAGGING WITH PRODUCTIVITY ANALYSIS FOR LUCBAN AGRICULTURE OFFICE"** as part of the requirements for **Capstone Project II**. We kindly ask for your permission to participate and answer the questionnaire, which will require approximately **10-15 minutes** to complete. Please rest assured that all information that will be collected will be used with confidentiality and solely for educational purposes, in compliance with the **Data Privacy Act of 2012 (Republic Act No. 10173).**

Your time and cooperation are deeply appreciated. For any inquiries, clarifications, or feedback, please do not hesitate to connect with us at **ivbbenzal@slsu.edu.ph, mjdbondoc@slsu.edu.ph,** and **lmbcorod@slsu.edu.ph.**

Sincerely,

ISABELITA VALERIE B. BENZAL **MARK JAMES D. BONDOC**

LAIHRA MAE B. COROD
Researchers

Noted:

DR. RENATO R. MAALIW III
Research Adviser

PROF. RACHELLE B. GAGAN
Research Co-Adviser

FOR THE RESPONDENTS:

I consent to the use of my personal information solely for the stated purposes. Access will be limited to authorized researchers, data will be kept secure, and no third parties will have access. I may review or request changes to my information, which will be disposed of according to university procedures once no longer needed.

Signature

APPENDIX F

End-Users Questionnaire

Republic of the Philippines
Southern Luzon State University
COLLEGE OF INDUSTRIAL TECHNOLOGY
Lucban, Quezon

End-User's Questionnaire

Name (Optional): ________________________ **Date:** __________

Direction: Read each statement below. Place a check (✔) on the space provided for your preferred answer. Use the scale below:

4 - Acceptable (A)
3 - Slightly Acceptable (SA)
2 - Slightly Unacceptable (SU) 1 -
Unacceptable (U)

	STATEMENT	4	3	2	1
Functional Suitability					
1	The system provides all the features needed to monitor and manage dairy livestock effectively. *(Ang sistema ay nagbibigay ng lahat ng tampok na kinakailangan upang mapanatili at pamahalaan ang mga gatasing hayop nang epektibo.)*				
2	The Quick Response (QR) code tagging correctly identifies and tracks each animal in the herd. *(Ang Quick Response code ay tumpak na nakikilala at sinusubaybayan ang bawat hayop sa kawan.)*				
3	The productivity reports provide accurate and reliable results for farm management. *(Ang mga ulat sa produktibidad ay nagbibigay ng tumpak at maaasahang mga resulta para sa pamamahala ng sakahan.)*				
4	The system has enough functions to support the daily operations of the Lucban Agriculture Office. *(Sapat ang mga function ng sistema upang suportahan ang pang-araw-araw na operasyon ng Lucban Agriculture Office.)*				
5	The analysis tools help farmers make better and more informed decisions about their livestock *(Ang mga tool sa pagsusuri ay nakakatulong sa mga magsasaka na gumawa ng mas mahusay at mas may kaalamang mga desisyon tungkol sa kanilang mga alagang hayop.)*				

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Lucban, Quezon

Performance Efficiency					
1	The system loads quickly and responds without delays. *(Mabilis mag-load ang sistema at tumutugon nang walang pagkaantala.)*				
2	The QR code scanning feature works fast and accurately when tagging animals. *(Mabilis at tumpak ang paggana ng feature sa pag-scan ng QR code kapag nagta-tag ng mga hayop.)*				
3	The system is stable even when entering multiple animal records at once. *(Mabilis at tumpak ang paggana ng feature sa pag-scan ng QR code kapag nagta-tag ng mga hayop.)*				
4	The system performs well and stays responsive on different devices (phones, laptops, computers). *(Gumagana nang ayos ang system at nananatiling tumutugon sa iba't ibang device (telepono, laptop, computer).)*				
5	The system provides real - time updates without noticeable delay. *(Ang system ay nagbibigay ng mga real-time na update nang walang kapansin-pansing pagkaantala.)*				
Compatibility					
1	The system works properly on different devices such as phones, laptops, and computers. *(Gumagana nang maayos ang sistema sa iba't ibang device tulad ng mga telepono, laptop, at computer.)*				
2	The system runs smoothly across different web browsers without errors. *(Maayos na gumagana ang sistema sa iba't ibang web browser nang walang anumang error.)*				
3	Farm data can be easily exported from the system in different formats (Excel, PDF, etc.). *(Madaling ma-export ang datos ng sakahan mula sa sistema sa mga magagamit na format (Excel, PDF, atbp.).)*				
4	The system works well alongside other applications running in the background. *(Maayos na gumagana ang sistema kasabay ng iba pang mga aplikasyon na tumatakbo sa background.)*				
5	The system integrates well with device cameras for QR code scanning. *(Ang sistema ay maayos na nakikipag-ugnayan sa mga camera ng device para sa pag-scan ng QR code)*				

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Lucban, Quezon

Interaction Capability					
1	The system is easy to understand and use. *(Madaling intindihin at gamitin ang sistema.)*				
2	The menus, buttons, and icons are clear and easy to follow. *(Ang mga menu, button, at icon ay malinaw at madaling sundan.)*				
3	The system allows me to finish tasks without confusion. *(Naiiraos ko ang mga gawain nang walang kalituhan.)*				
4	The system provides clear messages / notifications after I take an action. *(Ang system ay nagbibigay ng malinaw na mga mensahe / abiso pagkatapos kong gumawa ng aksyon.)*				
Reliability					
1	The system works consistently without frequent crashes or downtime. *(Ang system ay gumagana nang tuluy-tuloy nang walang madalas na pag-crash o pagkaantala.)*				
2	The system remains available whenever it is needed. *(Nananatiling available at nagagamit ang system tuwing kailangan ito.)*				
3	The system can quickly recover and keep livestock records after an interruption or problem like power or internet loss. *(Mabilis na makakabawi ang system at mapapanatili ang mga talaan ng hayop pagkatapos ng pagkaantala o problema tulad ng pagkawala ng kuryente o internet)*				
4	The system functions well without issue over a long period. *(Maayos na gumagana ang system nang walang problema sa mahabang panahon.)*				
Security					
1	User accounts are well-protected through secure login credentials (username and password). *(Mahusay at protektado ang mga user account sa pamamagitan ng ligtas na mga kredensyal sa pag-login (username at password).)*				
2	The information entered remains correct and accurate upon returning. *(Ang impormasyong inilagay ay mananatiling tama at wasto pagbalik.*				

