PigConnect: Web-based Pig Recommendation and Information System

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Bachelor of Science in Information Technology

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EXECUTIVE SUMMARY

The pig farming industry faces challenges such as inefficient resource management, limited access to real-time data, and suboptimal decision-making processes, which hinder productivity and profitability. PigConnect addresses these issues by providing a comprehensive farm management solution designed to enhance operational efficiency and improve decision-making through data-driven insights.

The primary goal of the project is to develop a user-friendly digital platform that enables farmers to monitor livestock health, manage inventory, and track production performance in real time. Additionally, connecting farmers and buyers in by having a built-in chat system for them to communicate with each other.

The system employs Incremental methodology which ensures that the features are developed, tested, and delivered in manageable phases. This approach allows for continuous improvement and early feedback integration while maintaining a focus on delivering a functional product at each stage.

The results indicate that the system has the potential to significantly reduce operational costs and improve farm productivity. If fully implemented, PigConnect could revolutionize farm management by fostering sustainable practices and promoting the economic viability of pig farming.

This project demonstrates the value of technology in agriculture, providing a scalable and impactful solution that addresses critical challenges in pig management.

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Lastly, we extend our heartfelt appreciation to the farmers who willingly shared their experiences, insights, and feedback. Your input has been invaluable in shaping PigConnect into a practical and impactful solution tailored to the real needs of the pig farming community.

DEDICATION

We, the researchers, humbly dedicate this capstone project to our parents and families, whose love, patience, and quiet sacrifices have carried us through every step of this journey. Your faith in us, even during moments when we doubted ourselves, became our greatest source of strength.

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Table of Contents

List of Tables

List of Figures

CHAPTER 1

I. Introduction

The pig farming industry in the Philippines plays a crucial role in the agricultural sector, contributing significantly to the local food supply and the rural economy. As of 2020, the Philippine Statistics Authority reported that the swine industry contributed approximately 15% to the total agricultural output, underscoring its importance. Small market piggeries, typically run by families, are essential to the livelihoods of rural households, ensuring food security and providing basic income. According to the Food and Agriculture Organization of the United Nations, around 65% of pig farms in the Philippines are small-scale operations managed by families, highlighting their prevalence and significance.

These farms are essential as they not only produce pork products but also support local economies through employment and economic activity. In 2019, the pig farming sector employed over 3 million people, according to Bautista. Despite their importance, small market piggeries face several challenges that hinder their efficiency and competitiveness. One of the primary challenges is the limited access to advanced technologies and resources necessary for effective farm management. Salazar & Rola (2019) noted that only about 20% of small-scale pig farmers have access to modern farming technologies, which impacts their productivity.

Many small-scale farmers are still dependent on traditional methods, which can lead to disorganization in managing critical aspects such as health monitoring, feeding schedules, and financial analysis. According to a study by Caballero-Anthony & Lee (2021), farms relying on traditional methods have an average productivity rate that is 30% lower compared to those using modern technologies. These manual processes are labor-intensive and prone to errors, contributing to reduced productivity and increased operational costs.

Moreover, the lack of transparency and efficiency in the buying and selling process further complicates matters for small market piggeries. The National Economic and Development Authority (2021) reported that approximately 40% of small-scale pig farmers face difficulties in finding

suitable buyers or negotiating fair prices, while buyers face challenges in sourcing pigs that meet their specific requirements regarding costs and quality.

Advancements in agricultural technology, particularly in precision farming and data analytics, present opportunities to address these challenges. Precision farming techniques can improve productivity by optimizing inputs such as feed and medication, while data analytics can provide insights for better decision-making. The World Bank (2020) highlighted that farms adopting precision farming techniques can see productivity increases of up to 25%. However, existing technological solutions are often designed for larger operations or generic livestock management, failing to meet the unique needs of small market piggeries in the Philippines.

To bridge this gap, this study proposes the development of PigConnect, an innovative platform tailored specifically for small market piggeries in the Philippines. PigConnect integrates advanced technologies, including AI-driven buyer recommendations and farm information management, to empower farmers and enhance market efficiency. By providing a user-friendly interface for managing farm operations, PigConnect aims to streamline processes such as pig inventory management, feeding schedules, expenses tracking and breeding records. The system's AI algorithms will analyze farm data to provide personalized recommendations to buyers, improving their purchasing experience and promoting fair market transactions.

Furthermore, PigConnect will include a robust communication platform that facilitates direct interaction between farmers and buyers. This feature will enable negotiations, farm visits, and transaction finalizations, thereby enhancing transparency and trust in the marketplace. Geolocation services will also be integrated to help buyers locate nearby farms, plan visits, and assess farm conditions firsthand.

In summary, PigConnect represents a significant advancement in supporting the sustainability and competitiveness of small market piggeries in the Philippines. By leveraging technology to address longstanding challenges, PigConnect aims to empower farmers, improve productivity, and create a more transparent and efficient marketplace for pigs, benefiting both producers and consumers alike.

II. Background of the Study

The pig farming industry in the Philippines plays a crucial role in the agricultural sector, contributing significantly to the local food supply and supporting the rural economy. It provides livelihoods for millions of families, especially in rural areas, where small-scale pig farming is a common source of income.

Many small-scale farmers, however, still rely on traditional methods, which are often labor-intensive and prone to inefficiencies. These practices can lead to disorganization in managing critical aspects of farm operations, such as health monitoring, feeding schedules, and financial analysis. For example, the lack of proper health tracking can result in delayed responses to diseases, potentially leading to severe outbreaks that compromise livestock health and farm profitability. Similarly, unstructured feeding schedules can cause overfeeding or underfeeding, affecting growth rates and increasing feed costs.

To address these challenges, integrating modern technologies such as data-driven management systems, real-time monitoring tools, and predictive analytics is essential. These innovations can empower farmers with actionable insights, streamline operations, and enhance productivity, ultimately promoting a more sustainable and profitable pig farming industry in the Philippines

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III. General Objectives

To create a web-based pig recommendation system that utilizes AI to filter buyer preferences, allows farmers to post pigs for sale, displays the location of available pigs, and facilitates direct purchasing, thereby streamlining the buying and selling process in the pig farming industry.

IV. Specific Objectives

The specific objectives are as follows:

1. Enable buyers to input their specific preferences for pigs, such as breed, age, and price range, to tailor their search experience.

2. Implement an AI-driven filtering mechanism that analyzes buyer preferences and matches them with available pigs posted by farmers, ensuring relevant results.

3. Provide a feature that shows the location of pigs for sale and allows buyers to initiate purchases directly from farmers, facilitating seamless transactions.

V. Significance of the Study

The development of this system is significant for several reasons. Firstly, it will empower pig farmers by providing them with the tools needed to manage their farms more efficiently and make data-driven decisions. This will lead to improved productivity, better animal welfare, and increased profitability. Secondly, by enhancing the buying experience with AI-driven recommendations and improved communication tools, this system will create a more transparent and efficient marketplace for pigs. This will benefit both farmers and buyers, leading to better market dynamics and economic outcomes.

Pig Farmers - As the primary beneficiaries, pig farmers will gain significantly from PigConnect by optimizing pig farm management. This can lead to increased productivity and better market prices for their pigs. An descriptive analytics dashboard will enable farmers to efficiently manage critical farm data, enhancing overall farm operations.

Buyers/Consumers - Buyers will have access to detailed information about pig farms, including their locations and feedback from other consumers. This transparency allows buyers to make well-informed decisions, improving trust and satisfaction within the market.

Fellow/Future Researchers - PigConnect serves as a case study for the successful application of smart farming technologies, offering valuable insights for future research and development in agricultural technology. The integration of advanced technologies such as AI and geolocation in PigConnect provides a rich dataset for analyzing and improving pig farming practices.

VI. Scope and Delimitations

Scope

The PigConnect project aims to develop a tailored management system for small market piggeries and buyers in Rizal province, Calabarzon, with Mr. Arnel S. Rieza as the target beneficiary, who owns 20 pigs and has 1 sow for breeding in Rizal. This comprehensive system will feature user authentication and profile management to ensure secure access, alongside a robust farmer management interface. This interface will include essential tools such as real-time weather updates, tracking the number of pigs, ages, and health status, managing breeding schedules, organizing feeding schedules to maintain optimal nutrition for pigs, tracking and managing expenses related to pig farming (including feed, health care, and other operational costs), and manual input for vaccination records. For buyers, PigConnect will offer a user-friendly web-based platform that simplifies the process of locating pig farms. This platform will be enhanced by AI-driven recommendations utilizing hybrid recommendation techniques, which combine content-based and collaborative filtering to match farms with suitable buyers based on user interactions and preferences.

Furthermore, a user feedback and rating system will foster trust and transparency by enabling mutual ratings between farmers and buyers. A significant component of PigConnect is the descriptive analytics dashboard, which will provide real-time data and analytics to offer insights into farm progress and productivity, aligning with ISO 9001 standards. Geolocation services will assist buyers in locating nearby farms, with a mobile-responsive design to enhance accessibility and user engagement. Additionally, PigConnect will incorporate a communication platform for interactions between farmers and buyers, and an email notification system for timely alerts. By addressing these components, PigConnect aims to improve farm management efficiency, market access, and overall sustainability for small market piggery owners in Rizal.

Delimitations

The project is specifically designed for Filipino pig farmers and focuses exclusively on domesticated pigs. No financial transactions will be facilitated within this project, and consequently, no payment gateway will be implemented. Geolocation features will be limited to displaying the locations of farms in Rizal, Philippines. System will not use any third-party chat services and will develop its own chat component. Security features that will be implemented are input validation and identity verification only. Access to the project will be restricted to web browsers; there will be no mobile application version, although the web design will be mobile-responsive to ensure usability on mobile devices. The system will only use email notifications for feeding schedules.

VII. Specific Client for Test Bed

The PigConnect project will conduct its initial testbed phase with one small-scale pig farmer in Rizal province, Calabarzon, Mr. Arnel S. Rieza, who owns 20 pigs, including one sow, expected to have 10 new piglets every four months. The piglets will be sold after three to four months. Based on the client, each new piglet born will have 5 sacks of feed in 3 to 4 months before they will be sold. This client was carefully chosen to provide practical insights into the system's functionality and usability in a real-world setting. By collaborating with an actual farmer, the project aims to gather valuable feedback that will help refine and optimize the system to better meet the needs of small-scale piggery owners.

The involvement of this specific client is crucial for several reasons. Firstly, it allows the project team to observe and understand the daily operations, challenges, and requirements of a typical small-scale pig farm. This includes tracking pig inventory, managing breeding and feeding schedules, monitoring health and vaccination records, and handling expenses related to pig farming. By integrating these real-world scenarios into the testbed phase, the team can ensure that PigConnect addresses the practical needs and pain points of its users.

Additionally, the client's feedback will be instrumental in identifying any usability issues or areas for improvement in the system's interface and functionalities. For example, the farmer can provide insights on the interactivity of the functionalities of the pig farm management system. This

direct input will enable the project team to make necessary adjustments and enhancements to ensure the system is user-friendly and efficient.

Collaborating with a real client will ensure that PigConnect is tested under authentic conditions, which is essential for validating the system's performance and reliability. The farmer's real-time usage of the system will help the developers check any bugs or technical issues that might not be evident in a controlled testing environment. This thorough testing process will contribute to delivering a robust and dependable management system for small-scale piggery owners.

In summary, partnering with a small-scale pig farmer in Rizal province for the testbed phase provides the PigConnect project with invaluable practical insights and feedback. This collaboration is essential for designing and testing a system that truly meets the needs of its target users, which will enhance the efficiency, productivity, and sustainability of small-scale pig farming operations.

VIII. Value Proposition

PigConnect is an innovative web-based management system tailored for small-scale piggery farmers in Rizal province, Calabarzon. It integrates advanced technologies such as AI-driven recommendations, geolocation services, and a descriptive analytics dashboard to revolutionize farm operations, enhance productivity, and boost profitability. The descriptive analytics dashboard, designed to meet the latest ISO standards, provides real-time data and analytics on inventory tracking, health monitoring, feeding schedules, and financial management, empowering farmers to make informed, data-driven decisions.

For buyers, PigConnect ensures a seamless purchasing process by offering AI-driven recommendations for suitable pig farms utilizing hybrid recommendation of user-based collaborative filtering and content-based filtering, user feedback, rating systems, and communication tools. By analyzing buyer preferences and interaction history, the system matches buyers with appropriate farms, improving transaction satisfaction and fostering a transparent marketplace. Geolocation services allow buyers to easily locate farms, assess farm conditions, and plan visits, enhancing buyer confidence and expanding market access for farmers.

The integrated communication platform streamlines negotiations, farm visits, and transactions, while the ratings and feedback mechanism builds trust and transparency in the marketplace, ensuring higher quality and reliability in transactions. By improving farm management efficiency, reducing labor requirements, and contributing to the overall well-being of the farming community, PigConnect promotes sustainable agricultural practices, economic growth, and enhanced livelihoods in rural areas.

Overall, PigConnect stands out as a comprehensive solution for small-scale piggery farmers, offering advanced management tools, improved market access, and enhanced buyer experiences. It not only optimizes farm operations but also drives economic and social benefits, ensuring long-term sustainability and growth for the pig farming sector in Bulacan province.

IX. Definition of Terms

AI-Driven Recommendation Systems - Advanced algorithms and machine learning techniques that analyze extensive datasets to offer personalized recommendations tailored to specific user requirements and preferences.

Analytics - Tools and techniques used in a farm management system to display data and trends in pig farming. Analytics help farmers understand performance metrics, monitor animal health, track feed efficiency, and make informed decisions based on data-driven insights.

Animal Welfare Standards - Guidelines and practices that ensure the humane treatment of animals, including considerations for their health, comfort, and well-being. These standards are crucial for maintaining ethical farming practices and improving the quality of animal products.

Artificial Intelligence - Technology used for analyzing historical data to make predictions and recommendations. AI is employed to analyze buyer's historical data and provide personalized recommendations, enhancing the buying experience and optimizing farm management practices.

Authentication - The process where the system validates users to determine if they are registered and authorized to access the platform. Authentication ensures that only verified users can access sensitive information and use the system’s features, enhancing security and trust.

Centralized Platform - A single, integrated system that consolidates various types of information and functionalities to serve as a comprehensive resource for users. PigConnect serves as a

centralized platform, providing farmers and buyers with tools for farm management, market information, and communication.

Collaborative Filtering - A recommendation system technique that predicts user preferences based on past behavior, utilizing either user-based or item-based methods. Collaborative filtering helps provide personalized recommendations to buyers based on their previous interactions and preferences.

Disease Management Practices - Strategies and procedures implemented to prevent, control, and treat diseases in livestock to maintain animal health and productivity.

Environmental Sustainability Efforts - Initiatives and practices aimed at minimizing the environmental impact of farming activities, including waste management, resource conservation, and pollution reduction.

Farm Management System - A comprehensive system used to manage various aspects of a farm, including inventory management, health monitoring, feeding schedules, and financial tracking.

Farming Methods - Different approaches to pig farming, such as conventional and organic practices, which vary in terms of feed ingredients, disease management, and sustainability. Understanding different farming methods helps farmers adopt the best practices suited to their operational goals.

Feed Ingredients - The components used in animal feed, which can include grains, proteins, vitamins, and minerals. The choice of feed ingredients influences the health and growth of livestock, and is a crucial factor in optimizing farm productivity.

Geolocation - The method used to display the location of farms. Geolocation services in PigConnect help buyers locate nearby farms, plan visits, and assess farm conditions firsthand, enhancing transparency and trust in the marketplace.

Knowledge Management - The process of creating, sharing, using, and managing the knowledge and information of an organization to enhance productivity and decision-making. Effective knowledge management in pig farming can lead to better resource utilization and informed decision-making.

Messaging System - A communication tool that facilitates interaction between buyers and farmers. The messaging system in PigConnect allows for direct communication, negotiation, and transaction finalization, promoting transparency and trust.

Real-Time Data Analytics - The process of analyzing data as it is generated to provide immediate insights and support timely decision-making. Real-time data analytics in PigConnect help farmers respond quickly to changes in farm conditions and market dynamics.

Sustainability Standards - Criteria and guidelines that promote environmentally responsible and resource-efficient practices in farming and other industries.

User Collaboration Filter - A recommendation system technique that generates personalized recommendations by leveraging historical user interactions.

User-Centric Approach - A method focused on the preferences and behaviors of individual users to provide highly personalized and relevant recommendations. This approach ensures that PigConnect delivers suggestions that are specifically tailored to each buyer's needs and preferences.

Chapter 2

REVIEW OF RELATED LITERATURE

This chapter presents a comprehensive review of related literature and studies pertinent to pig management systems, particularly in the context of small-scale pig farming in the Philippines. The objective is to understand the current challenges, technological innovations, and management practices that can potentially enhance the efficiency and productivity of small market piggeries.

I. Optimization of Farm Management Practices

In the realm of pig farming, challenges such as inefficient resource use, suboptimal feeding practices, and ineffective management strategies have long hindered farm productivity and profitability (Feng & Qian, 2019). These issues not only affect the economic viability of farms but also impact sustainability and the ability to meet market demands consistently. Recent research underscores the potential for improvement through the application of mathematical models aimed at optimizing feeding schedules and task allocation. Such approaches have been shown to significantly enhance overall farm performance, leading to better economic outcomes for farmers (Feng & Qian, 2019).

PigConnect represents a forward-looking initiative poised to integrate these research insights into practical farm management. By harnessing data-driven management tools and real-time analytics, PigConnect aims to revolutionize how pig farms operate. These technologies will empower farmers with actionable insights derived from detailed data analysis, enabling them to make informed decisions in areas such as feed formulation, resource allocation, and disease management. This capability not only improves operational efficiency but also enhances the ability to adapt quickly to market fluctuations and mitigate risks associated with disease outbreaks or environmental factors.

Furthermore, the adoption of advanced management practices through PigConnect aligns with broader agricultural goals of sustainability and resilience. By optimizing resource use and minimizing waste, the system promotes environmentally responsible farming practices. It also

strengthens the economic foundation of small-scale pig farmers by enhancing productivity and profitability, thereby supporting livelihoods and rural communities dependent on pig farming.

In essence, PigConnect represents more than just a technological upgrade; it signifies a strategic shift towards a more efficient, sustainable, and resilient pig farming industry in the Philippines. By bridging the gap between research findings and practical implementation, PigConnect aims to elevate standards in farm management, foster innovation, and ensure the long-term viability of pig farming as a cornerstone of the Philippine agricultural economy.

In the paper "Integrated application of standardization technology and e-commerce in livestock and poultry safe production - take pig as an example," authors X. Xu and C. Chen explore the enhancement of safety and efficiency in livestock and poultry production through the integration of standardized technology and e-commerce, focusing specifically on pig farming. The study emphasizes the critical role of standardization technology in ensuring consistent quality and safety standards by implementing uniform procedures and protocols for breeding, feeding, and health monitoring. This approach significantly reduces the risks associated with inconsistent practices. Additionally, the integration of e-commerce platforms facilitates direct connections between producers and buyers, streamlining the sales process and improving market access. By combining standardized production practices with e-commerce, consumers are assured of receiving products that meet stringent safety and quality standards.

Furthermore, the Internet of Things (IoT) technology is highlighted for its role in enhancing traceability and monitoring of livestock. Through the use of sensors and data collection devices, real-time tracking of health, growth, and environmental conditions of pigs is made possible, ensuring adherence to safety protocols and enabling timely adjustments. The case study presented in the paper illustrates the practical application and benefits of these technologies in achieving safer and more efficient production processes. The authors conclude that the integration of these technologies represents a significant advancement in the livestock industry, meeting the growing demands for safe and high-quality food products more efficiently and transparently.

Drawing from these insights, the PigConnect project aims to leverage similar technologies to enhance pig farming in Bulacan province. The scope of our project includes the development of a comprehensive management system tailored for small market piggeries, incorporating several

advanced technological components. The system will feature a user-friendly analytics dashboard providing real-time data and insights into farm progress and productivity, aligning with ISO 9001 standards. This dashboard will include visualization tools for key performance indicators and custom reports. We will employ user-based AI recommendations using collaborative filtering to analyze farm data and match pigs with suitable buyers based on user interactions and preferences, ensuring fair pricing and meeting buyer requirements.

Additionally, our platform will incorporate a user feedback and rating system to build trust and transparency, allowing mutual ratings between farmers and buyers. A robust communication platform will facilitate direct interactions between farmers and buyers, supported by an email notification system for timely alerts. Geolocation services will help buyers locate nearby farms and accurately assess farm conditions, while the system's mobile-responsive design will enhance accessibility and user engagement.

By concentrating on weather updates, inventory tracking, health monitoring, feeding schedules, and vaccination records, PigConnect aims to improve farm management efficiency, market access, and overall sustainability for small market piggery owners in Bulacan. These integrated technologies will address the longstanding challenges faced by small-scale farmers, leading to improved productivity, better animal welfare, and increased profitability.

In the paper "DEMETER Online Marketplace With Data Analytics for Agricultural Products Using Dynamic Programming Algorithm," Cordano, H. Z., Caballero, A. R., & Paraiso, C. M. (2022) addresses challenges in agricultural product supply chains, including inefficiencies and lack of transparency in market transactions. The proposed solution is the development of an online marketplace named DEMETER, which incorporates data analytics and dynamic programming algorithms to optimize the buying and selling processes. The methodology involves using heuristic and software algorithms to analyze data and improve decision-making within the marketplace. This approach aims to enhance the efficiency of supply chains by providing real-time data insights and optimizing transactions. The study's relevance to the PigConnect system lies in its use of advanced algorithms and data analytics to improve market efficiency and transparency, similar to how PigConnect plans to use AI-driven recommendations and real-time analytics to enhance pig farming and market access for small-scale farmers. By leveraging these technologies, PigConnect

can address challenges in farm management and market transactions, leading to improved productivity and profitability.

Table 2.1: List of Farm Management Systems.

Farm Management System	Features	Country of Origin
FarmLogs	Crop planning, field mapping, weather monitoring, inventory management, financial tracking, analytics	United States
Granular	Field mapping, crop planning, inventory management, profitability analysis, financial tracking	United States
Trimble Ag Software	Field mapping, guidance systems, crop health monitoring, yield monitoring, financial management	United States
Agrivi	Crop planning, inventory management, pest and disease monitoring, weather forecasting, financial analysis	Croatia

Farm Management System	Features	Country of Origin
FarmERP	Crop planning, inventory management, resource management, traceability, financial management	India
Agworld	Field mapping, crop planning, task management, agronomic insights, collaborative tools	Australia
Farmbrite	Livestock management, crop planning, inventory tracking, financial management, reporting	United States
Cropio	Field monitoring, satellite imagery analysis, crop health assessment, yield forecasting	Switzerland
Ag Leader SMS Software	Field mapping, yield monitoring, soil sampling, variable rate application, equipment management	United States

Farm Management System	Features	Country of Origin
AgSquared	Crop planning, task management, field mapping, harvest tracking, reporting	United States
PigConnect	Pig inventory and health management, breeding and feeding schedules, weather updates, expenses tracking, mediation platform, AI recommendations, geolocation, communication platform, user feedback and ratings	Philippines

Table 2.1 shows the lists of existing farm management systems and the proposed system which is PigConnect. This table also provides the specific features that the system has and their country of origin. While the other farm management system focuses on a broad range of agriculture activities, PigConnect will be specialized with pig farm management which will give more focus on the activities and needs of the pig farms. PigConnect will also be a mediation platform with AI recommendation which will match buyers with pig farm owners.

II. Methods and Analytics

In "Visual analytics for software requirements engineering," S. Reddivari (2013) explores the application of visual analytics to the field of software requirements engineering. The paper emphasizes the importance of visual analytics in enhancing decision-making processes and improving the management of software requirements. Key topics include data visualization techniques, visual analytics frameworks, and their impact on cognitive processes related to requirements engineering. The goal is to facilitate better understanding, analysis, and communication of requirements among stakeholders, ultimately leading to more effective and efficient requirements management.

The principles and approaches discussed in Reddivari's work are highly relevant to the PigConnect project, particularly in the development of the user-friendly descriptive analytics dashboard. The descriptive analytics dashboard aims to provide real-time data and insights to farmers, enabling informed decision-making regarding farm operations, feeding schedules, financial tracking, and health management. This aligns with Reddivari's emphasis on the role of visual analytics in enhancing decision-making. The dashboard will utilize data visualization techniques to present complex data in an easily understandable format, including graphs, charts, and maps that display key metrics and trends. This mirrors Reddivari highlighting the importance of data visualization in understanding and analyzing software requirements.

Additionally, the visual representations of data in PigConnect enhance the communication of farm conditions and requirements. By presenting data visually, the system supports the cognitive processes of farmers, helping them make sense of large volumes of data and identify actionable insights. This focus on cognitive support is also discussed in Reddivari’s work, where visual

analytics aids cognitive processes in requirements management. Overall, the integration of visual analytics into PigConnect aligns well with Reddivari's findings, enhancing decision-making, communication, and cognitive support for farmers, ensuring efficient farm management and improved productivity.

The systematic review on big data analytics in social media, conducted by Rahman and Reza (2022), delves into the comprehensive landscape of data analysis techniques and technologies applied in the realm of social networking. Their study underscores the significance of descriptive analytics as a foundational approach to summarizing historical data and extracting insights into past trends and patterns. This parallels our study's focus within the PigConnect project, where we aim to develop a user-friendly descriptive analytics dashboard for farmers. This dashboard will empower users by providing real-time data and analytics crucial for monitoring and managing various aspects of farm operations. While Rahman and Reza explore diverse data types such as text, image, audio, and video analytics in social media contexts, our project adapts similar principles to agricultural data, enhancing farmer decision-making through intuitive visualizations and insights.

Technologically, both studies emphasize the integration of advanced tools and platforms. Our project incorporates geolocation services, chat systems for communication, and email notifications to ensure timely alerts—features designed to optimize user engagement and operational efficiency for farmers. This technological integration aligns with the review's discussion of web 2.0 technologies and machine learning algorithms in social media analytics, albeit tailored to meet the specific needs of agricultural management. Furthermore, the structured framework and taxonomy proposed in Rahman and Reza's review provide a methodological guide for categorizing big data analytics dimensions, similar to our approach in organizing farm data for effective presentation and usability within the PigConnect platform.

In summary, while Rahman and Reza focus on social media analytics, the principles of leveraging descriptive analytics, integrating advanced technologies, and employing systematic frameworks for data analysis resonate deeply with our objectives in agricultural management. These parallels highlight the universal applicability of descriptive analytics methodologies across diverse domains, reaffirming their role in driving informed decision-making and enhancing

operational outcomes, particularly within the agricultural sector addressed by the PigConnect project.

III. AI-Driven Recommendation Systems

In contemporary agriculture, particularly in pig farming, the ability to access personalized decision support and relevant information is essential for optimizing operations and achieving sustainable growth. However, existing challenges such as information disparities and complex decision-making processes often impede these objectives, affecting user satisfaction and overall efficiency (Carole et al., 2024). Acknowledging this, AI-powered recommendation systems have emerged as a potent solution to address these challenges effectively.

AI-driven recommendation systems utilize advanced algorithms and machine learning techniques to analyze extensive datasets. These systems can offer personalized recommendations tailored to specific user requirements and preferences. In agriculture, this capability is transformative, providing farmers with insights into optimal practices such as feeding schedules and disease management strategies based on real-time environmental and health data, as well as market trends influencing product demand and pricing dynamics.

The study by Cha et al. (2019) explores the significant impact of AI recommendation systems on consumer preferences within e-commerce. Their research demonstrates that these systems play a pivotal role in influencing consumer decision-making by utilizing machine learning algorithms to analyze user data and behaviors. By delivering personalized product recommendations based on factors like past purchases, browsing history, and demographic details, AI-driven systems markedly enhance user engagement and satisfaction. This personalized approach not only increases the likelihood of consumers finding relevant products but also improves overall shopping experiences, leading to higher conversion rates and increased sales for e-commerce platforms.

Moreover, Cha et al. underscore the importance of transparency and trust in AI recommendations. Consumers are more likely to trust recommendations when they comprehend the algorithms behind them and perceive the process as impartial and fair. This transparency not

only boosts consumer confidence in AI-driven systems but also encourages their acceptance and adoption. Despite acknowledged benefits, the study highlights challenges such as data privacy concerns, algorithmic biases, and ongoing optimization needs. Nevertheless, the researchers emphasize the vast opportunities AI recommendation systems present for e-commerce, including enhancing customer satisfaction, driving revenue growth, and cultivating long-term customer loyalty through tailored and effective recommendations.

The integration of AI-driven recommendations into the PigConnect system marks a significant advancement for pig farmers in the Philippines. By harnessing AI technologies, PigConnect aims to equip farmers with actionable insights and decision support tools that enhance operational efficiency and productivity. For instance, farmers can receive timely recommendations on adjusting feeding schedules based on pig growth stages or environmental conditions, optimizing resource utilization and enhancing animal health outcomes.

Furthermore, these AI-driven recommendations extend beyond farm management to benefit stakeholders across the pig farming value chain. Buyers and distributors can utilize personalized insights on product availability, quality assessments, and market trends to make informed purchasing decisions. This not only streamlines transactions but also promotes market transparency and equity, fostering trust and sustainability within the industry.

Through embracing AI-driven recommendation systems, PigConnect not only improves the day-to-day management of pig farms but also contributes to broader agricultural objectives of efficiency, sustainability, and economic resilience. By facilitating informed decision-making and enhancing information accessibility, PigConnect supports the adoption of modern agricultural practices, positioning Filipino pig farmers to compete effectively in domestic and global markets. Ultimately, the integration of AI technologies through PigConnect represents a strategic advancement towards a more innovative, efficient, and sustainable pig farming sector in the Philippines, ensuring long-term prosperity for farmers and stakeholders alike.

The paper "Item-based Collaborative Filtering Recommendation Algorithms" by Sarwar et al. (2001) explores item-based collaborative filtering as an alternative to traditional user-based collaborative filtering methods. Collaborative filtering is a prevalent technique in recommender systems, predicting user preferences based on past behavior. The authors assert that item-based

collaborative filtering can yield more accurate recommendations and better performance, particularly in environments with sparse user-item interactions. This approach calculates item similarities by analyzing user-item interactions to identify items frequently co-rated by users, demonstrating greater scalability and efficiency with fewer computations compared to user-based methods. Key steps in the item-based approach include computing item similarities using metrics like cosine similarity and generating predictions by aggregating ratings of similar items.

For the development of PigConnect, we focus on implementing a user-centric collaborative filtering approach to enhance the buying experience for pig farmers and buyers. This approach involves collecting historical data on each buyer's interactions with pigs and farms, such as ratings, purchases, and other relevant activities. Instead of relying on similarities between different users, our system will analyze each individual buyer's past interactions to generate personalized recommendations.

The recommendation process begins with the collection and analysis of data on a buyer's past behaviors. By identifying patterns in the individual buyer's interactions, such as frequently purchased pigs or preferred farms, the system can predict which pigs or farms the buyer is likely to be interested in. This user-centric approach focuses exclusively on the preferences and behavior of each individual user, ensuring that the recommendations are highly personalized and relevant.

By leveraging a user-centric collaborative filtering approach, PigConnect can offer highly personalized recommendations tailored to the unique preferences and behaviors of each buyer. This method enhances user engagement by providing suggestions based on the individual buyer's history and preferences, thereby improving the overall buying experience and facilitating better market transactions. This approach is particularly effective for creating a personalized and efficient recommendation system tailored to the specific needs of pig farmers and buyers in the Philippines.

In the paper "Implementation and Effectiveness Evaluation of Four Common Algorithms of Recommendation Systems - User Collaboration Filter, Item-based Collaborative Filtering, Matrix Factorization and Neural Collaborative Filtering," H. Liu (2022) evaluates the performance and implementation of four widely used recommendation algorithms. The study examines User Collaboration Filter, Item-based Collaborative Filtering, Matrix Factorization, and Neural

Collaborative Filtering, focusing on their effectiveness, efficiency, and applicability in real-world scenarios, particularly in industries related to cloud computing and big data applications.

The User Collaboration Filter, also known as user-based collaborative filtering, is highlighted for its effectiveness in generating personalized recommendations by leveraging historical user interactions. This method is particularly relevant to PigConnect as it aligns with our focus on individual user preferences without relying on data from other users. Item-based Collaborative Filtering, which calculates similarities between items, is useful in scenarios with sparse user-item interactions but is less pertinent to PigConnect's user-centric approach. Matrix Factorization, which decomposes the user-item interaction matrix into latent factors, is noted for its efficiency and accuracy in handling large-scale data. However, its complexity might be more than what is necessary for PigConnect's initial implementation. Neural Collaborative Filtering uses neural networks to learn user-item interactions, capturing complex patterns and providing highly accurate recommendations. This sophisticated approach could be beneficial for PigConnect in advanced stages when more refined recommendation systems are required.

For PigConnect, a hybrid recommendation system is the most suitable method. This approach combines the strengths of both content-based filtering and collaborative filtering, providing a comprehensive recommendation process that enhances the buying experience by focusing on individual preferences, past behaviors, and similarities with other users. The hybrid system's versatility and effectiveness make it ideal for PigConnect, ensuring personalized and relevant recommendations with more accurate results. By analyzing features of pig farms such as location, size, and facilities, along with buyer preferences and interaction history, PigConnect can offer tailored recommendations that significantly improve user satisfaction. As PigConnect evolves, the hybrid recommendation system can adapt and incorporate more sophisticated elements like matrix factorization or neural collaborative filtering, further enhancing the recommendation process and optimizing user experiences.

Table 2.2: List of Farm management systems that use user-based analytics with collaborative filtering.

Farm Management System	Description	Features	Website
AgriXP	Farm management software offering solutions for planning, tracking, and analysis.	Resource management, task tracking, reporting and analytics.	AgriXP
Climate FieldView	Digital tools for monitoring and managing field conditions, offering data-driven insights.	Seed prescriptions, nitrogen management, harvest optimization.	Climate FieldView
PigConnect	Tailored management system for small market piggeries in Rizal province, Central Luzon.	Pig inventory and health management, breeding and feeding schedules, weather updates, expenses tracking, mediation platform, AI recommendations, geolocation, communication platform, user feedback and ratings	PigConnect

Table 2.2 PigConnect distinguishes itself by focusing on the specific needs of small market piggeries in Rizal province, Central Luzon, and integrating AI-driven buyer recommendations using collaborative filtering. Unlike broader agricultural systems, PigConnect is tailored to optimize farm management for domesticated pig farming, enhancing efficiency and market access while ensuring specialized features that meet the unique requirements of pig farmers in the region. This targeted

approach aims to streamline operations and improve profitability through data-driven insights and personalized recommendations for buyers, thereby facilitating transparent and efficient market interactions.

IV. Synthesis

The review of literature and related studies underscores the critical role of technological adoption, efficient management practices, and knowledge dissemination in improving the productivity and sustainability of pig farming. The proposed PigConnect system integrates these insights by offering advanced management tools, real-time analytics, and AI-driven recommendations to support small-scale pig farmers in overcoming traditional challenges and enhancing overall operational efficiency. By leveraging these technological advancements, PigConnect aims to foster a more efficient and transparent marketplace for pig farming in the Philippines, benefiting both farmers and buyers alike.

V. Gap Analysis

The pig farming industry is a critical component of agricultural production, yet it remains underserved in terms of modern technological solutions. Many pig farmers continue to rely on manual processes to manage their farms, including tracking livestock health, inventory management, and production monitoring. These traditional methods often lead to inefficiencies, data inaccuracies, and delayed responses to critical issues, ultimately affecting productivity and profitability.

While there are existing farm management systems available, they tend to cater to large-scale operations or require significant financial and technical investment. These solutions are often too complex or costly for small-scale farmers to adopt, leaving a notable gap in accessible and affordable technology tailored to their specific needs. Additionally, there is a lack of integrated platforms that provide real-time data and actionable insights, which are crucial for informed decision-making and optimizing farm performance.

The gap lies in the absence of a comprehensive, user-friendly, and cost-effective digital tool designed specifically for small-scale pig farmers. PigConnect aims to address this by offering a system that not only streamlines farm management tasks but also provides data-driven insights to improve productivity.

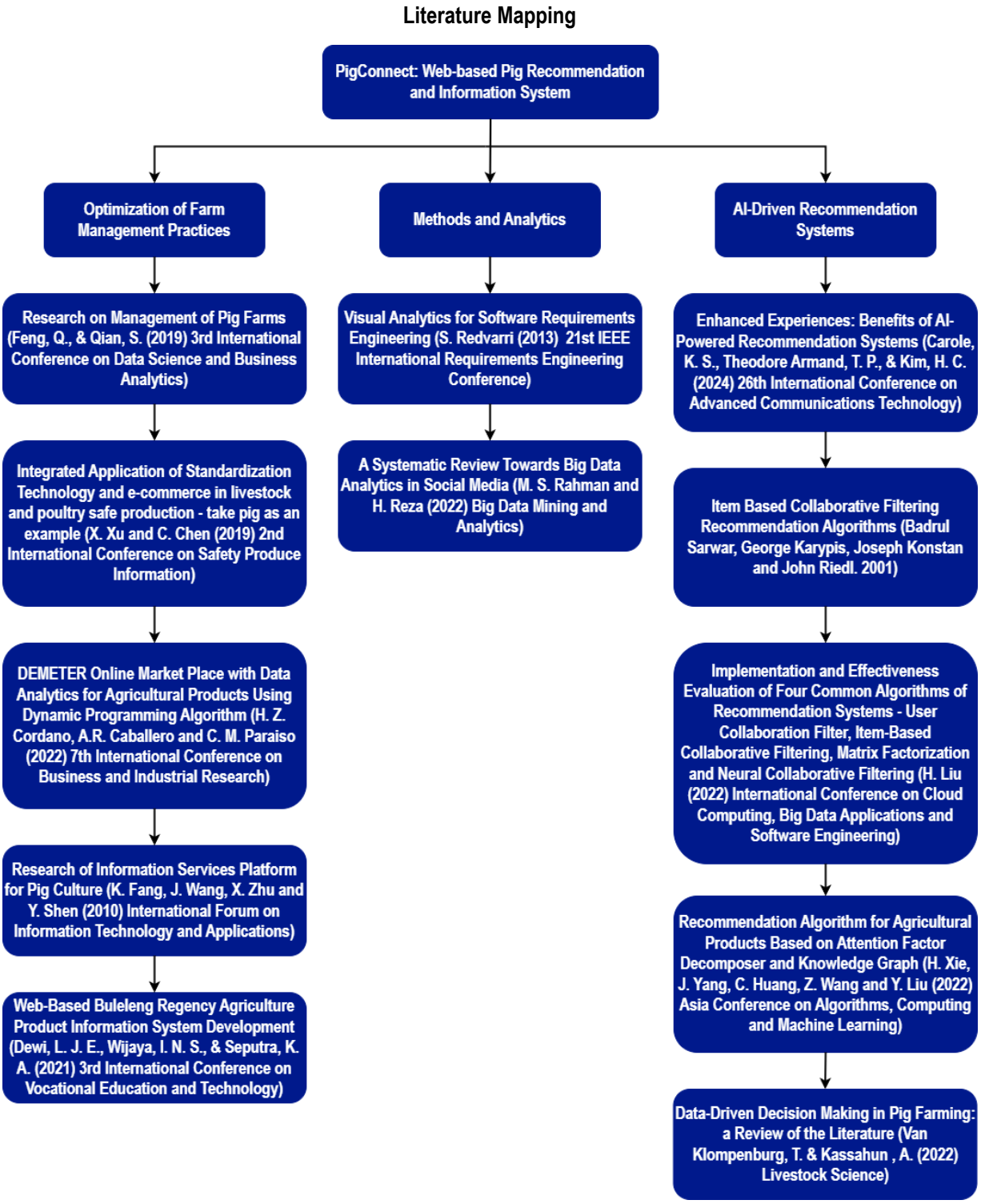


Figure 2.1 Literature Mapping

Figure 2.1 shows the literature mapping of the study where it shows the related literature and studies that was utilized for the proposed capstone project.

Chapter 3

I. Software Development Method

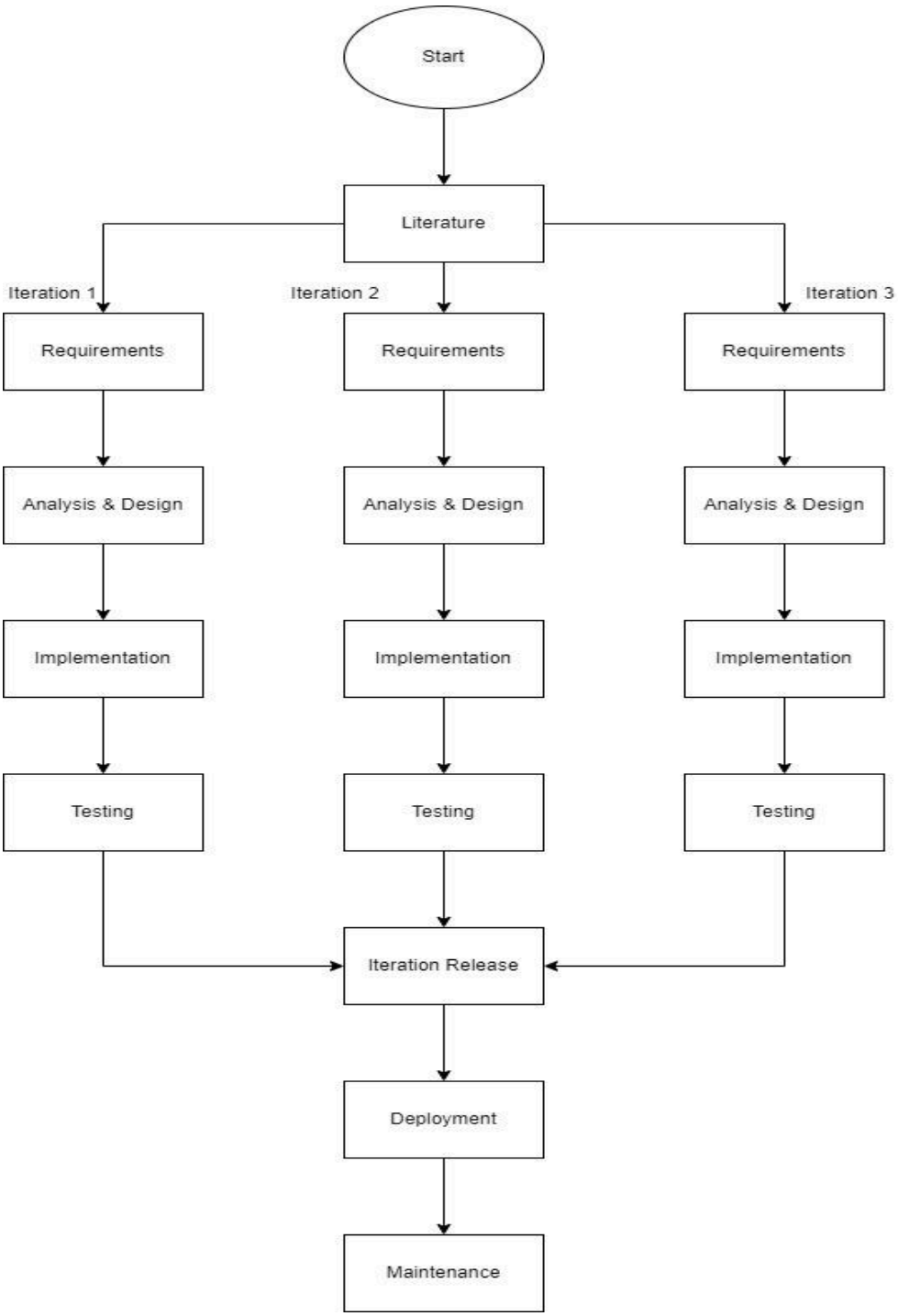


Figure 3.1 Iterative Methodology

The development of the PigConnect system adhered to the Incremental Methodology using a structured iterative process. The chosen approach mirrored a development model that ensured-+ continuous refinement through specific phases: requirements gathering, analysis and design, implementation, testing, and evaluation. The methodology was executed in three primary iterations. After thorough planning, designing, developing and testing the system, it will be sent to deployment to get feedback.

Requirements: Requirements were gathered through surveys and interviews with pig farmers and buyers to ensure the system was designed with real-world needs in mind. Key requirements included secure user authentication, farm management tools, AI-driven recommendations, geolocation services, and communication modules.

Analysis and Design: This phase involved designing the architecture and user interface of the system. The team developed conceptual frameworks, and data flow diagrams to map out the system's functionality. The design emphasized user-friendliness, modularity, and responsiveness to accommodate diverse devices and workflows.

Implementation: The system was developed in modules across three iterations, starting with basic features like account registration and dashboards. Subsequent iterations introduced advanced functionalities, including AI-driven recommendations, analytics, and real-time chat systems. Technologies like Laravel, MySQL, and Vue.js were utilized to ensure robustness and scalability.

Testing: Each iteration underwent rigorous testing to identify bugs and gather user feedback. Functional, security, and usability tests ensured that the system met quality standards. Feedback from farmers and buyers during the testing phase informed refinements and enhancements to the system.

Iteration Release: At the end of each iteration, the updated system was released for stakeholder evaluation. This process allowed for continuous feedback integration, enabling researchers to address issues and improve features incrementally.

Deployment: Once all iterations were completed, the system was deployed to a real-world testbed. A small-scale pig farmer in Rizal was selected for the deployment to validate the system's performance and gather insights from practical usage.

Maintenance: Post-deployment, the system entered the maintenance phase. This phase involved monitoring its functionality, addressing bugs, and rolling out updates to ensure compatibility with evolving user needs and technology standards. The admin team was tasked with keeping the system's data and features up to date.