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Lucban, Quezon

3	The system requires proper login authentication before granting access to any information. *(Kailangan ng awtorisadong pagpapatunay sa pag-login bago makapagbigay ng access sa anumang impormasyon ang sistema.)*					
4	The system maintains a complete history of all user actions for accountability. *(Pinapanatili ng sistema ang kumpletong kasaysayan ng lahat ng pagkilos ng gumagamit para sa pananagutan.)*					
5	Farm data is kept safe through regular automated backups. *(Ang datos ng sakahan ay pinananatiling ligtas sa pamamagitan ng regular na awtomatikong pag-backup.)*					
Maintainability						
1	The system continues to work after an update. *(Patuloy na gumagana ang sistema pagkatapos ng pag-update.)*					
2	The system displays a message whenever an error occurs. *(Nagpapakita ang system ng mensahe tuwing may nangyaring error.)*					
3	Problems reported to support are addressed with timely updates and assistance. *(Ang mga problemang iniulat sa support ay tinutugunan nang may napapanahong mga update at tulong.)*					
4	Error messages provided by the system are easy to understand and helpful. *(Madaling maunawaan at nakakatulong ang mga mensahe ng error na ibinibigay ng system.)*					
Flexibility						
1	The system provide access at any time and from any location with internet connection. *(Ang sistema ay nagbibigay ng access anumang oras at mula sa anumang lokasyon na may koneksyon sa internet.)*					
2	The system functions properly with different browsers. *(Gumagana nang maayos ang sistema sa iba't ibang browser.)*					

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Lucban, Quezon

3	The system can adapt to different screen sizes. *(Ang system ay umaangkop sa iba't ibang laki ng screen.)*				
4	Different types of farm records (health, breeding, production) can be easily added, viewed, and managed. *(Madaling maidagdag, matingnan, at mapamahalaan ang iba't ibang uri ng talaan sa sakahan (kalusugan, pag-aanak, produksyon).)*				
Safety					
1	The system maintains a complete audit trail of all actions performed by farmers. *(Pinapanatili ng sistema ang kumpletong talaan ng lahat ng aksyong ginawa ng mga magsasaka.)*				
2	The system protects information from being corrupted. *(Pinoprotektahan ng sistema ang impormasyon mula sa pagkasira.)*				
3	The system gives clear alerts or warnings when user makes a mistake or has done something unsafe. *(Ang sistema ay nagbibigay ng malinaw na mga babala o paalala kapag nagkakamali ang gumagamit o kaya nakagawa ng hindi ligtas na bagay.)*				
4	The system prevents loss of important farm data. *(Kontrolado ang seguridad ng system mula sa pagkawala ng mahahalagang datos sa sakahan.)*				
5	Regular automated backups ensure that livestock records can be recovered if needed. *(Tinitiyak ng regular na awtomatikong pag-backupna mababawi ang mga talaan ng hayop kung kinakailangan.)*				

APPENDIX G

It Expert's Questionnaire

Republic of the Philippines
Southern Luzon State University
COLLEGE OF INDUSTRIAL TECHNOLOGY
Lucban, Quezon

IT Experts Questionnaire

Name (Optional): ______________________ **Date:** __________

Direction: Read each statement below. Place a check (✔) on the space provided for your preferred answer. Use the scale below:

4 - Acceptable (A)
3 - Slightly Acceptable (SA)
2 - Slightly Unacceptable (SU) 1 -
Unacceptable (U)

	STATEMENT	4	3	2	1
Functional Suitability					
1	The system provides all necessary functions needed for monitoring and management.				
2	The Quick Response (QR) code scanning and tagging features ensure accurate livestock identification across different devices.				
3	The system generates reports with accurate data aggregation and correct calculations across different datasets.				
4	The system maintains functional accuracy when handling datasets or multiple users at the same time.				
5	The system properly validates livestock data to avoid error and missing records.				
Performance Efficiency					
1	Page loads, data entry, and report generation are complete within defined response time thresholds under normal conditions.				
2	The QR code scanning feature works fast and accurately.				
3	The system maintains stable performance during simultaneous access by multiple users.				
4	The database queries and transactions execute with minimal delays.				
5	The system efficiently manages server and client-side resources (CPU, memory, storage).				

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Lucban, Quezon

Compatibility					
1	The system can function on both desktop and mobile devices.				
2	The system runs consistently across common web browsers.				
3	The system can share or exchange data with other tools or systems used by the Agriculture Office.				
4	The system co-exists with other applications running on the same device without performance issues.				
5	The system integrates well with device cameras for QR code scanning.				
Interaction Capability					
1	The system's interface follows usability design standards to ensure intuitive interaction for different user roles.				
2	The menus, buttons, and icons are implemented with consistent design patterns and properly labeled for functional clarity across all modules.				
3	The system implements accessibility standards such as keyboard navigation, screen reader compatibility, and sufficient color contrast.				
4	Workflows are optimized to reduce redundant interactions, and task efficiency is measured through interaction design metrics.				
5	Feedback mechanisms designed with technical clarity, consistency, and proper error-handling protocols.				
Reliability					
1	The system works consistently without frequent crashes or downtime.				
2	The system remains available whenever it is needed.				
3	The system has proper fault tolerance mechanisms to continue functioning during minor failures.				
4	The system has redundancy, or backup functionality, to protect livestock records and productivity data.				
5	The logs and monitoring tools are in place to track system failures, crashes, or availability issues.				
Security					
1	The system uses encryption (in-transit and at-rest) to protect sensitive livestock and user data.				
2	Access control mechanisms are implemented to restrict data visibility and actions based on user roles.				