Iteration 1

This iteration focused on building the essential framework of the system, establishing a secure and functional foundation. The authentication module, along with the initial farmer and buyer dashboards, was at the heart of this iteration. These components ensured that users could interact with the system securely while laying the groundwork for more complex features in subsequent phases. This initial iteration served as a critical stepping stone, as it provided the system with stability and clarity in design, ensuring that all future developments were built on a robust and reliable baseline.

Iteration 2

The project was taken a step further by addressing the core needs of farm management, which enhanced the system’s practicality and relevance. Key features such as feeding schedules, vaccination tracking, expense monitoring, and descriptive analytics transformed the system into an invaluable tool for farmers. These functionalities were designed to be intuitive and aligned seamlessly with the users’ daily workflows, ensuring that the system genuinely improved farm operations. This phase also introduced AI-driven recommendations, which made the system smarter and more personalized for buyers, demonstrating a clear focus on user-centric design.

Iteration 3

The researchers brought the PigConnect system to its full potential by integrating advanced and innovative features. Real-time communication between farmers and buyers through the chat module, geolocation for farm discovery, and robust notification systems were pivotal additions that enhanced the system's interactivity and usability. Advanced AI-driven recommendations, tailored to user preferences, made PigConnect stand out as a truly competitive solution in its field. The team's meticulous attention to data security and validation during this phase ensured that the system was not only efficient but also trustworthy.

II. Data Gathering Tools and Procedures

Data collection involves:

A. **Surveys and Interviews:**

To gather valuable insights into current practices and challenges, structured questionnaires were distributed to pig farmers. These questionnaires aimed to understand their management practices, pain points, and openness to technology. The collected data shaped the development of PigConnect to address the needs of both farmers and buyers.

B. **System Testing:**

Once data was collected, selected farmers and buyers tested the initial prototype. They accessed the deployed website via a provided link. Their feedback identified system strengths and areas needing improvement.

III. Conceptual Framework

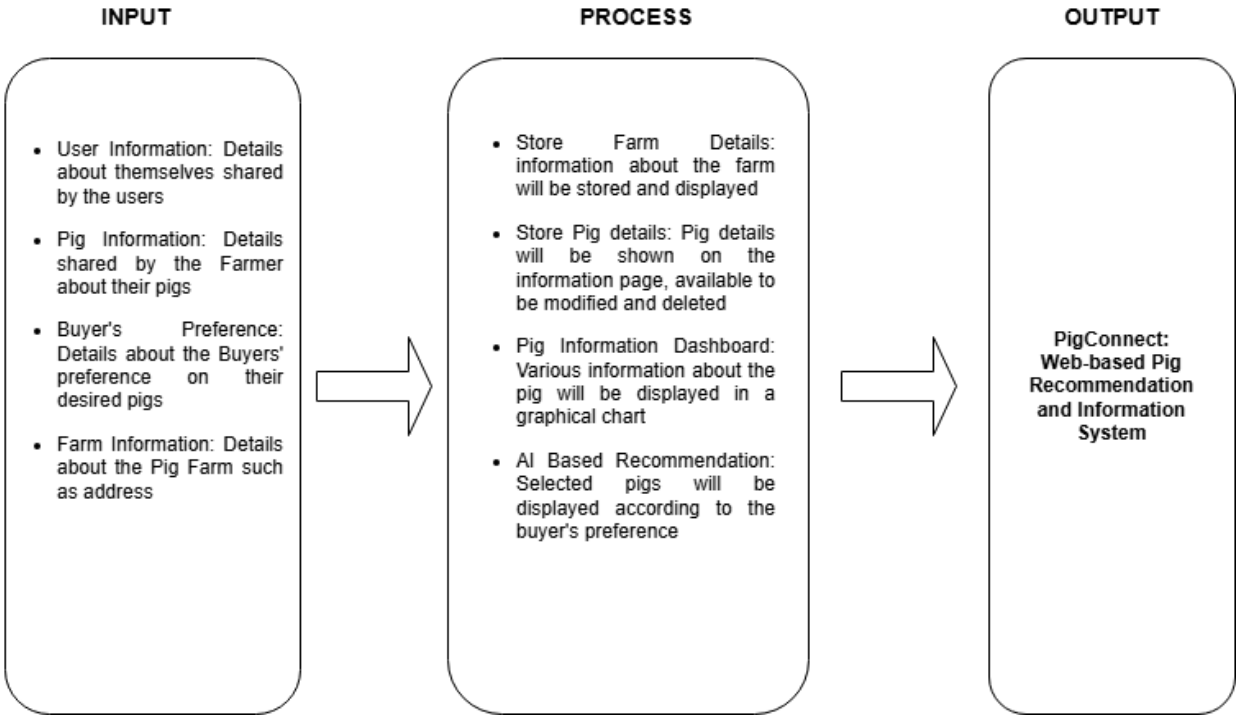


Figure 3.2 Conceptual Framework

Figure 3.2 The conceptual framework of the capstone project where it emphasizes the inputs of the system, process to be implemented to the system and the output which is the system itself.

IV. Proposed Computing Solutions

Design Requirements

Table 3.1: Design Requirements

	Customer Requirements	**Design Constraints**	**Measurement of Performance**	**Design Criteria**	**Solution 1**	**Solution 2**	**Solution 3**
CR1	The project development must be done within the timeframe given	Economic	Time to Present the Capstone Project (ahead or on-time)	Time	6 months	5 months	4 months
CR2	The project implemented AI recommendation system	Algorithm Selection	Feedback Quality	User Experience (UX)	Hybrid Recommendat ionSystem	Content-based Filtering	User-based Collaborative Filtering
CR3	The system implemented analytics dashboard to farmer's module	Scalability	Data Accuracy, Response Time	Performance Efficiency and Usability	Descriptive analytics	Predictive Analytics	Prescriptive Analytics
CR4	The system must ensure the security and privacy of user data at all times.	Compliance	Compliance Adherence	End-to-End Encryption	SHA Encryption	DES Encryption	Token-based

	Customer Requirements	Design Constraints	Measurement of Performance	Design Criteria	Solution 1	Solution 2	Solution 3
CR5	The platform must be accessible and fully functional across all major web browsers and compatible with various devices.	Responsive Design	User Feedback, Browser Testing, Device Testing	Platform Independent	Laravel Framework and VueJS, TailwindCSS	ExpressJS and ReactJS, Bootstrap	Java. Angular JS, MaterializeCSS
CR6	Personal data can be accessed by admin or verifying the master key to unlock the given account.	The admin must verify the user being registered	This method must be safe and secure.	Authenticity	Email Verification	SMS Verification	Two-Factor Authentication
CR7	The system must handle huge amounts of data.	The system can handle huge amount of data	Scalability Testing	Scalability	MySQL	MongoDB	Firebase
CR8	The system must implement validation for login and register	Validate inputs to prevent injection attacks (e.g., SQL injection).	Reliability	Input Validation	Client-Side and Server-Side Validation	Regular Expression Validation	Integration with Third-Party Validation Services
CR9	The system must implement verification for users creating and logging in to the system.	Implement verification mechanisms that are user-friendly and do not overly	Measure the time taken to complete the verification process, including sending	Implement secure protocols for transmitting verification	Email Verification	SMS Verification	Two-Factor Authentication

	Customer Requirements	Design Constraints	Measurement of Performance	Design Criteria	Solution 1	Solution 2	Solution 3
		complicate the registration and login processes.	verification emails and validating user responses.	emails and handling user responses securely.			

Table 3.1 outlined the comprehensive design requirements for a capstone project focused on developing an advanced system, likely aimed at enhancing agricultural practices through technology. The table detailed specific customer requirements, design constraints, measurements of performance, and criteria for evaluating proposed solutions. Key customer requirements included adherence to project timelines, implementation of an AI-driven recommendation system, and integration of an analytics dashboard tailored for farmers. Design constraints emphasized economic feasibility, while performance metrics encompassed factors like algorithm selection based on feedback quality, data accuracy, and system scalability. Each proposed solution, from hybrid recommender systems to different tech stacks, reflected a strategic approach to meeting these requirements effectively. This structured approach ensured that the project addressed critical aspects such as security, user accessibility, and data handling, aiming to deliver a robust, efficient, and user-friendly solution tailored for the agricultural sector.

System Architecture of the Proposed Computing Solutions

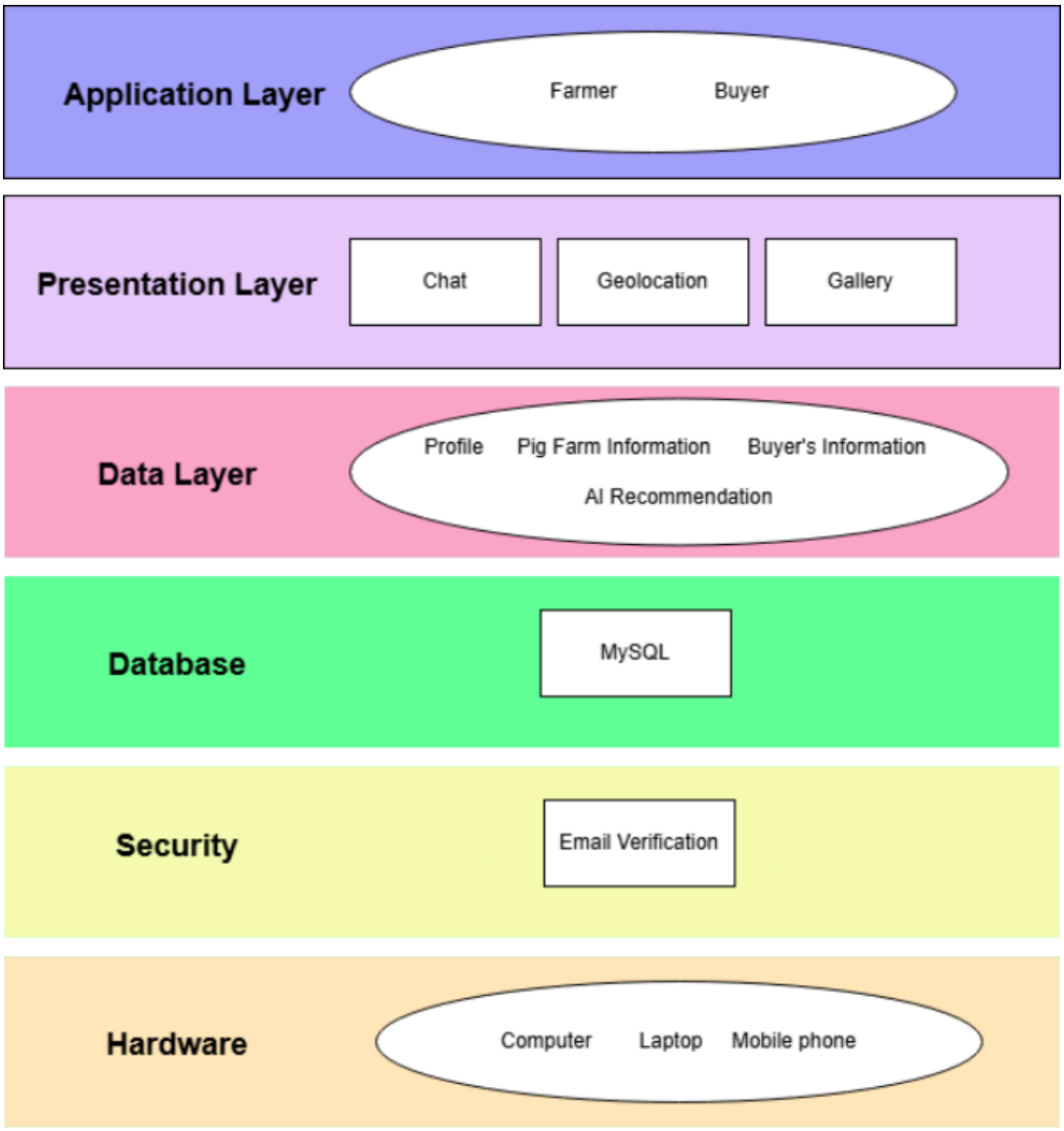


Figure 3.3 System Architecture of Solution 1

The figure 3.3 shows the system architecture for solution 1. Using the web browser, the farmer and buyer were able to access the website. They were routed to their respective views. The chat and geolocation were utilized by both buyers and farmers. The data from the data layer was stored in the database using MySQL. The system implemented email verification to verify the email address of the user and to provide access to the system. The system was designed to run on all devices.

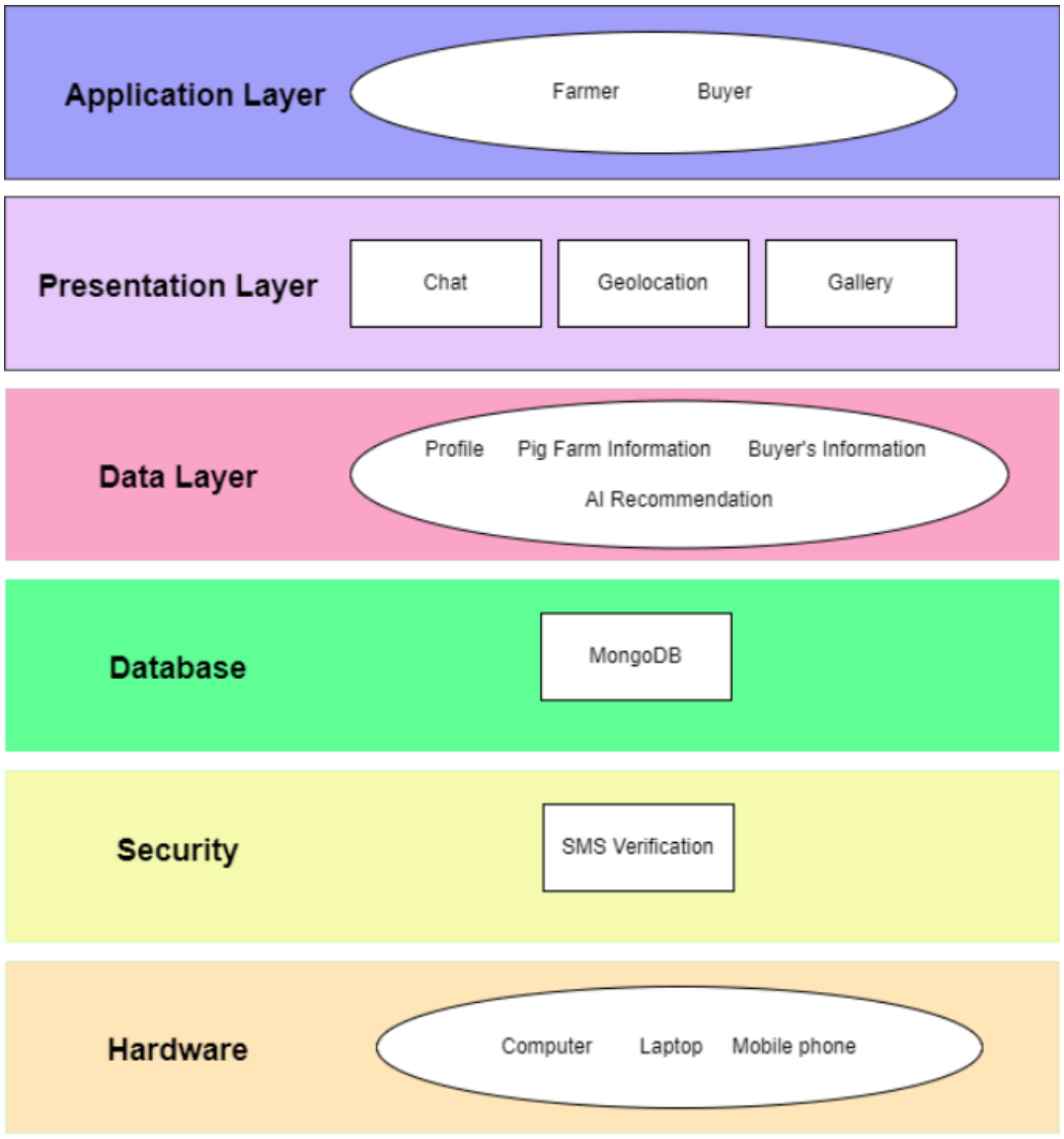


Figure 3.4 System Architecture of Solution 2

The figure 3.4 shows the system architecture for solution 2. Using the web browser, the farmer and buyer were able to access the website. They were routed to their respective views. The chat and geolocation were utilized by both buyers and farmers. The data from the data layer was stored in the database using MongoDB. The system implemented SMS verification to register the accounts and provide access to the system. The system was designed to run on all devices.

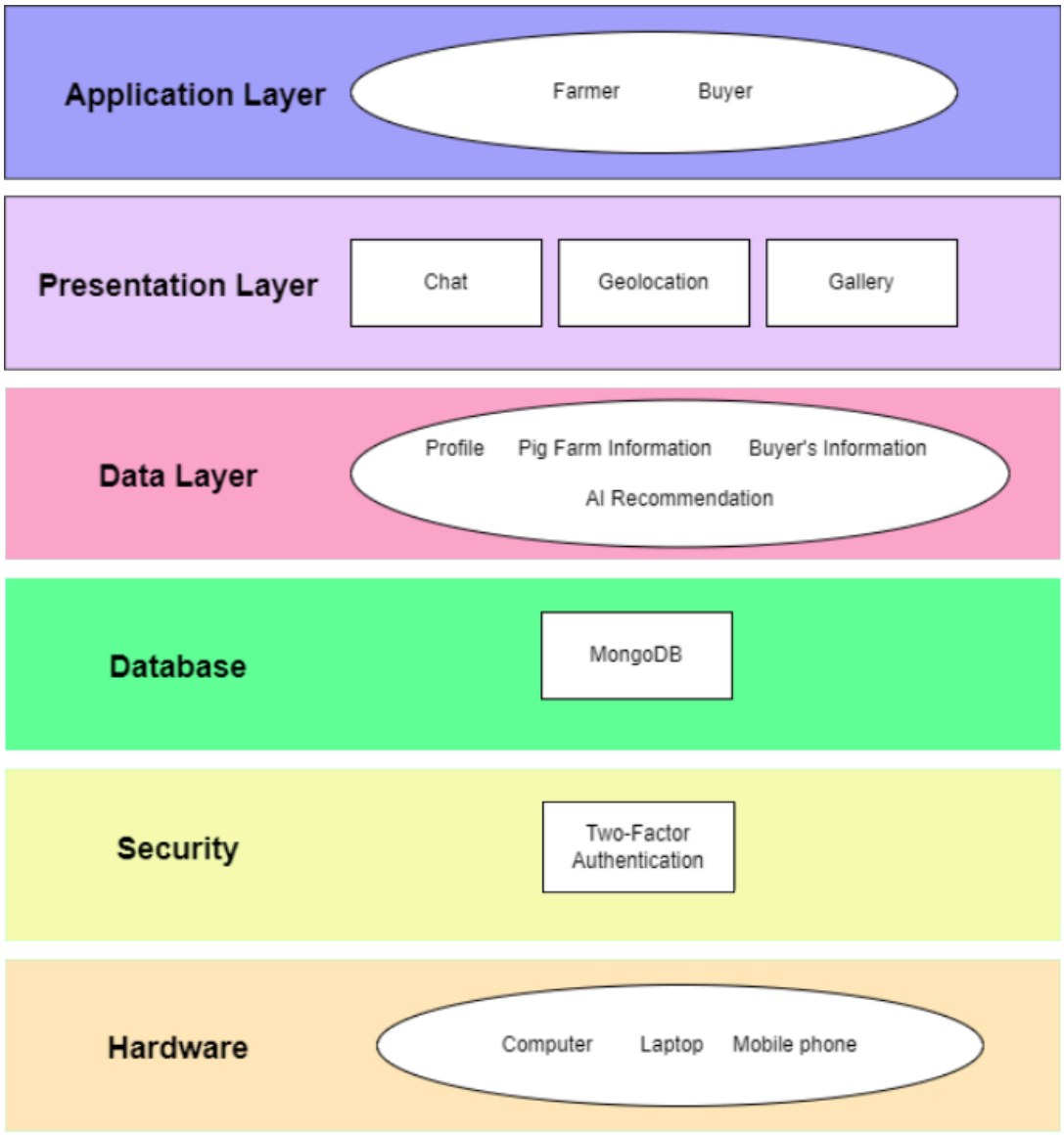


Figure 3.5 System Architecture of Solution 3

The figure 3.5 shows the system architecture for solution 3. Using the web browser, the farmer and buyer were able to access the website. They were routed to their respective views. The chat and geolocation were utilized by both buyers and farmers. The data from the data layer was stored in the database using Firebase. The system implemented two-factor authentication to register accounts and provide access to the system. The system was designed to run on all devices.

Evaluation of Proposed Computing Solutions (Decision Matrix)

Table 3.2: Decision Matrix

CR #	Weight	Solution 1	Solution 2	Solution 3
CR1	5%	.05*90=4.5	.05*85=4.25	.05*87=4.35
CR2	15%	.15*95=14.25	.15*89=13.35	.15*86=12.9
CR3	15%	.15*90=13.5	.15*85=12.75	.15*83=12.45
CR4	10%	.10*88=8.8	.10*85=8.5	.10*80=8.0
CR5	15%	.15*87=13.05	.15*83=12.45	.15*86=12.9
CR6	5%	.05*93=4.65	.05*88=4.4	.05*88=4.4
CR7	10%	.10*100=10	.10*90=9	.10*85=8.5
CR8	15%	.15*87=13.05	.15*84=12.6	.15*80=12
CR9	10%	.10*86=8.6	.10*80=8.0	.10*88=8.8
Total	100%	90.4%	85.3%	84.3%

Table 3.2 illustrated the developed decision matrix, presenting the scores corresponding to each proposed solution across the specified criteria or customer requirements. For CR 1, the winning solution was solution 1 at 4.5%, then 4.35% for solution 3, and 4.25% for solution 2. For CR 2, the winning solution was solution 1 at 14.25%, then 13.35% for solution 2, and 12.9% for solution 3. For CR 3, the winning solution was solution 1 at 13.5%, then 12.75% for solution 2, and 12.45% for solution 3. For CR 4, the winning solution was solution 1 at 8.8%, then 8.5% for solution 2 , and 8% for solution 3. Lastly, For CR 5, the winning solution was solution 1 at 13.05%, then 12.9% for solution 3, and 12.45% for solution 2. For CR 6, the winning solution was solution 1 at

4.65%, then 4.4% for both solution 2 and 3. For CR 7, the winning solution was solution 1 at 10%, then 9% for solution 2, and 8.5% for solution 3. For CR 8, the winning solution was solution 1 at 13.05%, then 12.6% for solution 2, and 12% for solution 3. For CR 9, the winning solution was solution 3 at 8.8%, then 8.6% for solution 1, and 8% for solution 2. Overall, the winning solution with the highest total percentage was solution 1 at 90.4%, followed by solution 2 at 85.3%, then solution 3 at 84.3%.

Visualization of Decision Matrix

Figure 3.6: Comparison of Solutions chart

In Figure 3.6, a line chart was presented as a visual representation, depicting the comparative performance of three distinct solutions concerning customer requirements. This visualization simplified the process of comparison and assessment, aiding in the determination of their suitability for the project.

V. IMPLEMENTATION OF PROCEDURES / APPROACHES OF THE WINNING SOLUTION 1

Customer Requirement 1

Task	July	August	September	October	November	December
Planning						
Design						
Development						
Testing						
Deployment						

Table 3.3. Customer Requirement 1 Gantt chart

The capstone project PigConnect: Intelligent Buyer Recommendations and Farmer Management System in Pig Farming was planned to be completed in 6 months. The planning stage was conducted in July and August 2024 where the researchers gathered data. The design stage was also carried out in August 2024 where the design of the planned system was created. Development and Testing were conducted from September to November 2024, as the system was developed module by module and underwent testing. The deployment began in November 2024 to check for possible bugs while it was being deployed then in December 2024 which marked the end of the required timeframe for completing the system.

Customer Requirement 2

Hybrid Recommendation

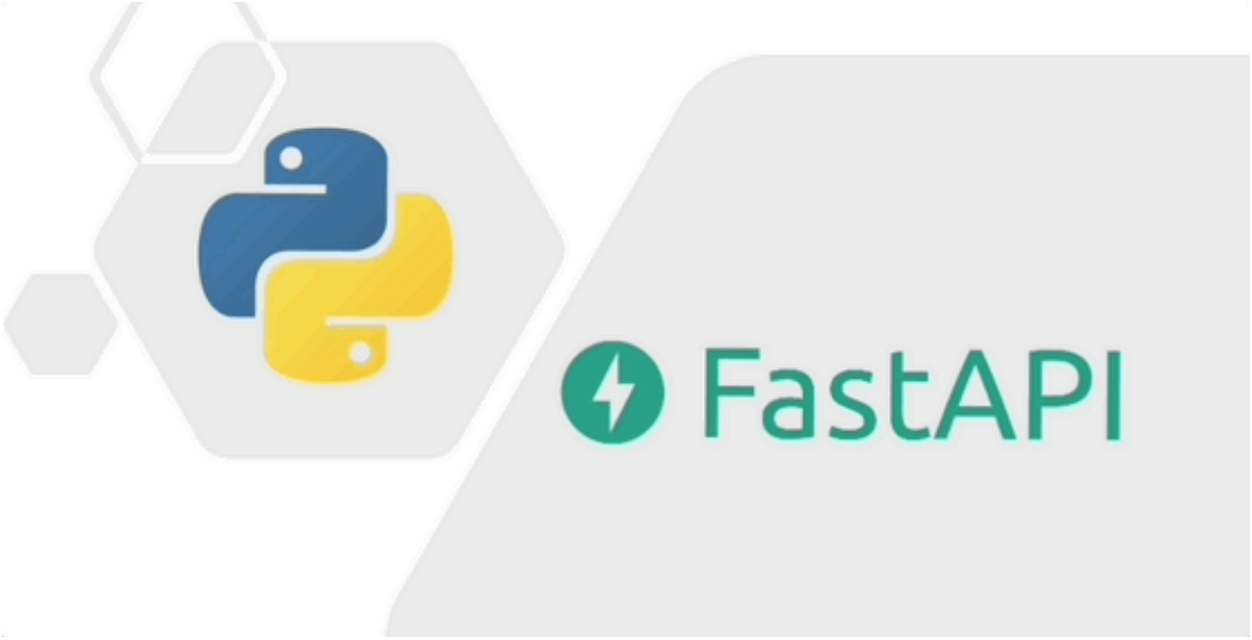


Figure 3.7 Python + FastAPI Framework

The capstone project implemented a hybrid recommendation system to provide personalized suggestions to buyers based on their preferences and interaction history, such as previous searches and visits. This system dynamically adapted its recommendations as users engaged with the platform. The implementation utilized Python as the core programming language and FastAPI as the backend framework to efficiently manage API endpoints and data flow. Additionally, OpenAI's language models were integrated to enhance recommendation accuracy and contextual understanding, allowing the system to deliver more intelligent and user-relevant suggestions in real time.

Customer Requirement 3

The capstone project implemented descriptive analytics to the farmer's module to provide detailed information regarding their farms real-time updates. Descriptive analytics helped the farmers to provide insights into how their farms are doing.

Customer Requirement 4

The capstone project implemented SHA encryption for sensitive data like user credentials and farm information. This is to ensure the confidentiality of the data of the users.

Customer Requirement 5

Figure 3.7 Laravel, VueJS and Tailwind CSS Framework

The capstone project ensures that the platform is accessible and fully functional across all major web browsers and compatible with various devices. To achieve this, the development team implemented responsive design principles using TailwindCSS. The system was built using Laravel for the back end and Vue.js for the front end, enabling a dynamic and adaptable interface across desktops, tablets, and mobile devices. Browser and device testing, along with user feedback, were conducted to ensure consistency and usability.

Customer Requirement 6

The capstone project implemented email verification for users trying to create accounts to prevent other users from creating dummy accounts.

Customer Requirement 7

Figure 3.8. MySQL

The capstone project used a MySQL database to store and manage data of the users. MySQL provided support to the MVC feature of the PHP, as Laravel was used for the back-end development.

Customer Requirement 8

The capstone project implemented client-side and server-side validation to its fields to ensure data integrity and avoid duplicate data creation. By doing so, the system optimized data entry processes, enhanced security, and improved overall data quality. Client-side validation provided immediate feedback to users, ensuring that input errors were caught early before data was sent to the server. Server-side validation acted as an additional layer of defense, verifying data integrity and consistency upon submission, thus safeguarding against potential malicious or erroneous inputs. This dual-layer validation approach contributed to a strong and reliable system, minimized data inconsistencies and improved user trust in the platform.

Customer Requirement 9

The capstone project implemented email verification for users creating accounts to ensure the validity of their email addresses, thereby enhancing security and reducing the risk of fraudulent registrations.

VI. Software, Hardware, and People Requirements

Table 3.4 Software, Hardware and People Requirements

Software Requirements	Hardware Requirements	People Requirements
Operating systems ● Any Operating System	Client Devices ● Smartphones ● Tablets ● Laptops ● PCs	Development Team ● Frontend Developer ● Backend Developer ● Project Manager/Lead Developer ● Researcher/Documentation
Development Tools and Languages ● vue.js ● HTML ● CSS ● Laravel ● Python	Back-UP Solutions ● External Hard Drives ● AWS ● Google Cloud Backup	
Databases ● MySQL	Networking Equipment ● Basic routers and switches (if any on-premises work)	
Web Server ● Apache		
APIs and Integration ● weatherAPI (To be updated) ● Google Maps API		

VII. System Requirements Specification

Functional Requirements

- **User Authentication and Profile Management**
  - **User Account Creation:** The system allowed users (farmers and buyers) to create accounts with unique credentials.
  - **Login Functionality:** Users were able to securely log in to access their accounts.
- **Farmer Management Interface**
  - **Input Farm Details:** Farmers were able to input and update information about their farms, such as location, size, and facilities.
  - **Manage Pig Inventory:** Farmers were able to track the number of pigs, their breeds, ages, and health status.
  - **Manage Expenses:** The system enabled farmers to log and categorize expenses related to pig farming.
  - **Weather Updates:** Farmers were able to receive real-time weather updates relevant to their farm locations.
- **Pig Inventory and Health Management**
  - **Input Vaccination and Immunization Details:** Farmers logged vaccination schedules and immunization records for each pig.
- **Analytics Dashboard**
  - **Real-Time Data:** The dashboard displayed real-time data on pig inventory, weather update and health.
  - **Analytics:** Provided insights and trends based on the collected data, such as productivity metrics and financial summaries.
  - **Visualization Tools:** Charts, graphs, and reports were included to help farmers understand their data.
  - **ISO 9001 Alignment:** The dashboard aligned with ISO 9001 standards for quality management.

- **Buyer Interface**
    - **Input Buyer Preferences:** Buyers were able to input their preferences for pigs, such as weight, age, and price range.
    - **AI-Based Recommendations:** The system used hybrid recommendation filtering (user-collaborative and content-based) to recommend pigs that match the buyer's preferences.
    - **View Farm Lists and Details:** Buyers were able to browse a list of farms and view detailed information about each.
- **Geolocation Services**
    - **Display Farm Locations:** The system showed the geographical locations of farms.
- **Communication Platform**
    - **Chat Functionalities:** The system allowed real-time messaging between farmers and buyers to negotiate and ask questions.
    - **Email Notifications:** It sent email alerts for important updates, such as new messages or changes in pig availability.
- **Feedback and Rating System**
    - **Provide Feedback:** Users were able to leave feedback about their transactions.
    - **View Ratings:** Users were able to view ratings and reviews to make informed decisions about interactions.
- **Notification System**
    - **Email Alerts:** Notify users of their scheduled feeding schedule via email.

Non-Functional Requirements

- **Performance**
    - **Real-Time Processing:** The system was able to process data and updates in real-time to ensure timely information.
    - **Response Time:** Ensure that the system was able to respond to user actions within an acceptable time frame.
- **Scalability**
    - **Handle Increased Load:** The system was able to support a growing number of users and data without performance degradation.
    - **Modular Design:** Implement a design that allows for easy scaling of system components.

- **Security**
  - **Data Encryption:** Protect sensitive user data with encryption both at rest and in transit.
  - **Authentication Mechanisms:** Implement strong authentication methods to prevent unauthorized access.
  - **Data Protection Compliance:** Ensure compliance with relevant data protection regulations.
- **Usability**
  - **Mobile-Responsive Design:** Ensure the web interface is usable on mobile devices without sacrificing functionality.
- **Reliability**
  - **System Uptime:** Aim for high system availability with minimal downtime.
  - **Backup and Recovery:** Implement reliable backup and recovery procedures to protect data integrity.
- **Maintainability**
  - **System Uptime:** Aim for high system availability with minimal downtime.
  - **Backup and Recovery:** Implement reliable backup and recovery procedures to protect data integrity..
- **Compatibility**
  - **Web Browsers:** Ensure compatibility with major web browsers, including Chrome, Firefox, Safari, and Edge.
  - **Third-Party Services:** Ensure the system can integrate with relevant third-party services..
- **Compliance**
  - **Industry Standards:** Align system processes and outputs with industry standards, including ISO 9001.
  - **Regulatory Requirements:** Ensure the system meets all necessary regulatory requirements.

IX. Context Diagram

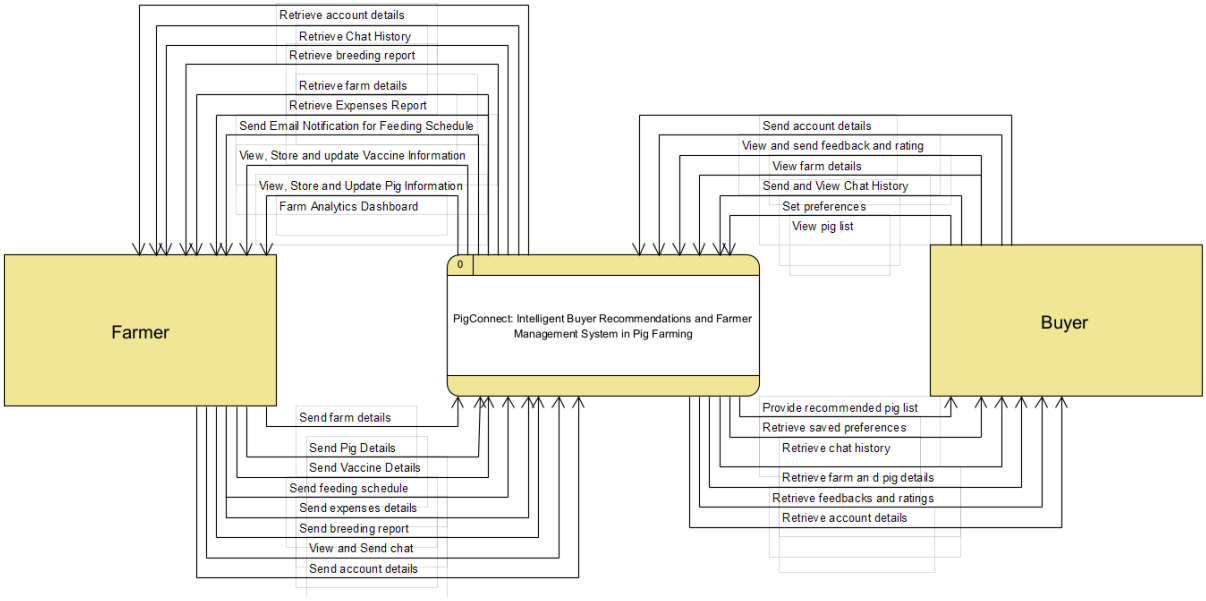


Figure 3.9 Context Diagram

Figure 3.9 shows the context diagram of the capstone project and how it functioned. Buyers were able to register, view farms, and leave feedback on those farms. Farmers were also able to register, view analytics, input pig information, and update pig information. The system sent notifications, issued alerts, and provided analytics to the farmer, while it also displayed farm information and sent notifications to buyers. Farmers and Buyers interacted with each other through the chat feature.

X. Data Flow Diagram

User Accounts

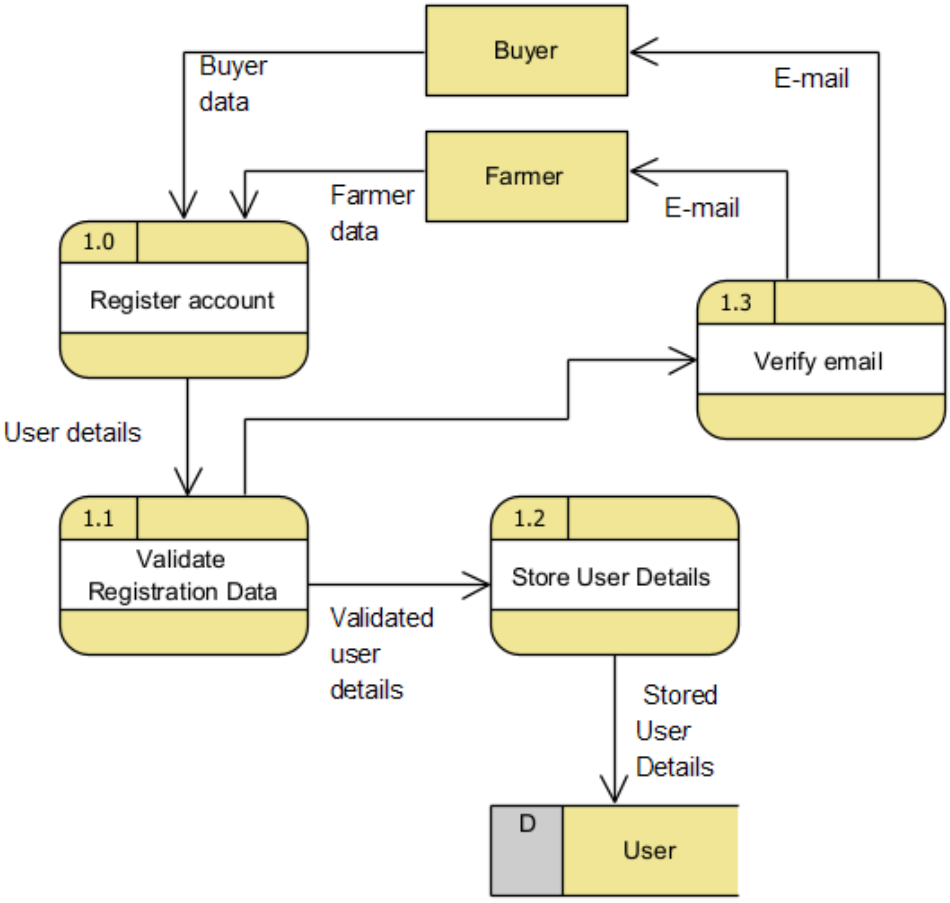
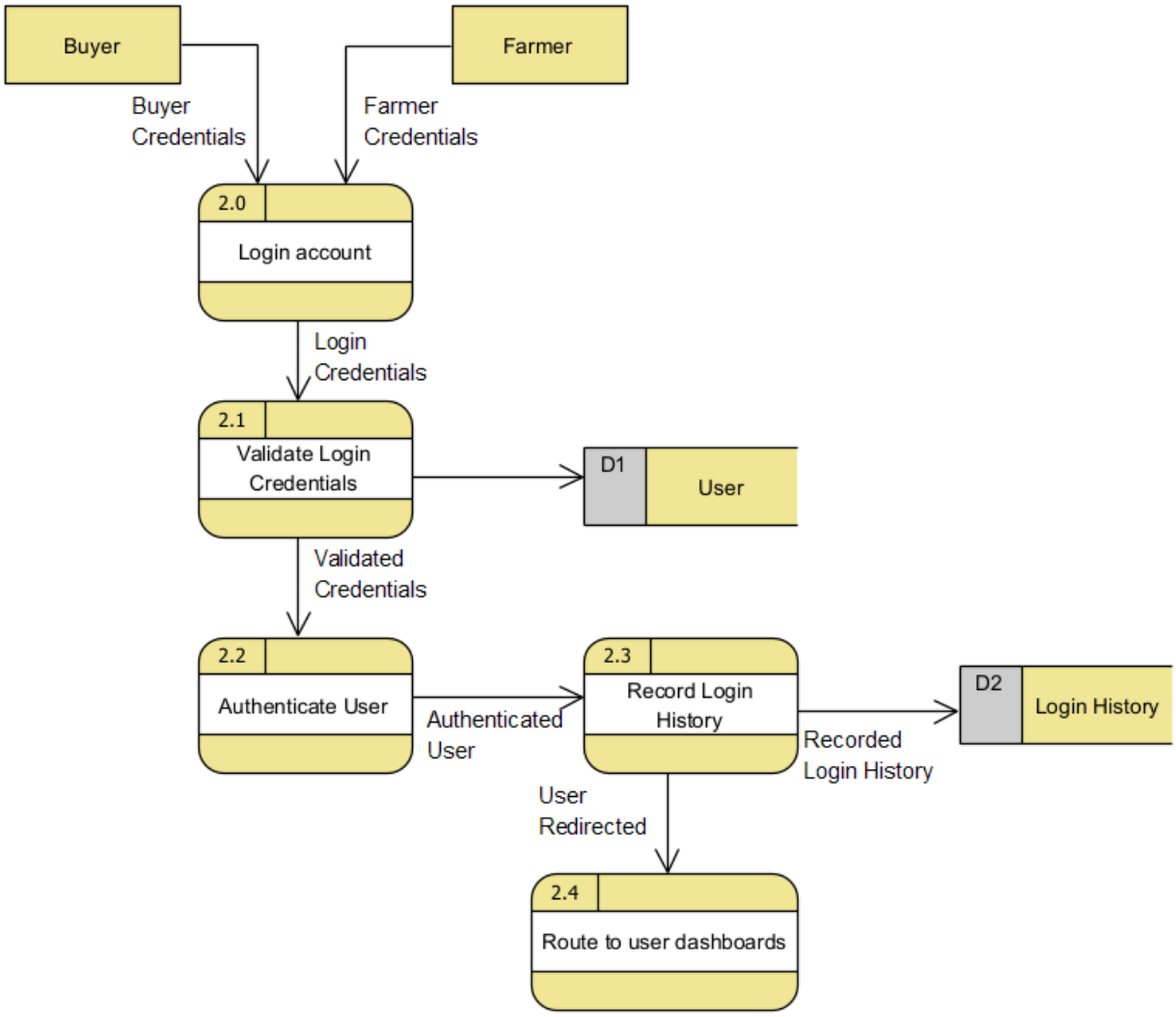


Figure 3.10 Register account Data Flow Diagram

Figure 3.10 Data Flow Diagram shows how the register account module within the system functioned. It included two actors: the Buyer and the Farmer. This module displayed the features: Register Account, Validate Registration Data, Verify Email, and Store User Details. Either the Buyer or the Farmer inputted their details into the Register Account, which then proceeded to Validate Registration Date to verify the data. Afterward, the system sends an email verification and if the verification is completed, the User data is stored, allowing the user to proceed to the Login page.



3.11 Login account data flow diagram

Figure 3.11 Data Flow Diagram illustrates how the login account module within the system operated. It involved two actors: the Buyer and the Farmer. This module included the features: Login Account, Validate Login Credentials, Authenticate User, Record Login History, and Route to User Dashboards. Either the Buyer or the Farmer inputted their login credentials into the Login Account, which then proceeded to Validate Login Credentials to validate the credentials. After the credentials were validated, the system authenticated the user and stored their login history. Finally, the system forwarded them access to the Buyer/Farmer Dashboard.

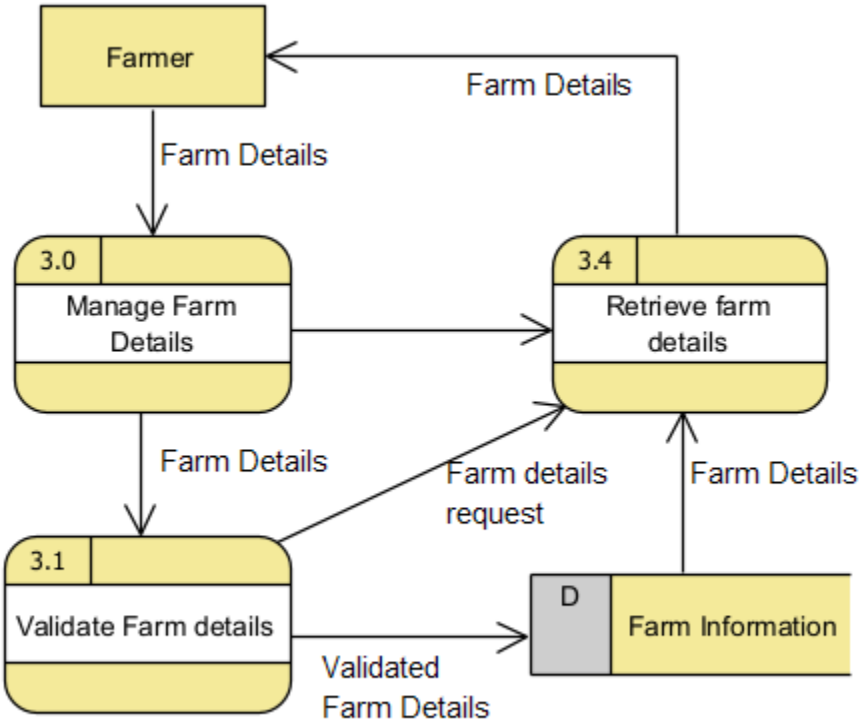


Figure 3.12 Manage Farm details DFD

Figure 3.12 shows the data flow diagram of how farm details were managed. It illustrated how the farm details were being validated and then stored in the database. Afterward, the system retrieved the updated farm details so the farmer could confirm that the information was successfully updated.