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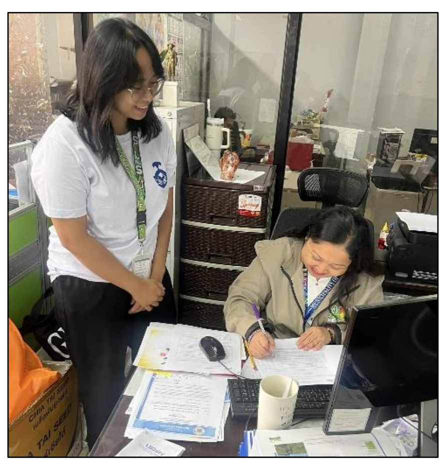
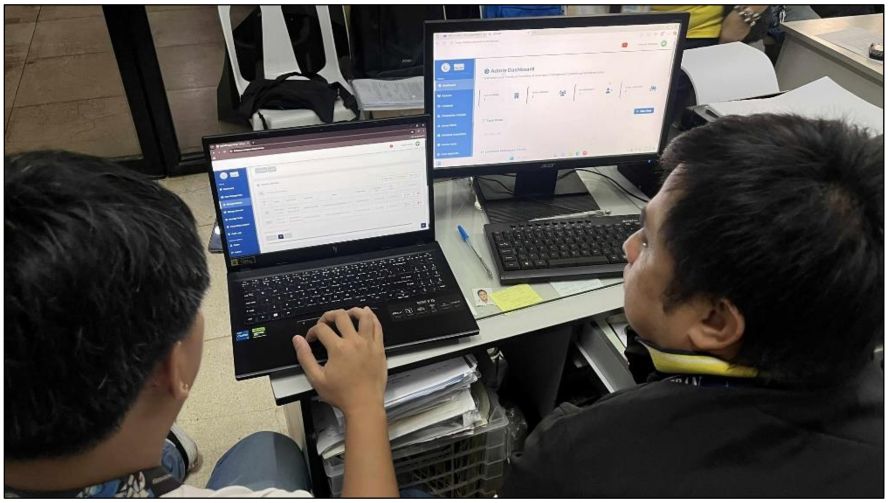
Lucban, Quezon

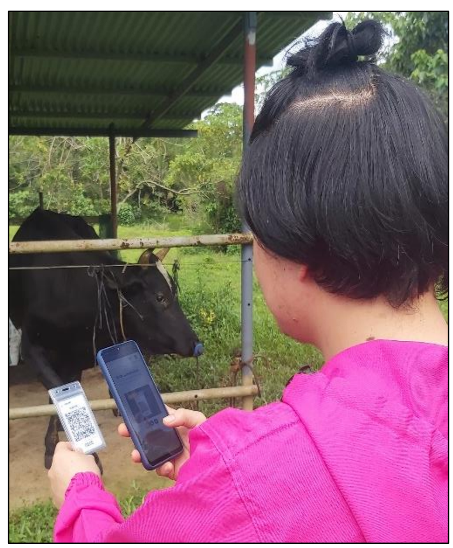
3	The system enforces secure authentication mechanisms before granting access.				
4	The system verifies the authenticity of users and devices before allowing access to sensitive functions.				
5	The system protects against brute force or repeated failed login attempts.				
Maintainability					
1	The system's documentation is sufficient for future developers to maintain it.				
2	Bug fixes and feature updates deployed do not affect other modules or cause downtime.				
3	The system design supports scalability for future feature expansions without requiring major rework.				
4	Documented dependencies are manageable to avoid compatibility issues during updates.				
5	There is a version control implementation to track changes and support collaborative development.				
Flexibility					
1	The system can adapt to changes in livestock processes without major rework.				
2	The modules are designed to be independent so changes in one do not break others.				
3	The system allows integration with future tools, databases, or APIs.				
4	New features or roles can be added easily without disrupting existing functions.				
Safety					
1	The transaction controls and access logs are in place to prevent unauthorized or accidental record changes.				
2	Input validations and data checks are implemented to prevent unsafe or incorrect entries.				
3	The alert and warning mechanisms are correctly implemented and logged for auditing unsafe actions.				
4	The system enforces user role restrictions to prevent accidental or unsafe operations by unauthorized users.				
5	Backup and recovery procedures are implemented and tested to ensure data integrity under failures.				

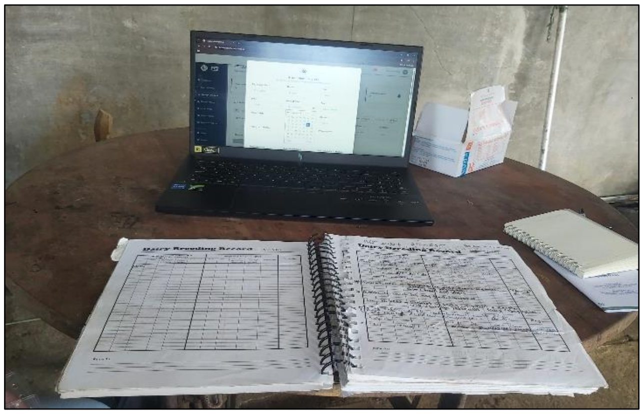
APPENDIX H

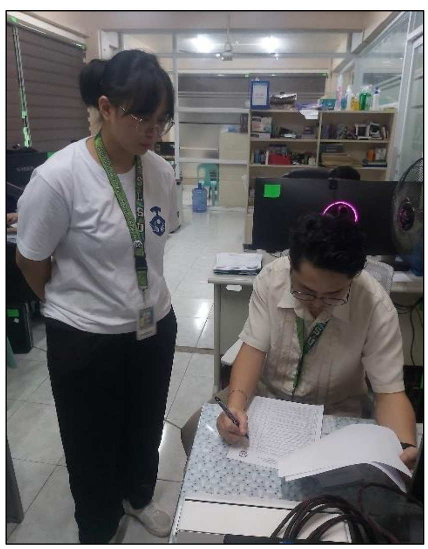
Photo Documentation











APPENDIX I

End-Users' Computation

Table 25: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Functional Suitability

Statement	4	3	2	1	WM
1. The system provides features I need to monitor and manage dairy livestock.	28	2	0	0	3.93
2. The QR code tagging correctly identifies and track each animal.	22	8	0	0	3.73
3. The productivity reports give accurate and reliable result.	22	8	0	0	3.73
4. The system has enough functions to support the work of the Lucban Agriculture Office	21	9	0	0	3.7
5. The analysis tools help in making better farm decisions.	25	5	0	0	3.83
Average Weighted Mean					**3.78**

Table 26: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Performance Efficiency