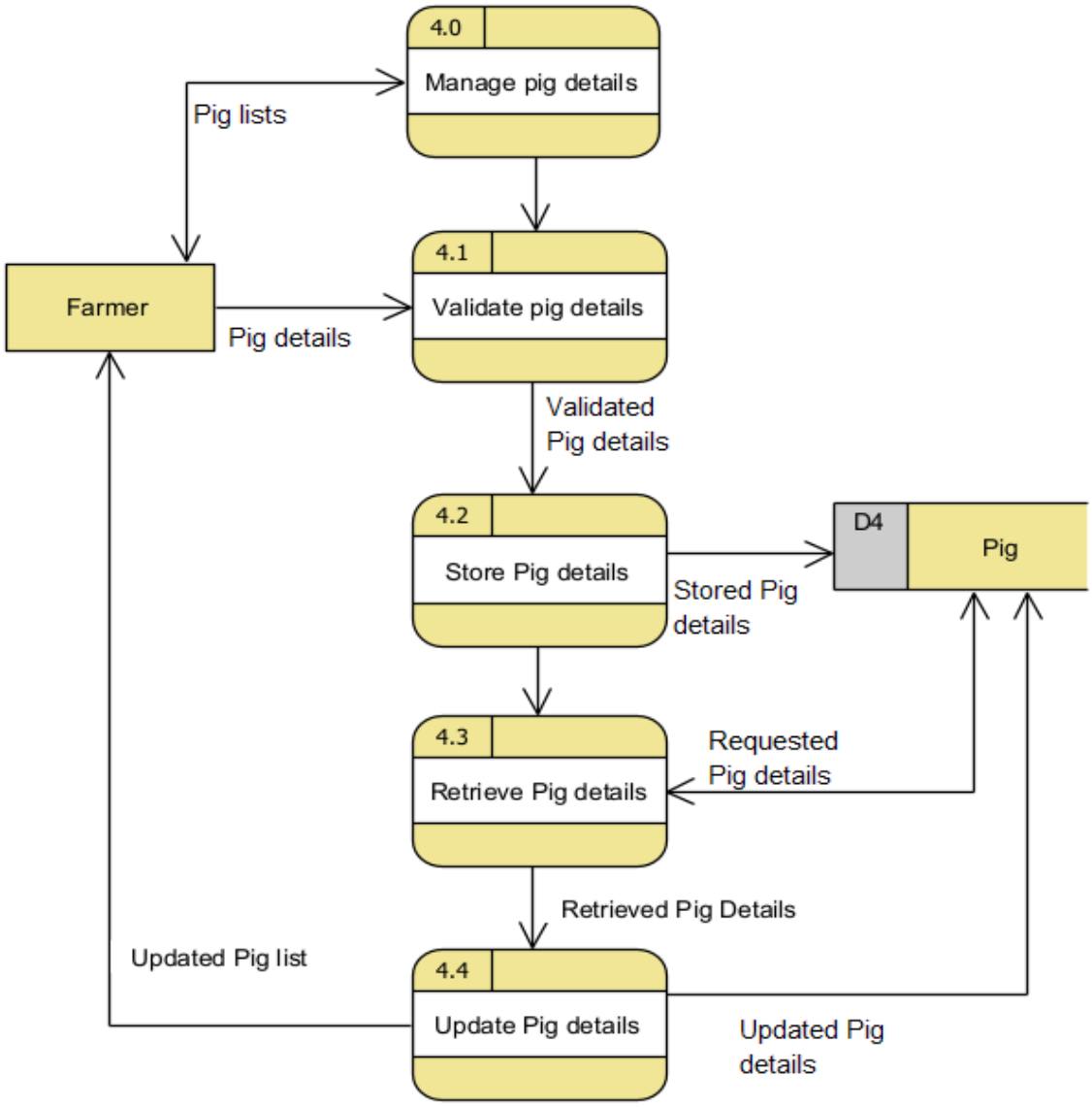


Figure 3.13 Manage Pig details DFD

Figure 3.13 shows the data flow diagram of pig details management. The farmer inputted the pig details and the system validated the inputs to ensure the required fields were provided. Once validated, the system stored the pig details in the database. After storing the information, it retrieved and updated the pig details to display the farmer's updated pig list.

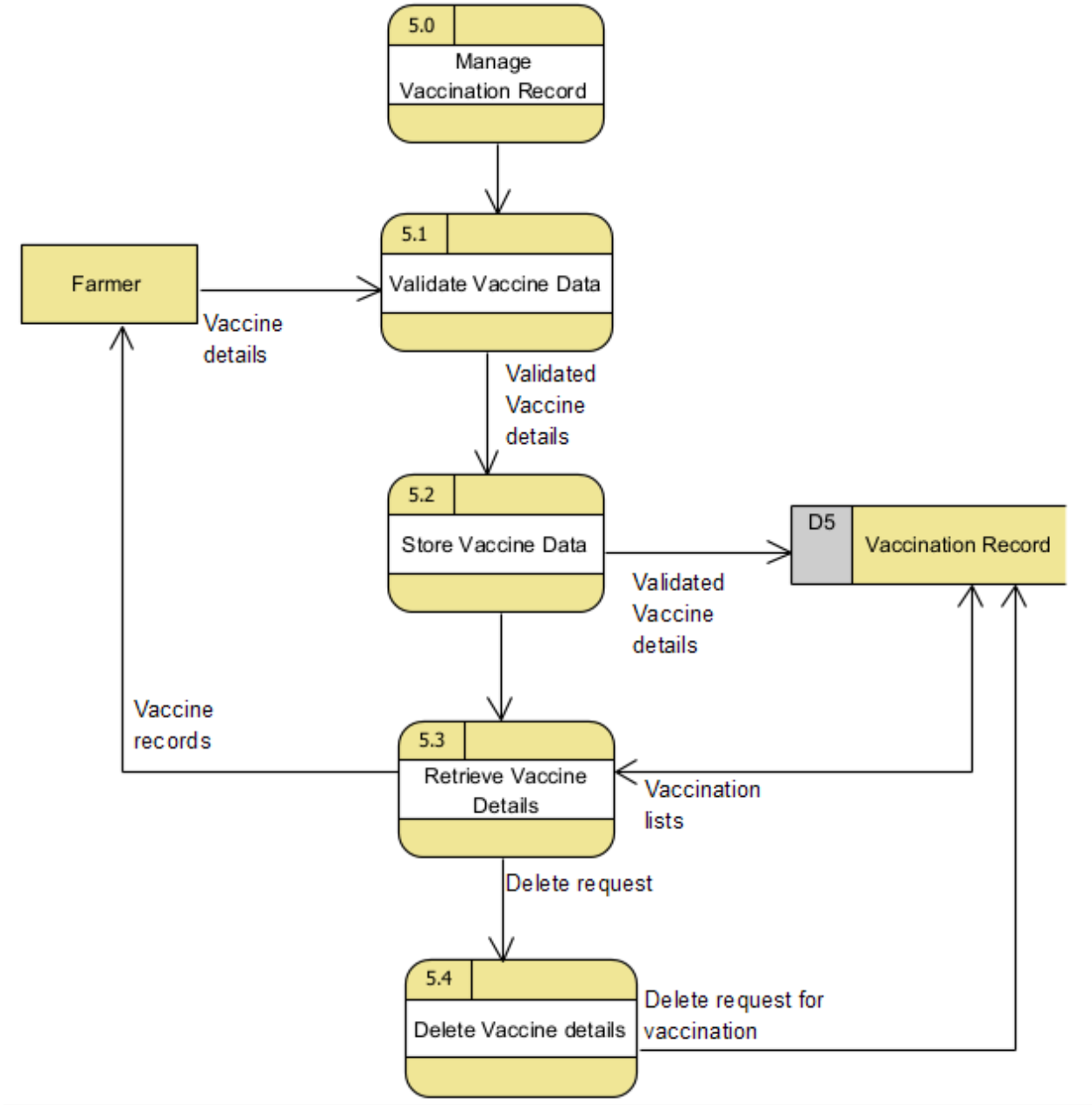


Figure 3.14 Manage Vaccination DFD

Figure 3.14 shows the data flow diagram of pig details management. The farmer inputted the pig details, and the system validated the inputs to ensure that all required fields were completed. Once validated, the system stored the pig details in the database. After storing the information, it retrieved and updated the pig details to display the farmer's updated list of pigs.

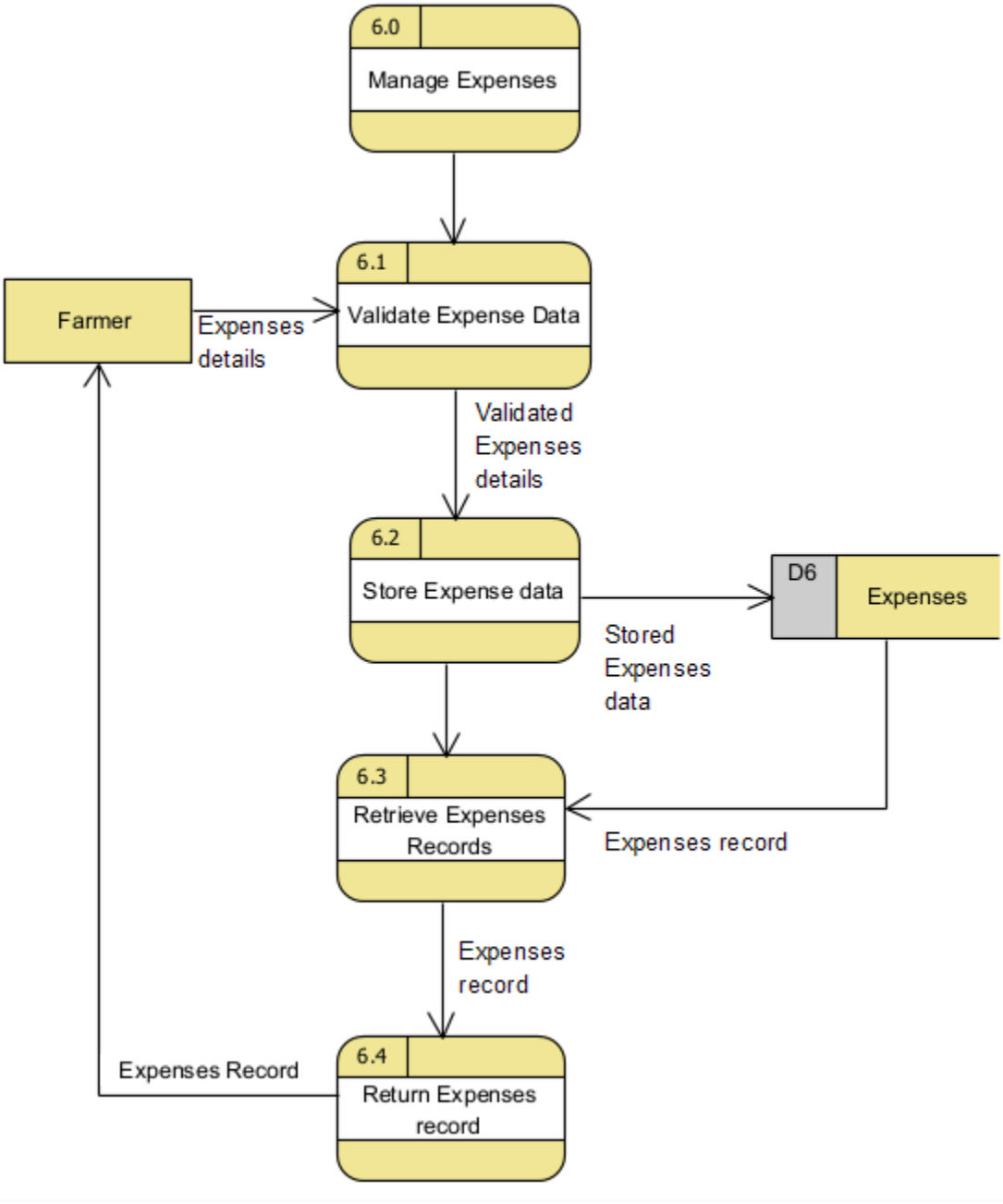


Figure 3.15 Manage expenses DFD

Figure 3.15 shows the data flow diagram of the managed expenses process. The system validated the expense entries to ensure that all required fields were completed, and then it stored the expense data in the expense database. Afterward, the system retrieved the expense records and returned them to the farmer for review.

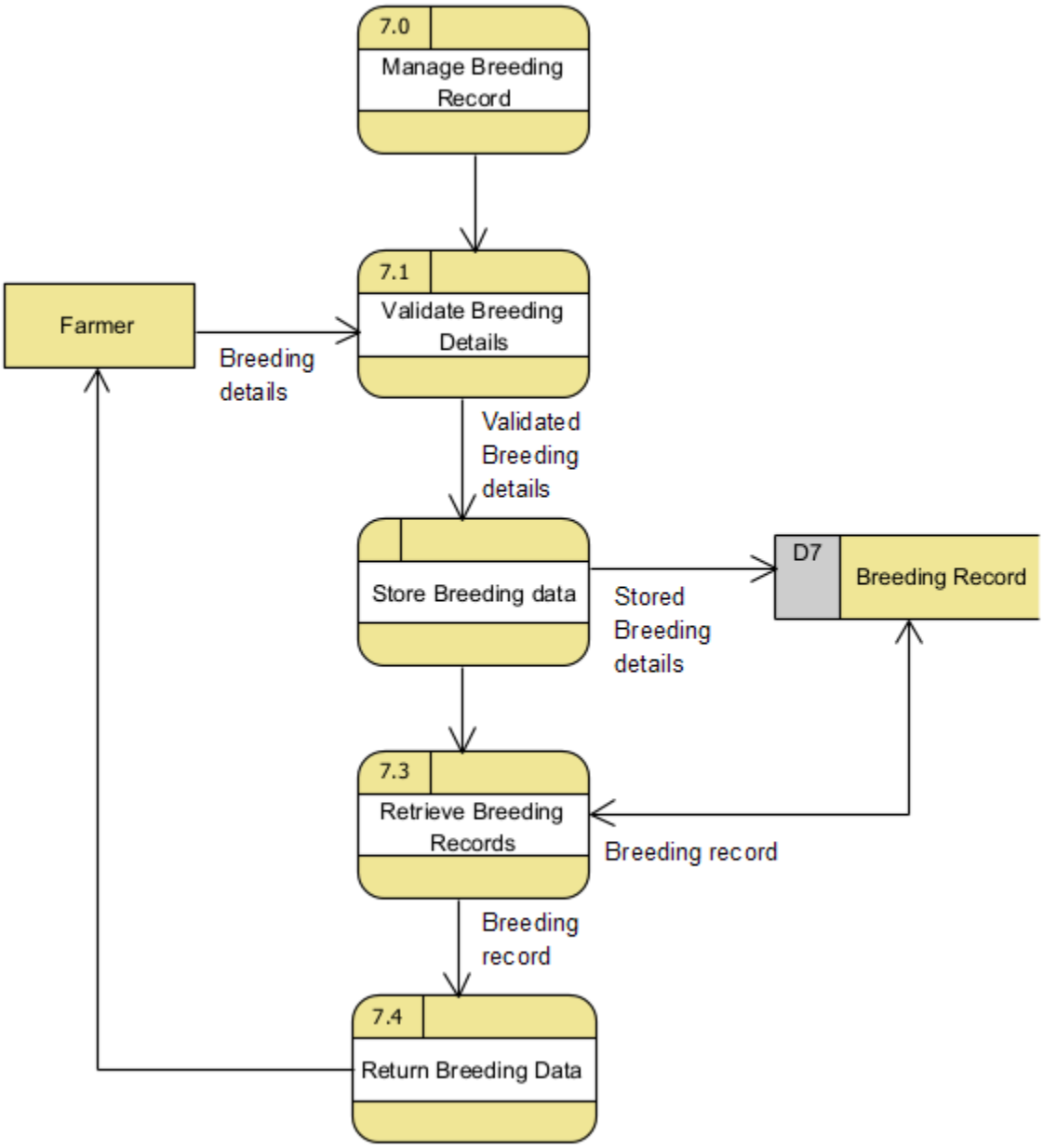


Figure 3.16 Manage Breeding Records DFD

Figure 3.16 shows the data flow of Manage Breeding Records. The farmer inputted the breeding details, which the system then validated and stored in the breeding records database. After storing the data, the system retrieved the record and returned the information to the farmer.

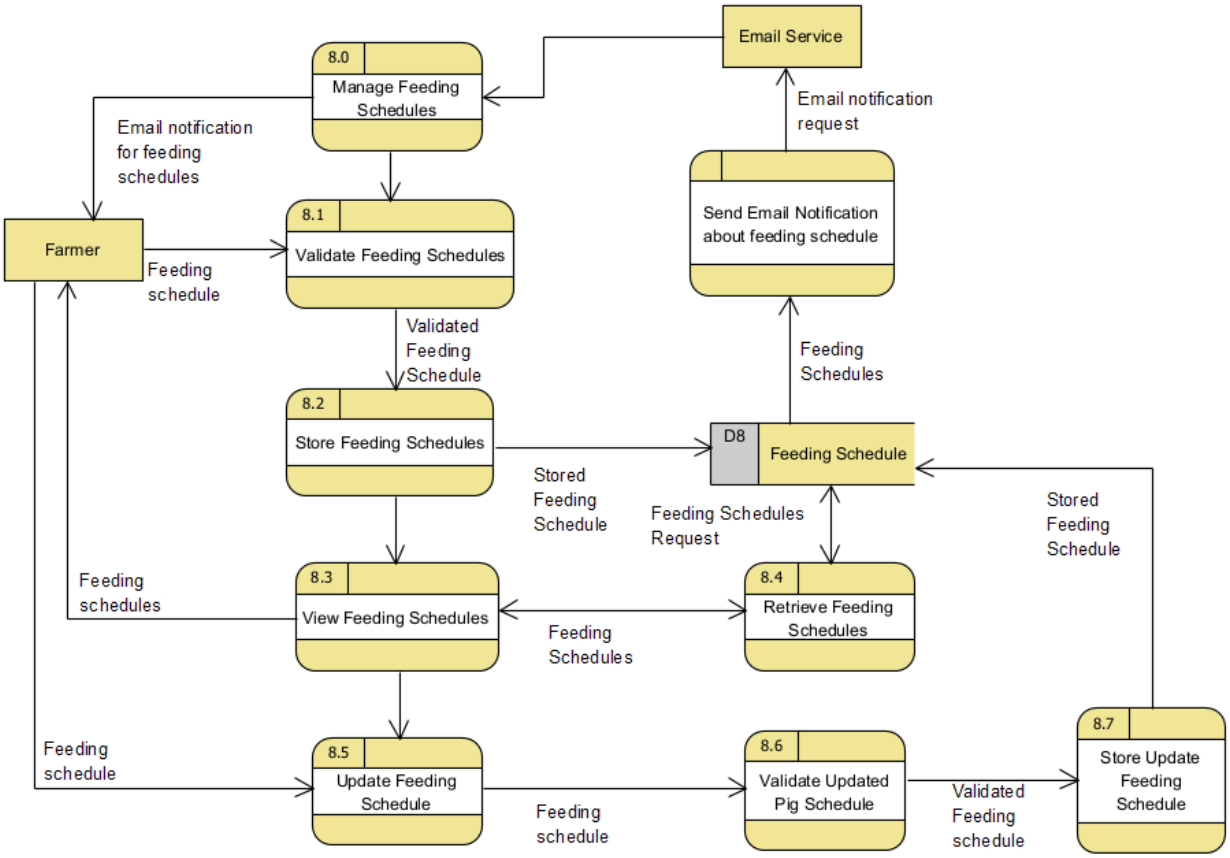


Figure 3.17 Manage Feeding Schedule Data Flow Diagram

Figure 3.17 shows the data flow of the Manage Feeding Schedule process. The farmer inputted the feeding schedule, and the system validated the input for correctness. Once validated, the system stored the feeding schedule. After that, it retrieved the updated schedule to confirm the changes made. Additionally, the system sent email notifications about the feeding schedule to the farmer.

Buyer's Module

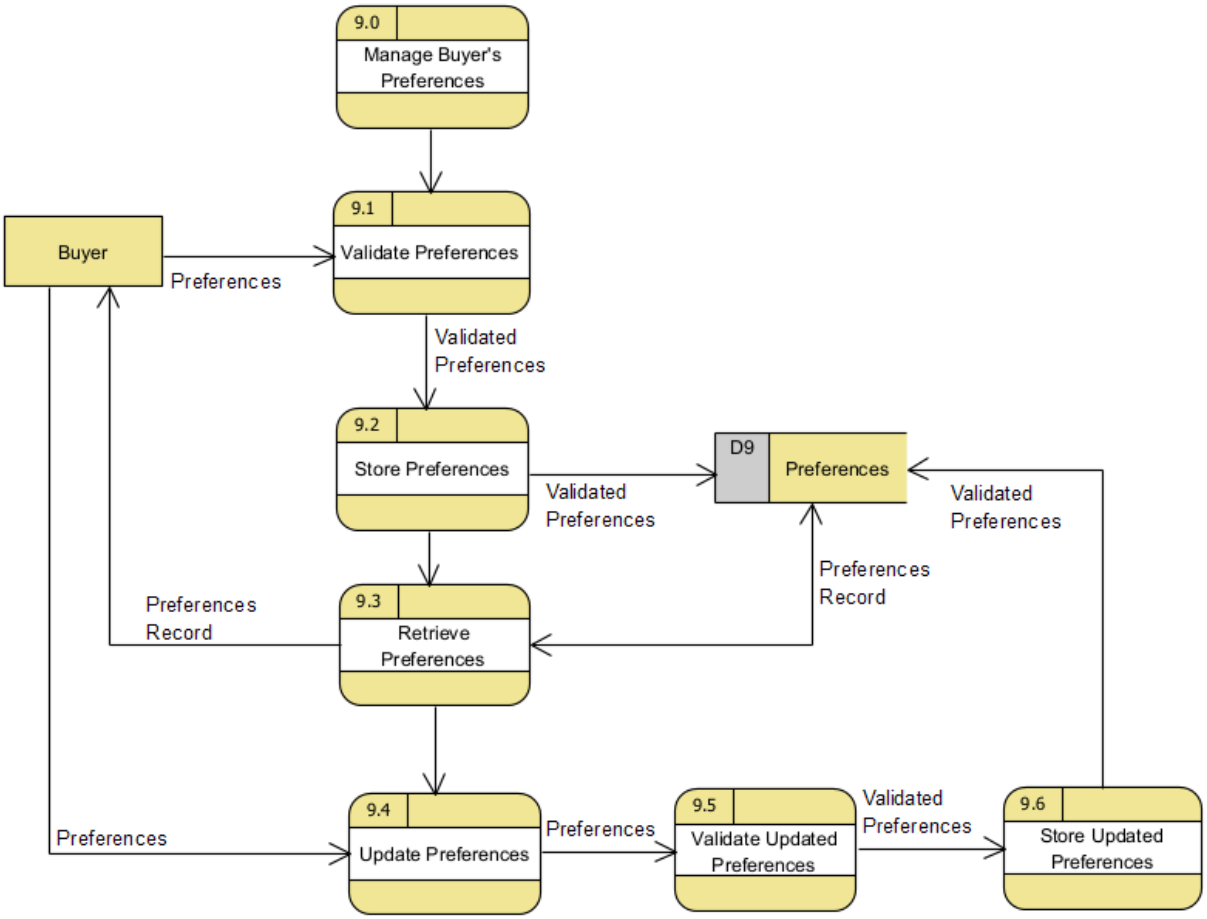


Figure 3.18 Buyer' Preferences Data Flow Diagram

Figure 3.18 shows the data flow of Manage Breeding Records. This section entailed the buyer entering their preferences, which the system then validated and stored. The preferences were then updated and retrieved, and the system returned the updated and stored preference data to the buyer.

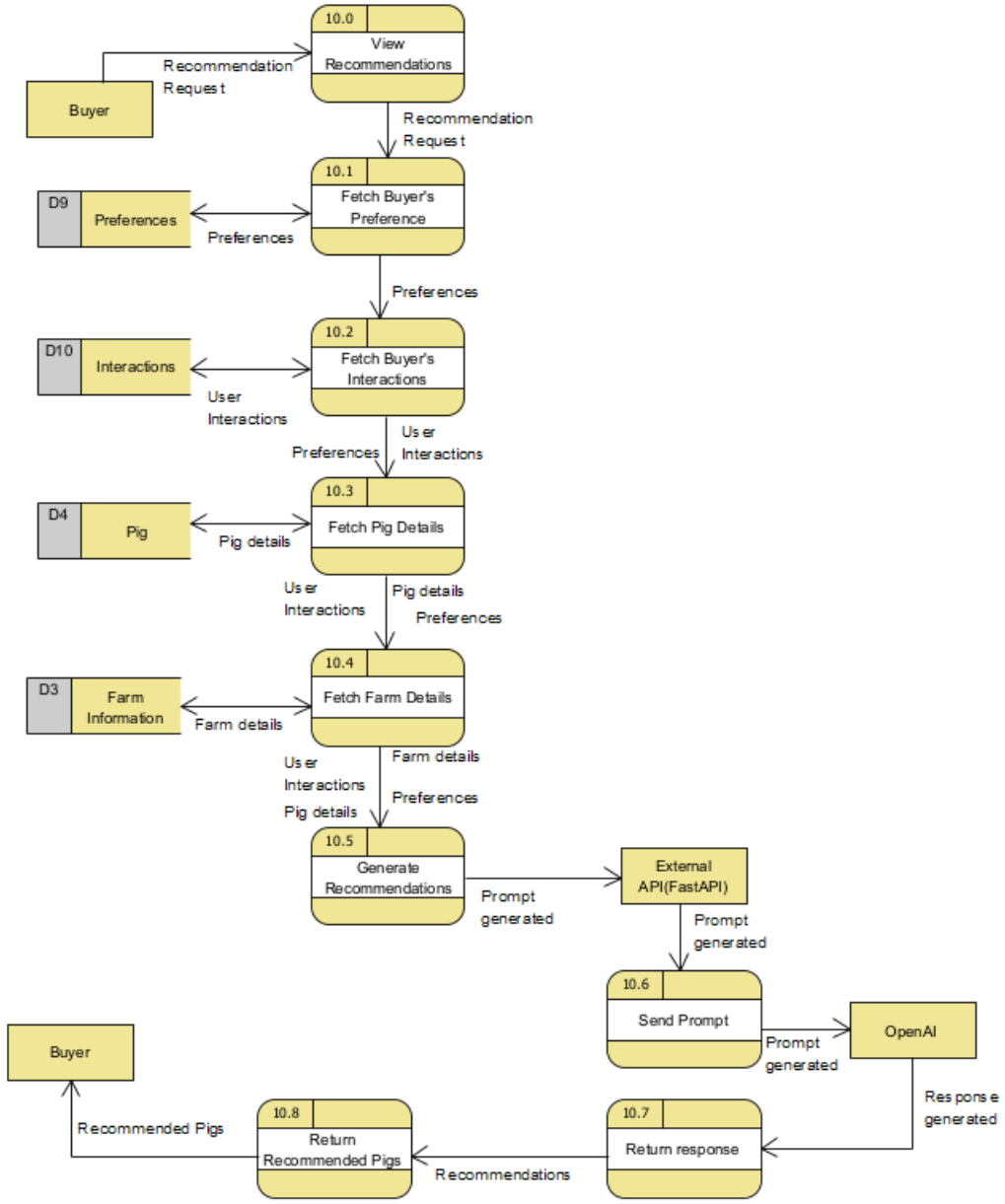


Figure 3.19 View Recommendations Data Flow Diagram

Figure 3.19 shows the View Recommendation data flow diagram, where the system fetched pig details, user interactions, and farm information. The system then generated recommendations and sent them to the FastAPI service, where the prompt was forwarded to the OpenAI API. The system received the response and returned the recommended pigs to the buyer.

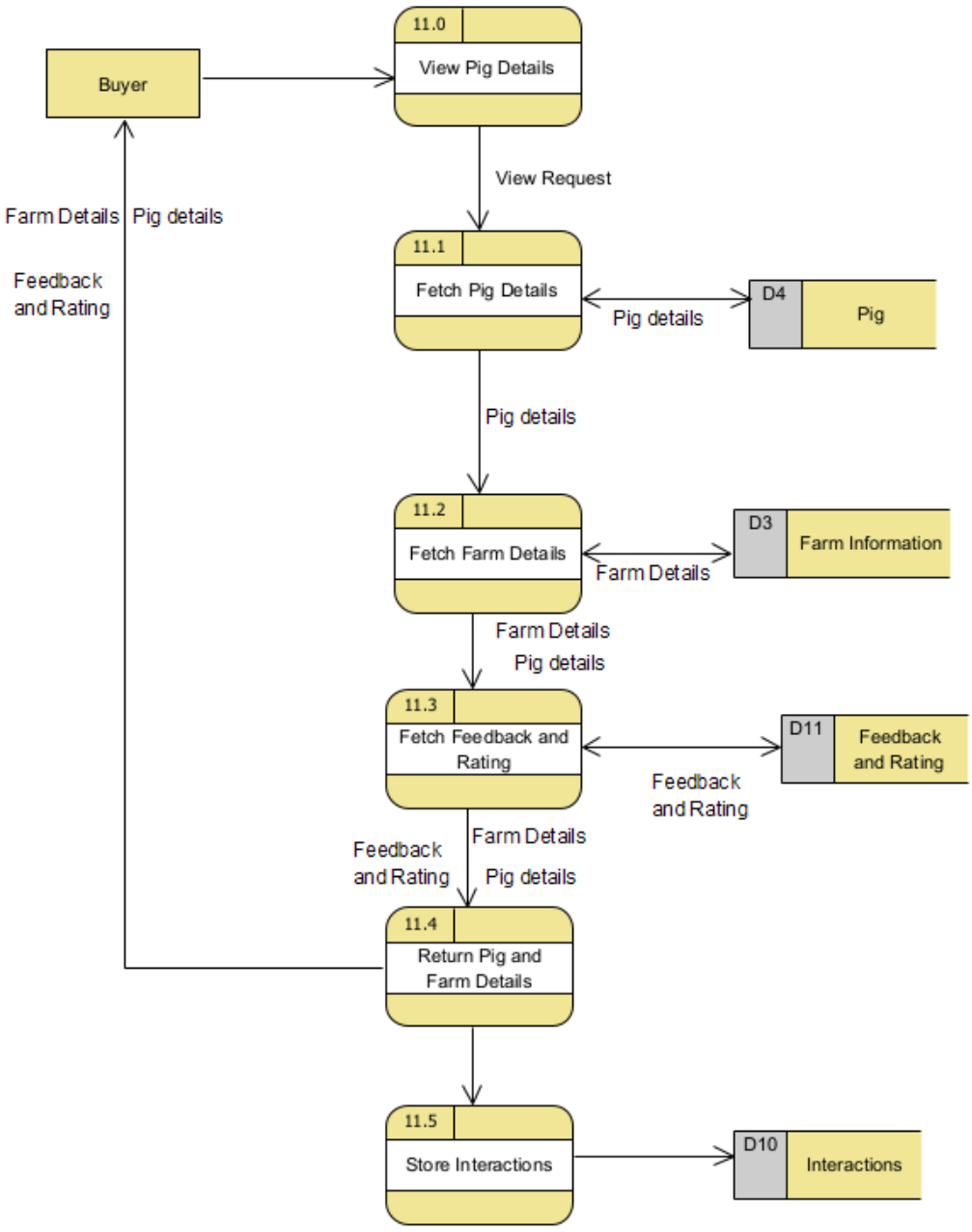


Figure 3.20 View Pig Details Data Flow Diagram

Figure 3.20 shows the View Pig Details data flow diagram, where the buyer requested to view the details of the recommended pigs. The system then fetched the pig and farm details, as well as the associated feedback and ratings, and returned the complete information to the buyer.

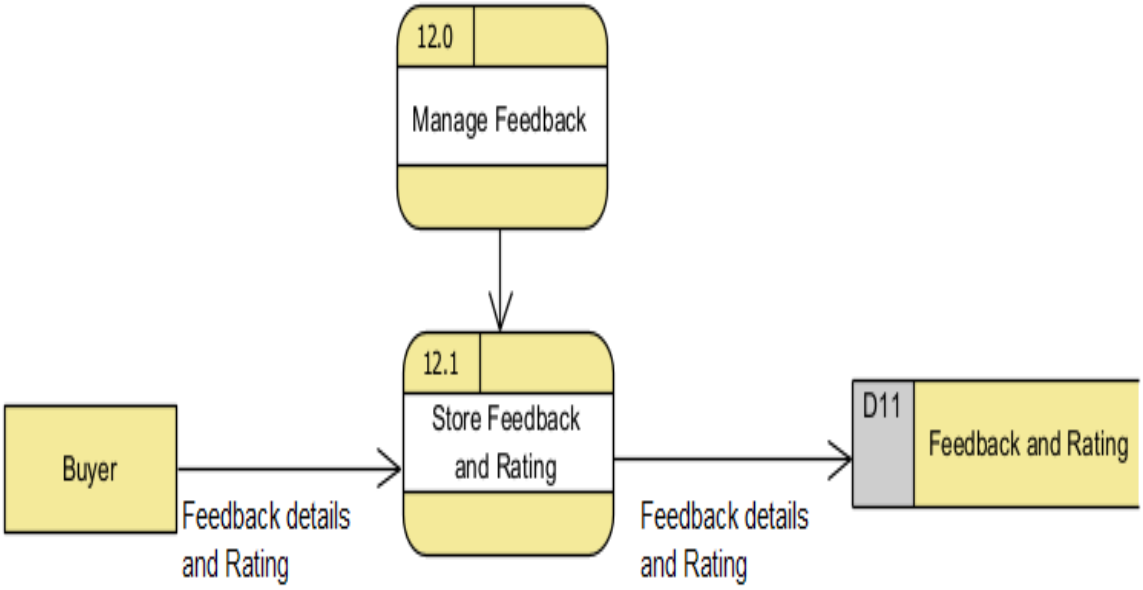


Figure 3.21 Manage Feedback Data Flow Diagram

Figure 3.21 shows the Managed Feedback data flow diagram, wherein the system stored the feedback and rating that the buyer provided to the farm.

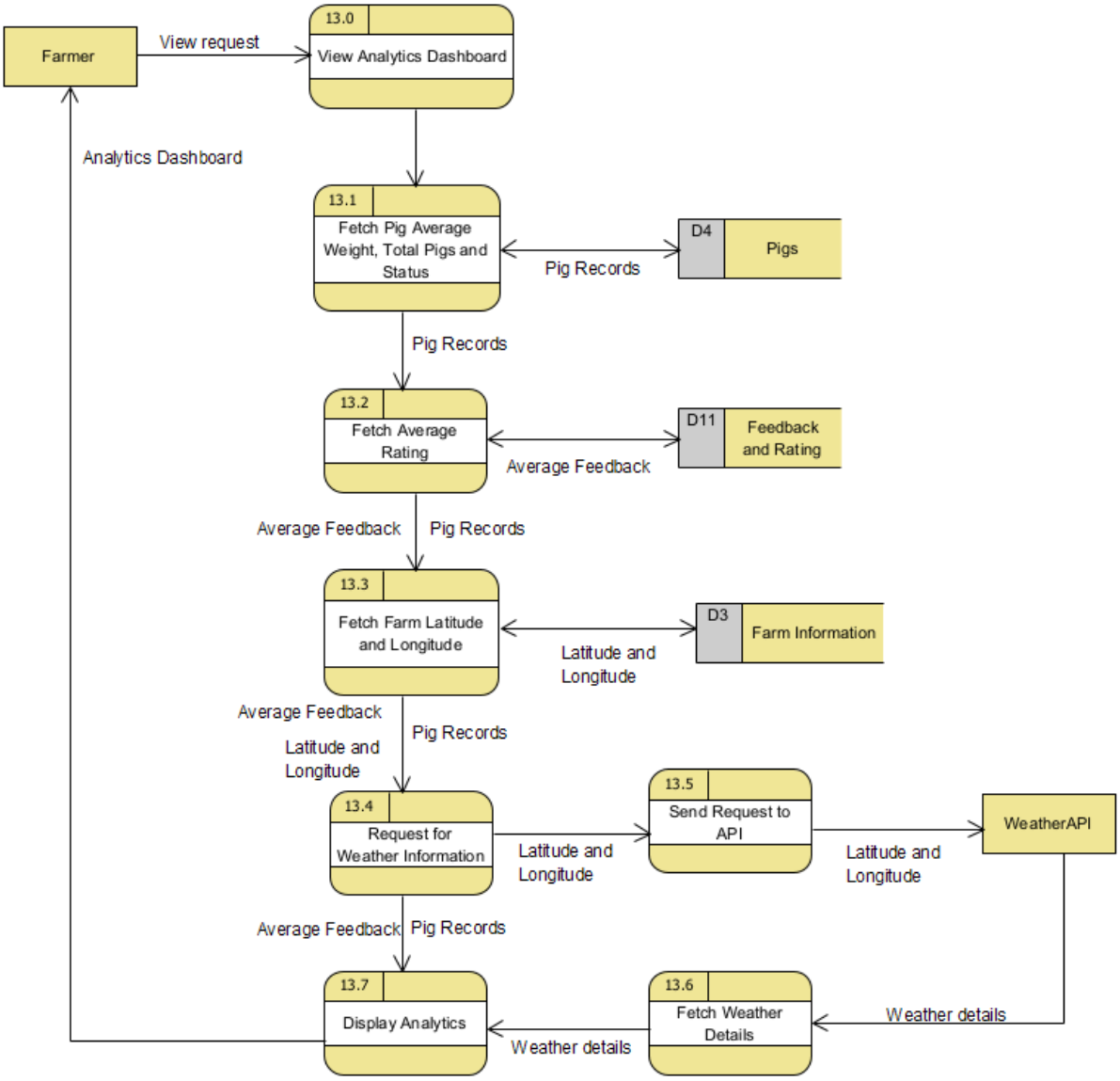


Figure 3.22 Farmer Dashboard Analytics Data Flow Diagram

Figure 3.22 shows the Farmer Dashboard Analytics data flow diagram, where the system fetched the average weight, total number of pigs, and health status from the pig database. It also retrieved the farmer's average rating from the feedback and rating database and obtained the farm's latitude and longitude from the farmer information database. This location data was sent to the WeatherAPI to retrieve weather details. The system then displayed the analytics based on the farmer's information.

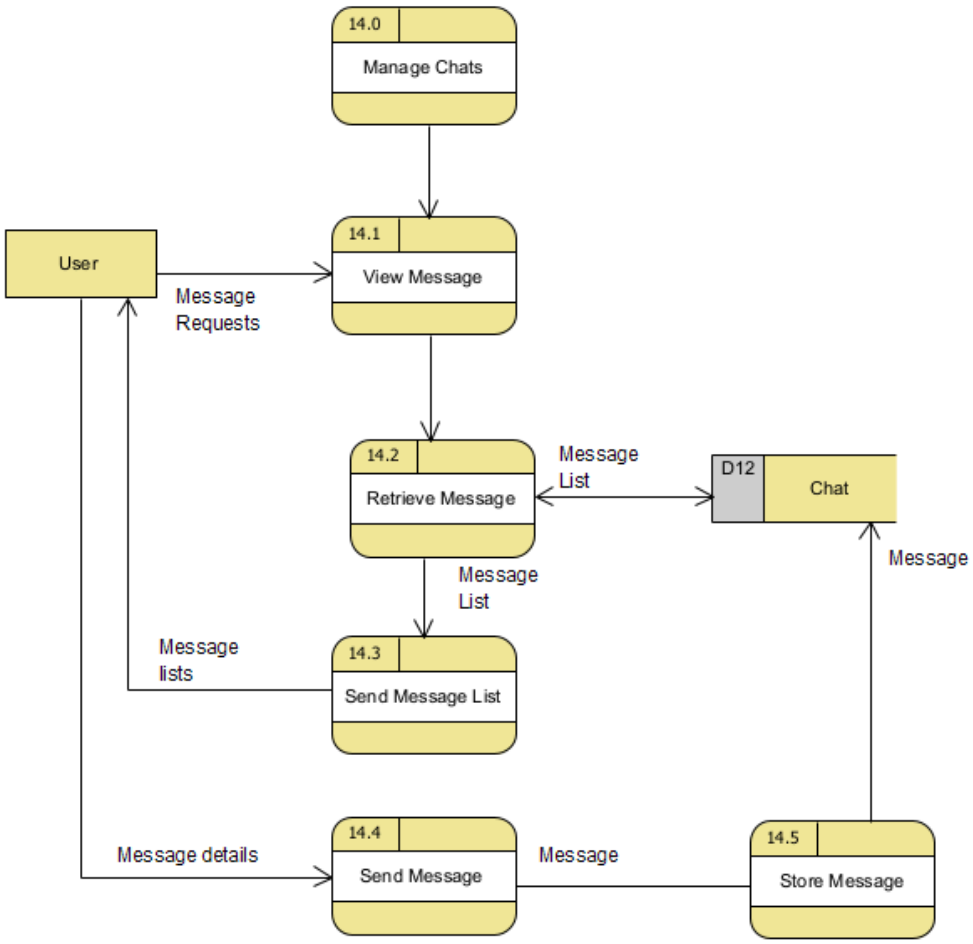


Figure 3.23 Manage Chat Data Flow Diagram

Figure 3.23 shows the Managed Chat data flow diagram, where users, both buyers and farmers, fetched their message lists. The system then retrieved the messages from the database and returned the message list to the user. When a user sends a message, the system stores it in the chat database.

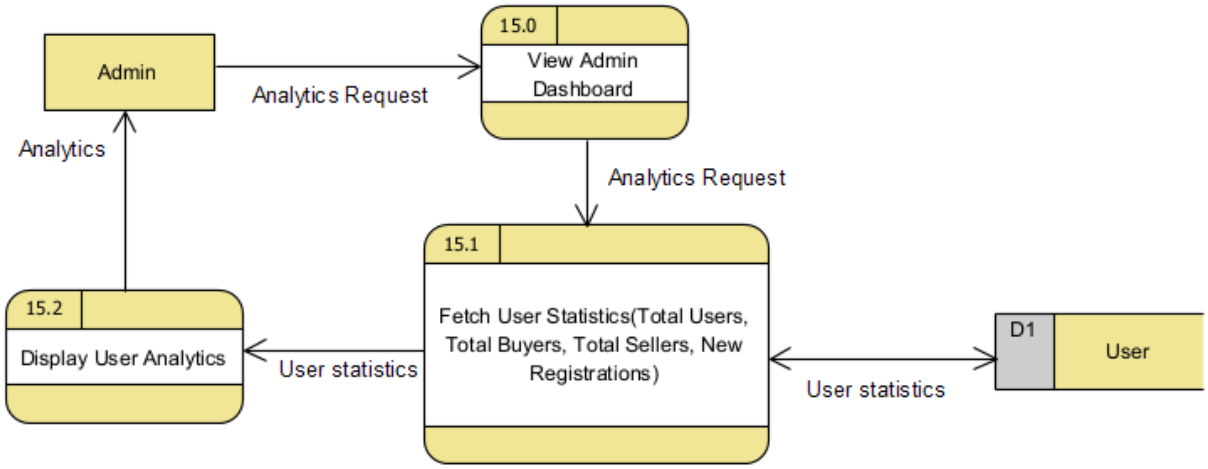


Figure 3.24 Admin Dashboard Data Flow Diagram

Figure 3.24 shows the Admin Dashboard data flow diagram, wherein the admin requested analytics related to users, such as total users, total buyers, total sellers, and new registrations. The system then retrieved the requested data and displayed the analytics to the admin.

XI. Entity Relationship Diagram

Figure 3.25 Entity Relationship Diagram

Figure 3.25 shows the Entity Relationship Diagram (ERD) that was followed to develop the system. The ERD outlined the structure of the database by illustrating the relationships between various entities within the system. This diagram served as a blueprint for how data was stored, organized, and accessed, ensuring that all necessary information was efficiently managed and interrelated to support the functionality of PigConnect.

XII. Swimlane Flowcharts / Process Charts

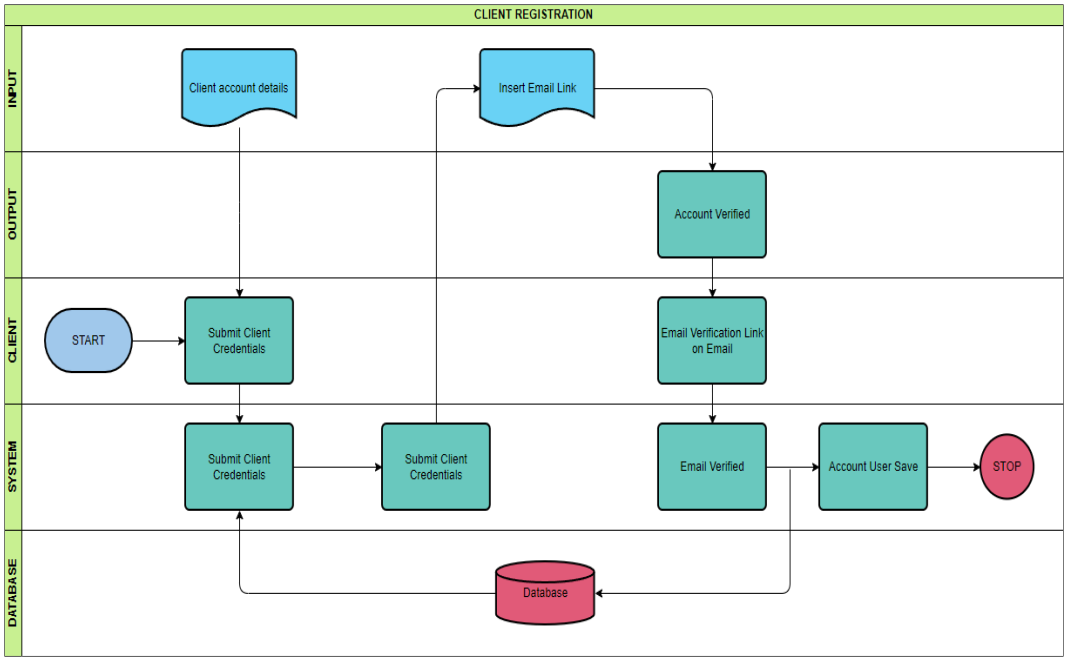


Figure 3.26 Account Registration

The Client Registration diagram details how client account details was processed, verified via email, and stored in the database.