Statement	4	3	2	1	WM
1. The system loads quickly and responds without delays.	18	12	0	0	3.60
2. The QR code scanning feature works fast and accurately.	19	11	0	0	3.63
3. The system stays fast even when I enter multiple data.	15	15	0	0	3.50
4. The system works well and stays fast on different devices.	21	9	0	0	3.70
5. The system provides real - time updates without noticeable delay.	19	11	0	0	3.63
Average Weighted Mean					**3.61**

Table 27: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Compatibility

Statement	4	3	2	1	WM
1. The system works properly on different devices such as phones, tablet and computers.	17	13	0	0	3.57
2. The system runs smoothly in different web browsers without errors.	16	14	0	0	3.53
3. I can easily share data from this system in formats I can use.	22	8	0	0	3.73
4. The system works well alongside other applications running in the background.	17	13	0	0	3.57
5. The system integrates well with device cameras for QR code scanning.	19	11	0	0	3.63
Average Weighted Mean					**3.61**

Table 28: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Interaction Capability

Statement	4	3	2	1	WM
1. The system is easy to understand and use.	21	9	0	0	3.70
2. The menus, buttons, and icons are clear and easy to follow.	19	11	0	0	3.63
3. The system allows me to finish tasks without confusion.	7	13	0	0	3.23
4. The system provides clear messages / notifications after I take an action.	23	7	0	0	3.77
Average Weighted Mean					**3.54**

Table 29: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Reliability

Statement	4	3	2	1	WM
1. The system works consistently without frequent crashes or downtime.	20	10	0	0	3.67
2. The system remains available whenever it is needed.	18	12	0	0	3.60
3. The system can quickly recover and keep livestock records after an interruption or problem like power or internet loss.	16	14	0	0	3.53
4. The system functions well without issue over a long period.	11	19	0	0	3.37
Average Weighted Mean					**3.54**

Table 30: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Security

Statement	4	3	2	1	WM
1. User accounts are well-protected through secure login credentials (username and password).	23	7	0	0	3.77
2. The information entered remains correct and accurate upon returning.	18	12	0	0	3.60
3. The system requires proper login authentication before granting access to any information.	19	11	0	0	3.63
4. The system maintains a complete history of all user actions for accountability.	20	10	0	0	3.67
5. Farm data is kept safe through regular automated backups.	22	8	0	0	3.73
Average Weighted Mean					**3.68**

Table 31: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Maintainability

Statement	4	3	2	1	WM
1. The system continues to work after update.	24	6	0	0	3.80
2. The system displays a message whenever an error occurs.	18	12	0	0	3.60
3. Problems reported to support are addressed with timely updates and assistance.	19	11	0	0	3.63
4. Error messages provided by the system are easy to understand and helpful.	24	6	0	0	3.80
Average Weighted Mean					**3.71**

Table 32: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Flexibility

Statement	4	3	2	1	WM
1. The system provide access at any time and from any location.	18	12	0	0	3.60
2. I am able to access it only when connected to the internet.	17	13	0	0	3.57
3. The system functions properly in different browsers.	25	5	0	0	3.83
4. Different types of farm records (health, breeding, production) can be easily added, viewed, and managed.	25	5	0	0	3.83
Average Weighted Mean					**3.71**

Table 33: Frequencies and Mean Distribution of End-Users on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Safety

Statement	4	3	2	1	WM
1. The system maintains a complete audit trail of all actions performed by farmers.	24	6	0	0	3.8
2. The system protects information from being corrupted.	23	7	0	0	3.77
3. The system gives clear alerts or warnings when user makes a mistake or has done something unsafe.	21	9	0	0	3.7
4. The system prevents loss of important farm data.	24	6	0	0	3.8
5. Regular automated backups ensure that livestock records can be recovered if needed.	23	7	0	0	3.77
Average Weighted Mean					**3.77**

APPENDIX J

It Expert's Computation

Table 34: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Functional Suitability

Statement	4	3	2	1	WM
1. The system provides all necessary functions needed for monitoring and management.	7	3	0	0	3.70
2. The Quick Response (QR) code scanning and tagging features ensure accurate livestock identification across different devices.	8	2	0	0	3.80
3. The system generates reports with accurate data aggregation and correct calculations across different datasets.	7	3	0	0	3.70
4. The system maintains functional accuracy when handling datasets or multiple users at the same time.	7	3	0	0	3.70
5. The system properly validates livestock data to avoid error and missing records.	8	2	0	0	3.80
Average Weighted Mean					**3.74**

Table 35: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Performance Efficiency

Statement	4	3	2	1	WM
1. Page loads, data entry, and report generation are complete within defined response time thresholds under normal conditions.	7	3	0	0	3.70
2. The QR code scanning feature works fast and accurately.	8	2	0	0	3.80
3. The system maintains stable performance during simultaneous access by multiple users.	8	2	0	0	3.80
4. The database queries and transactions execute with minimal delays.	8	2	0	0	3.80
5. The system efficiently manages server and client-side resources (CPU, memory, storage).	7	3	0	0	3.70
Average Weighted Mean					**3.76**

Table 36: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Compatibility

Statement	4	3	2	1	WM
1. The system fully functional on both desktop and mobile devices.	9	1	0	0	3.90
2. The system run consistently across major web browser.	8	2	0	0	3.80
3. The system can share or exchange data with other tools or systems used by the Agriculture Office.	8	2	0	0	3.80
4. The system co-exists with other applications running on the same device without performance issues.	9	1	0	0	3.90
5. The system integrates well with device cameras for QR code scanning.	8	2	0	0	3.80
Average Weighted Mean					**3.84**

Table 37: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Interaction Capability

Statement	4	3	2	1	WM
1. The system's interface follows usability design standards to ensure intuitive interaction for different user roles.	5	5	0	0	3.50
2. The menus, buttons, and icons are implemented with consistent design patterns and properly labeled for functional clarity across all modules.	5	5	0	0	3.50
3. The system implements accessibility standards such as keyboard navigation, screen reader compatibility, and sufficient color contrast.	6	4	0	0	3.60
4. Workflows are optimized to reduce redundant interactions, and task efficiency is measured through interaction design metrics.	8	2	0	0	3.80
5. Feedback mechanisms designed with technical clarity, consistency, and proper error-handling protocols.	8	2	0	0	3.80
Average Weighted Mean					**3.64**

Table 38: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Reliability

Statement	4	3	2	1	WM
1. The system works consistently without frequent crashes or downtime.	8	2	0	0	3.80
2. The system remains available whenever it is needed.	6	4	0	0	3.60
3. The system has proper fault tolerance mechanisms to continue functioning during minor failures.	7	3	0	0	3.70
4. Is there redundancy or backup functionality to protect livestock records and productivity data.	7	3	0	0	3.70
5. The logs and monitoring tools in place to track system failures, crashes, or availability issues.	6	4	0	0	3.60
Average Weighted Mean					**3.68**

Table 39: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Security

Statement	4	3	2	1	WM
1. The system uses encryption (in-transit and at-rest) to protect sensitive livestock and user data.	7	3	0	0	3.70
2. Access control mechanisms are implemented to restrict data visibility and actions based on user roles.	9	1	0	0	3.90
3. The system enforces secure authentication mechanisms before granting access.	7	3	0	0	3.70
4. The system verifies the authenticity of users and devices before allowing access to sensitive functions.	7	3	0	0	3.70
5. The system protects against brute force or repeated failed login attempts.	5	5	0	0	3.50
Average Weighted Mean					**3.70**

Table 40: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Maintainability

Statement	4	3	2	1	WM
1. The system's documentation is sufficient for future developers to maintain it.	9	1	0	0	3.90
2. Bug fixes and feature updates deployed do not affect other modules or cause downtime.	7	3	0	0	3.70
3. The system design supports scalability for future feature expansions without requiring major rework.	8	2	0	0	3.80
4. Documented dependencies are manageable to avoid compatibility issues during updates.	7	3	0	0	3.70
5. There is a version control implementation to track changes and support collaborative development.	7	3	0	0	3.70
Average Weighted Mean					**3.76**

Table 41: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Flexibility

Statement	4	3	2	1	WM
1. The system can adapt to changes in livestock processes without major rework.	8	2	0	0	3.80
2. The modules are designed to be independent so changes in one do not break others.	7	3	0	0	3.70
3. The system allows integration with future tools, databases, or APIs.	8	2	0	0	3.80
4. New features or roles can be added easily without disrupting existing functions.	8	2	0	0	3.80
Average Weighted Mean					**3.78**

Table 42: Frequencies and Mean Distribution of IT Experts on the Level of Acceptability of Lbdairy: A Web-Based Dairy Livestock Monitoring And Management System Using Qr Code Tagging With Productivity Analysis For Lucban Agriculture Office in terms of Safety

Statement	4	3	2	1	WM
1. The transaction controls and access logs are in place to prevent unauthorized or accidental record changes.	6	4	0	0	3.60
2. Input validations and data checks are implemented to prevent unsafe or incorrect entries.	5	5	0	0	3.50
3. The alert and warning mechanisms are correctly implemented and logged for auditing unsafe actions.	7	3	0	0	3.70
4. The system enforces user role restrictions to prevent accidental or unsafe operations by unauthorized users.	10	0	0	0	4.00
5. Backup and recovery procedures are implemented and tested to ensure data integrity under failures.	7	3	0	0	3.70
Average Weighted Mean					**3.70**

APPENDIX L

Users' Manual

LBDairy

Web-Based Monitoring and Management System with Productivity Analytics for Dairy Livestock

User Manual and System Guide

Prepared for:
Lucban Municipal Agriculture Office and Local Dairy Farmer

Developed by:
BS Information Technology Students, Southern Luzon State University

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Table of Contents

Acknowledgments / Credits

The development team extends their deepest gratitude to everyone who contributed to the creation and success of the LBDAIRY: A Web-Based Monitoring and Management System with Productivity Analytics for Dairy Livestock.

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System Overview

What is LBDairy?

LBDAIRY is a web-based platform designed to improve dairy livestock monitoring and management through QR code tagging. It enables effective tracking of animal records and integrates productivity analysis to support data-driven decision-making for the Lucban Agriculture Office.

System Purpose and Objectives

Objectives:

- To provide a centralized database for recording livestock, farm, and production data.
- To enable real-time tracking and monitoring of livestock health, growth, and breeding records.
- To generate automated analytics and reports that help assess farm productivity and performance.
- To improve communication between farmers and administrators through alerts, inspections, and issue tracking.
- To support data transparency and efficiency within the agricultural management process.

Target Users

LBDAIRY is designed to serve three main user roles, each with tailored access and functions:

- **Super Administrator** – Oversees the entire system, manages admin accounts, and monitors overall productivity and audit logs.
- **Administrator** – Manages registered farmers, livestock records, inspections, and productivity reports per farm.
- **Farmer** – Records livestock data, monitors individual animal performance, and manages farm operations such as sales, clients, suppliers, and expenses.

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Key System Features

- Role-Based Dashboards – Personalized interfaces for super admin, admin, and farmer users.
- Comprehensive Livestock Management – Recordkeeping for health, growth, breeding, calving, and milk production.
- Productivity Analytics – Visual reports and charts to evaluate performance per farm and livestock.
- Alerts and Notifications – Automated alerts for health issues, inspections, and administrative updates.
- Import and Export Functionality – Supports CSV, PDF, and PNG formats for data transfer and reporting.
- Audit Logs – Track and monitor user activities for transparency and system accountability.

Technology Used

The development of the LBDAIRY system utilized a combination of modern web technologies to ensure efficiency, scalability, and user-friendliness across all modules.

Technologies include:

- Backend: PHP (Laravel Framework)
- Frontend: HTML, CSS, Tailwind CSS, JavaScript
- Database: MySQL
- QR Code Integration: PHP QR Code, Zxing.js
- Data Visualization: Chart.js
- API & Offline Support: Service Workers
- Web Hosting: Hostinger
- Development Tool: Visual Studio Code

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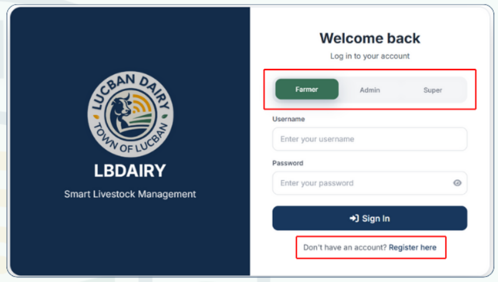
System Access



Login Guide

The LBDAIRY system features three separate login portals based on user roles:

- Farmer
- Admin
- Super Admin
- (Each role has access to distinct system features and dashboards.)