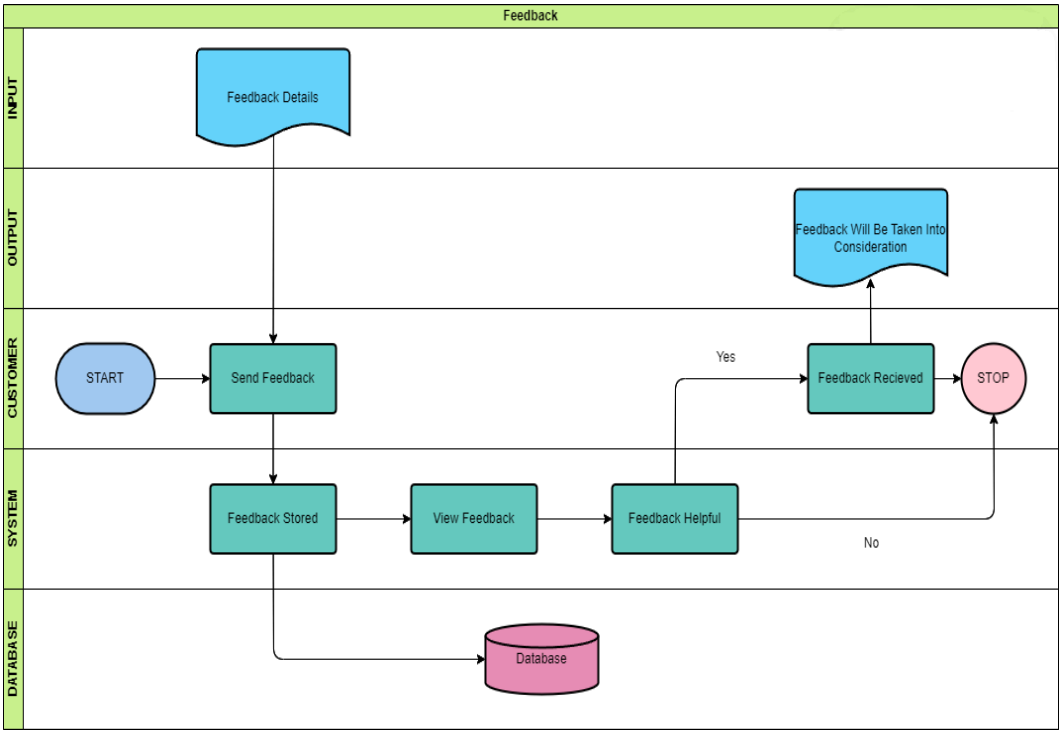


Figure 3.27 Customer Feedback

The process of handling customer feedback began with the customer sending feedback, which the system stored and displayed for review. If deemed helpful, it was acknowledged and taken into consideration, and all feedback details were stored in the database for record-keeping and analysis.

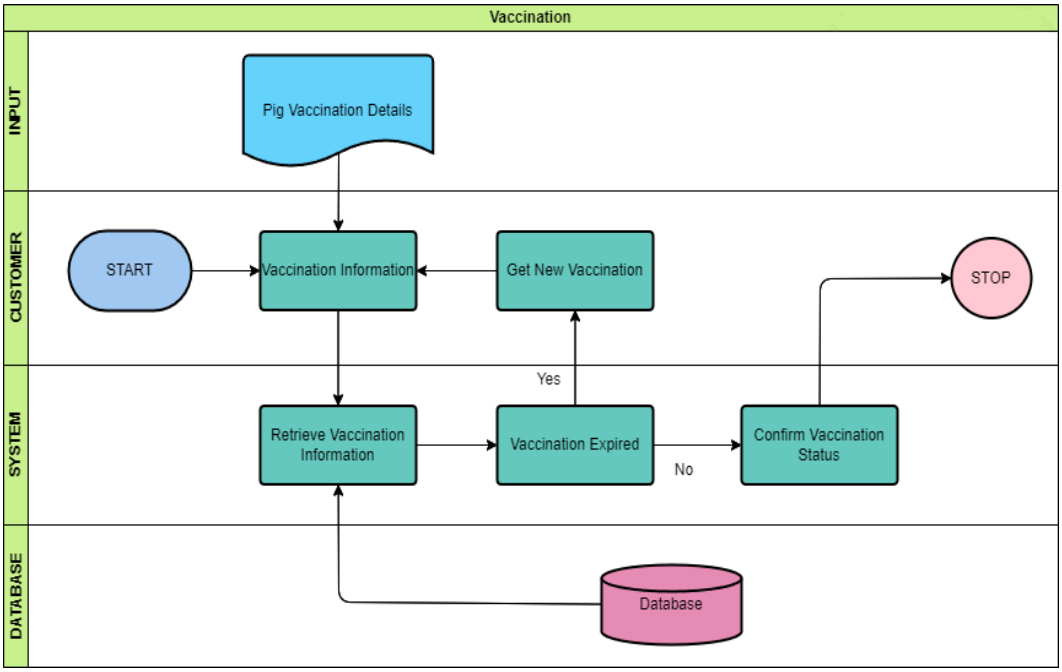


Figure 3.28 Pig Vaccination

The diagram illustrated the process where customers inputted pig vaccination details. The system retrieved and confirmed the vaccination status from the database, and if it expired, it prompted for a new vaccination. The database stored and updated all vaccination information, ensuring efficient and timely management.

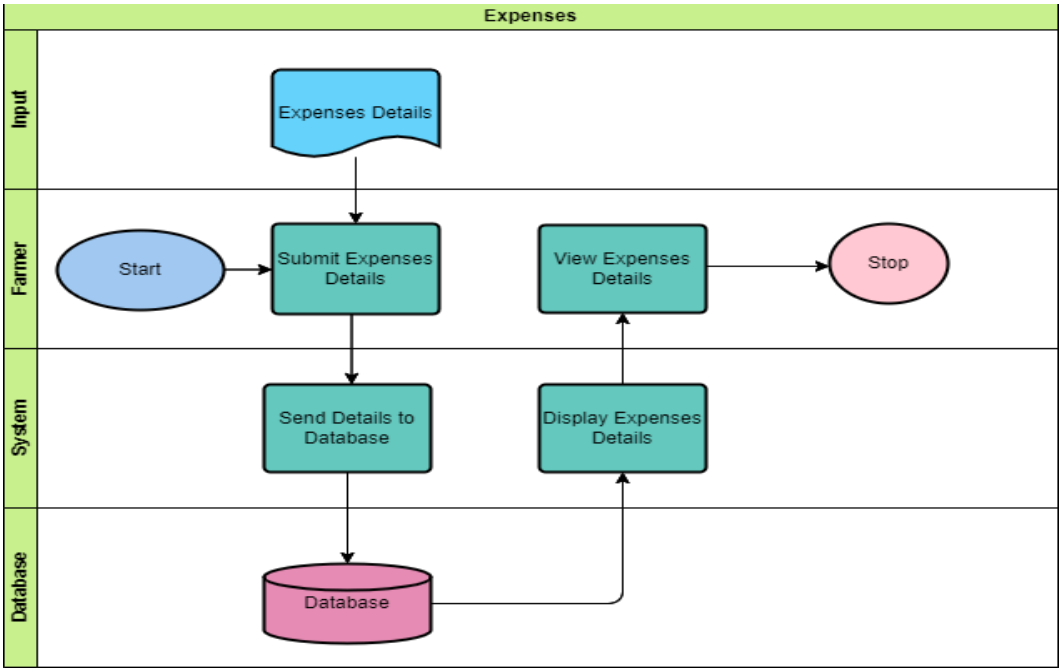


Figure 3.29 Expenses Report

The diagram showed the process where the admin wrote an expense report, which the system then received. If the report was accepted, it proceeded to the final step; if not, it was returned to the admin for revisions. This ensured proper handling and approval of expense reports.

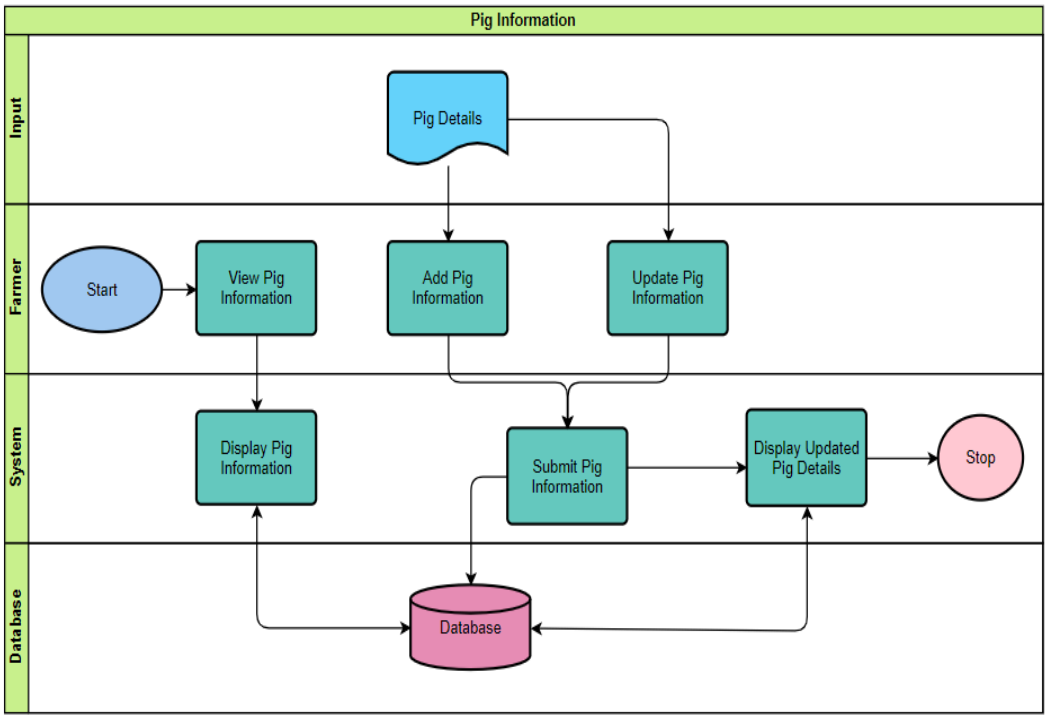


Figure 3.30 Upload Pig Details

Figure 3.30 illustrates the reusability process within the PigConnect system. It depicted how historical data, such as past transactions, pig health records, and farm analytics, were stored securely and could be retrieved for future use. This process ensured that data was not only preserved but also repurposed to generate insights, support recommendations, and assist in farm management decisions. By incorporating reusability, the system enhanced efficiency, reduced redundant input, and supported data-driven decision-making.

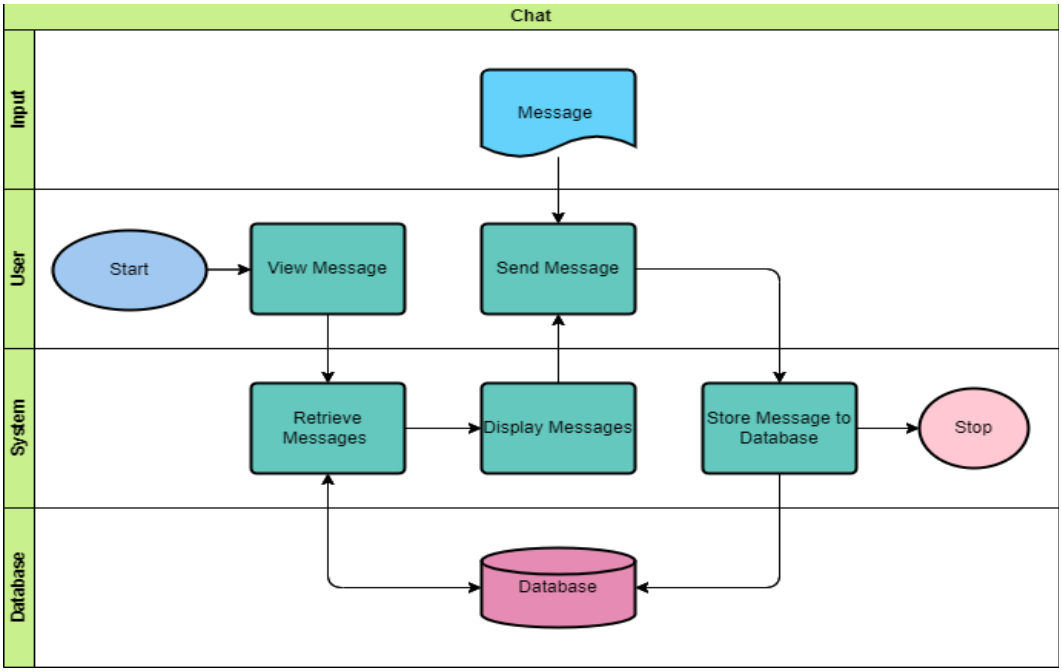


Figure 3.31 Chat Module

Figure 3.31 shows the chat process where users, either farmers or buyers, view their chats. The system then retrieves the messages from the database then displays them. Users were able to send messages to their counterparts and the system stored those messages in the database.

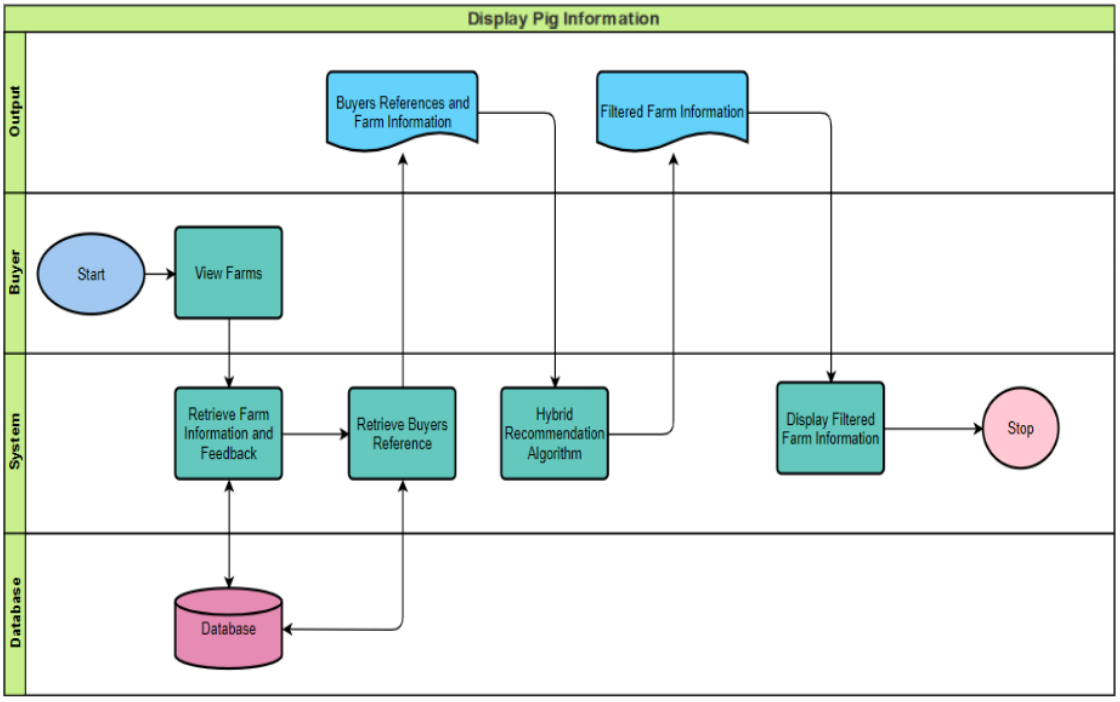


Figure 3.32 Display Pig Information

Figure 3.32 shows the Display Pig Information process, where buyers viewed pigs and the system retrieved pig information and feedback from the database, along with the buyer's preferences. The system then outputted both the pig information and the buyer's preferences, and computed a similarity score between the buyer's preferences and each farm's information. It then sorted the results in descending order. After the farm information was successfully filtered, it was displayed by the system.

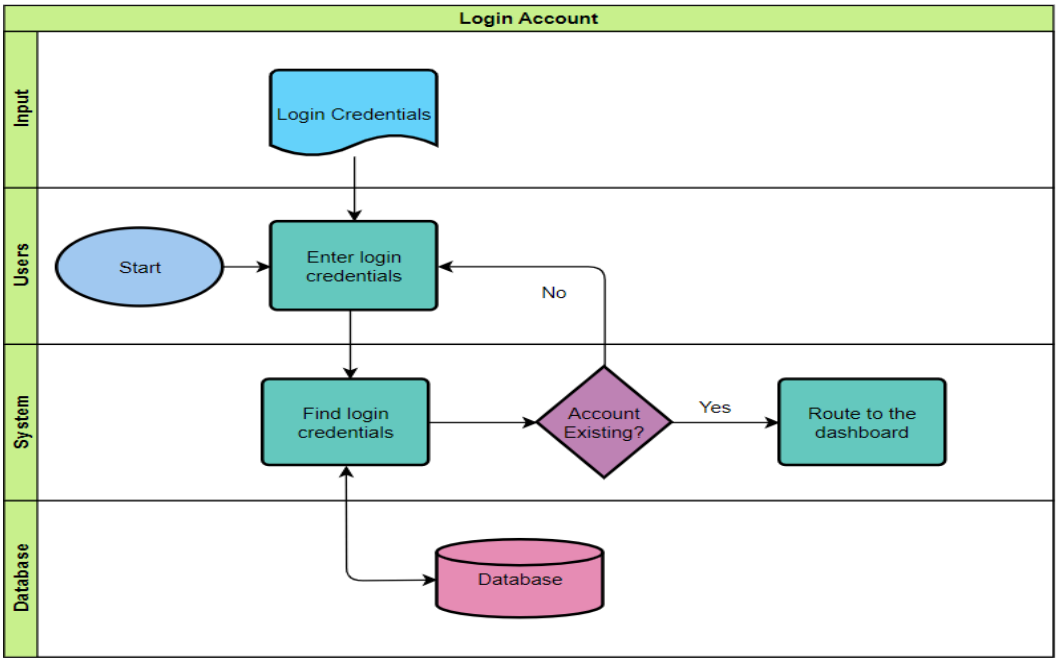


Figure 3.33 Login Account

Figure 3.33 shows the login account process, where users enter their login credentials. The system then searched for the user's credentials in the database. If the credentials did not exist, the system prompted the users to re-enter their login details; otherwise, they were routed to their respective dashboards.

XIII. Project Development

Programming Framework Used

The capstone project used Laravel for back-end development to implement the MVC architecture, Eloquent ORM, built-in authentication, server-side validation, and API development. Vue.js was used for front-end development to provide interactivity, ensure the responsiveness of the web application, and enable client-side validation. Python was utilized to develop the AI recommendation system, as it offered libraries that streamlined the development process. For data visualization, Chart.js was employed due to its ease of interactivity and seamless integration with the front end.

Table 3.5 Programming Framework Used

Component	Technology/Framework	Features/Benefits
Backend	Laravel (PHP)	MVC architecture, Eloquent ORM, built-in authentication
Frontend	Vue.js	Reactive data binding, component-based architecture
Database	MySQL	Reliability, scalability, extensive community support
API Development	Laravel	API resource classes, built-in authentication
AI Recommendation System	Python (with FastAPI)	Extensive ML libraries, lightweight API framework
Data Visualization	Chart.js or D3.js	Interactive charts, easy integration with Vue.js
Client-Side Validation	Vue.js	Immediate feedback, improved user experience
Server-Side Validation	Laravel	Ensures data integrity and security

XIV. Product Backlog

Table 3.6 Product Backlog

Backlog Item	Estimate
Authentication Module	20
As a farmer or buyer, I'd want to register my account.	4
As a farmer or buyer, I'd want to log in to my account.	4
As a farmer or buyer, I'd want to make changes to my account settings.	5
As a farmer or buyer, I'd want to enable two-factor authentication for my account.	5
As a farmer or buyer, I'd want to log out of my account.	2
Geolocation Module	11
As a buyer, I can view the location of farms on a map.	6
As a buyer, I can search for farms based on location.	5
Farm Management System Module	33
As a farmer, I can input and manage my farm data.	15
As a farmer, I can schedule tasks and receive reminders.	10
As a farmer, I can track feed and medication inventory.	8
Analytics Module	22
As a farmer, I can view data analytics on my farm's performance.	12

Backlog Item	Estimate
As a buyer, I can view reports on farming practices and trends.	10
Artificial Intelligence Module	38
As a buyer, I can receive AI-powered product recommendations based on my preferences.	20
As a farmer, I can use predictive analytics for disease management and resource needs.	18
Messaging System Module	14
As a buyer, I can send messages to farmers.	8
As a farmer, I can receive notifications for important updates.	6

XV. Sprint Backlog

Table 3.7 Sprint Backlog

Module	Task(s)	Assigned To	Status	Estimated Hours
Authentication	As a user, I want to register my account	Logdat, Randel B.	Completed	4
	As a user, I want to log in to my account		Completed	3
	As a user, I want to log out of my account		Completed	4
	As a user, I want to receive email authentication for my account		Completed	5
Farm Management	As a farmer, I want to add and manage farm information	Returan, Ronn Virgil V.	Completed	8
	As a farmer, I want to track livestock health records		Completed	10
	As a farmer, I want to view farm performance analytics		Completed	7
Geolocation	As a user, I want to view the location of farms on a map	Gratela, Charles G.	Completed	6
	As a farmer, I want to update my farm's location		Completed	4

Module	Task(s)	Assigned To	Status	Estimated Hours
Analytics	As a user, I want to see trends and data analytics related to pig farming	Ibasco, Angelo Joaquin S.	Completed	10
	As a farmer, I want to analyze my farm's performance data		Completed	8
Artificial Intelligence	As a buyer, I want recommendations based on historical purchasing data	Gratela, Charles G.	Completed	10
	As a farmer, I want insights into buyer preferences and trends		Completed	9
Messaging System	As a farmer, I want to communicate with buyers	Logdat, Randel B.	Completed	5
	As a buyer, I want to message farmers for inquiries		Completed	5

Algorithms

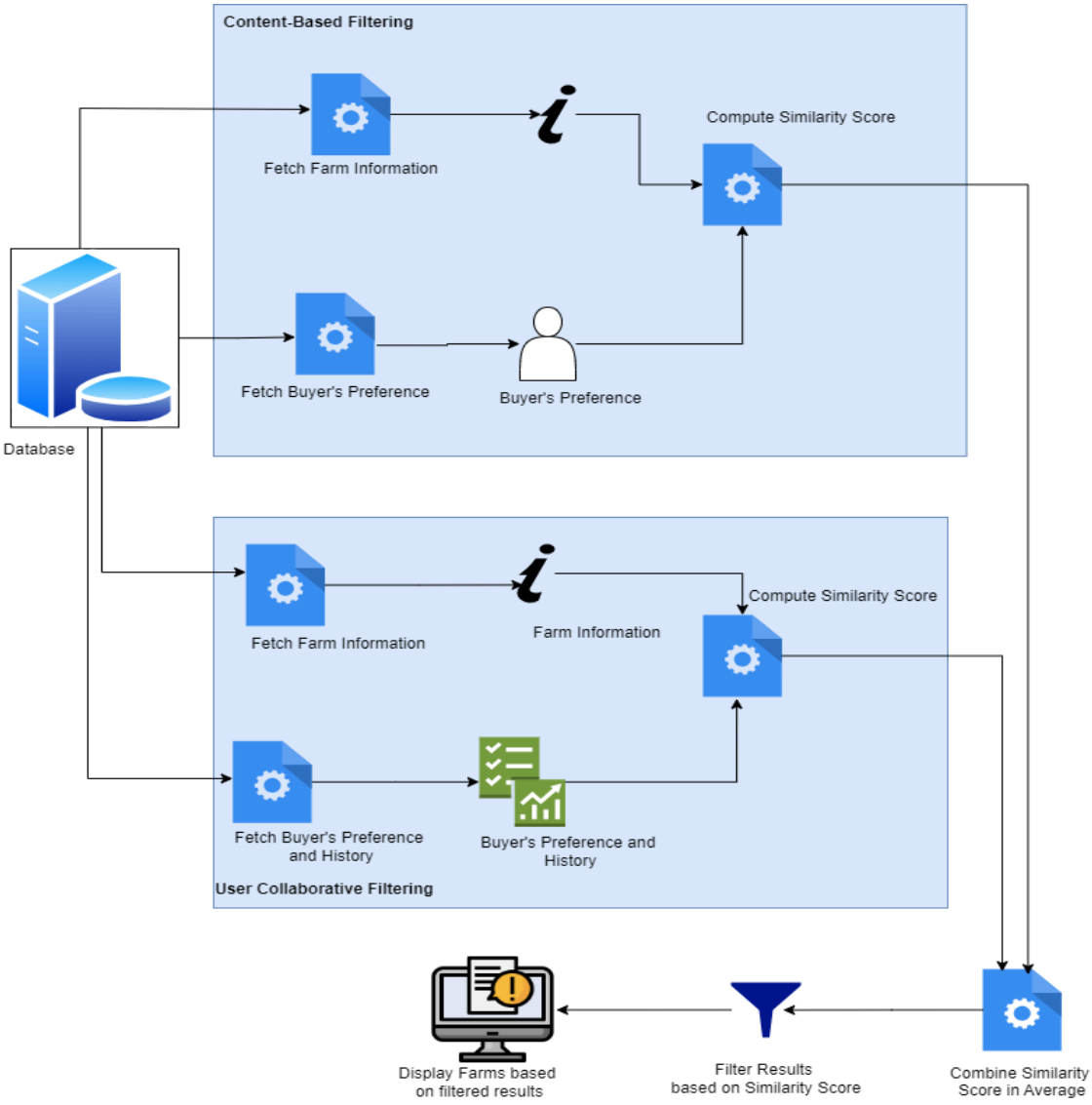


Figure 3.34 Hybrid Recommendation

This capstone project implemented a hybrid recommendation system to the buyer's module which combined collaborative filtering and content-based filtering to provide recommendations to buyers based on their preferences and history of searches and visits. The algorithm will be as follows:

1. Data Collection and Preprocessing

1.1 Data Collection:

- **User Preferences Data:** Collect detailed data on each buyer's preferences, such as preferred farm location, farm size, facilities, cleanliness, and price ranges.
- **Interaction Data:** Track interactions like visits, views, and inquiries by each buyer on pig farms.

1.2 Data Preprocessing:

- **Feature Extraction:** Extract features from the data that described the pig farms, such as location (geographical coordinates), farm size, facilities (e.g., barns, feeding systems), cleanliness ratings, and pricing.

2. Profile Construction

2.1 Build User Profile:

- **Profile Construction:** Build a profile for each buyer based on their interaction history and stated preferences regarding pig farms.

2.2 Build Pig Farm Profiles:

- **Profile Construction:** Construct profiles for each pig farm based on its features and historical interactions (e.g., number of visits, inquiries).

3. Collaborative Filtering

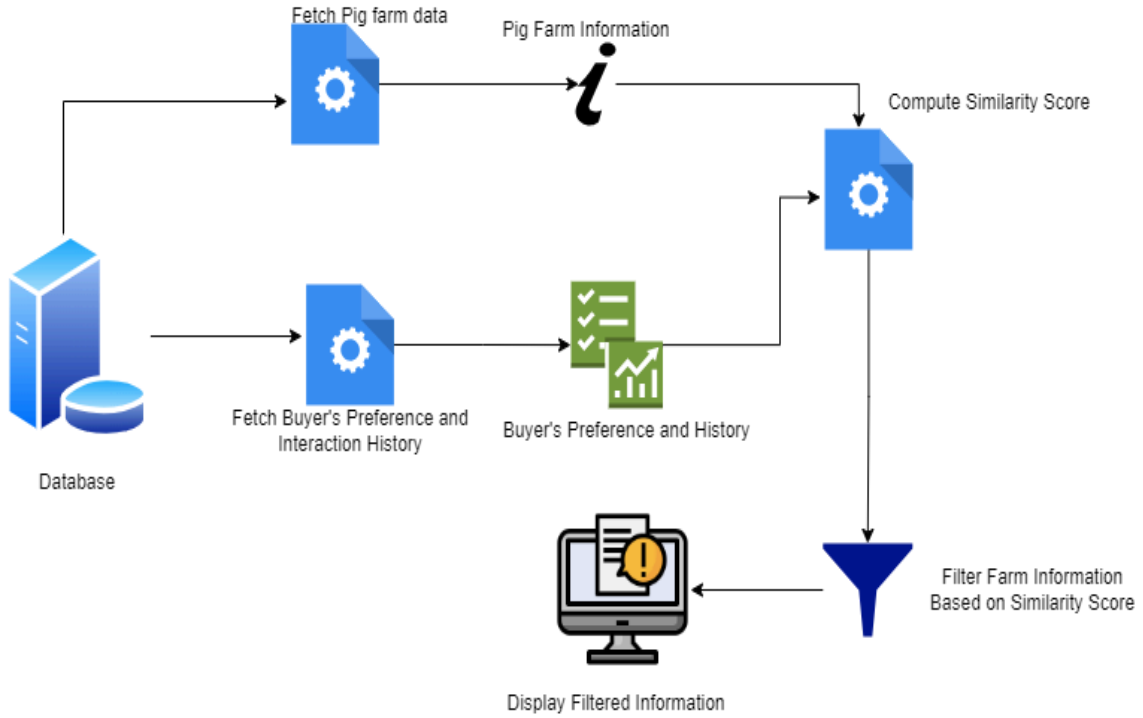


Figure 3.35 User-based Collaborative Filtering

Figure 3.35 The user-based collaborative filtering method that was used to filter recommendations based on the buyer's preferences and similar users.

3.1 Similarity Calculation:

- **Calculate User Similarity:** For each pair of users, the system calculated their similarity based on their preferences and interactions with pig farms. Techniques such as cosine similarity were used for this calculation.

3.2 Top-N Recommendations:

- **Generate User-Based Recommendations:** Recommended pig farms to a user based on similar users' preferences and historical interactions. Rank pig farms were ranked by their predicted ratings.

4. Content-Based Filtering

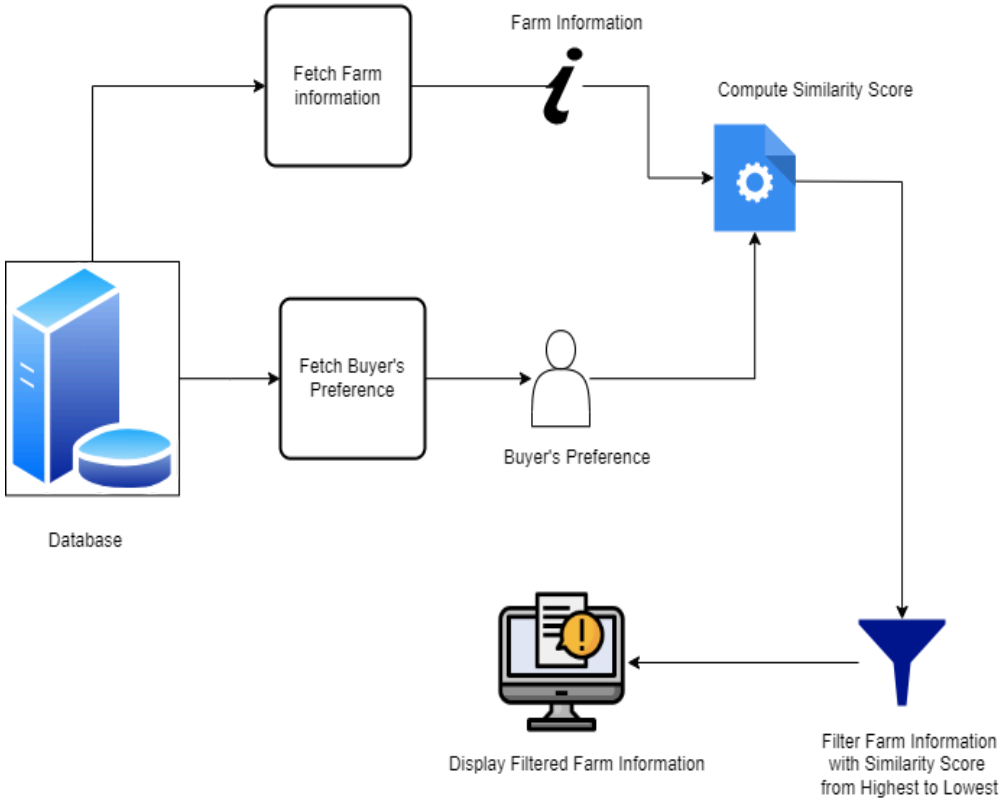


Figure 3.36 Content-Based Filtering

Figure 3.36 A sample diagram of the content-based filtering that was used to recommend to buyers based on the features of the farms themselves and the buyer's past interactions or preferences.

4.1 Calculate Pig Farm Similarity:

- **Similarity Calculation:** For each pig farm, the system calculated its similarity to the user's profile based on farm features using techniques like cosine similarity.

$$\cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2}\sqrt{\sum_{i=1}^{n} B_i^2}}$$

Figure 3.37 Cosine Similarity Equation

4.2 Weighted Feature Matching:

- **Weighting Features:** Assigned weights to different farm features based on their importance to the user's preferences.

5. Hybrid Recommendation Logic

5.1 Combine Recommendations:

- **Weighted Combination:** Combined recommendations from collaborative filtering and content-based filtering approaches.
    - Weighted sum: Computed a weighted sum of the scores from both approaches with weights determined based on their performance or user preferences.

5.2 Top-N Recommendations:

- **Generate Hybrid Recommendations:** Selected the top N pig farms with the highest hybrid scores to recommend to the user.

XVII. Project Implementation

Table 3.8 Software Implementation Plan

Task Description	Assigned to	Status
Register Account	Returan, Ronn Virgin V.	Completed
Login Account	Returan, Ronn Virgin V.	Completed
Logout Account	Returan, Ronn Virgin V.	Completed
Verify Account	Returan, Ronn Virgin V.	Completed
Create farmer's dashboard and analytics	Gratela, Charles G.	Completed
Create recommendation system	Gratela, Charles G.	Completed
Pig information input	Gratela, Charles G.	Completed
Vaccination Input	Gratela, Charles G.	Completed
Expenses Input	Gratela, Charles G.	Completed
Breeding Input	Gratela, Charles G.	Completed
Buyer's interface	Logdat, Randel B.	Completed
Display farm information	Logdat, Randel B	Completed
Chat module	Logdat, Randel B.	Completed
Geolocation	Logdat, Randel B.	Completed
Feedback	Ibasco, Angelo Joaquin S.	Completed
Rating	Ibasco, Angelo Joaquin S.	Completed
Search	Ibasco, Angelo Joaquin S.	Completed

Table 3.8 The software implementation plan which was used as a guide for specific members and their key tasks. This plan encompassed the functionalities of the system that were developed to ensure the efficiency of the progress in the development of the system.

Table 3.9 End-User Training plan

Target User	Required Hours	Status
Small scale pig farm owners	1 hour	Completed
Buyers or Dealers	1 hour	Completed
Farm workers	30 minutes	Completed

Table 3.9 The end-user training plan, providing the target users, hours required for training, and the status of the training. This ensured that the target users were provided with the necessary training to effectively maximize the system according to their specific needs.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 PROJECT PRESENTATION

This section aims to exhibit the results of development for each component of the system.

SPECIFIC OBJECTIVE NO. 1:

Enable buyers to input their specific preferences for pigs, such as breed, age, and price range, to tailor their search experience.

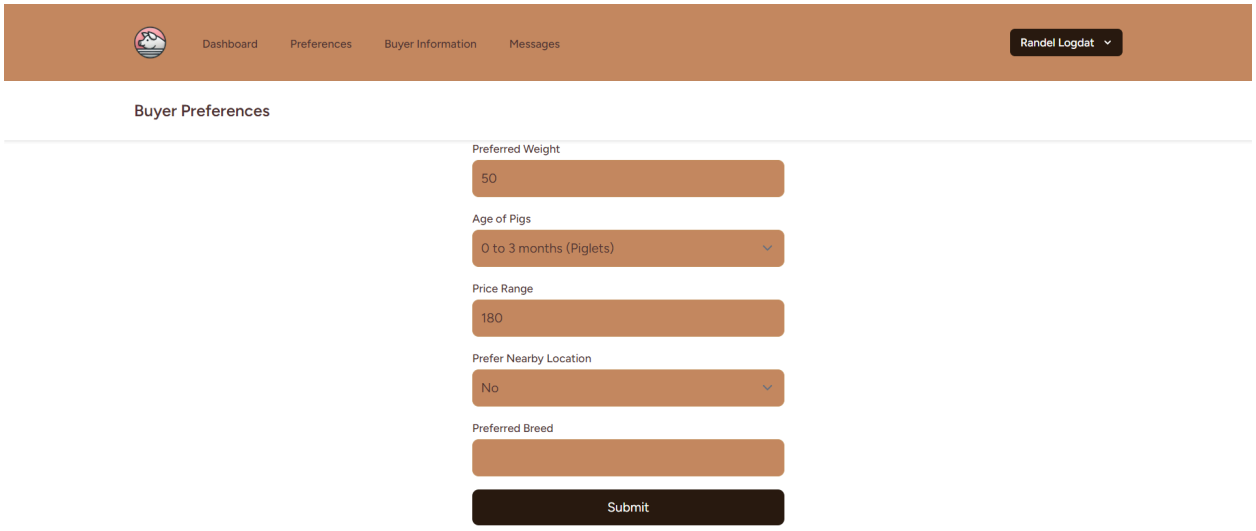


Figure 4.1 Buyer's Preference View

Figure 4.1 shows the Buyer's Preference view wherein buyers can set their preferences based on weight, age of pigs, price range, breed, and if they prefer nearby locations. This is to personalize the recommendation process of the system that will be provided to the buyers.

SPECIFIC OBJECTIVE NO. 2:

Implement an AI-driven filtering mechanism that analyzes buyer preferences and matches them with available pigs posted by farmers, ensuring relevant results.

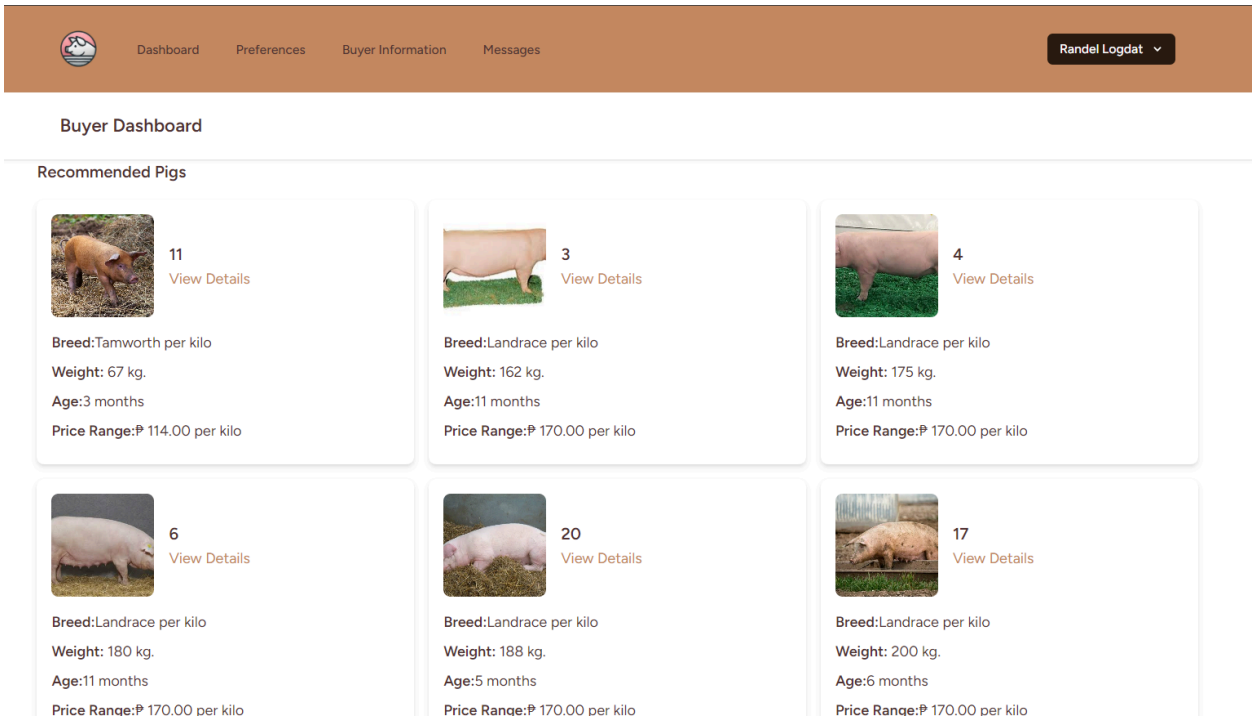


Figure 4.2 Buyer's Dashboard View

Figure 4.2 Illustrates the buyer's dashboard of the system which provides recommendations based on the farmer's set preferences using hybrid recommendation system and if no preferences are set, the system employs content-based filtering.

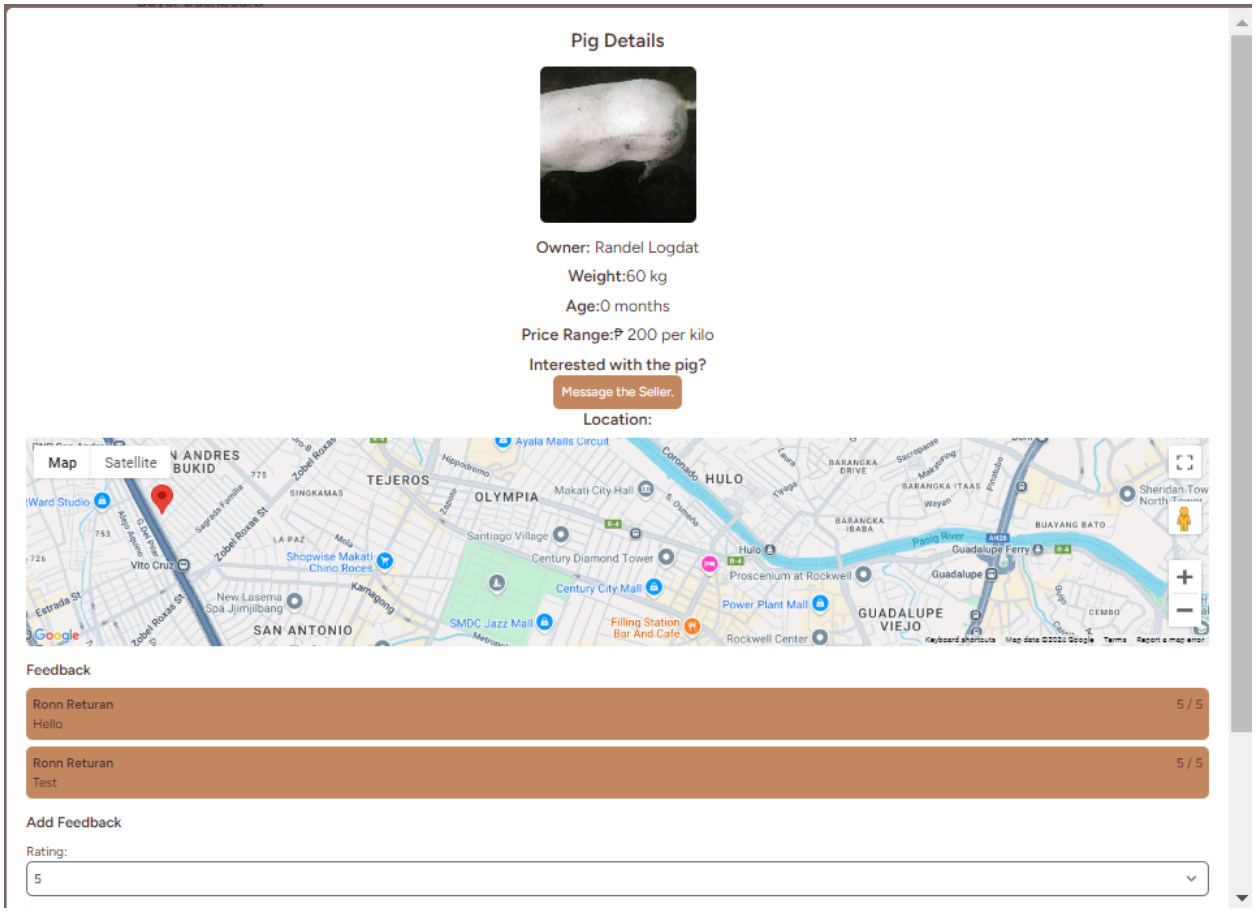


Figure 4.3 Farmer's Details Modal

Figure 4.3 shows the farmer's detail modal wherein it provides information about the farmer and where the geolocation was implemented to provide the exact location of the farm.

Table 4.1 Pseudocode for the Hybrid Recommendation System used in the system using OpenAPI.

Pseudocode	Description

# Import necessary libraries 	
 	
# Configure logging 	
 	
# Initialize FastAPI app 	
 	
# Set OpenAI API key 	
 	
# Dependency to get the database session 	
def get_db():
  # Create a new database session
  # Yield the session
  # Close the session
 	
# Define request model for interaction tracking 	
class InteractionRequest:
  user_id: int
  pig_id: int
 	
# Endpoint to get recommendations 	
@app.get("/recommendations")
def hybrid_recommendations_endpoint(user_id: int, db: Session = Depends(get_db)):
  try:
  # Log fetching recommendations
 	
  # Fetch user preferences
  preferences = fetch_user_preferences(user_id, db)
  # Log fetched preferences
 	
  # Fetch user interactions
  interactions = fetch_user_item_interactions(db, user_id)
  # Log fetched interactions
 	
  # Fetch all pigs
  pigs = fetch_pigs(db)
  # Log fetched pigs
 	
  # Fetch user similarities and item similarities
  user_similarities_df = fetch_user_similarities()
  user_item_matrix = fetch_user_item_matrix()
	The pseudocode provides a clear and structured approach to fetching recommendations and tracking interactions in a system that uses both FastAPI and Laravel. The FastAPI backend handles the core logic of fetching data and generating recommendations using a hybrid approach, while the Laravel controller handles the frontend logic of communicating with the FastAPI backend to fetch recommendations and track interactions. This separation of concerns ensures that the system is modular, maintainable, and scalable.

```
        item_similarities_df = fetch_item_similarities()

        # Generate hybrid recommendations
        recommendations = hybrid_recommendations(user_id,
user_similarities_df, user_item_matrix, item_similarities_df, pigs)
        # Log fetched recommendations

        return {"recommendations": recommendations}
    except Exception as e:
        # Log error
        raise HTTPException(status_code=500, detail="Failed to fetch
recommendations")

# Endpoint to track interaction
@app.post("/api/track_interaction")
def track_interaction(interaction: InteractionRequest, db: Session =
Depends(get_db)):
    try:
        # Log tracking interaction

        # Record interaction in the database
        record_interaction(interaction, db)
        # Log success

        return {"message": "Interaction tracked successfully"}
    except SQLAlchemyError as e:
        # Log error
        raise HTTPException(status_code=500, detail="Failed to track
interaction")

# Function to fetch user preferences
def fetch_user_preferences(user_id, db: Session):
    # Query user preferences from the database
    # Query buyer information from the database
    # If preferences and buyer info exist, set latitude and longitude
    # Log fetched preferences
    return preferences

# Function to fetch user interactions
def fetch_user_item_interactions(db: Session, user_id: int):
    # Query user interactions from the database
    # Log fetched interactions
    return interactions

# Function to fetch pigs
def fetch_pigs(db: Session):
```

```
    # Query pigs from the database
    # Format pig list
    # Log fetched pigs
    return pig_list

# Function to fetch user similarities
def fetch_user_similarities():
    # Fetch user similarities from the database or precomputed data
    return user_similarities_df

# Function to fetch user-item matrix
def fetch_user_item_matrix():
    # Fetch user-item matrix from the database or precomputed data
    return user_item_matrix

# Function to fetch item similarities
def fetch_item_similarities():
    # Fetch item similarities from the database or precomputed data
    return item_similarities_df

# Function to generate hybrid recommendations
def hybrid_recommendations(user_id, user_similarities_df,
user_item_matrix, item_similarities_df, filtered_pigs, top_n=5):
    IF user_similarities_df IS empty OR user_id NOT IN
user_similarities_df:
        RETURN content_based_recommendations(item_similarities_df,
filtered_pigs, top_n)

    # Collaborative filtering recommendations
    similar_users = SORT user_similarities_df[user_id] IN descending
order EXCEPT user_id
    collaborative_recommendations = SUM
user_item_matrix[similar_users] SORTED IN descending order LIMIT
top_n

    # Content-based filtering recommendations
    filtered_pig_ids = EXTRACT pigId FROM filtered_pigs
    content_recommendations = EMPTY Series
    FOR EACH pig_id IN filtered_pig_ids:
        similar_items = SORT item_similarities_df[pig_id] IN descending
order EXCEPT pig_id LIMIT top_n+1
        IF similar_items IS NOT empty:
            content_recommendations = CONCATENATE
content_recommendations WITH similar_items

    content_recommendations = COUNT VALUES IN
```

content_recommendations SORTED BY frequency LIMIT top_n
REMOVE duplicates
 	
    # Combine recommendations and remove duplicates
    hybrid_recommendations = CONCATENATE
content_recommendations WITH collaborative_recommendations
REMOVE duplicates LIMIT top_n
 	
    RETURN hybrid_recommendations
 	
# Function to generate content-based recommendations 	
def content_based_recommendations(item_similarities_df,
filtered_pigs, top_n):
    # Generate content-based recommendations based on item
similarities
    return recommendations	

SPECIFIC OBJECTIVE NO. 3:

Provide a feature that shows the location of pigs for sale and allows buyers to initiate purchases directly from farmers, facilitating seamless transactions.

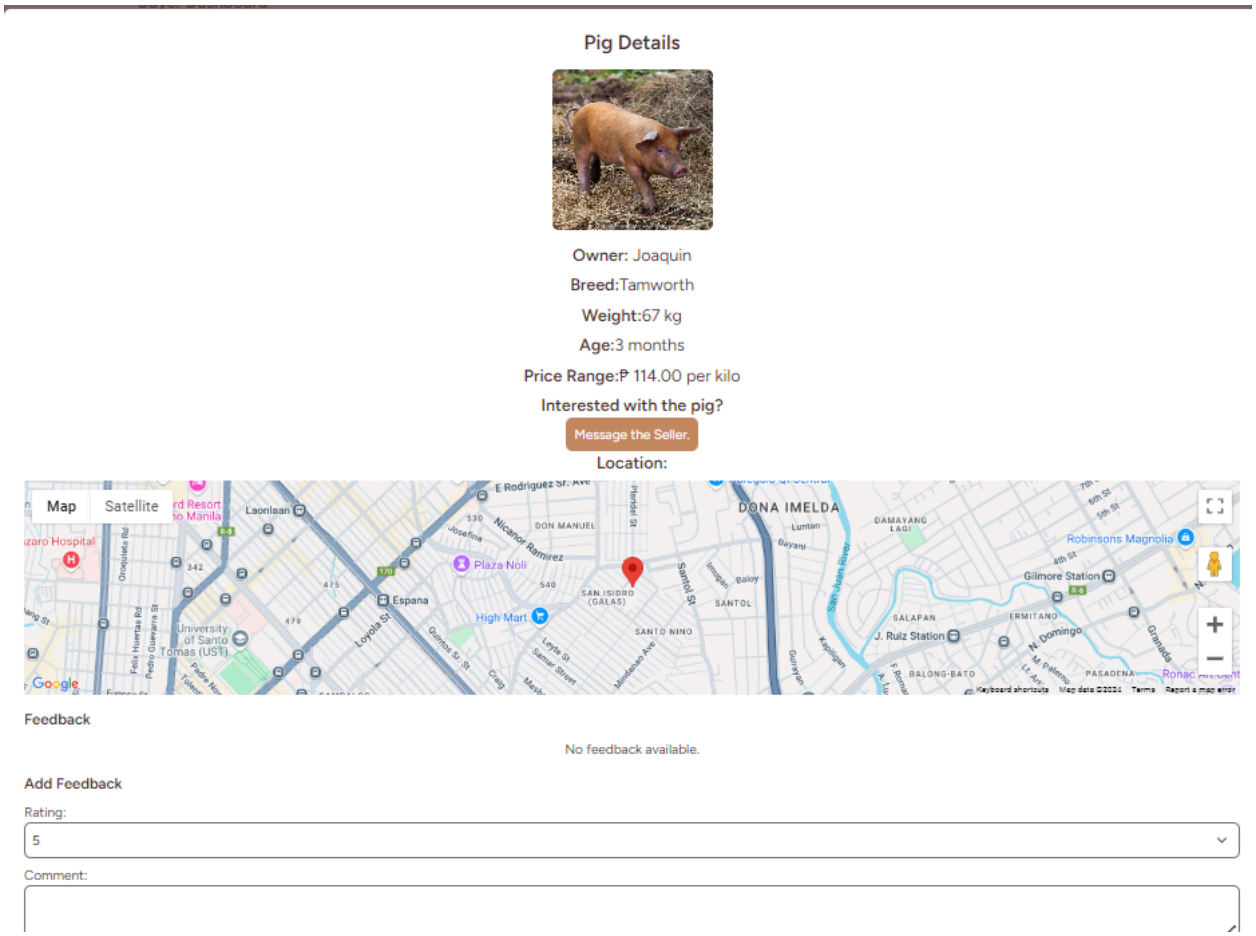


Figure 4.4 Pig Details in Buyer's Dashboard

Figure 4.4 shows the pig details in the buyer's dashboard wherein it provides the location where the farm is located. Also, the buyer can directly send a message to the farmer by clicking the "Message the Seller" button to start the interaction. This is to provide direct messaging to both users so that they can further discuss the transactions.

4.2 PROJECT EVALUATION

Table 4.2 System Evaluation Survey Questionnaires

Criteria	Questions
Functional suitability	1. Completeness ○ The system includes all required features, such as pig inventory management, analytics, and AI recommendations, to meet user needs. 2. Correctness ○ The system outputs (e.g., analytics, recommendations) are accurate and meet expectations during practical use. 3. Appropriateness ○ The system features to support efficient accomplishment of pig farm management and buyer-seller interactions.
Performance efficiency	4. Time Behavior ○ The system provides real-time analytics and geolocation updates promptly. ○ AI recommendations are generated quickly and accurately based on user preferences. 5. Resource Utilization ○ The system performs well without delays, even when managing large volumes of data (e.g., multiple farms, and buyers). 6. Capacity ○ The system can handle numerous users and transactions simultaneously without performance degradation.

Interaction Capability	7. Learnability ○ The system is easy for new users (farmers and buyers) to understand and navigate. 8. Operability ○ The interface supports the smooth execution of tasks like updating pig information, managing schedules, and accessing analytics. ○ The system is easy to operate and manage. 9. User Engagement ○ The system's features, such as dashboards and communication tools, encourage active participation. ○ Engagement mechanisms, like notifications or personalized insights, motivate regular usage. 10. Self-Descriptiveness ○ The system provides clear guidance and feedback, minimizing the need for external help.
Reliability	11. Faultlessness ○ The system executes core functions (e.g., inventory management, and messaging) without errors or interruptions. 12. Data Accuracy ○ Data inputs and outputs (e.g., pig health status, buyer feedback) are accurate and reliable.
Security	13. Confidentiality ○ The system ensures sensitive user data (e.g., farm information, buyer details) is accessible only to authorized users.

	14. Integrity ○ The system prevents unauthorized modifications to user records and ensures consistency over time.
Maintainability	15. Analysability ○ Automated processes (e.g., analytics and recommendations) effectively reduce manual workload. 16. Reusability ○ Historical data is stored securely and can be reused for future insights or analysis. 17. Modifiability ○ The system allows updates to features or configurations without disrupting existing functionality.
Overall Feedback	18. What feature did you find the most helpful? ○ _____ 19. What improvements would you recommend for PigConnect? ○ _____

Table 4.2: This system survey questionnaire is designed to evaluate the functionality, performance, usability, and overall effectiveness of the PigConnect platform from the perspective of its users. The goal is to ensure that the system meets farmers' and buyers' needs while delivering a seamless, efficient, and secure experience. It assesses functional suitability by checking whether the system includes all required features (like inventory management and analytics) and ensures outputs are accurate and relevant. Performance efficiency is measured by evaluating how quickly and reliably the system handles real-time updates, large data volumes, and multiple users. Interaction capability is analyzed through ease of use, engagement, and clarity, ensuring both farmers and buyers can navigate and operate the system effortlessly. The questionnaire also examines reliability (error-free operation and data accuracy), security (data confidentiality and integrity), and maintainability (ability to adapt and reuse data without disruptions). Lastly, users are encouraged to share feedback on the features they find most useful and suggest improvements.

FUNCTIONAL SUITABILITY

Completeness: The system includes all required features, such as pig inventory management, analytics, and AI recommendations, to meet user needs.

14 responses

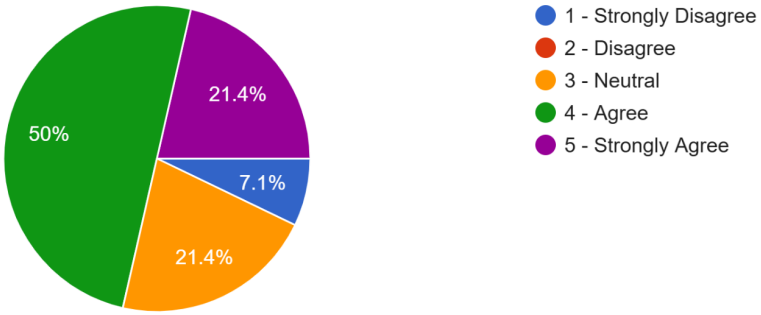


Figure 4.5 Completeness

Figure 4.5 presents the result of the first question for our System feedback survey in which at least 50% of the respondents agree, 21.4% strongly agree, 21.4 are neutral and 7.1% strongly disagree.

Correctness: The system outputs (e.g., analytics, recommendations) are accurate and meet expectations during practical use.

14 responses

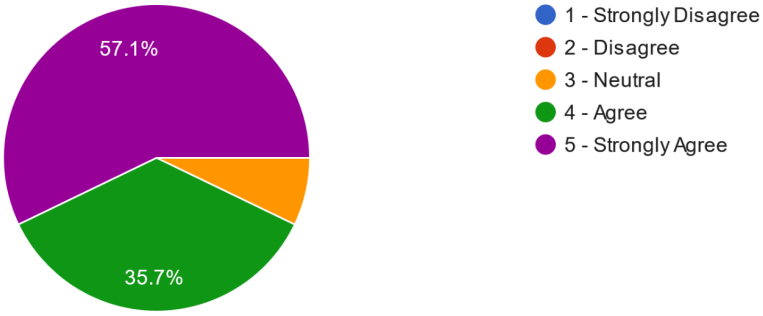


Figure 4.6 Correctness

Figure 4.6 shows that in this question, 57.1% of the total respondents strongly agreed that the system outputs are accurate and meet expectations during practical use. While 35.7% of the total respondents agreed and 7.1% percent were neutral in their answers.

Appropriateness: The system features support efficient accomplishment of pig farm management and buyer-seller interactions.

14 responses

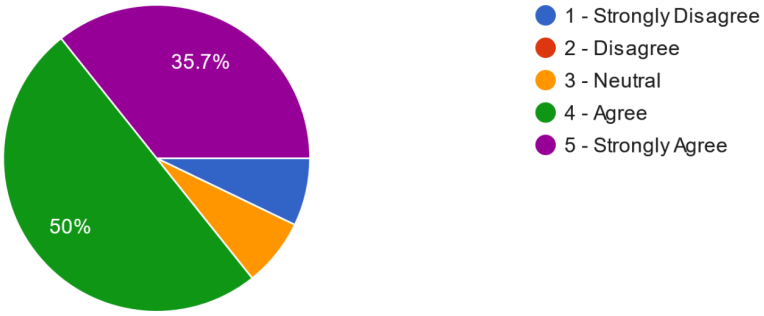


Figure 4.7 Appropriateness

Figure 4.7 shows how efficient is the buyer-farmer interaction and vice versa. 50% of the respondents agree with this sentiment and 35.7% of the respondents strongly agree with it. Two respondents answered neutral and that they strongly disagreed with the feature.

PERFORMANCE EFFICIENCY

Time Behavior: The system provides real-time analytics and geolocation updates promptly.

14 responses

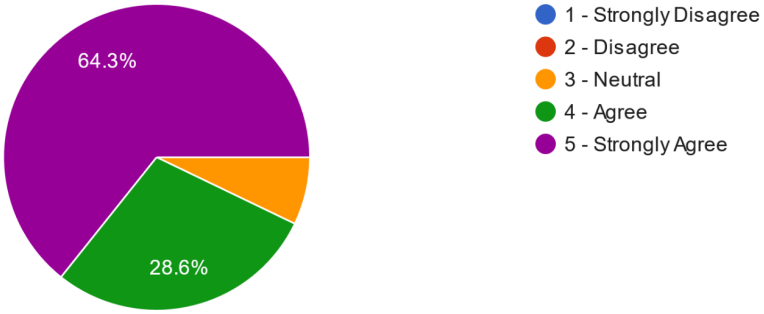


Figure 4.8 Time Behavior 1

Figure 4.8 tackles the time behavior if the system provides real-time analytics and geolocation updates promptly. The pie chart shows that 64.3% of the total respondents strongly agree, 28.6% agree and 7.1% are neutral in their answers.

Time Behavior: AI recommendations are generated quickly and accurately based on user preferences.

14 responses

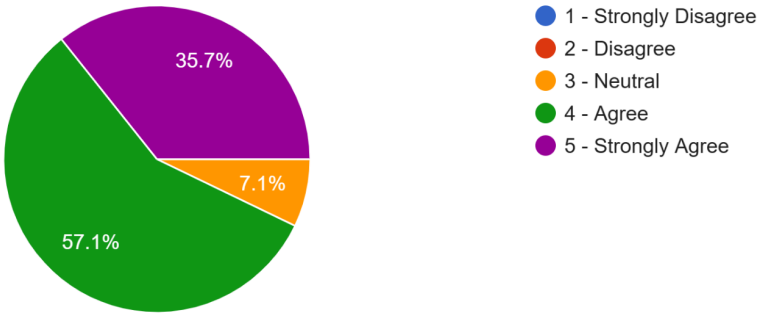


Figure 4.9 Time Behavior 2

Figure 4.9 showcases the performance of the AI recommendation on the buyer's side of the system. 57.1% of the respondents agree that it loads quickly and accurately, 35.7% strongly agree, and 7.1% of the respondents answered neutral.

Resource Utilization: The system performs well without delays, even when managing large volumes of data (e.g., multiple farms, buyers).

14 responses

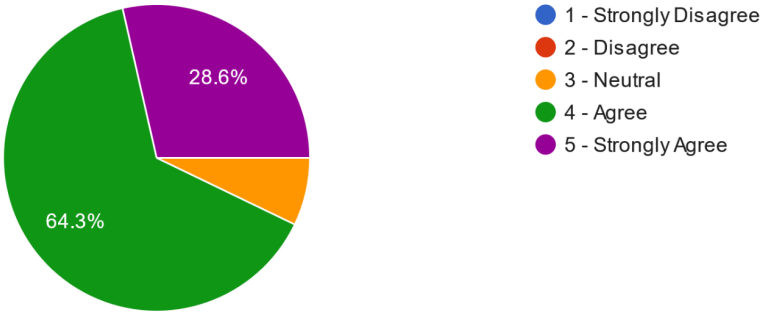


Figure 4.10 Resource Utilization

Figure 4.10 shows how the system performs under stress. 64.3% of the respondents agree the system performs well, 28.6% strongly agree, 7.1% neutral.

The system can handle numerous users and transactions simultaneously without performance degradation.

14 responses

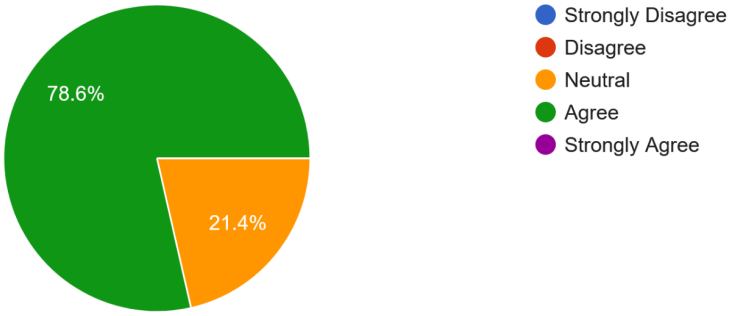


Figure 4.11 Capacity

Figure 4.11 is how well the system can perform for extended periods of time with no issues. The majority of respondents had no problems using the system while a few seem to have minor problems while using it.

INTERACTION CAPABILITY

Learnability: The system is easy for new users (farmers and buyers) to understand and navigate.

14 responses

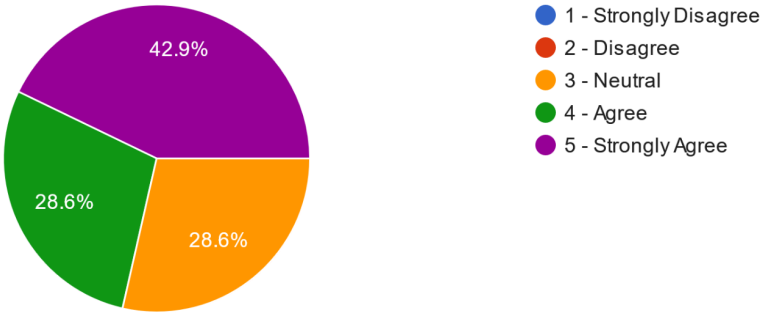


Figure 4.12 Learnability

Figure 4.12 is all about the interaction capabilities of our system. First is learnability in which the system is easy for new users to understand and navigate. 42.9% of the respondents strongly agree with this statement, 28.6% agree while the last 26.8% are neutral with their answers.

Operability: The interface supports smooth execution of tasks like updating pig information, managing schedules, and accessing analytics.

14 responses

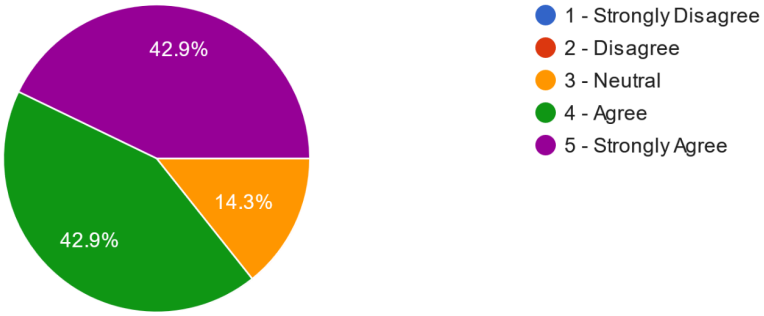


Figure 4.13 Operability 1

Figure 4.13 shows the smoothness of the execution of tasks in the system. 42.9% of the respondents are split on agree and strongly agree, while the remaining 14.3% are neutral.

Operability: The system is easy to operate and manage.

14 responses

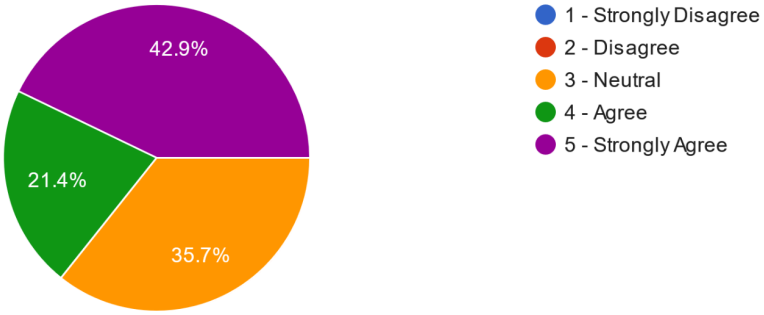


Figure 4.14 Operability 2

Figure 4.14 is about operability in which the system is easy to operate and manage. As shown in the pie chart, 42.9% of the respondents strongly agree. 21.4% agree and 35.7% are neutral.

User Engagement: The system's features, such as dashboards and communication tools, encourage active participation.

14 responses

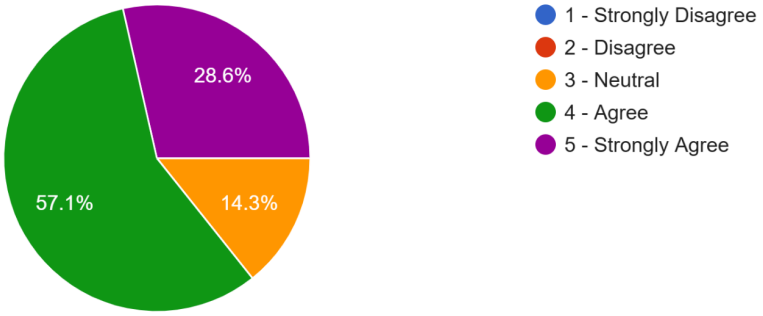


Figure 4.15 User Engagement 1

Figure 4.15 is for user engagement in which the system's features like our dashboards and communication tools such as our chat system, encourage our users to actively participate. 57.1% agree, 28.6% strongly agree and only 14.3% are neutral with their answers.

User Engagement: Engagement mechanisms, like notifications or personalized insights, motivate regular usage.

14 responses

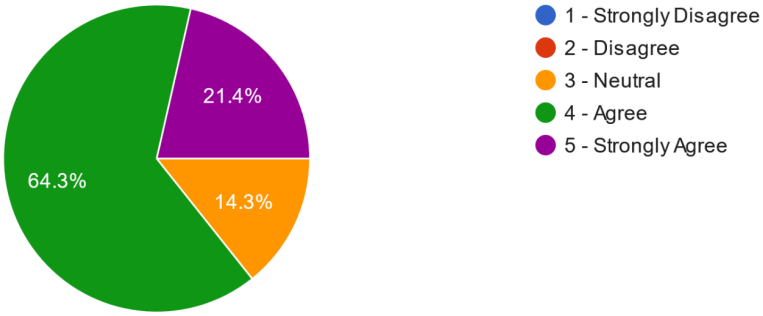


Figure 4.16 User Engagement 2

Figure 4.16 is a continuation of the previous figure, which questions how user engagement in terms of notifications and personalized insights. 64.3% of the respondents agree, 21.4% strongly agree and 14.3% are neutral.

Self-Descriptiveness: The system provides clear guidance and feedback, minimizing the need for external help.

14 responses

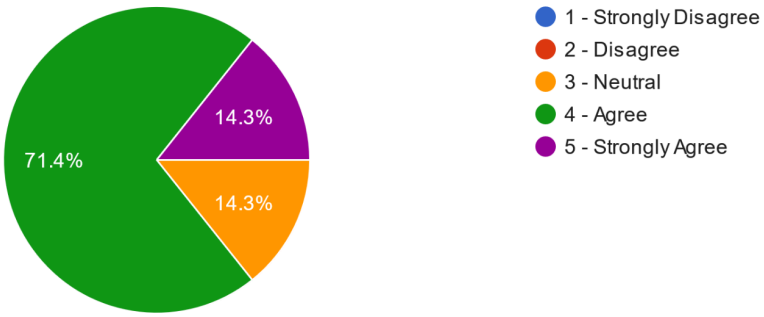


Figure 4.17 Self-Descriptiveness

Figure 4.17 is about the self-descriptiveness of the system in which the system provides clear guidance and feedback, minimizing the need for external help. The majority of the respondents 71.4% agree, 14.3% strongly agree, and the last 14.3 are neutral with their answers.

RELIABILITY

Faultlessness: The system executes core functions (e.g., inventory management, messaging) without errors or interruptions.

14 responses

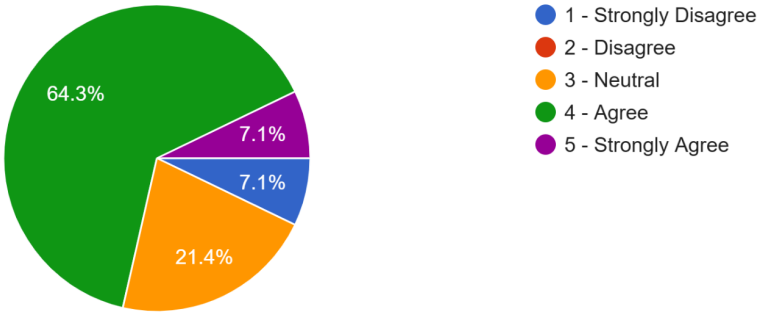


Figure 4.18 Faultlessness

Figure 4.18 shows how often respondents will get an error while using the system. The majority of the respondents agreed with 64.3% and 7.1% strongly agreeing. The remaining respondents may have encountered an error while using the system.

Data Accuracy: Data inputs and outputs (e.g., pig health status, buyer feedback) are accurate and reliable.

14 responses

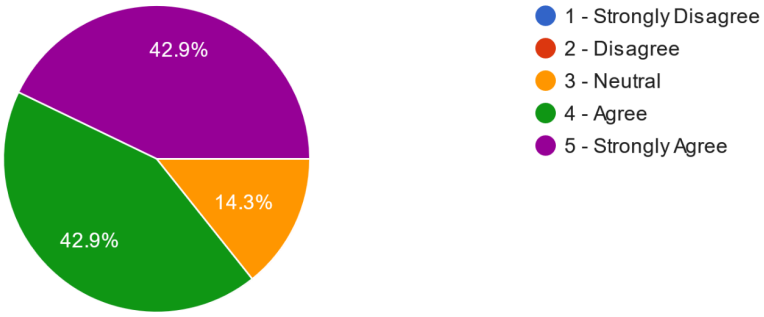


Figure 4.19 Data Accuracy

Figure 4.19 shows the respondents about the system's data accuracy and if it's reliable. Half of the respondents agreed and strongly agreed while the remaining answered neutral.

SECURITY

Confidentiality: The system ensures sensitive user data (e.g., farm information, buyer details) is accessible only to authorized users.

14 responses

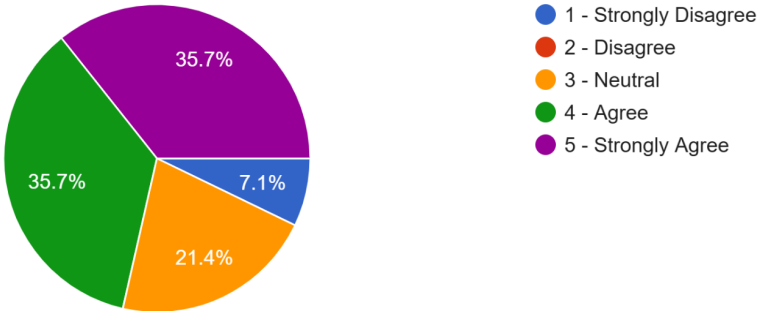


Figure 4.20 Confidentiality

Figure 4.20 is the start of our Security criteria for our system. We asked the respondents if our system ensures confidential information is accessible only to authorized users. 35.7% answered that they strongly agree. Another 35.7% agree, 21.4% are neutral and 7.1% strongly disagree.

Integrity: The system prevents unauthorized modifications to user records and ensures consistency over time.

14 responses

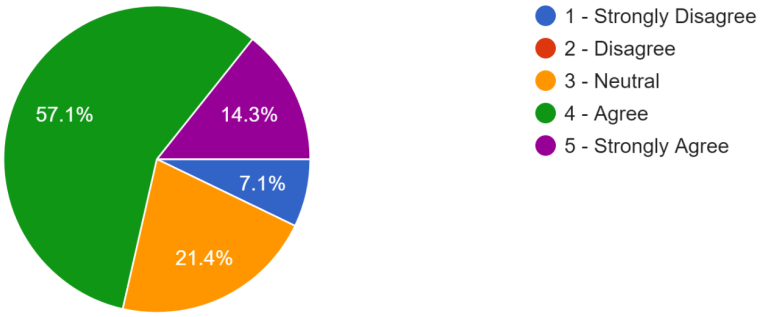


Figure 4.21 Integrity

Figure 4.21 shows the integrity of our system in which the system prevents unauthorized modifications to user records and ensures consistency over time. 57.1% agree, 14.3% strongly agree, 21.4% are neutral and lastly, 7.1% strongly disagree.

MAINTAINABILITY

Analysability: Automated processes (e.g., analytics and recommendations) effectively reduce manual workload.

14 responses

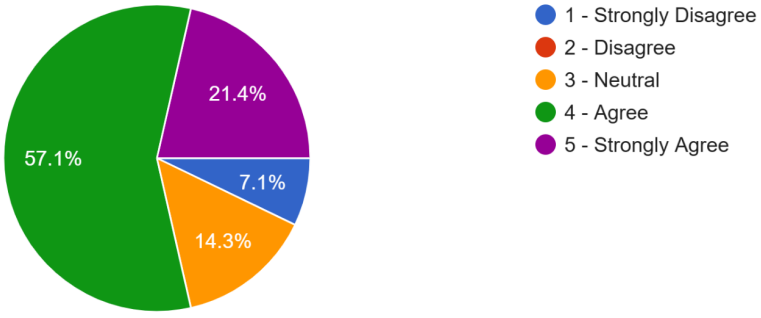


Figure 4.22 Analysability

Figure 4.22 shows our analysability in which automated processes such as analytics and recommendations effectively reduce manual workload. 57.1% which is the majority of the respondents agree. 21.4% of the respondents strongly agree, 14.3 were neutral and 7.1% strongly disagree.

Reusability: Historical data is stored securely and can be reused for future insights or analysis.
14 responses

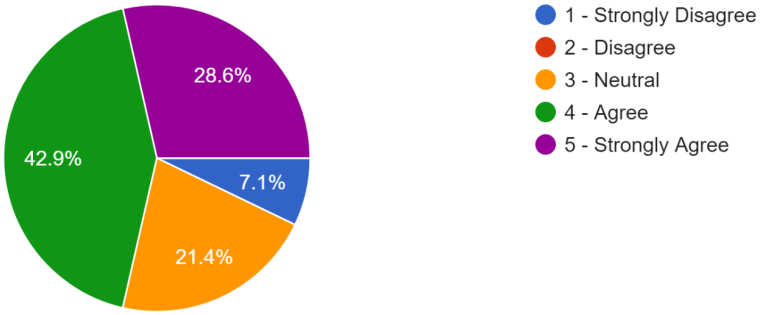


Figure 4.23 Reusability

Figure 4.23 shows the reusability of the historical data that is stored securely and can be reused for future insights or analysis. 42.9% of the total respondents answered that they agree. 28.6% of the respondents strongly agree, 21.4% were neutral with their answers and lastly 7.1% strongly disagree.

Modifiability: The system allows updates to features or configurations without disrupting existing functionality.
14 responses

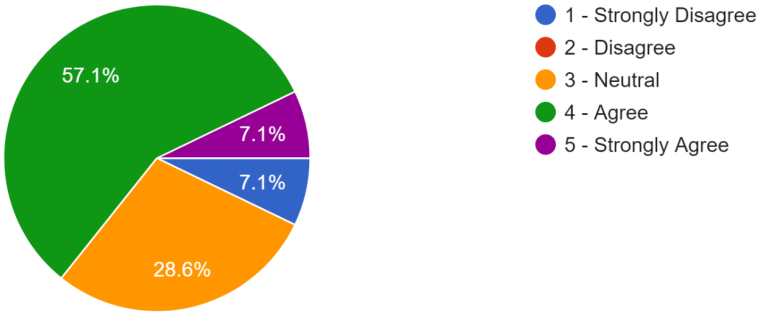


Figure 4.24 Modifiability

Figure 4.24 shows the modifiability of our system if the system allows updates to features or configurations without disrupting existing functionality. 57.1 of the respondents agree. 28.6% are neutral with their answers, 7.1% strongly agree and lastly 7.1% strongly disagree.

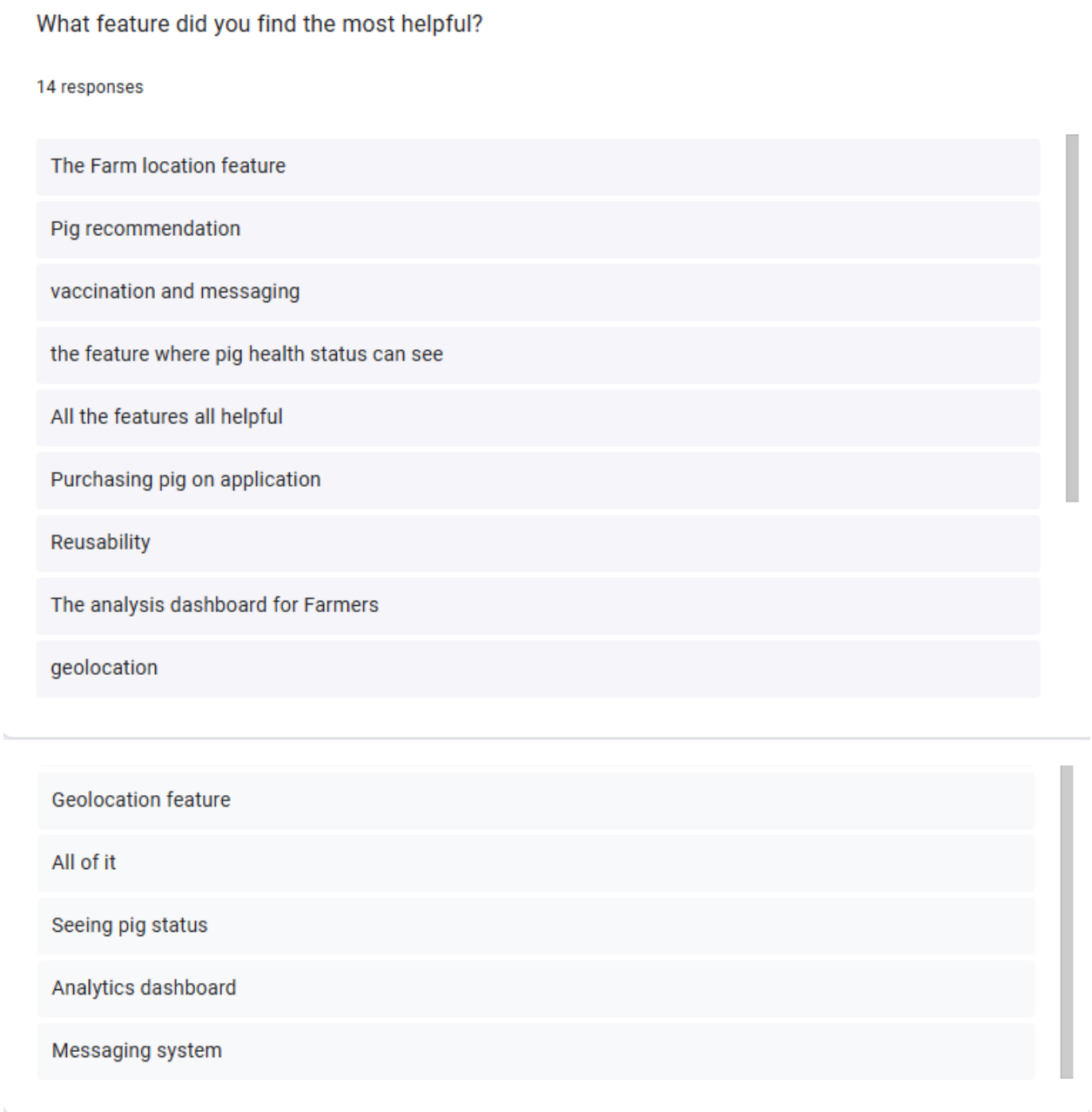


Figure 4.25 What feature did you find the most helpful

Figure 4.25 shows all the respondents' answers to what feature of the system would be the most beneficial to them. Most of the respondents have varying answers which will be beneficial for the continued improvement of the system.

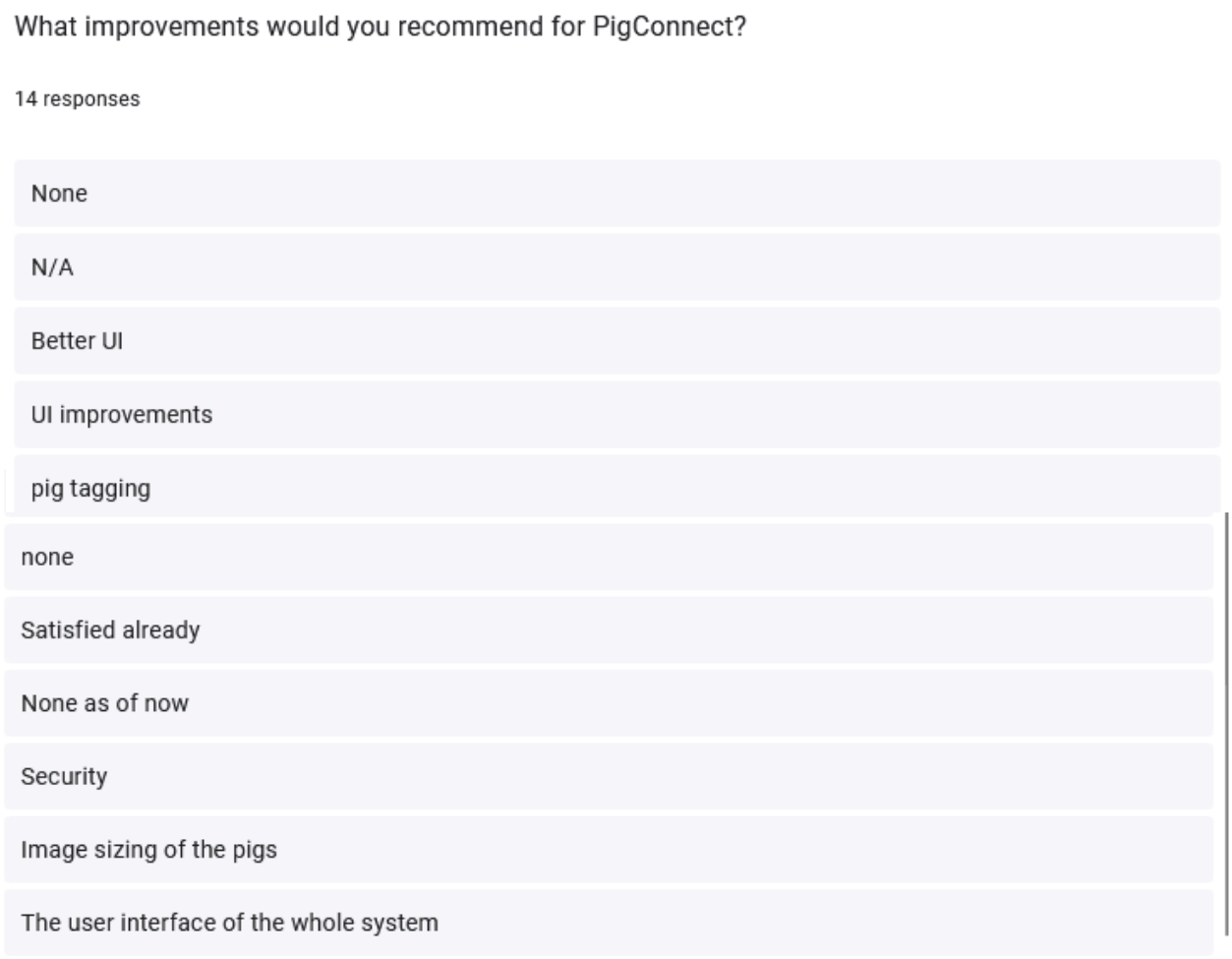


Figure 4.26 What improvements would you recommend for PigConnect

Figure 4.26 is another open-ended question on what improvements could be made. The majority are asking to further improve the user interface, answering none or thinking it's already satisfied. There are also answers in regard to security and pig tagging or identification.

Table 4.3 Survey Questionnaires for Pig Farmers

Criteria	Questions
Basic Information	Name: _____ Farm Address: _____ How big is your farm size? ● Small (10 to 50 pigs) ● Medium (51 to 100 pigs) ● Large (100+ pigs) What kind of pig farm do you operate? ● Commercial ● Smallholder ● Organic How do you keep track of your pig inventory? ● Manual records ● Spreadsheets (microsoft excel, google sheets, etc.) ● Software If you chose software, what kind? _____
Feeding	Do you keep health records of your pigs? ● Yes ● No What type of information do you track? (select all that apply) ● Birth date ● Health history ● Vaccinations ● Feeding schedule ● Tracking weight gain What kind of food do you feed to your pigs? ● Commercial feed ● Homemade feed

	• Leftovers
Challenges and Needs	What are some challenges that you have experienced? • Record keeping • Health management • Marketing What feature do you think is most valuable in a farm management system? • Inventory tracking • Health and record management • Financial tracking • Analytics report Do you have any suggestions for features in a pig farm management system? _____

Table 4.3 is a survey specifically tailored for Pig Farmers. This questionnaire is designed to understand the daily operations, challenges, and needs of pig farmers. It covers key areas like basic farm details, feeding practices, and common difficulties in managing a farm. By asking about how farmers track inventory, manage pig health, and handle feeding schedules helps identify what tools or processes they currently use and where they need support. It also invites farmers to share their biggest challenges and suggest features they'd find valuable in a farm management system, like record-keeping, health tracking, or financial analytics.

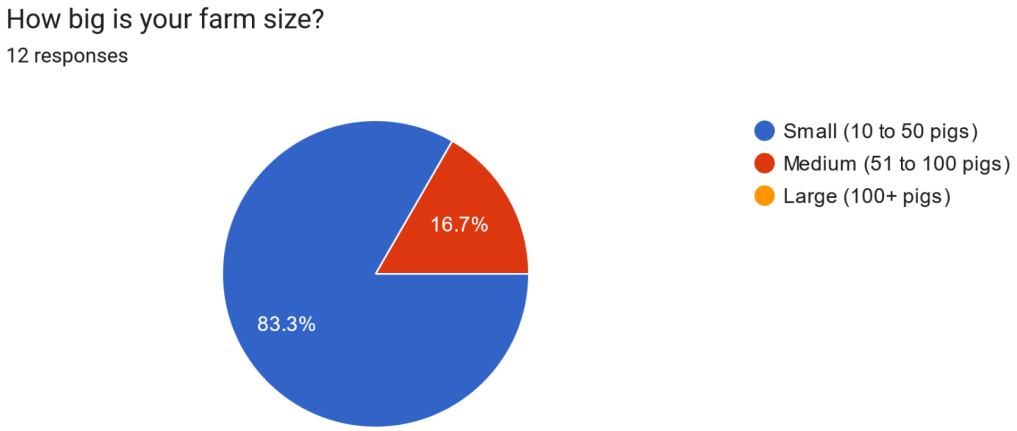


Figure 4.27 How big is your farm size

In Figure 4.27 we asked the respondents how big their farm sizes are. The majority of the respondents 83.3% answered that they only have a small farm of at least 10 to 50 pigs. The remaining number of respondents is 16.7% and they answered that they have a medium-sized farm with at least 51 to 100 pigs in their care.