Login Steps:

1. Go to the LBDAIRY login page.
2. Select your user role (Farmer, Admin, or Super).
3. Enter your Username and Password.
4. Click the Sign In button to access your account.

- (If you do not have an account, click "Register here" at the bottom of the page.)

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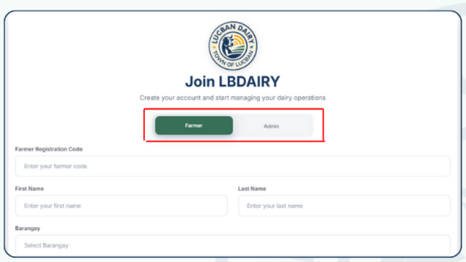
System Access



Registration Guide (*for Farmer/Admin*)

Steps:

1. Click "**Register as Farmer**" from the Admin login tab.
2. Complete the form with the following details:
   - Full Name
   - Username
   - Email Address
   - Password and Confirm Password
   - Designation / Department
   - Contact Number
   - Additional Information
3. Click Register.
4. Your account will be reviewed and approved by the Super Admin.

- *Super Admin accounts are created directly by the system administrators* and are not open for public registration.
- These accounts have full access to all modules, user management, and system configurations.

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User Roles and Permissions

LBDAIRY uses a role-based access control system, giving each user access only to the features suited to their role: Super Admin, Admin, and Farmer.

Main Capabilities:

- Log in to view and update personal livestock records.
- Record health, growth, and production data.
- Monitor productivity trends and alerts.
- Receive notifications from Admins regarding inspections or advisories.

Access Restrictions:

- Cannot view or edit other farmers' data.
- Cannot access Admin- or Super Admin-level management tools.

Summary of Access Control

Feature / Module	Super Admin	Admin	Farmer
User Management	✅ Full	✅ Limited	❌ None
Farm & Livestock Records	✅ View/Edit	✅ Manage	✅ Own Data
Productivity Analytics	✅ Global	✅ Local	✅ Personal
Audit Logs	✅ All Users	✅ Farmer Only	❌ None
System Settings	✅ Full	❌ None	❌ None

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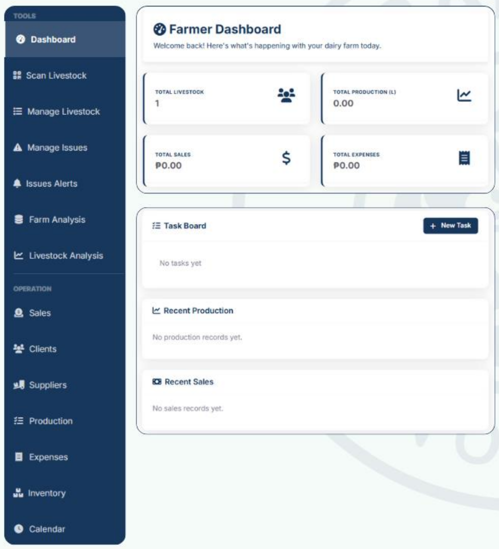
Dashboard Overview

The LBDAIRY Dashboard serves as the system's central hub, giving users quick access to all key modules and insights based on their role.



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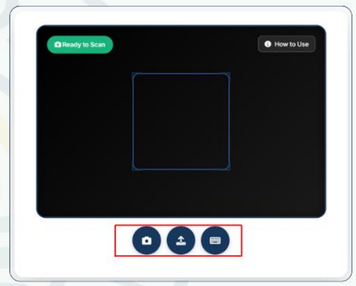
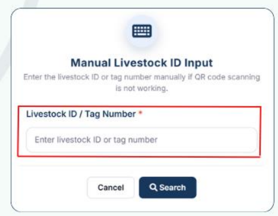
Scan QR Code

The Scan QR Code module allows farmers to instantly access livestock records by scanning or uploading a QR image. It streamlines livestock tracking and monitoring.



- **Scan:** Identify livestock using the camera.
- **Upload:** Access records by uploading a QR image.
- **Search:** Quickly find specific livestock by name, tag, or ID.
- **View Records:** Instantly open detailed livestock information.
- **Quick Access:** Navigate directly to individual animal profiles.



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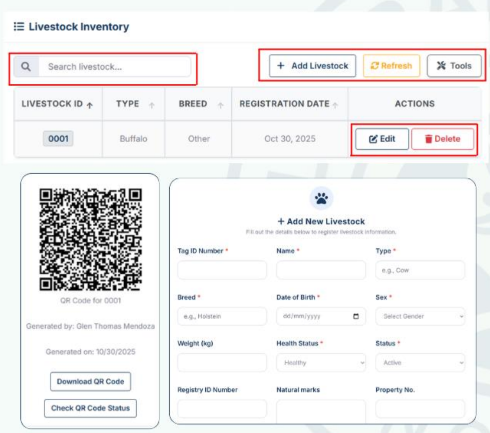
Manage Livestock

The Manage Livestock module provides farmers with an organized view of all their livestock, enabling easy data management and updates.



- **Search:** Find livestock by ID, name, or type.
- **Add:** Register new livestock with complete details.
- **Edit:** Update growth, calving, and milk production data.
- **Delete:** Remove inactive livestock records.
- **Import:** Upload livestock records through a CSV file.
- **View:** Access individual livestock records and productivity details.

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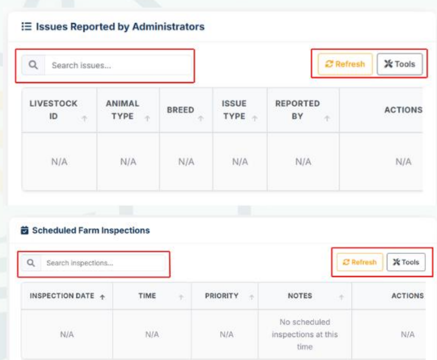
Manage Issues

The Manage Issues module displays all alerts or problems reported for the farmer's livestock, allowing them to monitor active and resolved issues efficiently.



- **Search:** Find specific livestock issues by date, type, or description.
- **Refresh:** Update the list to display the most recent reported issues.
- **Export:** Download issue reports in PNG, CSV, or PDF format.
- **Print:** Generate a printable version of reported issues for documentation.
- **View:** Open detailed information about each reported issue, including date, livestock ID, and description.

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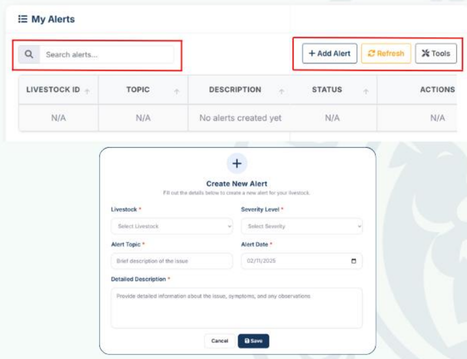
Issue Alert to Admin

The Issue Alert module enables farmers to report livestock-related issues directly to the admin for review and quick resolution.



- **Search:** Locate specific alerts by date, topic, or livestock ID.
- **Refresh:** Update the list to show the latest submitted alerts.
- **Export:** Download alert records in PNG, CSV, or PDF format for documentation.
- **Print:** Generate a printable copy of all issued alerts for reporting purposes.
- **View:** Access detailed alert information, including issue type, description, and date sent.
- **Add Alert:** Submit a new alert to the admin by providing the issue topic, description, and date for immediate attention.

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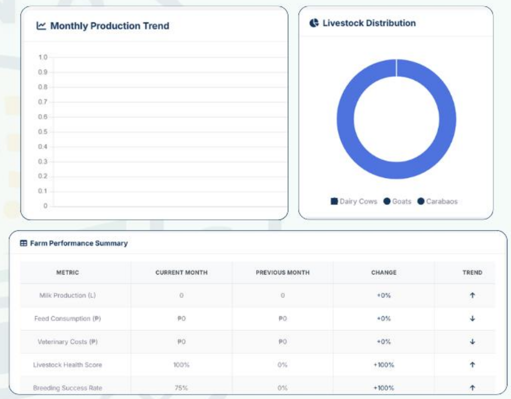
Farm's Productivity Analysis

The Farm's Productivity Analysis module summarizes the overall performance of the farm, helping farmers understand production efficiency.



- **Analysis Table:** Displays summarized production data, including livestock count, total yield, and efficiency rate.
- **Charts:** Presents visual insights through graphs showing productivity trends over time.
- **Metrics:** Highlights key indicators such as monthly output, daily averages, and overall efficiency percentage for data-driven decision-making.

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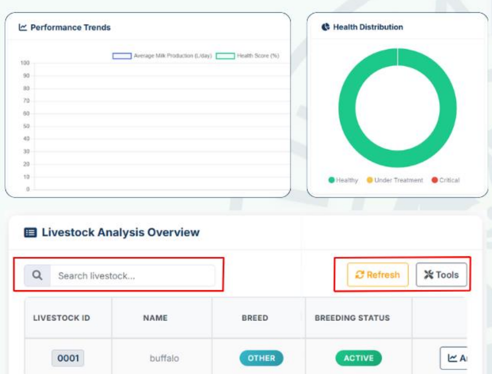
Livestock's Productivity Analysis

The Livestock's Productivity Analysis module provides monthly insights into the productivity of individual animals.



- **Search:** Locate specific livestock productivity records by ID, name, or date.
- **Refresh:** Update the dashboard to show the latest productivity data and changes.
- **Export/Print:** Generate and download productivity reports in PNG, CSV, or PDF format for documentation.
- **View Analysis:** Access detailed production data and performance metrics of each livestock.
- **History:** Review past productivity records to monitor growth and efficiency trends.

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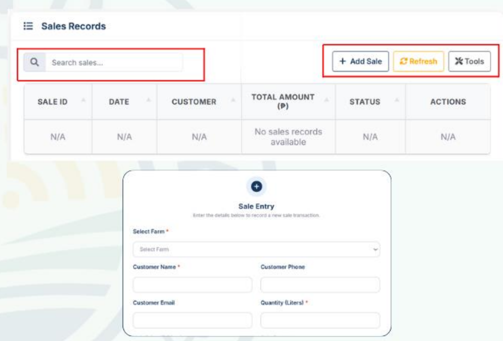
Manage Sales

The Manage Sales module allows farmers to track and record all product sales for performance monitoring and financial reporting.



- **Search:** Find specific sales records by date, sales ID, or amount.
- **Refresh:** Update the list to display the most recent sales entries.
- **Export/Print:** Generate and download sales reports in PNG, CSV, or PDF format for documentation or accounting.
- **Add Sales:** Input new sales transactions, including sales ID, date sold, items sold, and total amount.
- **View:** Access complete details of individual sales transactions.
- **Edit:** Modify existing sales records to correct or update transaction details.
- **Delete:** Remove inaccurate or outdated sales records from the system.

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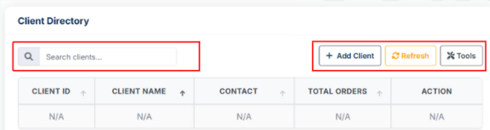
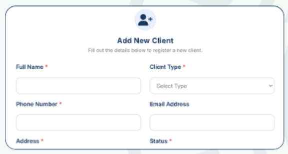
Manage Clients

The Manage Clients module organizes client details and transaction histories, ensuring accurate recordkeeping and financial transparency.





- **Search:** Locate client records by name, ID, or transaction date.
- **Refresh:** Update the list to display the latest client information and changes.
- **Export/Print:** Generate client reports in PNG, CSV, or PDF format for documentation or reporting.
- **Add:** Input new client details, including client ID, name, and address.
- **View:** Access detailed client profiles, including transaction and payment history.
- **Edit:** Update client details such as name, address, or contact information.
- **Delete:** Remove outdated or incorrect client records from the system.

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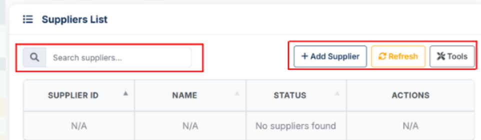
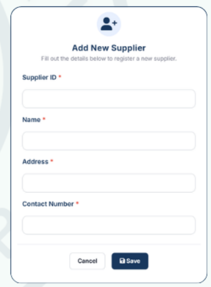
Manage Suppliers

The Manage Suppliers module allows farmers to monitor supplier transactions, payments, and outstanding balances efficiently.