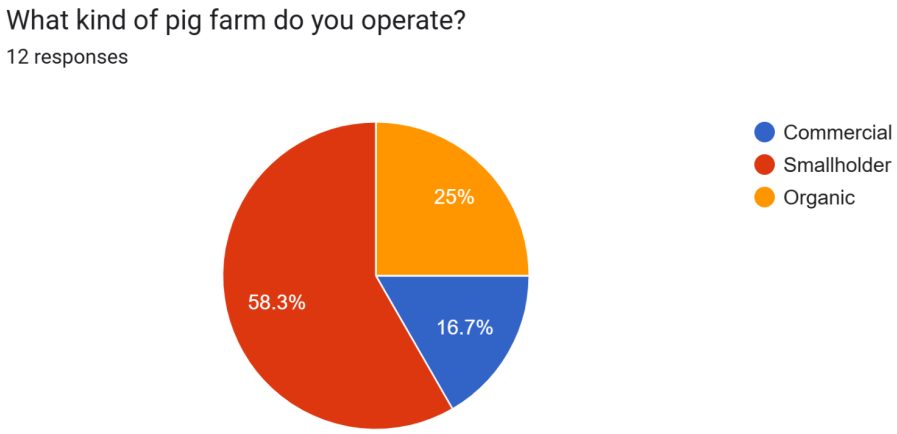


Figure 4.28 What kind of pig farm do you operate

Figure 4.28 The majority of the respondents are smallholder farmers at 58.3%, while the remaining are organic farmers at 25% and commercial farmers at 16.7% are their pig farm operations.

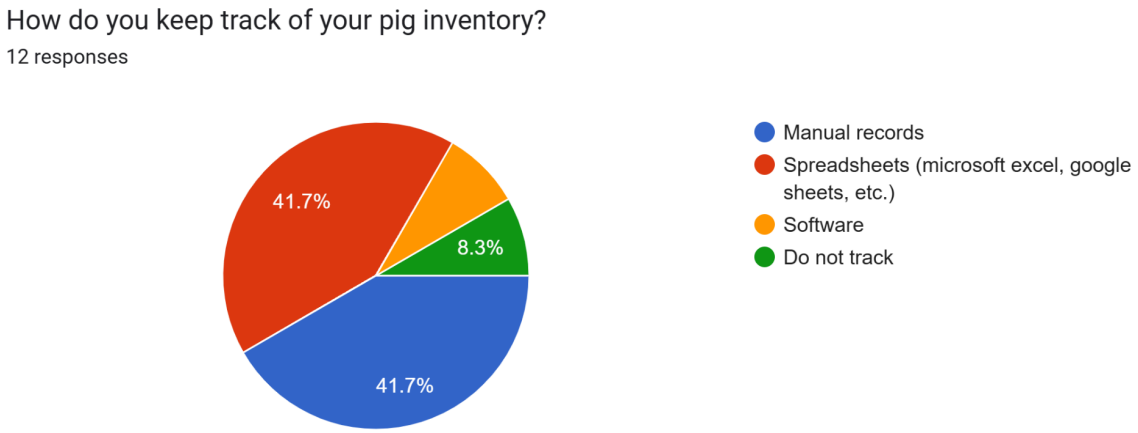


Figure 4.29 How do you keep track of pig inventory

Figure 4.29 is all about how farmers do their record keeping. There is a split between manual record keeping and using spreadsheets. There are some respondents who answered that they do not track their pig info and another uses software for it.

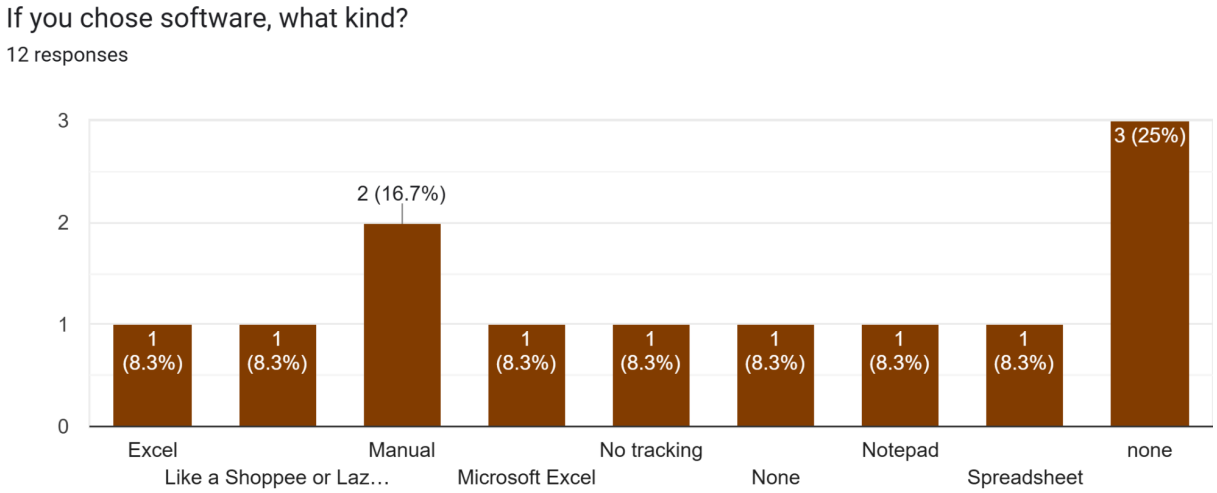


Figure 4.30 If you chose software, what kind

Figure 4.30 shows all the different software tools used by pig farmers in inputting all their data. As depicted in this graph, all of the respondents who answered this survey had different preferences when it came to storing their data for their farms.

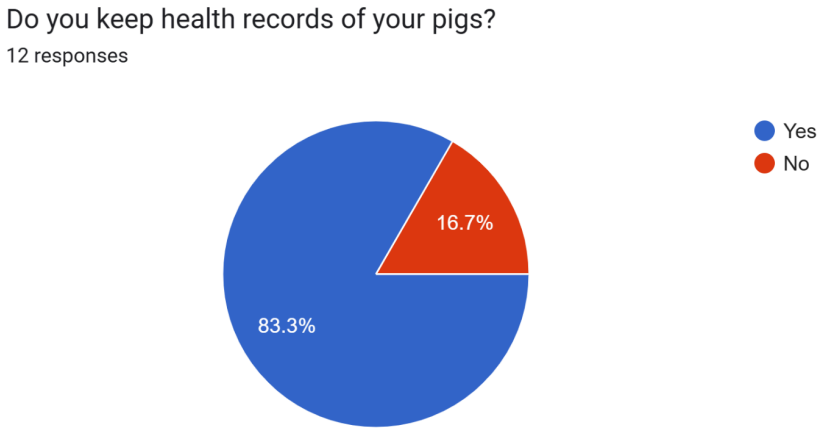


Figure 4.31 Do you keep health records of your pigs

Figure 4.31 respondents were asked if they keep the health records of their pigs. 83.3% answered that they in fact do keep the health records of their pigs, while 16.7% do not.

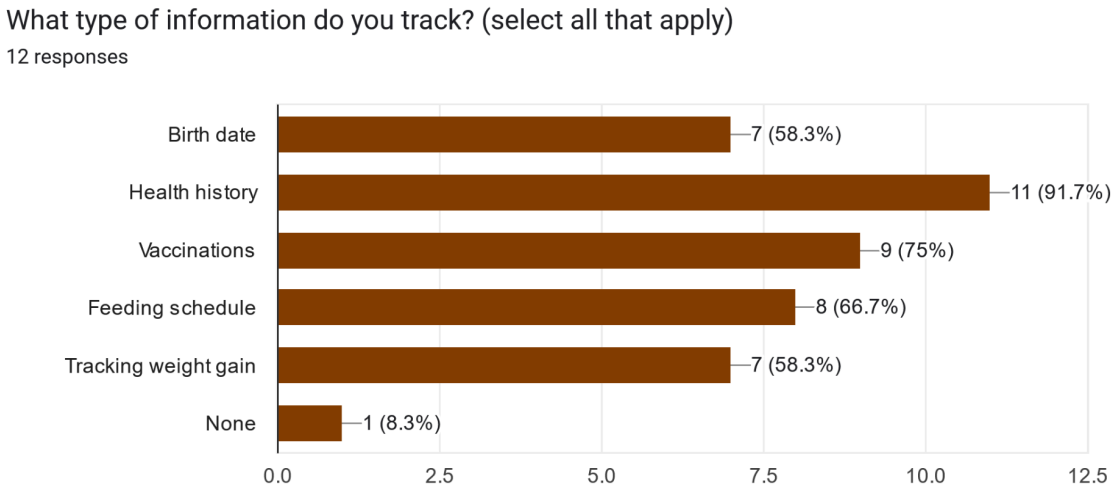


Figure 4.32 What type of information do you track

Figure 4.32 is a line chart that has different information to gather on which information that farmers look after. Respondents can choose a specific one or multiple. From the chart, the majority of farmers track down their health, followed by their vaccination and feeding schedule.

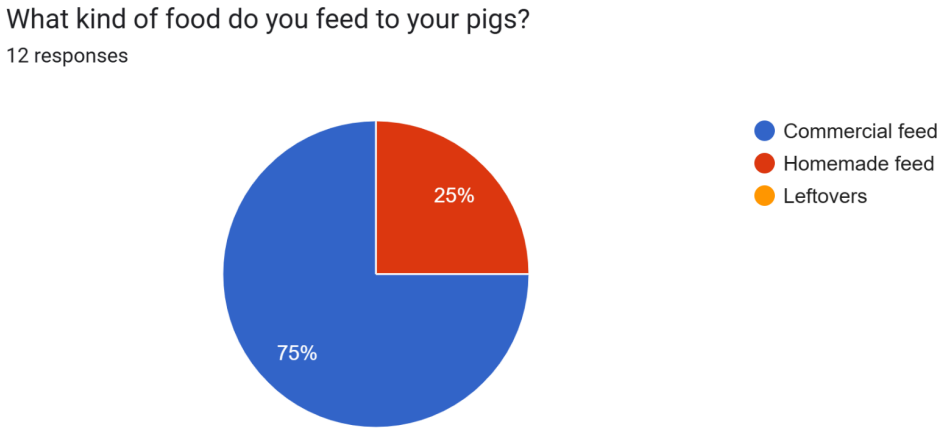


Figure 4.33 What kind of food do you feed to your pigs

Figure 4.33 The researchers asked farmers what kind of diet they use for their pigs. 75% of the respondents answered commercial feed and 25% answered homemade.

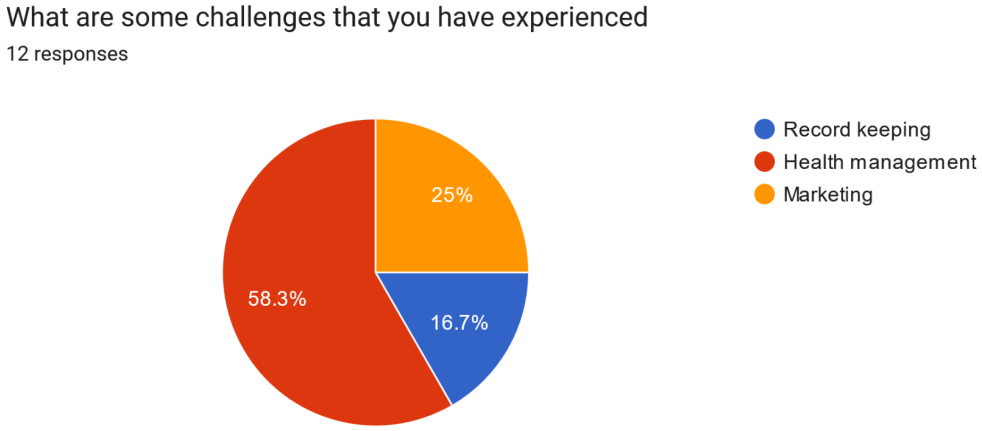


Figure 4.34 What are some challenges that you have experienced

Figure 4.34 The researchers asked the respondents what are some of the challenges they experienced when handling pig farms. 58.3% of the respondents answered that health management is the main challenge they encountered 25% came from the challenges of marketing their pigs to buyers and 16.7% had a hard time with record keeping of their pig farms.

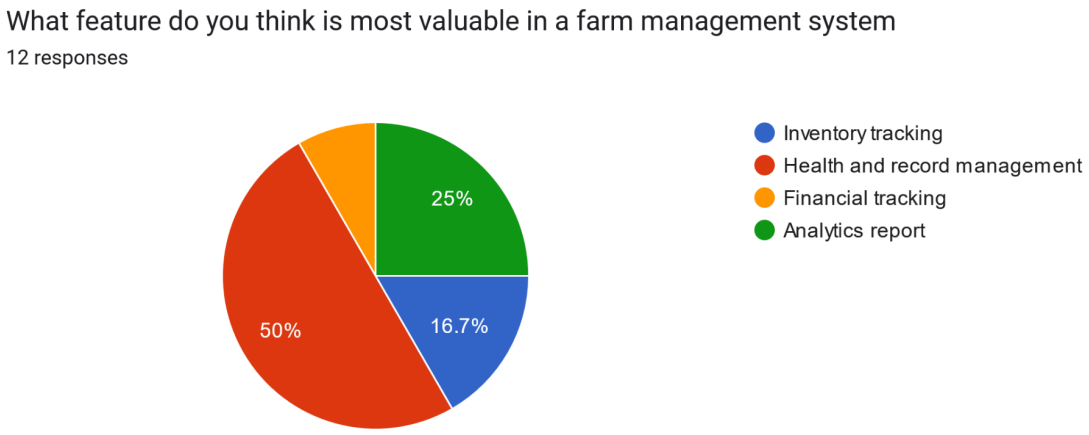


Figure 4.35 What feature do you think is the most valuable in a farm management system

Figure 4.35 shows what farmers think is a needed feature in a farm management system. 50% of the respondents have chosen health and record management, and 25% for analytics reports. While 16.7% is for inventory tracking and 8.3% for financial tracking.

Figure 4.36 Do you have any suggestions for features in a pig farm management system

Figure 4.36 is an open-ended question to ask farmers what features they would like in a pig farm management system. Most of the farmers want to have a feature of looking up a pig's health and pig feeding schedule.

Table 4.4 Survey Questionnaires for Pig Buyers

Criteria	Questions
Basic Information	Name: _____ E-mail Address: _____ What is your business type? ● Wholesale ● Retail
Pig Demographic Information	How often do you purchase pigs? ● Weekly ● Bi-weekly ● Quarterly ● Annually What is the primary reason for your purchase? ● Breeding ● Meat production ● Re-seller What age of pigs do you typically purchase? ● Weanlings (4-8 weeks old) ● Growers (2-4 months old) ● Market-ready (6 months and older) What is your preferred source for purchasing pigs? ● Local farmers

	• Online platforms • Slaughterhouse How do you evaluate the quality of pigs before purchasing? • Visual inspection • Health certifications • Recommendations from others What factors influence your purchasing decisions? • Price • Health status • Breed type • Seller reputation • Distance to the supplier (how close they are to you) What is your average price range for purchasing pigs? • Below $100 • $100 - $200 • $200 - $300 • Above $300
Feedback and Suggestions	How satisfied are you with your current suppliers? (1-5 scale)  What challenges do you face when purchasing pigs? _____ What improvements would you like to see in the buying process? _____ What additional services or products would you find valuable from pig suppliers? _____ Do you have any other suggestions? _____

Table 4.4 This questionnaire is tailored to understand the needs, preferences, and challenges faced by pig buyers, helping PigConnect create a system that bridges the gap between

buyers and suppliers more effectively. The questions are designed to gather comprehensive insights into the buyer's business type, purchasing habits, and decision-making factors. The "Basic Information" section helps us get to know the buyer's business type—whether they're wholesale or retail. The "Pig Demographic Information" digs deeper into purchasing habits, like how often buyers make purchases, what age or type of pigs they prefer, and why they're buying (breeding, meat production, or resale). It also asks about how buyers assess quality and what matters most to them—like price, health, or seller reputation. Lastly, the feedback section gives buyers a chance to share their challenges and what they'd like to see improved, like better buying options or additional services.

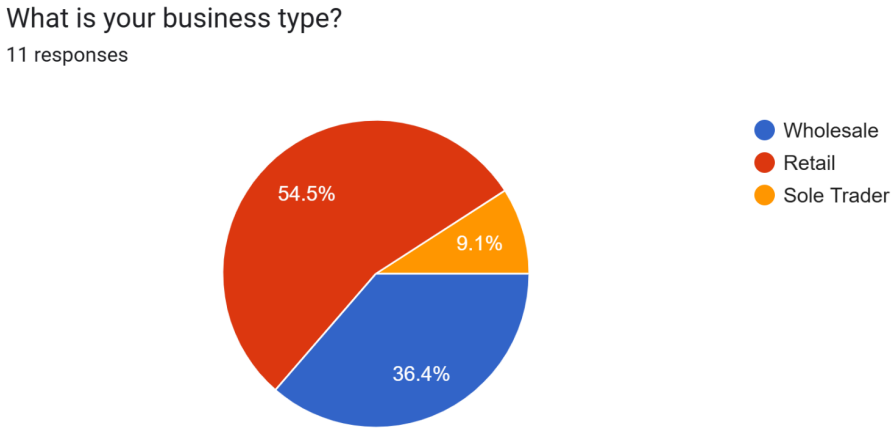


Figure 4.37 What is your business type

Figure 4.37 what their business type is and 54.5% answered that they do retail business for pigs. 36.4% do wholesale and 9.1% are sole traders. This shows that the majority of our respondents have retail as their preferred business type when it comes to pig farms.

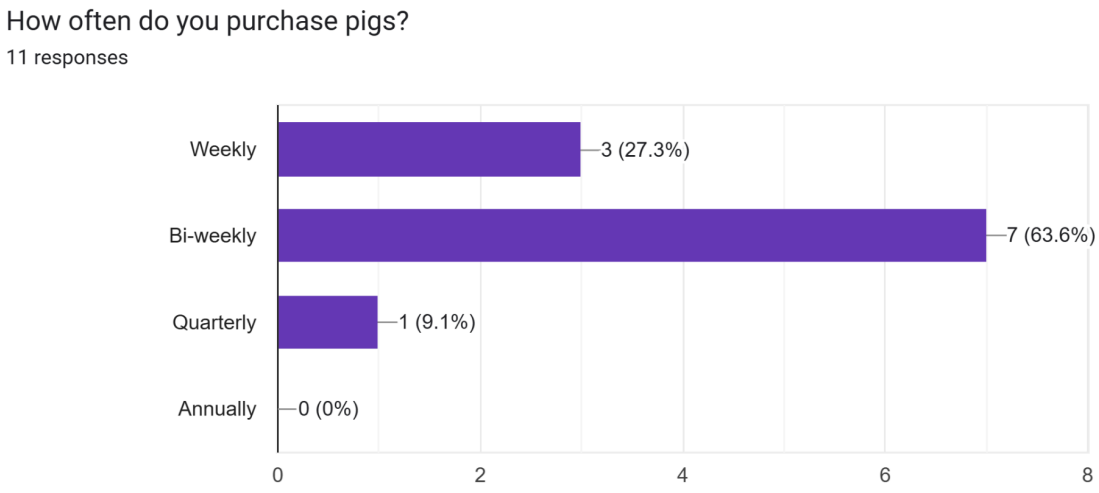


Figure 4.38 How often do you purchase pigs

Figure 4.38 The researchers asked the respondents how often they purchase pigs from pig farmers. The majority of the respondents or 63.6% answered that they purchase pigs bi-weekly, 27.3% answered weekly and 9.1% buy pigs on a quarterly basis.

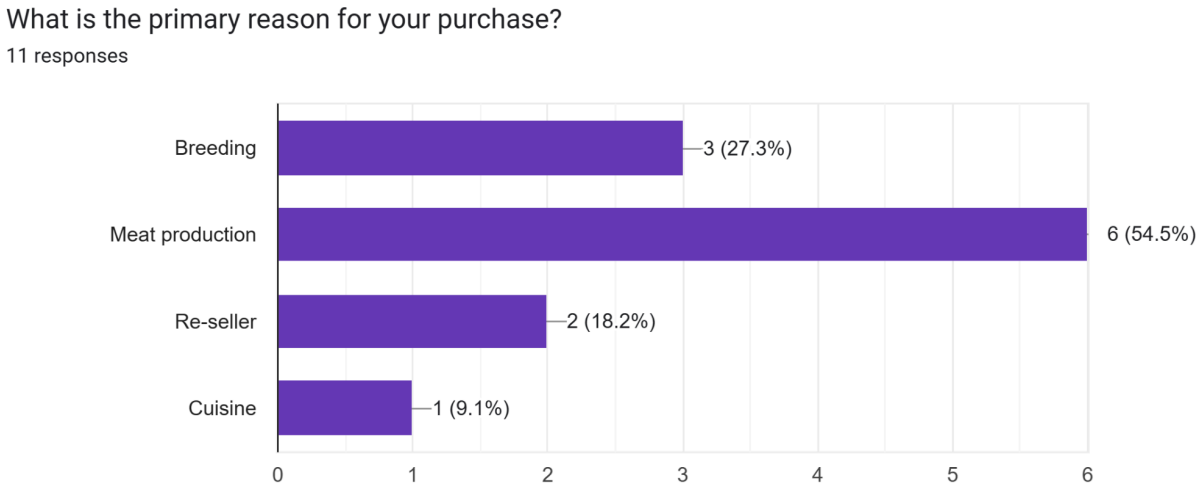


Figure 4.39 What is the primary reason for your purchase

Figure 4.39 54.5% of the respondents answered that their primary reason for buying pigs from pig farms is for meat production. 27.3% of the respondents answered for breeding purposes, 18.2% re-sell the pigs they purchase, and 9.1% are for cuisine.

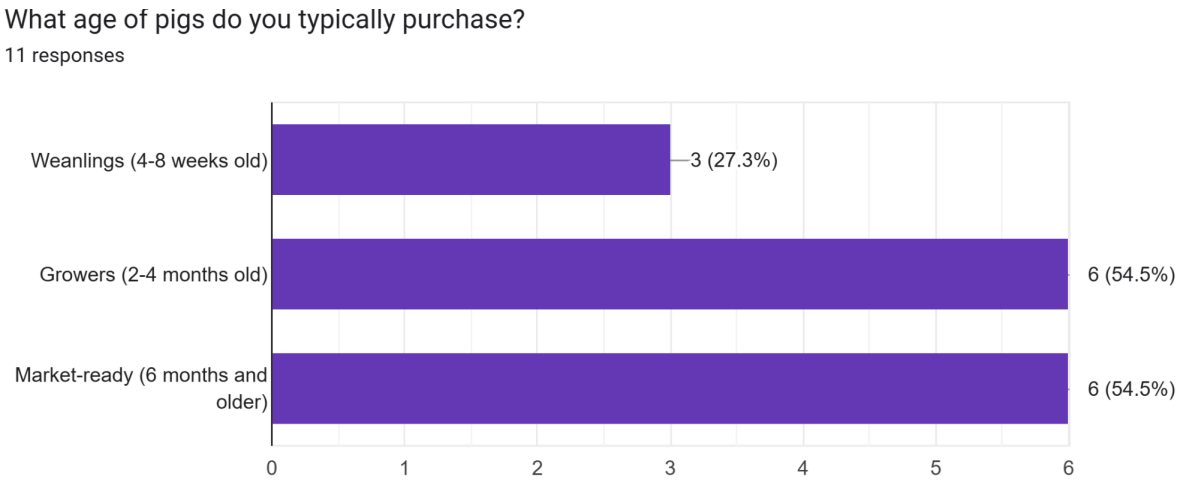


Figure 4.40 What age of pigs do you typically purchase

Figure 4.40 The researchers asked the respondents at what age of pigs they typically purchase, 54.5% answered 8 months and older which is the typical age for market-ready pigs. Another 54.5% answered at least 2-4 months old which is still growing. Lastly, 27.3% answered that they purchase pigs when they are at least 4-8 weeks old in which case they are the ones that take care of these pigs until they are mature enough to be market-ready.

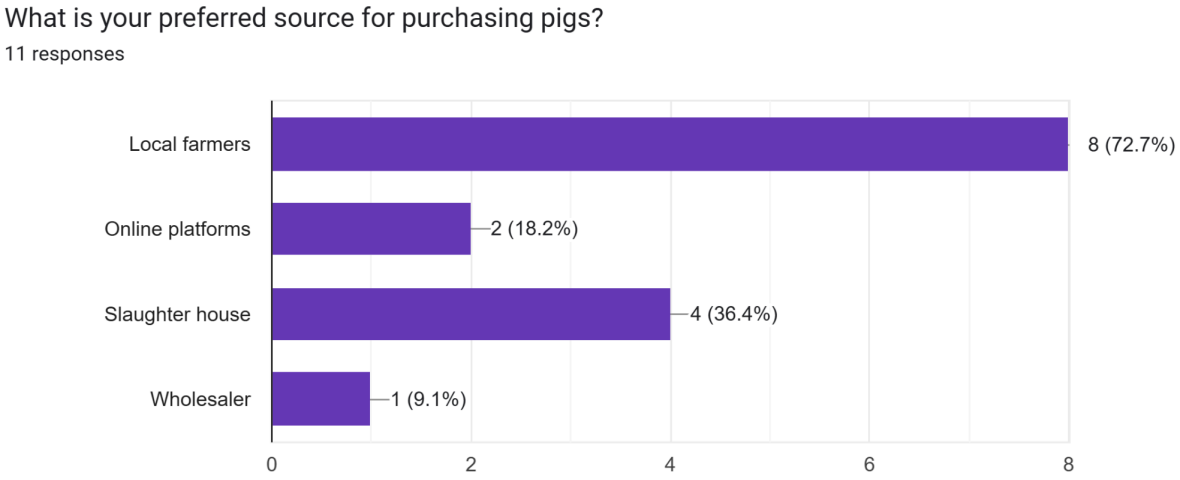


Figure 4.41 What is your preferred source for purchasing pigs

Figure 4.41 is a line chart showing a buyer's preferred source for buying pigs. 72.7% of respondents chose to buy from local farmers, 36.4% chose the slaughterhouse, 18.2% on online platforms, and 9.1% picked wholesalers.

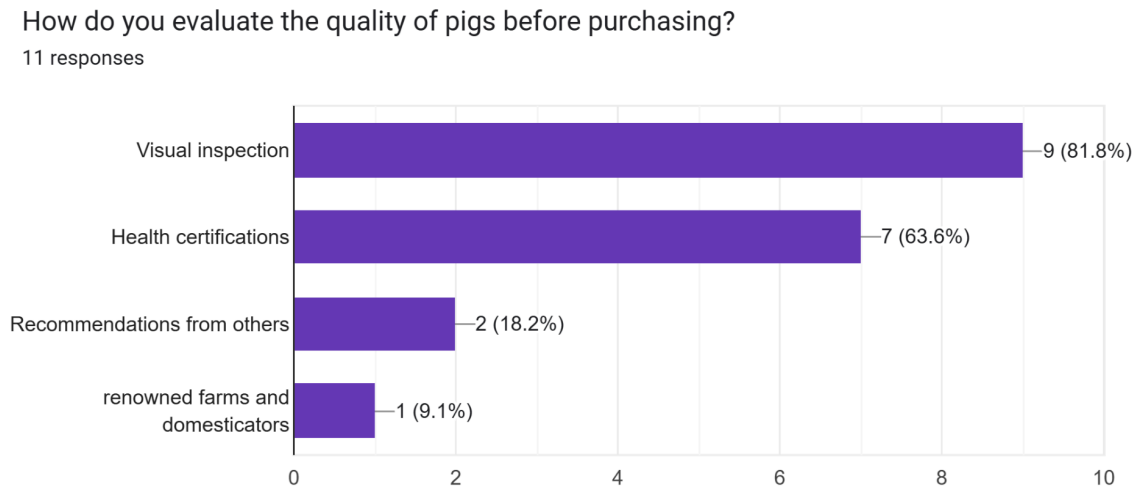


Figure 4.42 How do you evaluate the quality of pigs before purchasing

Figure 4.42 The respondents were asked how they evaluate the quality of pigs before purchasing. 81.8% of the total respondents answered that they evaluate the quality of pigs through visual inspection. 63.6 base their purchases on health certificates. 18.2% value the recommendations of others while 9.1% base their purchases on renowned farms and domesticators.

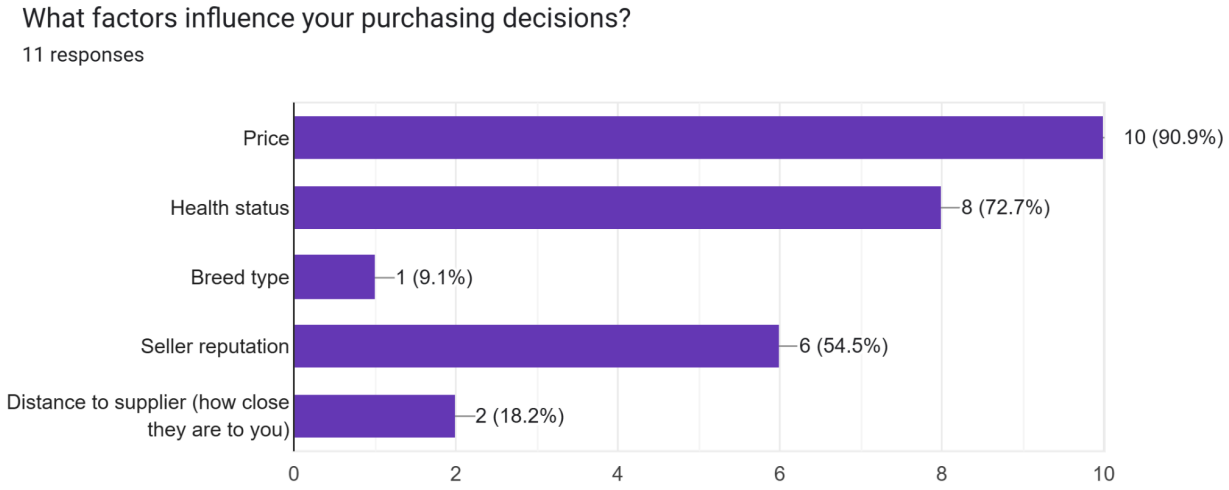


Figure 4.43 What factors influence your purchasing decisions

Figure 4.43 shows what influences buyers to buy pigs. 90.9% is due to the price, 72.7% is for their health, 54.5% because of a seller's reputation, 18.2% because it is nearby to them, and 9.1% for a pig's breed.

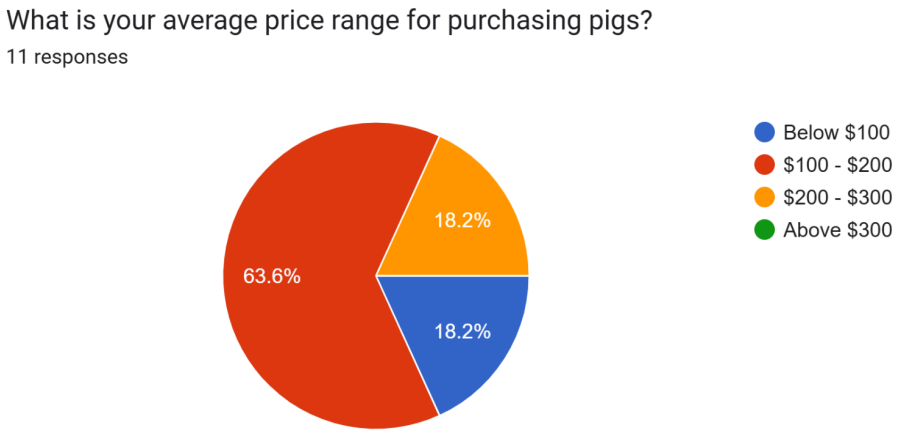


Figure 4.44 What is your average price range for purchasing pigs

In Figure 4.44 we asked the respondents on their preferred price range when purchasing pigs. 63.6% answered at least $100 to $200 (5,866.85 to 11,733.70 in PHP peso based on the current exchange rate of USD and PHP) 18.2% answered between $200 to $300 (11,733.70 to 17,600.55 in PHP peso based on the current exchange rate of USD and PHP). While 18.2% answered below $100 (PHP 5,866.85 and below).

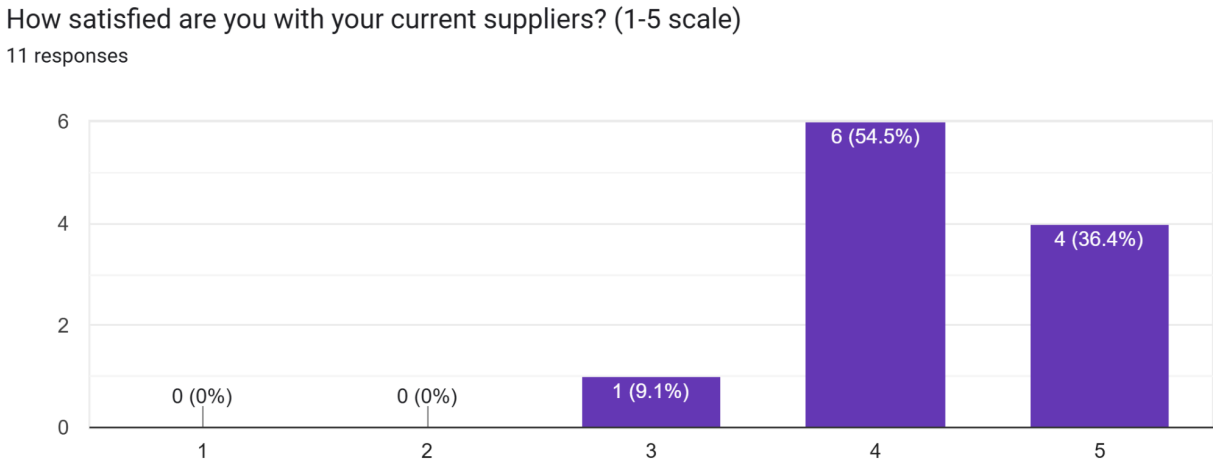


Figure 4.45 How satisfied are you with your current supplier

Figure 4.45 The respondents were asked how satisfied they were with their current suppliers. 54.5% were satisfied with their current suppliers, 36.4$ were very satisfied and 9.1% felt normal with their current suppliers.

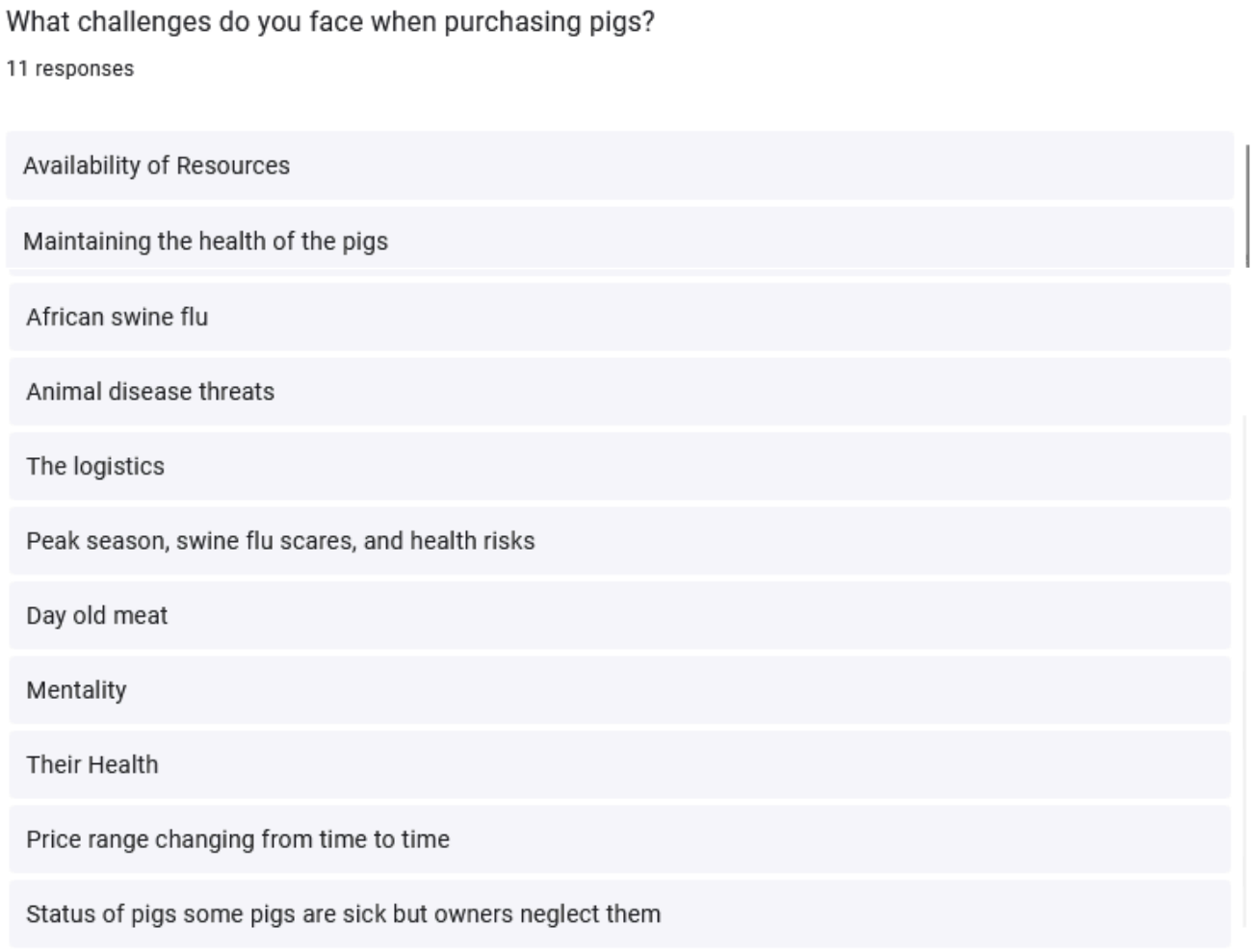


Figure 4.46 What Challenges do you face when purchasing pigs

Figure 4.46 shows answers that buyers have trouble with in purchasing pigs. The majority are pointing out the health of the pigs and their diseases. Some due to the price and some due to the availability of resources.

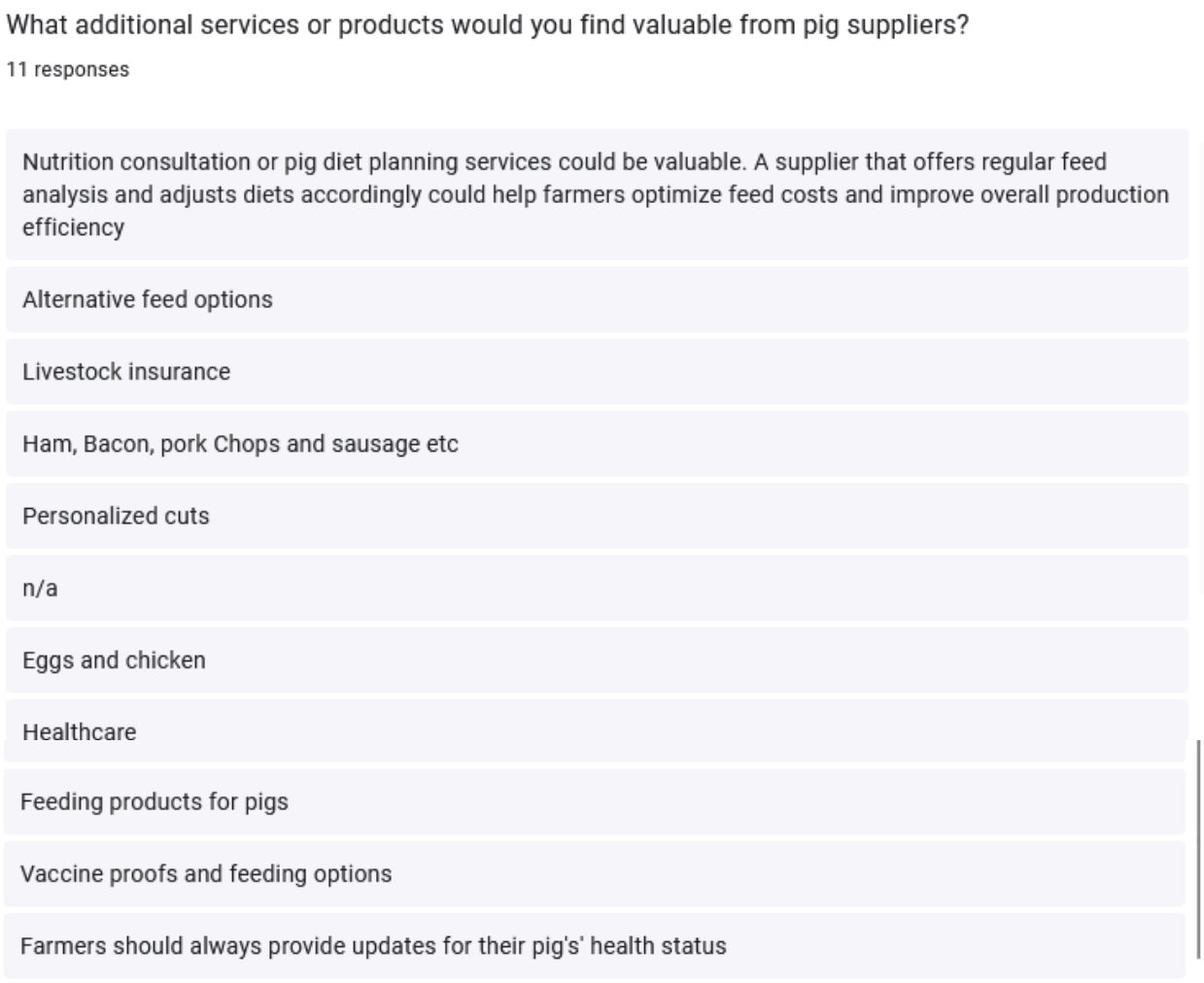


Figure 4.47 What additional services or products would you find valuable from pig suppliers

Figure 4.47 is an open-ended question on what buyers would like to have more from pig suppliers. Some are asking for vaccination proofs and knowing the health status of pigs.

Figure 4.48 Do you have any suggestions for purchasing pigs

Figure 4.48 All of the respondents do not have any suggestions with regard to the current market and the purchasing of pigs.

Table 4.5 User Acceptance Testing Summary

Module	Acceptance Requirement	Test Output		Result
		Passed	Failed	
User Authentication and Profile Management	Users can successfully register, log in, and update their profiles. Passwords and sensitive data are securely encrypted..	✔		Completed
Farmer Management Interface	Farmers can easily input, and update pig records	✔		Completed
The Pig Inventory and Health Management	System allows for tracking pig weight, feeding schedules, and vaccination records.	✔		Completed
Analytics Dashboard	Provides real-time farm analytics, including financial and pig performance data.	✔		Completed
Buyer Interface	Buyers can browse available pigs and view necessary information (age, weight, farm details).	✔		Completed
Geolocation Services	System provides accurate locations of farms for buyers and suppliers.	✔		Completed
Communication Platform	Messaging system enables real-time communication between farmers and buyers.	✔		Completed

Feedback and Rating System	Buyers can rate and leave feedback for sellers.	✔		Completed
Notification System	Email alerts are sent for key actions (e.g., feeding schedules, new buyer inquiries).	✔		Completed

Table 4.5 User Acceptance Testing

Table 4.5 shows all the modules of the system and their acceptance requirements.

Table 4.6 System Evaluation Survey Summary

5 - 4.51 Highly Acceptable
4.50 - 4.01 Acceptable
4 - 3.51 Moderately Acceptable
3 - 2.51 Fairly Acceptable
2.50 - 1 Not Acceptable

Performance Criterion	Mean (Respondents)	Standard Deviation	Interpretation
Functional Suitability	4.12	0.74	Acceptable
Performance Efficiency	4.36	0.50	Acceptable
Interaction Capability	4.16	0.63	Acceptable
Reliability	3.88	0.72	Moderately Acceptable
Security	3.82	1.05	Moderately Acceptable
Maintainability	3.71	0.99	Moderately Acceptable

Table 4.6 System Evaluation Survey Summary

Table 4.6 presents a System Evaluation Survey Summary, highlighting key performance criteria such as Functional Suitability, Performance Efficiency, Interaction Capability, Reliability, Security, and Maintainability. The mean scores indicate that most aspects, like Performance Efficiency and Interaction Capability, are rated as "Acceptable," reflecting general user satisfaction. However, criteria like Security, Reliability, and Maintainability are rated as "Moderately Acceptable," suggesting that while the system performs adequately, there are areas for improvement. The standard deviation values show a relatively consistent response from users across the criteria. This summary provides valuable insights into both the strengths and areas for enhancement in the system.

4.3 FINDINGS AND DISCUSSION

This section provides an overview of the findings and analysis gathered through the evaluation of PigConnect, focusing on how the application aligns with its core objectives and the specific needs of its target users—pig farmers and buyers. The evaluation highlights the system's strengths in improving farm management processes, such as tracking pig inventory and health records, enhancing buyer-seller communication, and offering AI-powered recommendations. By addressing critical challenges like record-keeping, health management, and marketing, PigConnect demonstrates its potential to streamline operations and foster more efficient and informed decision-making for both farmers and buyers. The usability of the system, combined with its real-time geolocation services and analytics dashboard, underscores its role in modernizing pig farming practices and ensuring a seamless experience for its users.

4.3.1 Major Findings 1

The target users, pig farmers and buyers, found the functionality of PigConnect highly effective in managing farm operations and facilitating buyer-seller interactions. Features such as pig inventory tracking, health management, and AI-driven recommendations proved to be valuable in addressing common challenges like record-keeping, marketing, and monitoring pig health. The system’s ability to provide real-time geolocation updates and personalized insights significantly enhances decision-making processes for both farmers and buyers, aligning well with their operational needs.

4.3.2 Major Findings 2

Farmers and buyers found the system intuitive and easy to navigate, allowing them to complete necessary tasks such as updating records for pigs, managing schedules and reviewing analytics with minimal training and support needed. The users who were not very into tech did have a bit of a learning curve, especially with the initial onboarding. Providing additional support or simplified onboarding tools would ensure that these users adopt the service in a way that is less disruptive to their experience as well as make the application even more approachable to a wider audience.

4.4 CONTRIBUTIONS

Contributions to Pig Farmers

PigConnect is designed to make life easier for pig farmers by providing simple yet effective tools to manage their farms. With features like inventory tracking and health monitoring, it helps farmers stay on top of their pigs' growth, health, and breeding schedules. This not only reduces the stress of farm management but also makes daily operations smoother and more productive. The system also simplifies the buying and selling process by improving communication between farmers, and customers. Plus, with data-driven insights and AI recommendations, farmers can make smarter choices about pricing, feeding, and breeding, leading to better farm performance and increased profits.

Contributions to Pig Buyers

PigConnect offers a clear and efficient way to find and purchase pigs. Buyers can get detailed information about the pigs they are interested in, such as health status, breed type, and age, which helps them make better purchasing decisions. The system also helps buyers track when pigs are available for sale, making the buying process faster and more reliable. With the added transparency of a feedback system, buyers can feel confident in their purchases, knowing they're working with reputable farmers.

Contributions to Technology and Innovation

Developers have the ability to analyze user feedback and performance data by analyzing. They can identify the areas of improvement and accordingly add the features by keeping in mind the target audience which is farmers, buyers, and other stakeholders in agriculture. This ongoing improvement ensures that the system remains up-to-date and useful as the agriculture sector evolves, while also providing developers with an opportunity to innovate and shape the future of technology.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The analysis of the Pig Management System yielded several significant findings related to the operations, efficiency, and challenges faced by pig farms. The system's primary focus is on tracking and managing the health, breeding, growth, and feeding of pigs, with the goal of enhancing overall productivity and ensuring the well-being of the animals.

5.2 CONCLUSIONS

The development of PigConnect has demonstrated significant potential in improving the efficiency and management of pig farming operations. By integrating technology into key areas such as animal tracking, health monitoring, breeding management, and record-keeping, the system has streamlined operations, reduced manual errors, and enabled farmers to make more informed, data-driven decisions.

5.3 RECOMMENDATIONS

The following recommendations emphasize the aim to address the limitations and expand the functionalities identified during the development of the system:

- Implement a comprehensive pig identification system, such as RFID or ear tags, to enhance traceability, health monitoring, and breeding management. This system would allow farmers to track individual pigs, monitor their health and growth patterns, and ensure the optimization of breeding schedules, ultimately improving farm productivity and minimizing losses.

- Incorporate SMS notification system instead of email notification to enhance real-time communication and alert capabilities within PigConnect. By delivering timely information directly to SMS, the system ensures prompt action on critical tasks, improving overall farm efficiency and reducing potential risks.

References:

Philippine Statistics Authority. (2020). *Agricultural Indicators System: Swine Industry*.

Food and Agriculture Organization of the United Nations. (2019). *FAO Statistical Yearbook*. Rome: FAO.

Bautista, O. K. (2019). *Piggery Production and Management in the Philippines*. Manila: University of the Philippines Press.

Salazar, C., & Rola, A. (2019). Adoption of Technology in Small-Scale Pig Farming. *Philippine Journal of Agricultural Economics, 34*(2), 85-98.

Caballero-Anthony, M., & Lee, Y. (2021). Challenges in the Philippines Swine Industry. *Journal of Agriculture and Food Information, 16*(1), 19-32.

World Bank. (2020). *Transforming Philippine Agriculture: Policies and Investments*. Washington, D.C.: World Bank Publications.

National Economic and Development Authority. (2021). *Philippine Development Plan 2017-2022*.

Feng, Q., & Qian, S. (2019). Research on management of pig farms. In *2019 3rd International Conference on Data Science and Business Analytics (ICDSBA)* (pp. 57-60). Istanbul, Turkey.

Trujillo-Diaz, J., Diaz-Piraquive, F. N., Herrera, M. M., Gomez, J., Rodriguez, J. A., & Sarmiento, H. R. (2019). Design of theoretical dimensions for a knowledge management model applied to the Colombian Swine Industry. In *2019 Congreso Internacional de Innovación y Tendencias en Ingenieria (CONIITI)* (pp. 1-6). Bogota, Colombia.

Razzak, M.A. "An Empirical Study on Lean and Agile Methods in Global Software Development." In *2016 IEEE 11th International Conference on Global Software Engineering Workshops (ICGSEW)*, pp. 61-64, 2016.

Carole, K. S., Theodore Armand, T. P., & Kim, H. C. (2024). Enhanced experiences: Benefits of AI-powered recommendation systems. In *2024 26th International Conference on Advanced Communications Technology (ICACT)* (pp. 216-220). PyeongChang, Korea, Republic of. 918Cha, N., Cho, H., Lee, S., & Hwang, J. (2019). Effect of AI recommendation system on the consumer preference structure in e-commerce: Based on two types of preference. In *2019 21st International Conference on Advanced Communication Technology (ICACT)* (pp. 77-80). PyeongChang, Korea (South).

Fidan, H., Teneva, A., Stankov, S., & Dimitrova, E. (2018). Consumers' behavior of restaurant selection. In *2018 International Conference on High Technology for Sustainable Development (HiTech)* (pp. 1-3). Sofia, Bulgaria.

Ujakpa, M. M., Kamati, E., Ngola, S. T. G. A., Sheepo, T. A., & Ilonga, J. (2022). The development of a livestock farm management information system (LFMIS). In *2022 IST-Africa Conference (IST-Africa)* (pp. 1-11). Ireland.

Joseph, A. M., Jali, N., Robert Jupit, A. J., & Khartini Jali, S. (2021). eMarket for local farmers. In *2021 IEEE 19th Student Conference on Research and Development (SCOReD)* (pp. 30-35). Kota Kinabalu, Malaysia.

Saha, J. (2023). A Survey on Artificial Intelligence (AI) based Job Recommendation Systems.

Goehr, L. (2022). An Intelligent Recommendation System Using Market Segmentation. In Smart Innovation, Systems and Technologies.

Stępień, S., Smędzik-Ambroży, K., Guth, M., Muntean, A., Ștefania, S., Maican, S., & Pastiu, C. A. (2022). The importance and determinants of market integration of small family farms in selected countries of Central and Eastern Europe.

Ernesto, M., & Pernia, A. (1983). Small-scale industry promotion: Economic and social impact analysis. *Research Papers in Economics*.

Aditya, K., Shastry, H. A., & Sanjay, A. (2020). Data analysis and prediction using big data analytics in agriculture. *doi: 10.1007/978-981-15-0663-5_10*

Zhang, J., & Cheng, J. (2024). Design of Personalized Recommendation System for E-commerce Based on Artificial Intelligence. In 2024 IEEE 7th Eurasian Conference on Educational Innovation (ECEI) (pp. 152-155). Bangkok, Thailand. IEEE.

Cha, N., Cho, H., Lee, S., & Hwang, J. (2019). Effect of AI Recommendation System on the Consumer Preference Structure in e-Commerce: Based on Two types of Preference. In 2019 21st International Conference on Advanced Communication Technology (ICACT) (pp. 77-80). PyeongChang, Korea (South). IEEE.

Li, L., & Wei, X. (2009). Study on the Supply Chain Management of Agriculture Product under E-Commerce Environment. In 2009 Second International Conference on Intelligent Computation Technology and Automation (pp. 333-337). Changsha, China. IEEE.

Zhang, Y., & Lu, Y. (2018). Research on the Problems and Strategies of Rural E-Commerce in the Age of Internet + Agriculture. In 2018 14th International Conference on Semantics, Knowledge and Grids (SKG) (pp. 257-260). Guangzhou, China. IEEE.

Carole, K. S., Theodore Armand, T. P., & Kim, H. C. (2024). Enhanced Experiences: Benefits of AI-Powered Recommendation Systems. In 2024 26th International Conference on Advanced Communications Technology (ICACT) (pp. 216-220). PyeongChang, Korea, Republic of. IEEE.

Liu, Y., & Tong, S. (2022). Research on Personalized Tourism Intelligent Recommendation System Based On Data Analysis Algorithm. In 2022 International Conference on Artificial Intelligence of Things and Crowdsensing (AIoTCs) (pp. 504-508). Nicosia, Cyprus. IEEE.

Apichottanakul, A., Goto, M., Piewthongngam, K., Pathumnakul, S., & Ramirez, F. J. (2021). Customer behaviour analysis based on buying-data sparsity for multi-category products in the pork industry: A hybrid approach. Cogent Engineering, 8(1).

Fu, S., Ma, R., He, G., Chen, Z., & Liu, H. (2023). A study on the influence of product environmental information transparency on online consumers' purchasing behavior of green agricultural products. Frontiers in Psychology, 14.

Stampa, E., Schipmann-Schwarze, C., & Hamm, U. (2020). Consumer perceptions, preferences, and behavior regarding pasture-raised livestock products: A review. Food Quality and Preference, 82, 103872. https://doi.org/10.1016/j.foodqual.2020.103872

Aoki, K. (2020). Consumer Behavior for Information on Food Products. In T. Shimmura, T. Nonaka, & S. Kunieda (Eds.), Service Engineering for Gastronomic Sciences (pp. 161-172). Springer.

Kasihma, T., Matsumoto, S., & Hasuike, T. (2019). A Practical Study on the Information Sharing System for Producers. In S. Yamamoto & H. Mori (Eds.), Human Interface and the Management of Information. Visual Information and Knowledge Management. HCII 2019 (Vol. 11569, pp. 408-421). Springer.

Foti, V. T., & Timpanaro, G. (2021). Relationships, sustainability and agri-food purchasing behaviour in farmer markets in Italy. British Food Journal, 123(13), 428-453.

Lazaroiu, G., Andronie, M., Uţă, C., & Hurloiu, I. (2019). Trust Management in Organic Agriculture: Sustainable Consumption Behavior, Environmentally Conscious Purchase Intention, and Healthy Food Choices. Frontiers in Public Health, 7, 340.

Sarwar, B., Karypis, G., Konstan, J., & Riedl, J. (2001). Item-based collaborative filtering recommendation algorithms. In Proceedings of the 10th International Conference on World Wide Web (WWW '01) (pp. 285-295). Association for Computing Machinery.

Liu, H. (2022). Implementation and Effectiveness Evaluation of Four Common Algorithms of Recommendation Systems - User Collaboration Filter, Item-based Collaborative Filtering, Matrix Factorization and Neural Collaborative Filtering. In 2022 International Conference on Cloud Computing, Big Data Applications and Software Engineering (CBASE) (pp. 224-227). Suzhou, China. IEEE.

Xu, X., & Chen, C. (2019). Integrated application of standardization technology and e-commerce in livestock and poultry safe production - take pig as an example. In 2019 2nd International Conference on Safety Produce Informatization (IICSPI) (pp. 496-499). Chongqing, China. IEEE.

Cordano, H. Z., Caballero, A. R., & Paraiso, C. M. (2022). DEMETER Online MarketPlace With Data Analytics for Agricultural Products Using Dynamic Programming Algorithm. In 2022 7th International Conference on Business and Industrial Research (ICBIR) (pp. 538-543). Bangkok, Thailand. IEEE.

S. Reddivari, "Visual analytics for software requirements engineering," 2013 21st IEEE International Requirements Engineering Conference (RE), Rio de Janeiro, Brazil, 2013, pp. 389-392,

M. S. Rahman and H. Reza, "A Systematic Review Towards Big Data Analytics in Social Media," in Big Data Mining and Analytics, vol. 5, no. 3, pp. 228-244, September 2022.

APPENDICES

Appendix A - Consent Form

Technological Institute of the Philippines - Manila
College of Computer Studies

FROM: **LOGDAT, RANDEL B.; GRATELA, CHARLES G.; IBASCO, ANGELO JOAQUIN S.; RETURAN, RONN VIRGIL V.**

FOR: **ARNEL S. RIEZA**

SUBJECT: **LETTER OF INTENT FOR CAPSTONE 1 PROJECT**

Good day,

We are pleased to introduce PigConnect, an innovative platform designed to support and enhance the operations of small-scale pig farmers in Rizal province, CALABARZON. As the agricultural sector in the Philippines continues to evolve, it is crucial to provide small-scale farmers with the tools and technologies necessary to remain competitive and efficient.

PigConnect is tailored specifically for small market piggeries, addressing the unique challenges they face. Our platform integrates advanced features such as AI-driven buyer recommendations, comprehensive farm management tools, and robust communication systems. Key components of PigConnect include:

- **Inventory Management**: Streamlined processes for tracking and managing livestock and supplies.
- **Health Monitoring**: Efficient tracking and management of pig health and vaccinations.
- **Financial Tracking**: Tools for monitoring expenses and revenues to improve financial oversight.
- **Personalized Recommendations**: AI-driven insights and recommendations to optimize farm operations.
- **Direct Communication**: A platform for farmers and buyers to interact directly, facilitating better market access and relationships.

Our goal is to empower small-scale pig farmers by providing a platform that enhances productivity, improves market transparency, and fosters economic growth. By leveraging modern technologies, PigConnect will help farmers make informed decisions, manage their farms more effectively, and connect with buyers more efficiently.

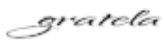
Technological Institute of the Philippines - Manila
College of Computer Studies

We are eager to collaborate with your organization to further refine and implement PigConnect, ensuring it meets the needs of our target users and delivers maximum impact. We believe that together, we can significantly contribute to the advancement of the pig farming industry in the Philippines.

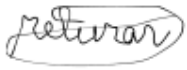
Thank you for considering our proposal. We look forward to the opportunity to discuss this initiative further and explore potential collaboration.

Sincerely,

Randel B. Logdat
3rd-Year, BS IT Student



Charles G. Gratela
3rd-Year, BS IT Student



Ronn Virgil V. Returan
3rd-Year, BS IT Student

Angelo Joaquin S. Ibasco
3rd-Year, BS IT Student

Noted by:

Dr. Bryan G. Dadiz
Adviser, Capstone 1

Dr. Jheanel E. Estrada
Course Instructor, Capstone 1

Technological Institute of the Philippines - Manila
College of Computer Studies

Arnel S. Rieza
Client

Appendix B - List of Revisions

REVISIONS LIST FOR THESIS/CAPSTONE ORAL EXAMINATION

Title:	PigConnect: Web-based Pig Recommendation and Information System
Date/ Time:	December 11, 2024 / 11:00 AM

☐ Thesis ☑ Final Defense ☐ Proposal Defense

LIST OF REVISIONS

DOCUMENTS	SOFTWARE/SYSTEM
Renamed the Title	Including admin module
Making the data diagram modular — Make correct & complete	Populate the dataset
Modified the conceptual framework	Generate reports
Switching to iterative methodology ✓	Changes to the filtering
Changes to the objectives	
Changes to the specific objectives	Move Pig Farms ✓
Process of Data Diagram	
Changes to iteration	Dropdown for pig preference
	Preferences are cleared
	One preference is still submitted
	Automatic location on current area
	Notification for messages
	Push notification for feeding schedule
	Alert for breeding schedule

(Use additional sheet if necessary)

PROPONENT/S (Name and Signature)	PANELIST/S (Name and Signature)
Charles G. Gratela	Dr. Larry A. Vea
Randel B. Logdat	Dr. Jheanel E. Estrada
Angelo Joaquin S. Ibasco	Mr. Dennis Nava

Ronn Virgil V. Returan	

Check Appropriate Box:

- ☐ Approved with no Revision
- ☐ Approved with Revision
- ☑ Approved w/ Major Revision
- ☐ Redefense
- ☐ Not Accepted

Appendix C - Conformity of Revisions

TO BE PRINTED AND SIGNED

Appendix D - System Evaluation Evidence

A. Survey Questionnaire

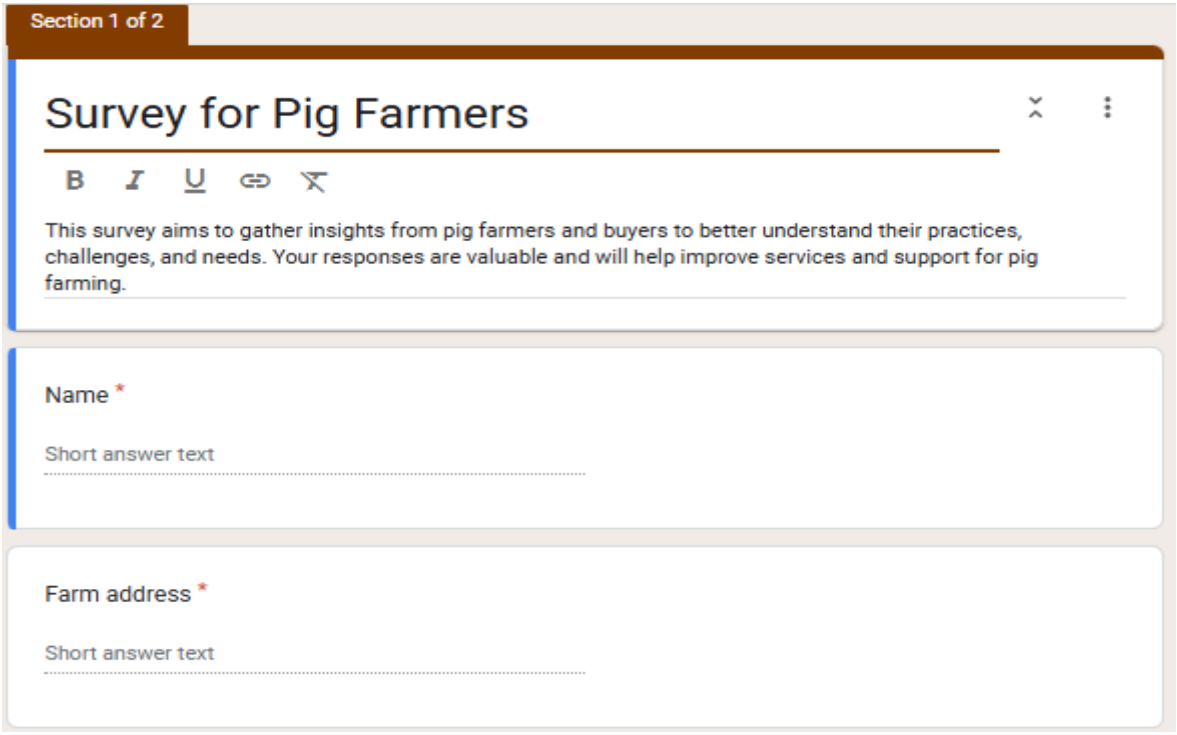


Figure A.1 Farmer Personal Information

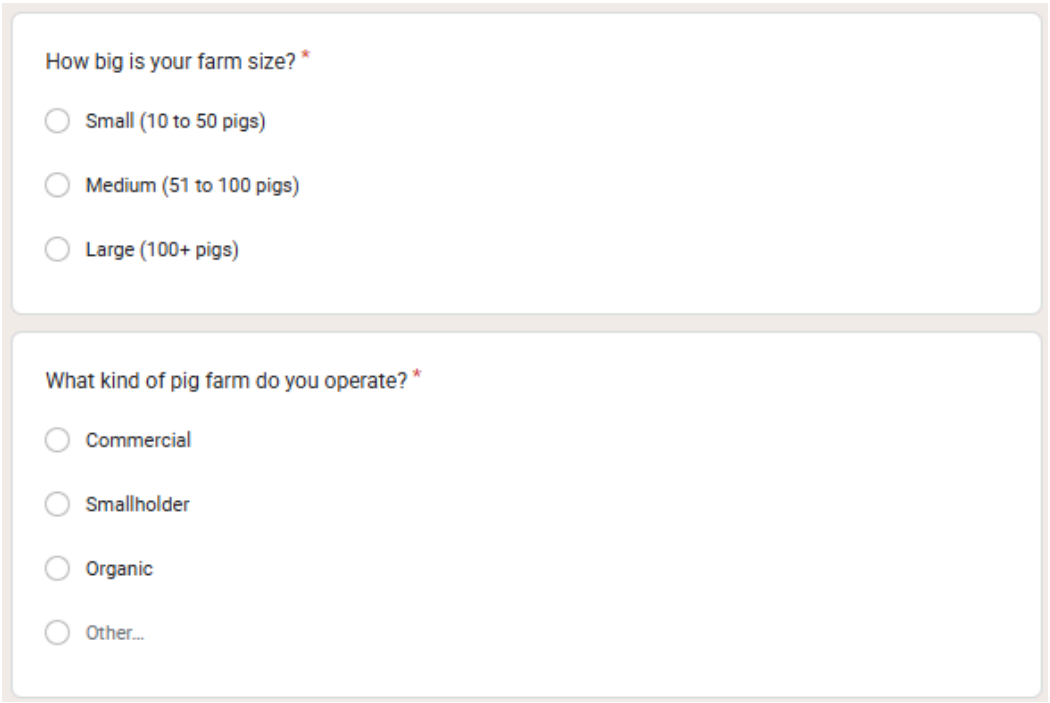


Figure A.2 Size and Operation of Pig Farm

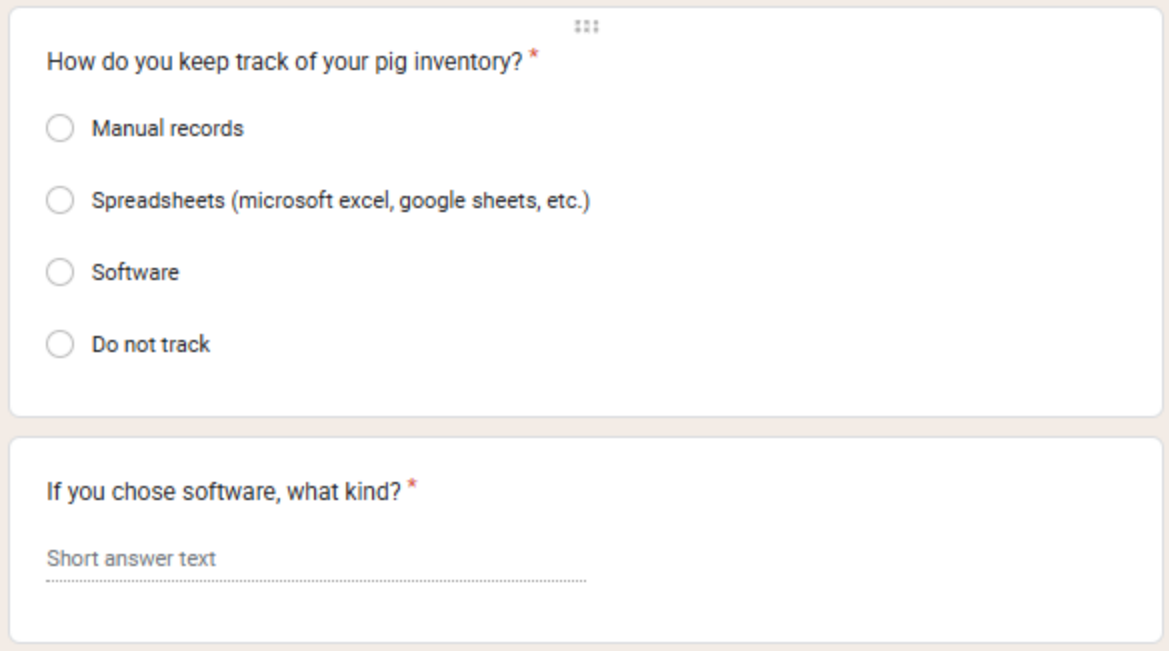


Figure A.3 Method of Tracking Pig Inventory

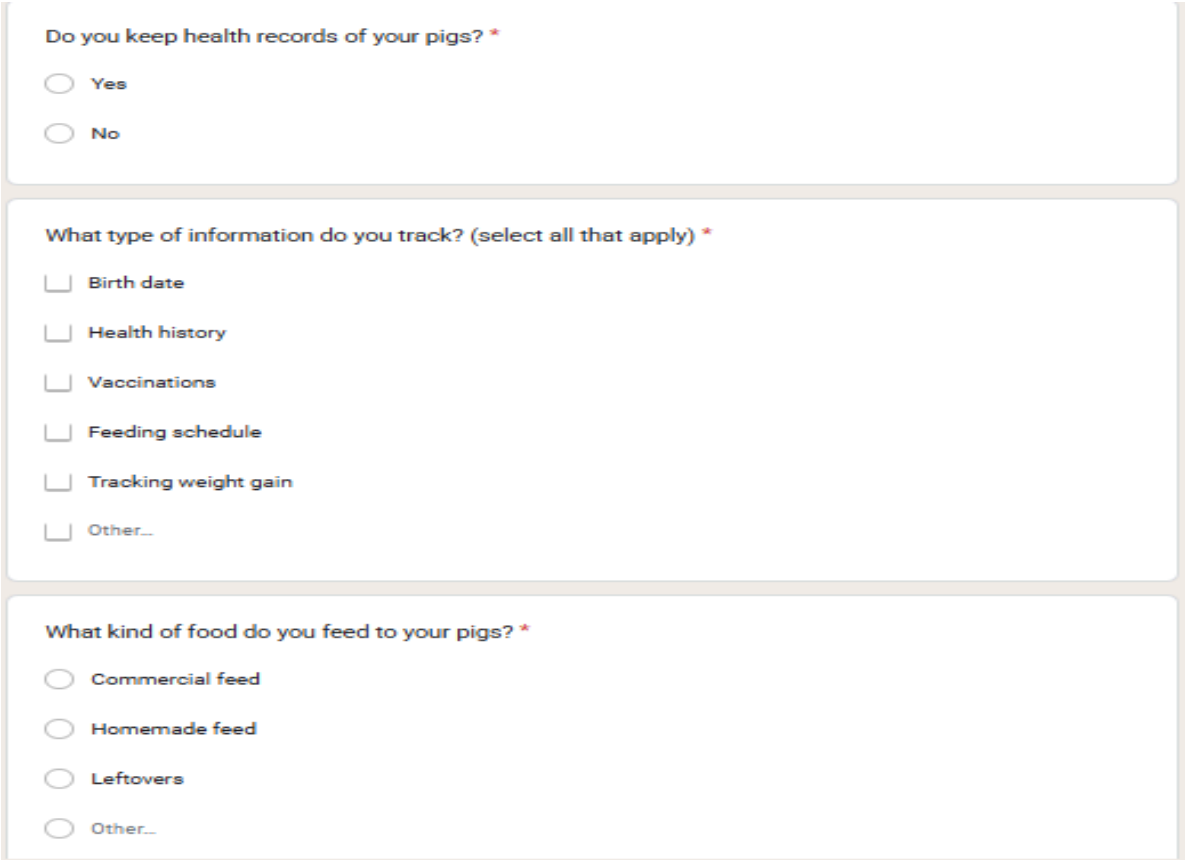


Figure A.4 Recording Data of Pig Health

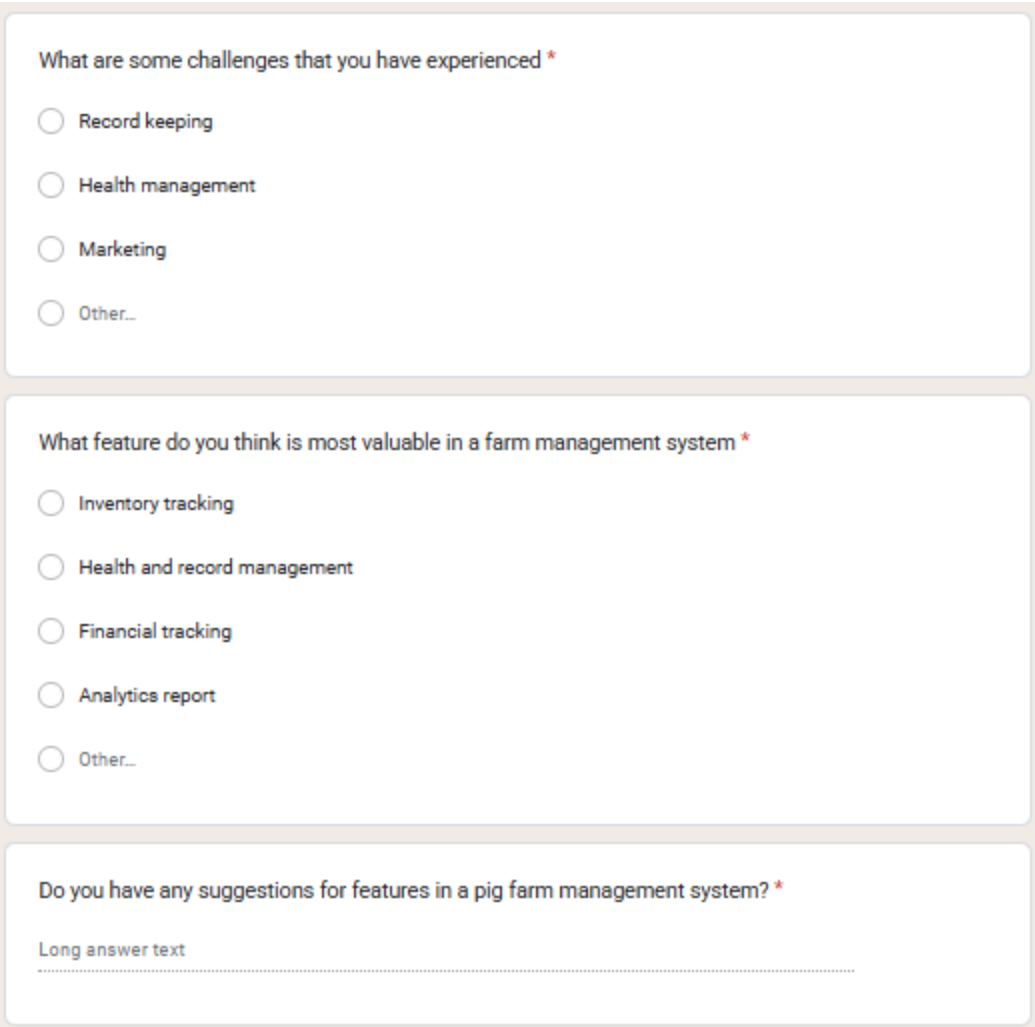


Figure A.5 Challenges that Farmers Encounter in Pig Farming

B. Accomplished Survey Questionnaire

How big is your farm size?

12 responses

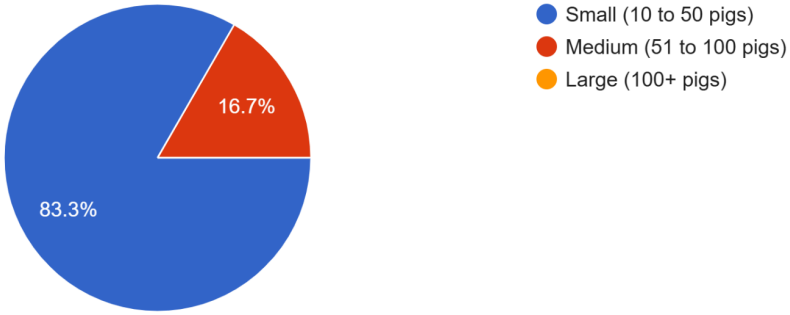


Figure B.1 Farm Size Result

What kind of pig farm do you operate?

12 responses

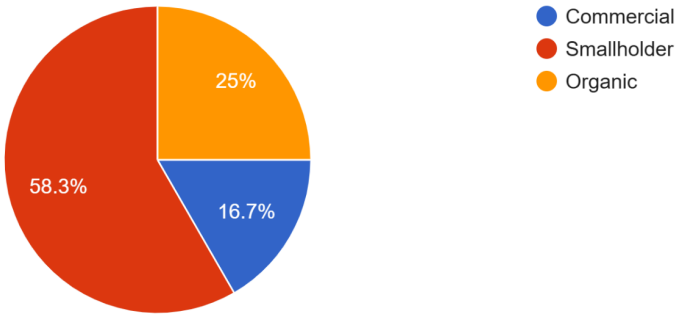


Figure B.2 Pig Farm Operation

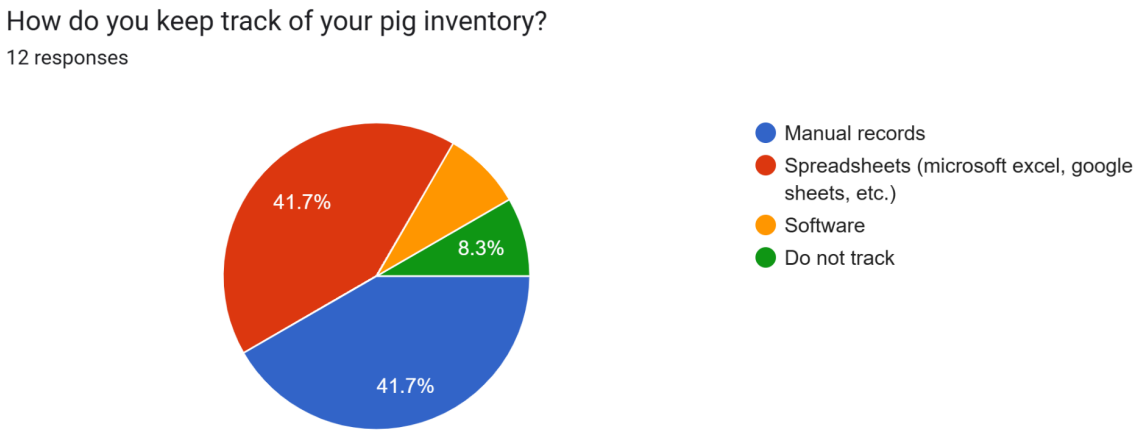


Figure B.3 Pig Inventory Tracking Result

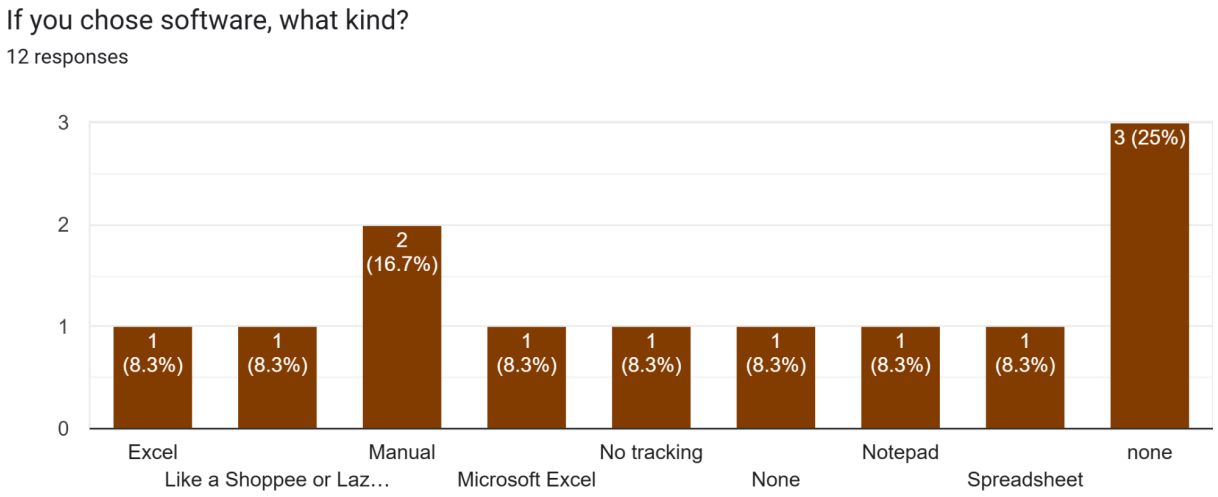


Figure B.4 Software(s) Used in Tracking Pig Inventory

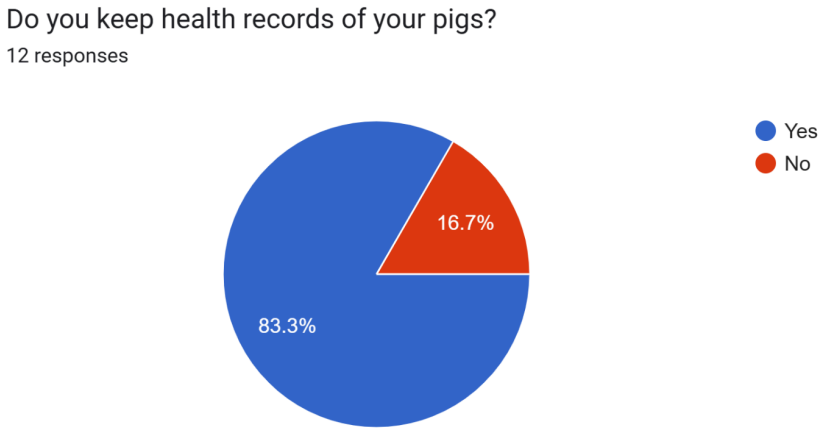


Figure B.5 Tracking Pig Health Result

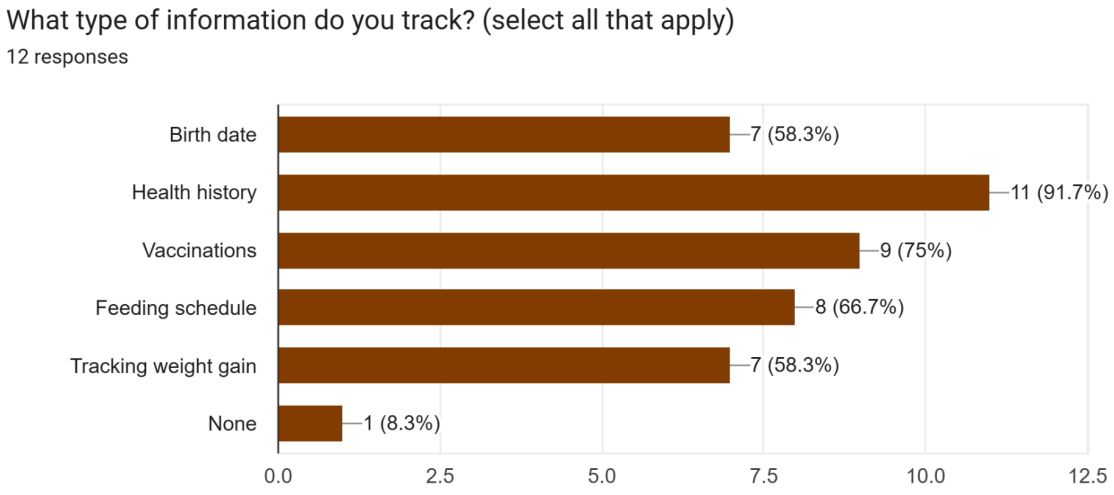


Figure B.6 Type of Information that Pig Farmers Track in Pig Health

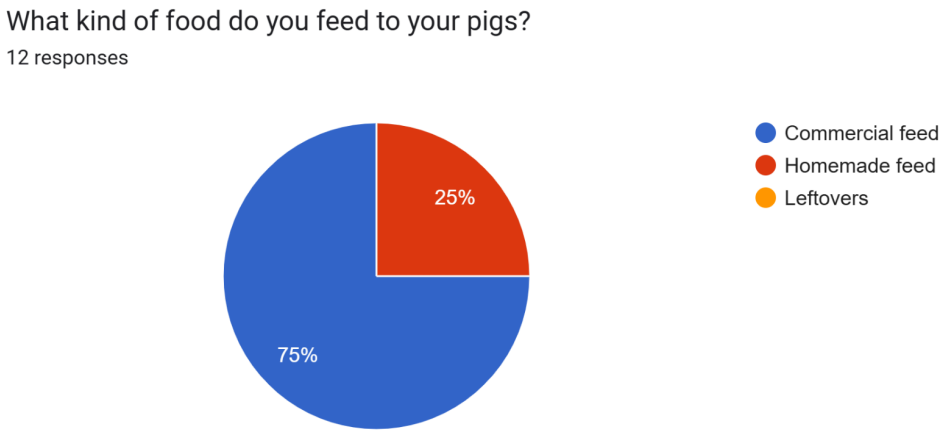


Figure B.7 What Kind of Food Farmers Feed their Pigs

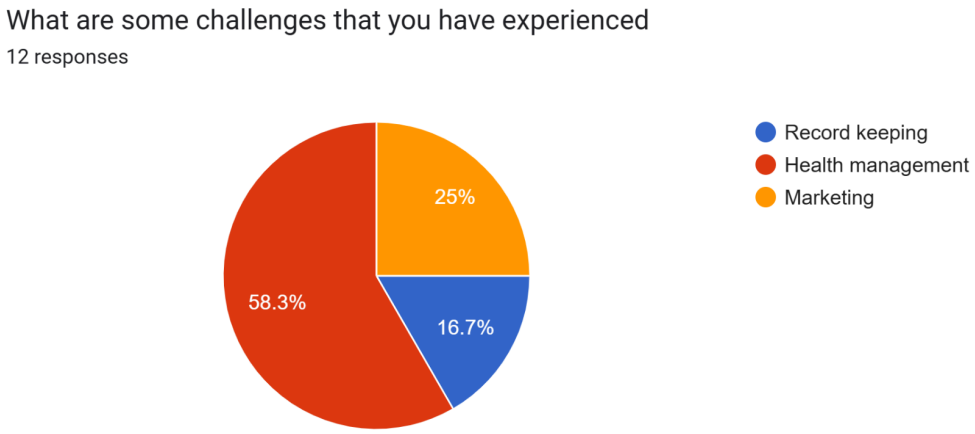


Figure B.8 Challenges that Farmers Experience in Pig Farming

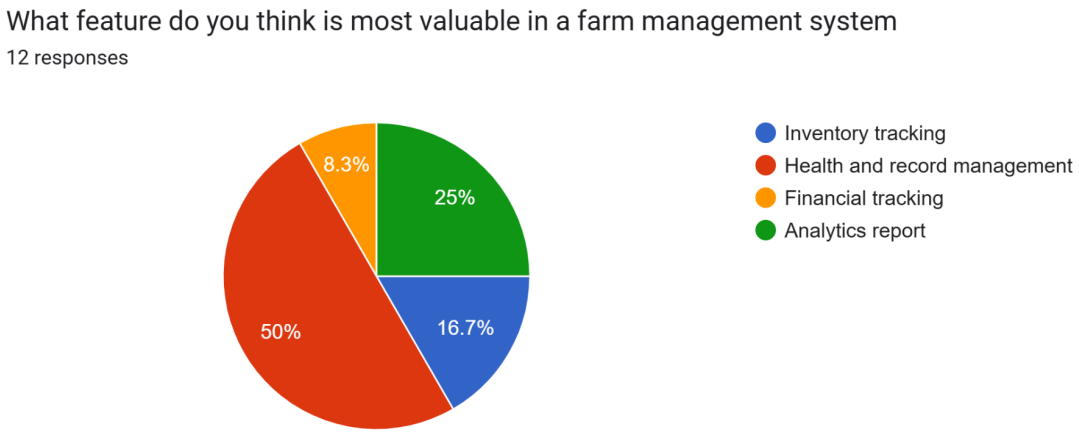


Figure B.9 Result of Features that Farmers Want in a Farm Management System

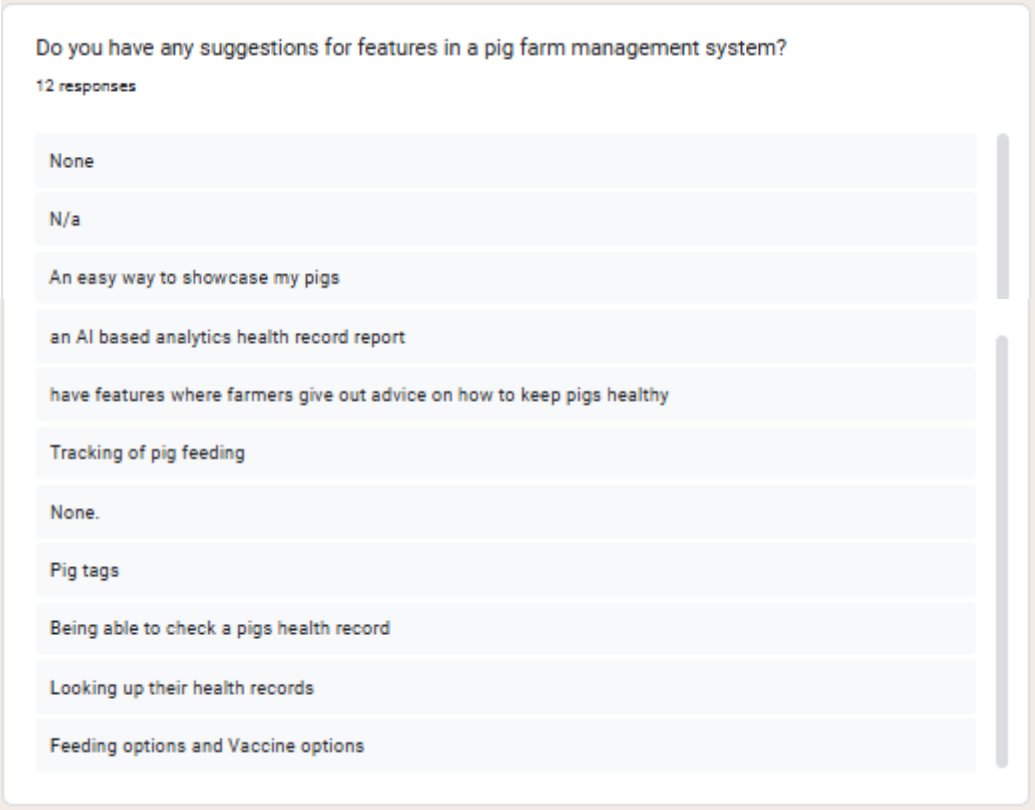
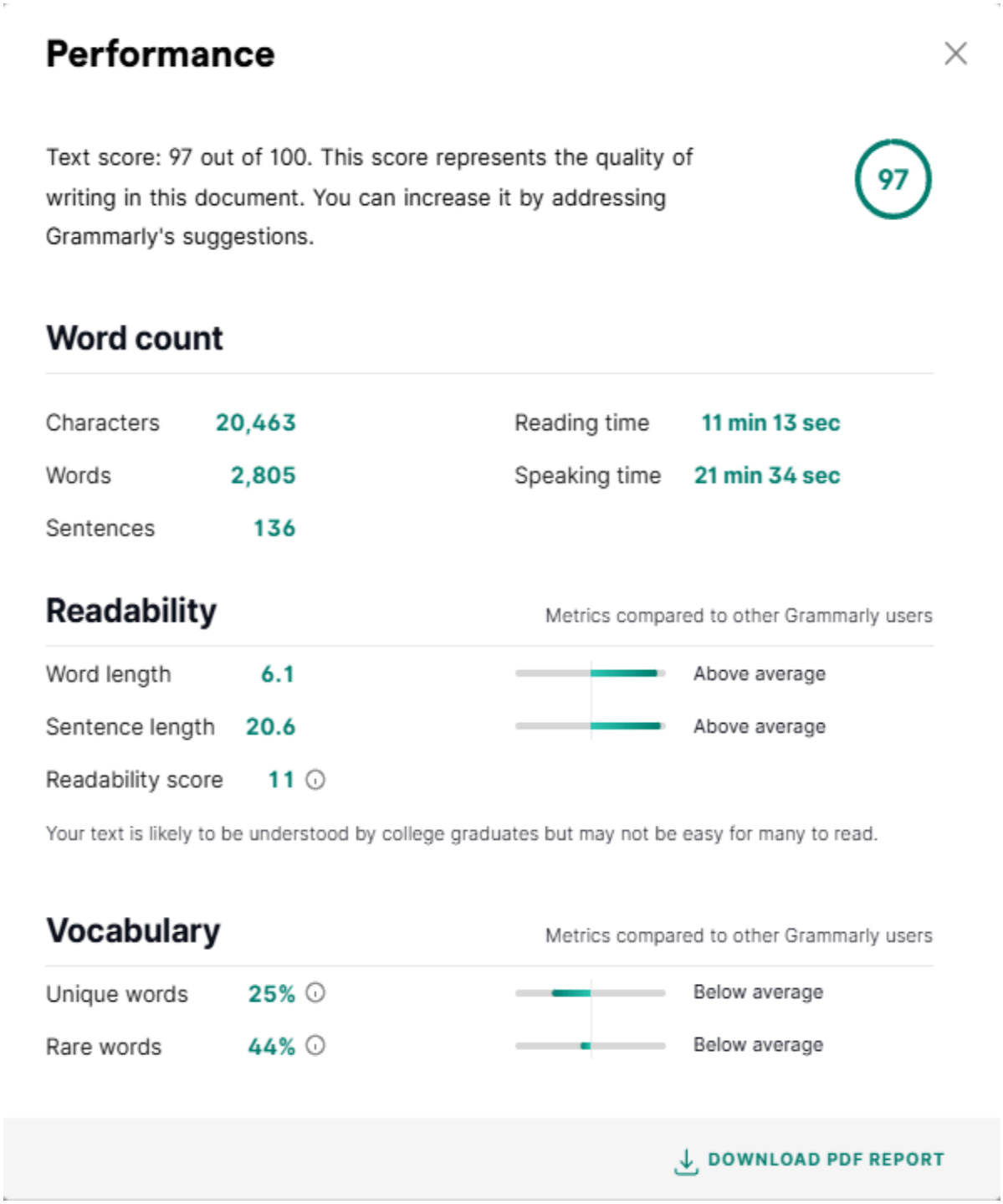