- **Search:** Find suppliers by ID or name.
- **Add:** Input supplier information (Name, Address, ID).
- **Import:** Upload supplier records in CSV format.
- **Ledger:** Manage payment history and due amounts.
- **History:** Access quarterly supplier data.
- **Export/Print:** Generate reports for documentation.

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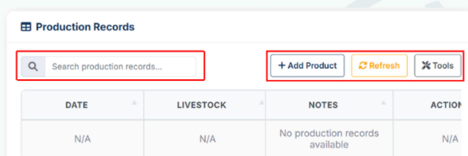
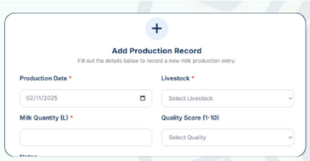
Manage Production

The Manage Production module helps farmers record and track product batches, ensuring organized stock management.





- **Search:** Find production records by product ID, name, or batch.
- **Refresh:** Update the list to reflect recent production entries and changes.
- **Export/Print:** Generate production reports in PNG, CSV, or PDF format for documentation.
- **Add:** Input new production details, including product ID, name, batch, and stock quantity.
- **View:** Access complete production information and historical records.
- **Edit:** Modify production data to correct or update existing entries.
- **Delete:** Remove outdated or incorrect production records from the database.

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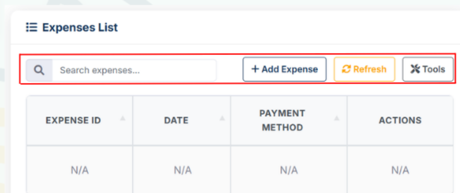
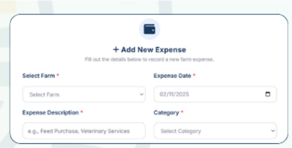
Manage Expenses

The Manage Expenses module keeps track of farm expenditures to monitor costs and support budgeting decisions.





- **Search:** Find specific expense records by date, expense ID, or amount.
- **Add Expense:** Input new expense entries, including expense ID, name, date, amount, and paid amount.
- **Refresh:** Update the list to show the latest expense records and modifications.
- **Export/Print:** Generate and download expense reports in PNG, CSV, or PDF format for documentation and accounting.
- **View:** Review detailed information for each recorded expense.
- **Edit:** Modify existing expense entries to correct or update details.
- **Delete:** Remove inaccurate or outdated expense records from the system.

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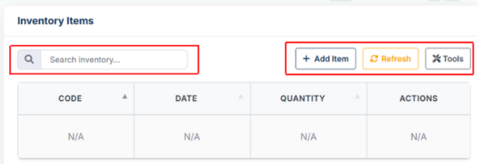
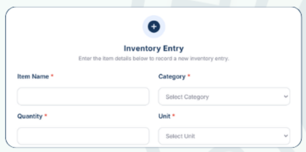
Manage Inventory

The Manage Inventory module allows farmers to monitor all items, supplies, and equipment related to farm operations.





- **Search:** Quickly find specific products by ID, name, or category.
- **Add:** Input new inventory items, including product details and stock quantity.
- **Refresh:** Update the list to reflect the latest inventory changes.
- **Export/Print:** Generate reports for record-keeping or review.
- **Edit & Delete:** Modify or remove outdated product information.
- **View:** Display detailed information about each product's stock and status.

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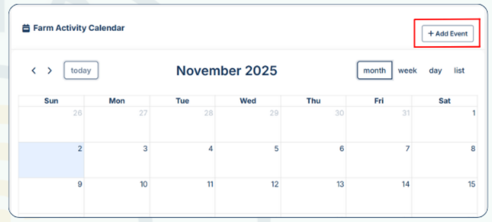
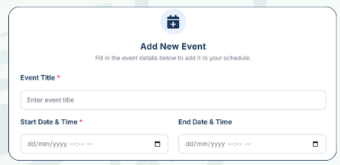
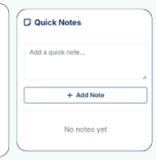
Schedule Calendar

The Schedule Calendar module provides a visual overview of all upcoming farm events and inspections.







- **Add Notes:** Record reminders or important updates for specific dates.
- **Add Event:** Schedule upcoming activities such as inspections, meetings, or tasks.
- **View Schedules:** Display all planned events and notes in a clear, calendar-based view.
- **Update:** Modify existing events or notes to reflect any changes in schedule.

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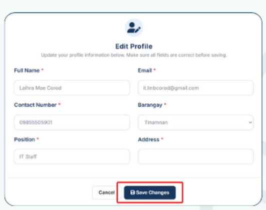
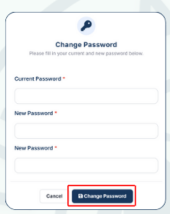
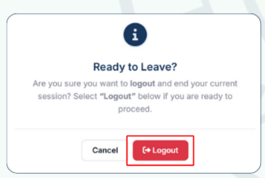
Manage Profile & Logout

The Manage Profile module allows users to maintain their account information securely.





- **View Details:** Access personal and account details.
- **Edit Profile:** Update information such as name, contact, or role.
- **Change Password:** Modify account password to maintain security.



Logout

The Logout module securely ends the user's session, protecting sensitive data and preventing unauthorized access. It ensures that all user activities are properly closed before exiting the system.

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Privacy and Terms of Use

This section outlines the rules, responsibilities, and data protection practices for all users to ensure secure and ethical system use.

- **User Responsibilities:** Users must provide accurate and up-to-date livestock and farm records while following proper data management practices.
- **Prohibited Activities:** Unauthorized access, falsifying data, tampering with records, or sharing credentials is strictly forbidden and may result in account suspension or disciplinary action.
- **System Ownership and Compliance:** LBDAIRY is the property of the Lucban Municipal Agriculture Office. All users must comply with institutional policies and applicable data privacy laws, and report any misuse or breaches to the designated IT administrator.

Contact Us at:

For inquiries, technical support, or feedback regarding the LBDAIRY System, please reach out through the following channels:

lbdairy@gmail.com / it.mjdrbondoc@gmail.com

0950 369 3383 or 0985 550 5906

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