Figure B.10 Farmer Suggestions for Features

Appendix E - Grammarly Results

Checked via Grammarly.com



Performance

Text score: 97 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

97

Word count

Characters	20,463	Reading time	11 min 13 sec
Words	2,805	Speaking time	21 min 34 sec
Sentences	136		

Readability

Metrics compared to other Grammarly users

Word length	6.1	Above average
Sentence length	20.6	Above average
Readability score	11	

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words	25%	Below average
Rare words	44%	Below average

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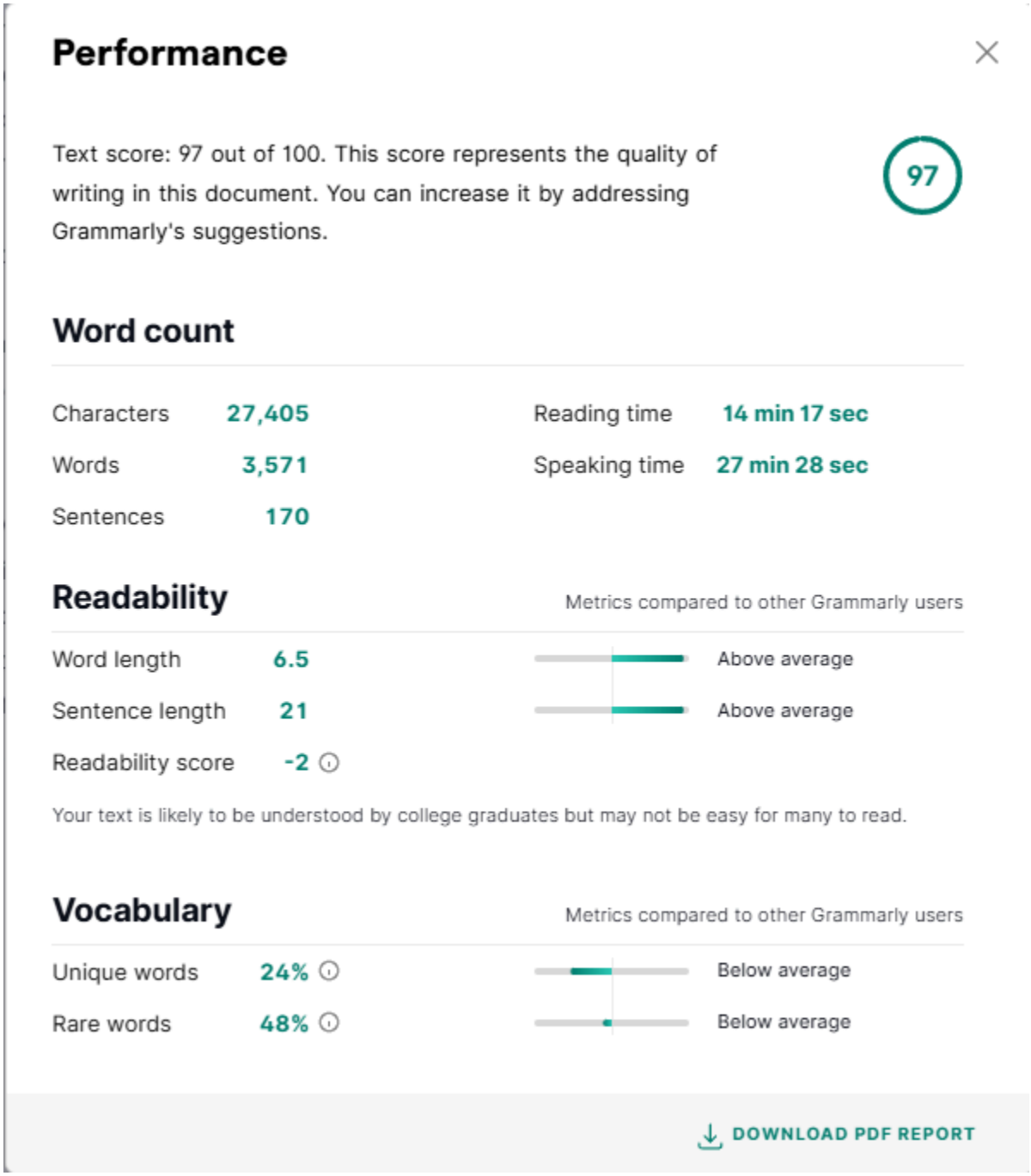

Performance

Text score: 97 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

97

Word count

Characters	27,405	Reading time	14 min 17 sec
Words	3,571	Speaking time	27 min 28 sec
Sentences	170		

Readability

Metrics compared to other Grammarly users

Word length	6.5	Above average
Sentence length	21	Above average
Readability score	-2	

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words	24%	Below average
Rare words	48%	Below average

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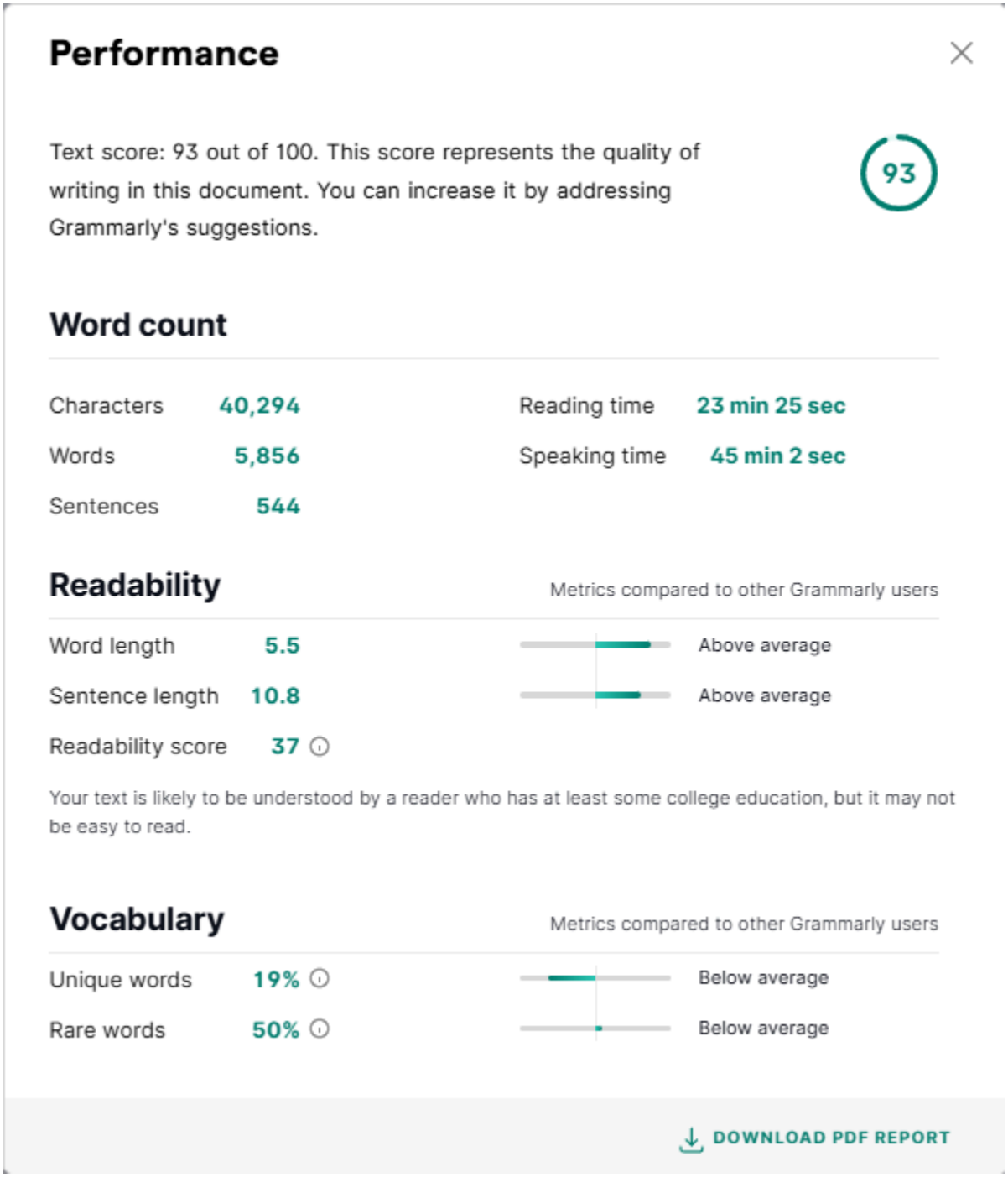

Performance

Text score: 93 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

93

Word count

Characters	40,294	Reading time	23 min 25 sec
Words	5,856	Speaking time	45 min 2 sec
Sentences	544		

Readability

Metrics compared to other Grammarly users

Word length	5.5	Above average
Sentence length	10.8	Above average
Readability score	37	

Your text is likely to be understood by a reader who has at least some college education, but it may not be easy to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words	19%	Below average
Rare words	50%	Below average

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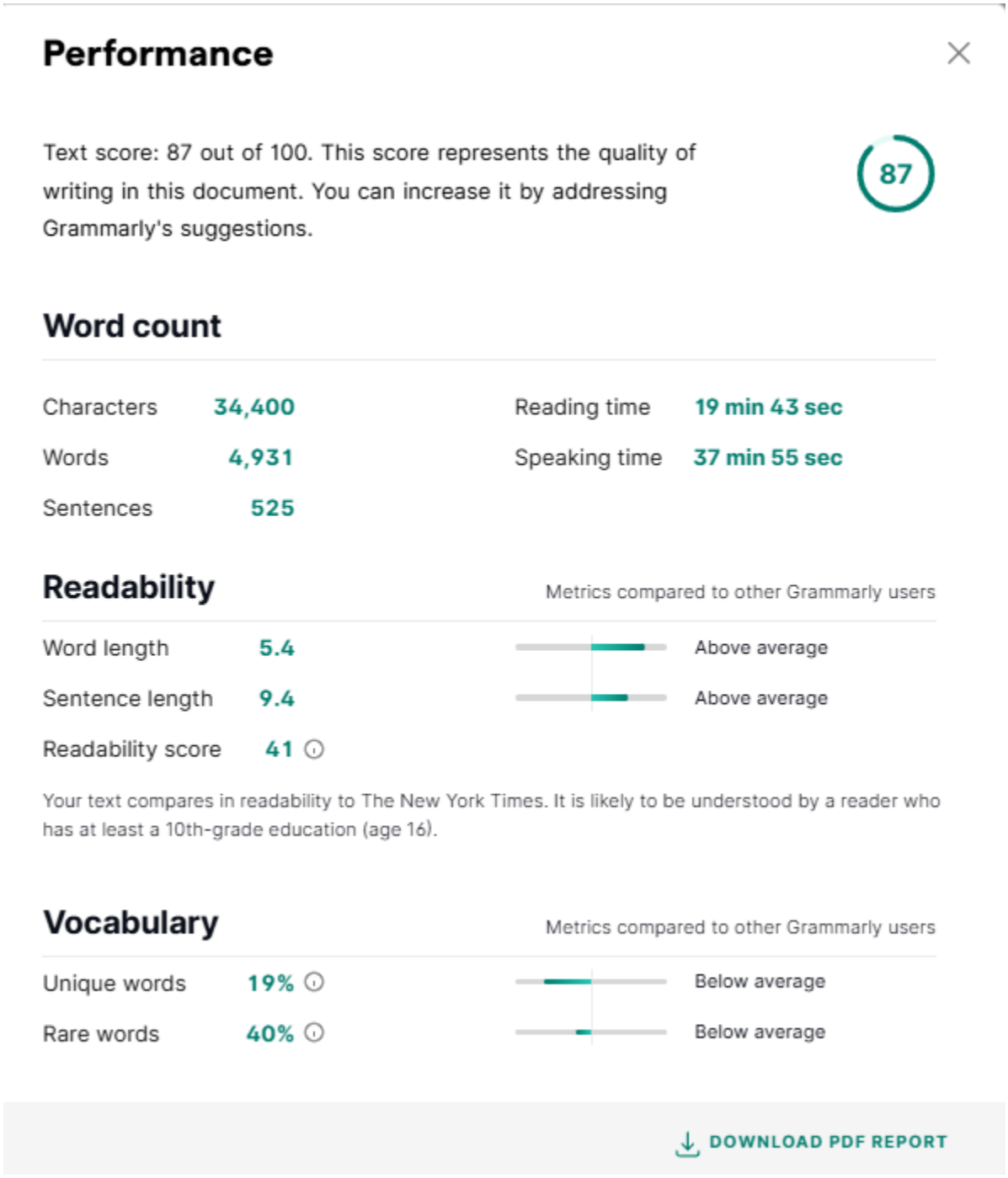

Performance

Text score: 87 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

87

Word count

Characters	34,400	Reading time	19 min 43 sec
Words	4,931	Speaking time	37 min 55 sec
Sentences	525		

Readability

Metrics compared to other Grammarly users

Word length	5.4	Above average
Sentence length	9.4	Above average
Readability score	41	

Your text compares in readability to The New York Times. It is likely to be understood by a reader who has at least a 10th-grade education (age 16).

Vocabulary

Metrics compared to other Grammarly users

Unique words	19%	Below average
Rare words	40%	Below average

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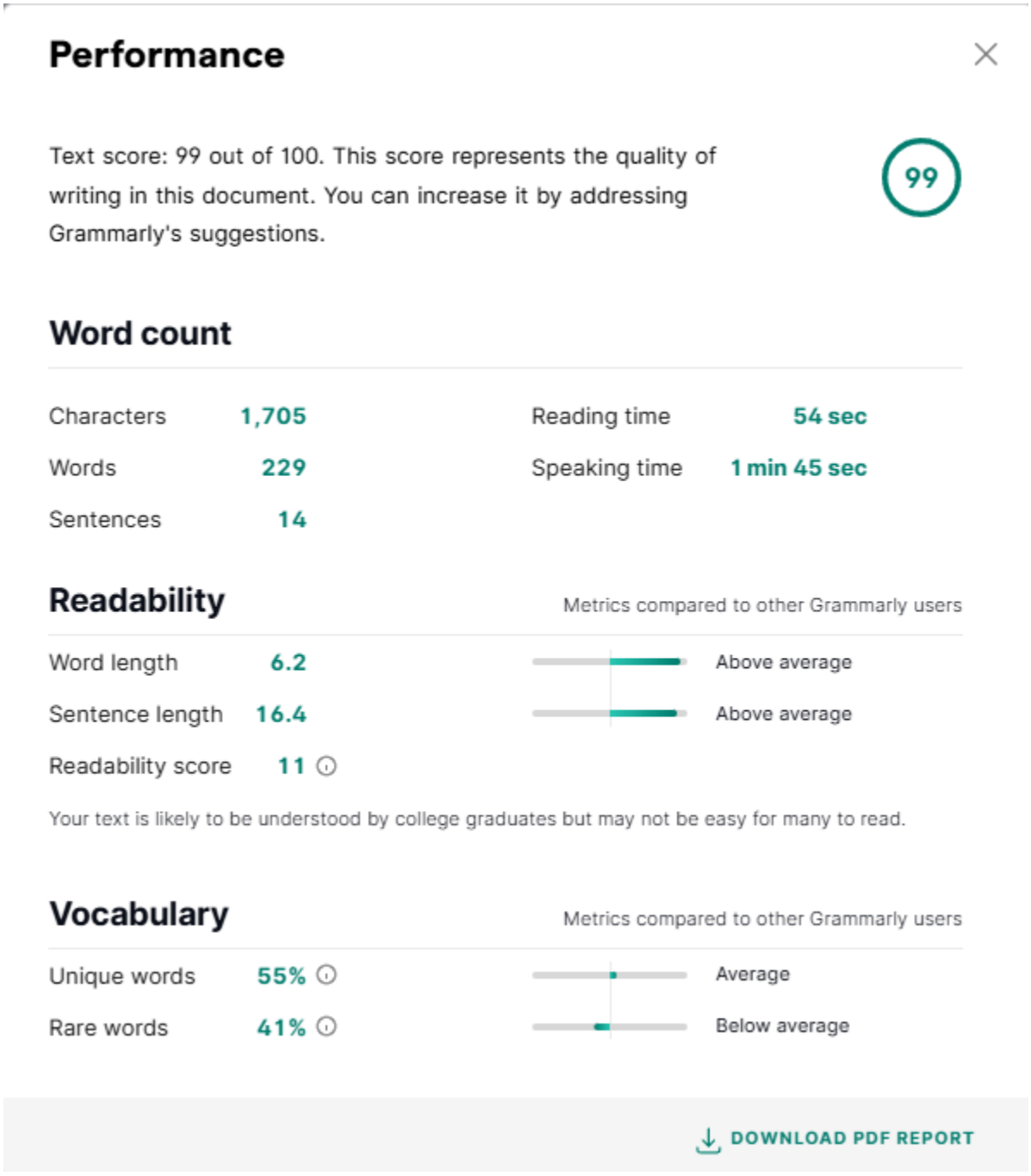

Performance

Text score: 99 out of 100. This score represents the quality of writing in this document. You can increase it by addressing Grammarly's suggestions.

99

Word count

Characters	1,705	Reading time	54 sec
Words	229	Speaking time	1 min 45 sec
Sentences	14		

Readability

Metrics compared to other Grammarly users

Word length	6.2	Above average
Sentence length	16.4	Above average
Readability score	11	

Your text is likely to be understood by college graduates but may not be easy for many to read.

Vocabulary

Metrics compared to other Grammarly users

Unique words	55%	Average
Rare words	41%	Below average

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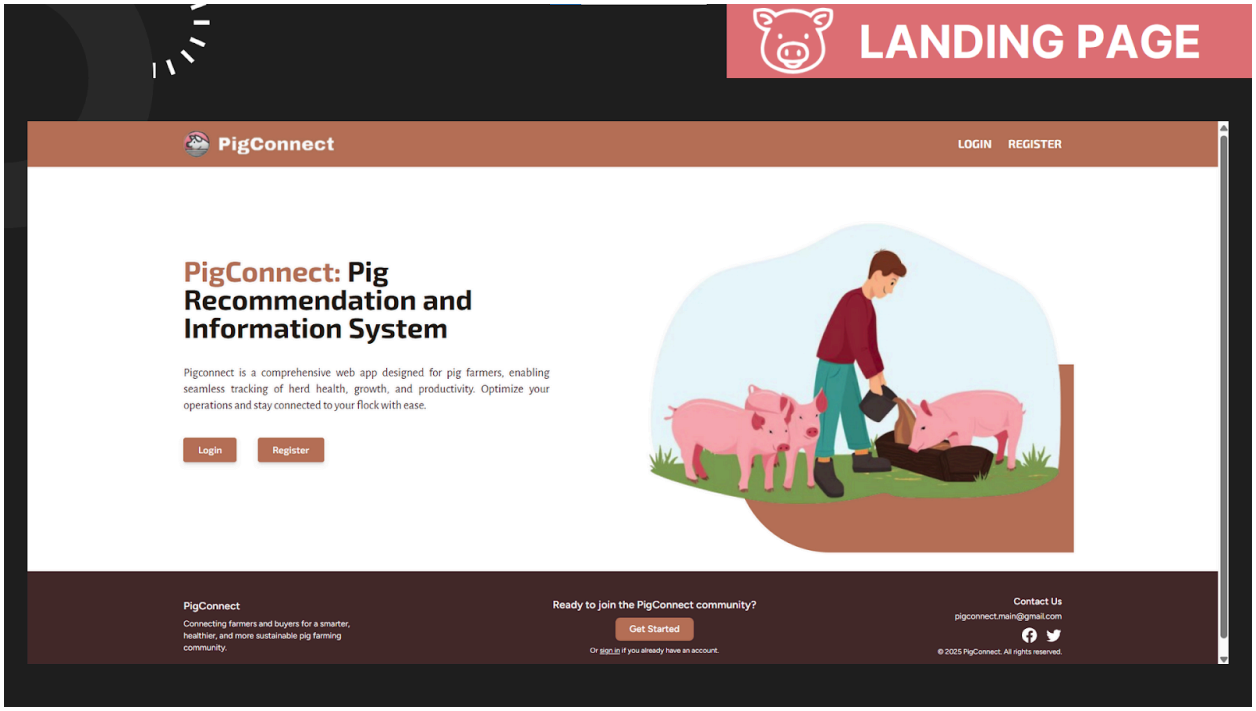
Appendix F - Plagiarism Results

Appendix G - User Manual



Accessing the System (For All Users)

Sign-Up Process

- Go to the PigConnect homepage.
- Click “Sign Up”.
- Choose your role: Farmer, Buyer

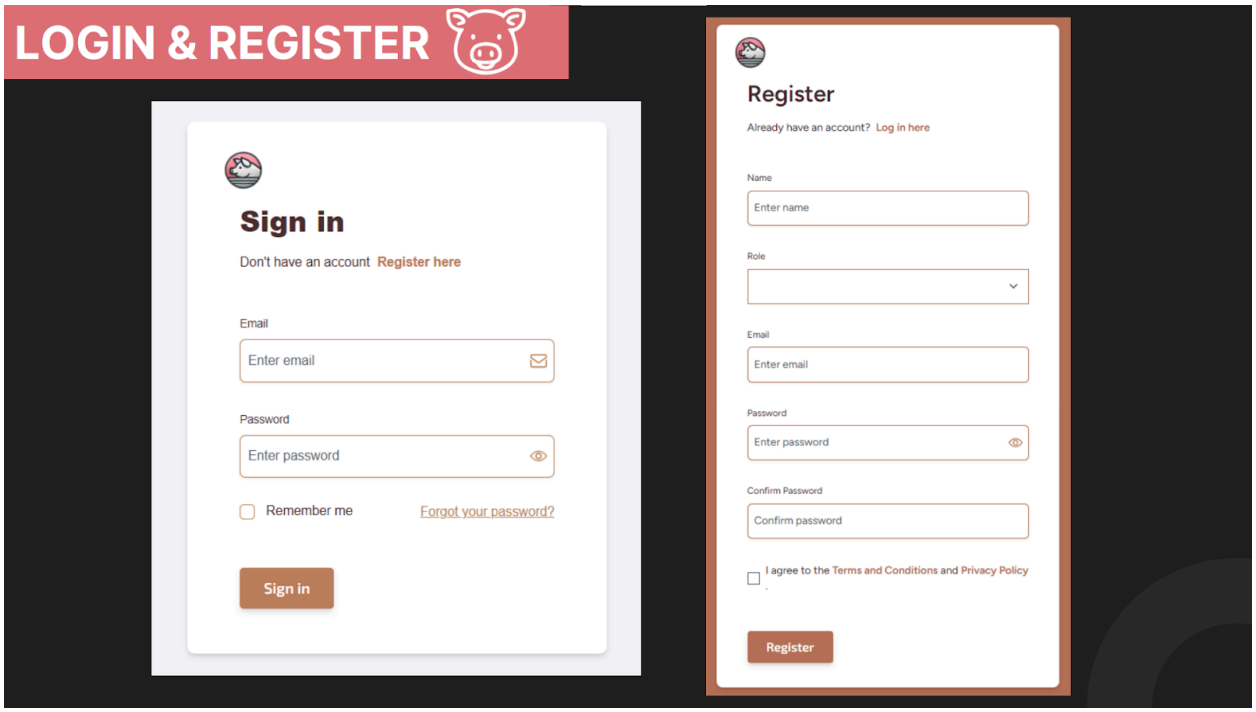
Fill out the form:

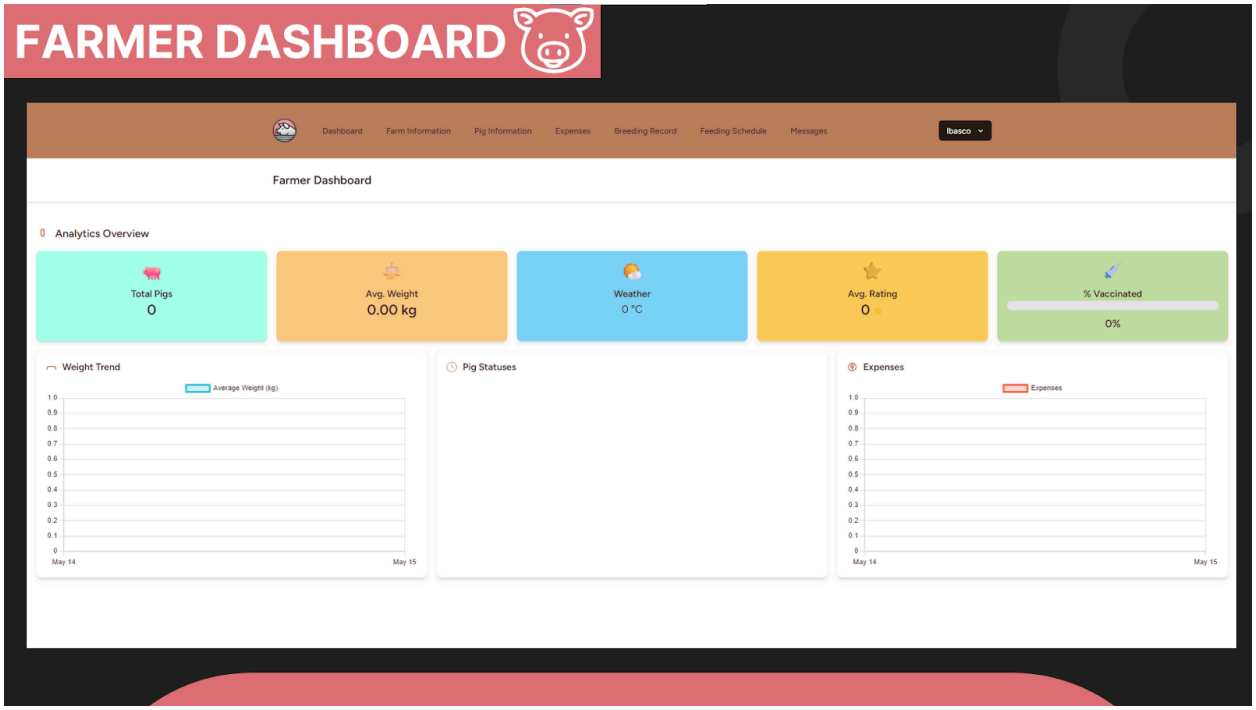
  - Full Name
  - Email Address
  - Password

- Submit the form and verify your email address via the verification link sent to your inbox.
- Once verified, proceed to log in.

Login Process

- Click on **“Login”** on the homepage.
- Enter your registered **email and password**.
- Click **“Login”**.
- You will be redirected to your respective dashboard based on your user role.





Pig Farmers' Guide

Farmer Dashboard

The farmer dashboard is the central control panel for all farm-related activities. It provides an overview of your pig inventory, scheduled tasks (like feedings or vaccinations), financial summaries, and system alerts all in one place. It's designed to be simple, informative, and responsive, helping farmers manage operations more efficiently at a glance.

Upon logging in, farmers are directed to a centralized dashboard showing:

- Analytics overview of pigs
- Health alerts
- Scheduled feedings
- Breeding records

Feeding Schedule

- Go to the “Feeding Module”.
- Set daily or weekly feed schedules for individual pigs or groups.
- Include feed type, quantity, and time.
- The system will send alerts before each scheduled feeding.

Breeding Tracker

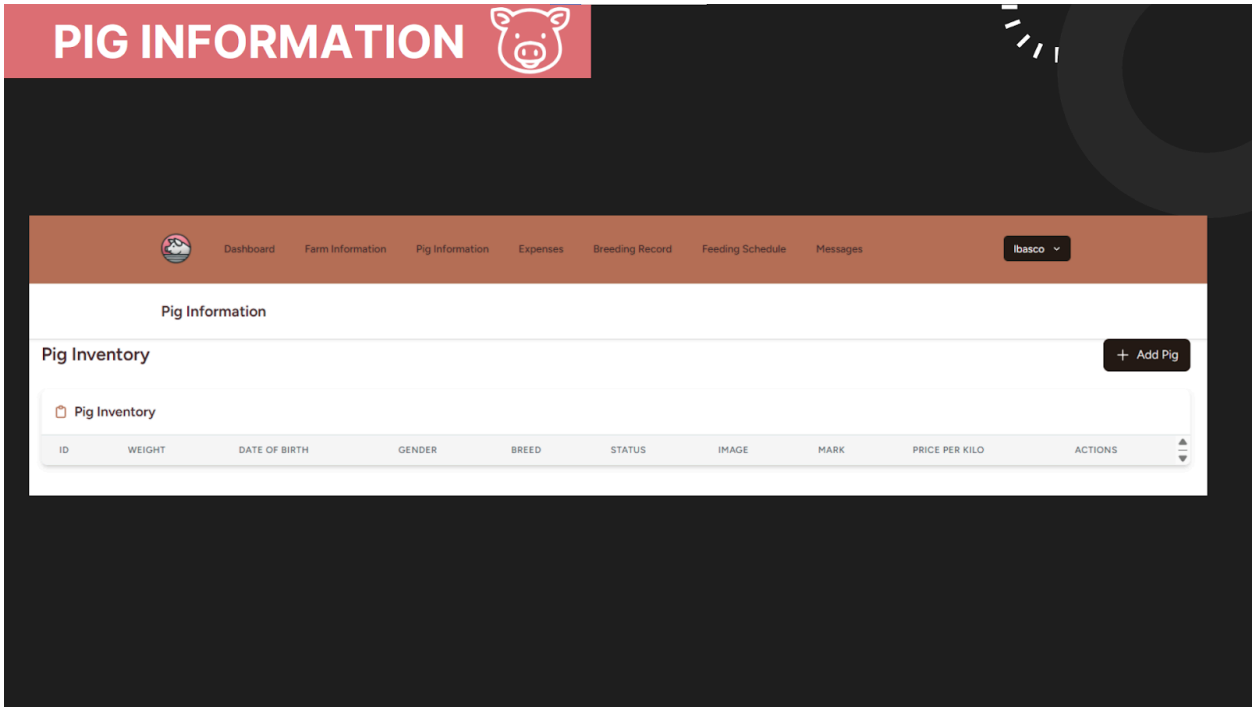
- Log breeding dates, pregnancy status, and birthing outcomes.
- Monitor timelines and view historical breeding performance.

Health and Vaccination Records

- Use the **“**Health Records” section to log:
    - Vet checkups
    - Medications administered
    - Vaccination dates and types
- Schedule and get notified about upcoming treatments or health checks

Messaging System

- Buyers can contact you via the in-platform messaging module.
- Chat history is stored for reference.
- Use this feature to negotiate prices or schedule farm visits.



Pig Inventory Management

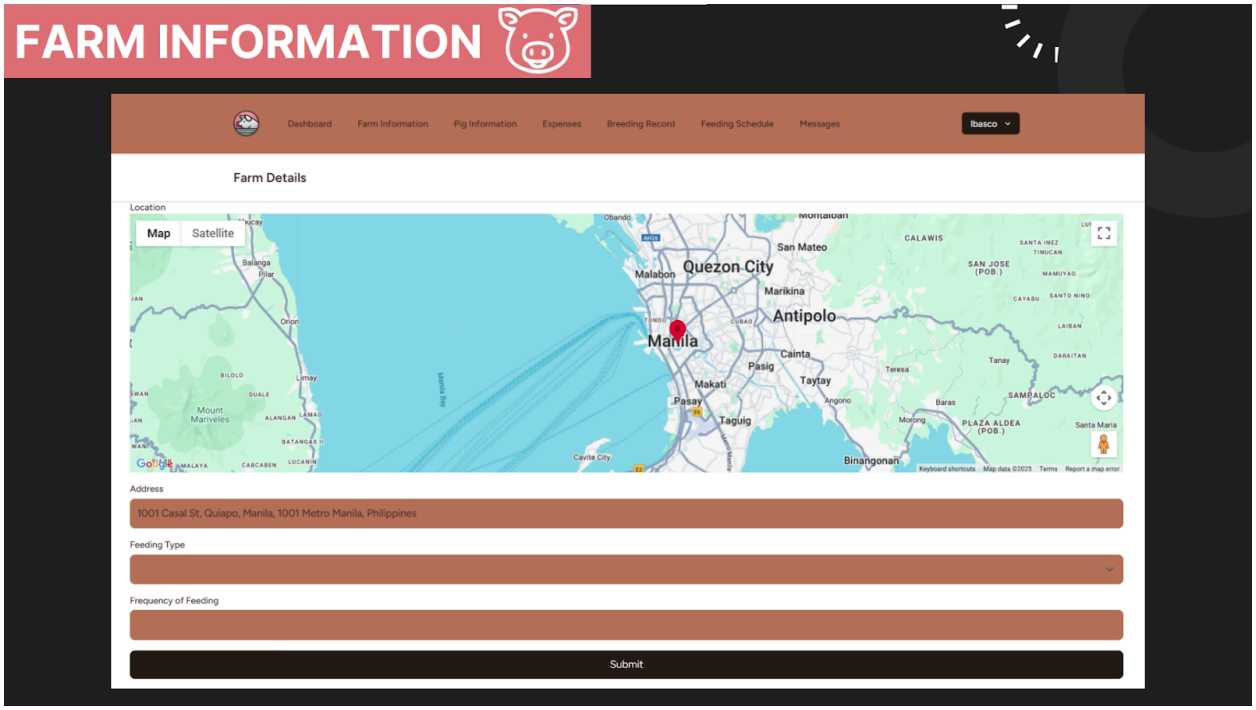
This module allows farmers to add, update, and monitor each pig in their care. You can track individual pig profiles with details like breed, weight, age, health status, and sale status. It serves as a digital logbook to help keep your farm records clean, accurate, and always accessible.

- Navigate to the **"Pig Information"** tab.
- Add new pigs with details such as:
    - Date of Birth
    - Gender
    - Status
    - Breed

    - Weight
    - Image
    - Age
    - Mark (as Proof of Vaccination)
    - Price (Per Kilo)
    - Actions
- Update pig information as they grow (e.g., weight or health status).
- Mark pigs as "For Sale" if you want them visible to buyers.

List Pigs for Sale

- Choose pigs marked for sale.
- Add price, photos, and buyer-visible notes.
- Enable geolocation so buyers can see your farm on the map.



Setting Up and Managing Farm Location

PigConnect allows farmers to display their farm's location to buyers using a built-in geolocation feature powered by Google Maps API. This improves visibility, helps buyers plan visits, and ensures trust and traceability in listings.

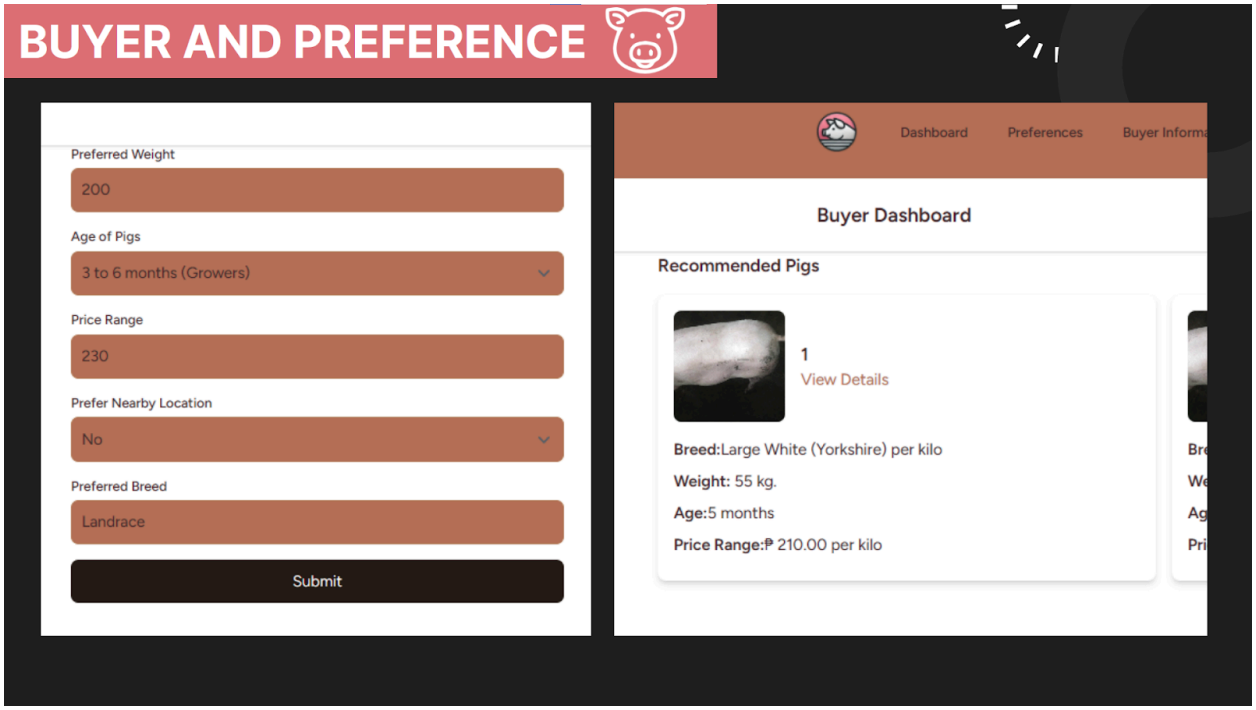
How to Set Your Farm Location:

- Go to your Profile or Dashboard Settings.
- Click on "Edit Farm Information".
- In the Farm Location section:
    - Use the interactive map to pin your exact farm location.
    - You can manually enter your address, or allow the system to detect your current location automatically using GPS.

- Click “Save Location” to update your profile.

For buyers on how to view farm locations:

- While browsing pigs for sale, listings will display a map icon or a “View on Map” button.
- Click it to:
    - See the farm’s exact location on Google Maps.
    - View estimated distance from your current location (if location services are enabled).
    - Get directions directly using the embedded map interface



Buyers' Guide

Buyer Dashboard

Buyers are welcomed with a personalized dashboard showing recommended pigs, saved favorites, and recent activity. It's built for quick navigation and easy access to the tools that help buyers find the right pigs based on their preferences and location.

Once logged in, buyers see:

- Recommended pigs (AI-generated)
- Active listings
- Recent searches

Setting Preferences

- Go to "Preferences" in your profile.

- Set desired:
    - Breed
    - Age range
    - Price Range
    - Weight range
    - Preference in distance of location
- These preferences help the AI suggest the best-matched pigs.

Searching for Pigs

- Use the search bar or advanced filters to search by:
    - Location
    - Price
    - Weight
    - Breed

Chat with Farmers

- Click “Message Seller” on any listing.
- Use the built-in messaging tool to:
    - Ask questions
    - Schedule a visit
    - Finalize a purchase

Appendix H - Publishable Paper

Technological Institute of the Philippines
Capstone 2

PigConnect: Web-based Pig Recommendation and Information System

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Abstract

The pig farming industry faces challenges such as inefficient resource management, limited access to real-time data, and suboptimal decision-making processes, which hinder productivity and profitability. PigConnect addresses these issues by providing a comprehensive farm management solution designed to enhance operational efficiency and improve decision-making through data-driven insights.The primary goal of the project is to develop a user-friendly digital platform that enables farmers to monitor livestock health, manage inventory, and track production performance in real time. Additionally, connecting farmers and buyers in by having a built-in chat system for them to communicate with each other. The system employs Incremental methodology which ensures that the features are developed, tested, and delivered in manageable phases. This approach allows for continuous improvement and early feedback integration while maintaining a focus on delivering a functional product at each stage.The results indicate that the system has the potential to significantly reduce operational costs and improve farm productivity. If fully implemented, PigConnect could revolutionize farm management by fostering sustainable practices and promoting the economic viability of pig farming. This project demonstrates the value of technology in agriculture, providing a scalable and impactful solution that addresses critical challenges in pig management.

Introduction

The pig farming industry in the Philippines plays a crucial role in the agricultural sector, contributing significantly to the local food supply and the rural economy. As of 2020, the Philippine Statistics Authority reported that the swine industry contributed approximately 15% to the total agricultural output, underscoring its importance. Small market piggeries, typically run by families, are essential to the livelihoods of rural households, ensuring food security and providing basic income. According to the Food and Agriculture Organization of the

United Nations, around 65% of pig farms in the Philippines are small-scale operations managed by families, highlighting their prevalence and significance. These farms are essential as they not only produce pork products but also support local economies through employment and economic activity. In 2019, the pig farming sector employed over 3 million people, according to Bautista. Despite their importance, small market piggeries face several challenges that hinder their efficiency and competitiveness. One of the primary challenges is the limited access to advanced technologies and resources necessary for effective farm management. Salazar & Rola (2019) noted that only about 20% of small-scale pig farmers have access to modern farming technologies, which impacts their productivity. Many small-scale farmers are still dependent on traditional methods, which can lead to disorganization in managing critical aspects such as health monitoring, feeding schedules, and financial analysis. According to a study by Caballero-Anthony & Lee (2021), farms relying on traditional methods have an average productivity rate that is 30% lower compared to those using modern technologies. These manual processes are labor-intensive and prone to errors, contributing to reduced productivity and increased operational costs. Moreover, the lack of transparency and efficiency in the buying and selling process further complicates matters for small market piggeries. The National Economic and Development Authority (2021) reported that approximately 40% of small-scale pig farmers face difficulties in finding suitable buyers or negotiating fair prices, while buyers face challenges in sourcing pigs that meet their specific requirements regarding costs and quality. Advancements in agricultural technology, particularly in precision farming and data analytics, present opportunities to address these challenges. Precision farming techniques can improve productivity by optimizing inputs such as feed and medication, while data analytics can provide insights for better decision-making. The World Bank (2020) highlighted that farms adopting precision farming techniques can see productivity increases of up to 25%. However, existing technological solutions are often designed for larger operations or generic livestock management, failing to meet the unique needs of small market piggeries in the Philippines. To bridge this gap, this study proposes the development of PigConnect, an innovative platform tailored specifically for small market piggeries in the Philippines. PigConnect integrates advanced technologies, including AI-driven buyer recommendations and farm information management, to empower farmers and enhance market efficiency. By providing a user-friendly interface for managing farm operations, PigConnect aims to streamline processes such as pig inventory management, feeding schedules, expenses tracking and breeding records. The system's AI algorithms will analyze farm data to provide personalized recommendations to buyers, improving their purchasing experience and promoting fair market transactions. Furthermore, PigConnect will include a robust communication platform that facilitates direct interaction between farmers and buyers. This feature will enable negotiations, farm visits, and transaction finalizations, thereby enhancing transparency and trust in the marketplace. Geolocation services will also be integrated to help buyers locate nearby farms, plan visits, and assess farm conditions firsthand. In summary, PigConnect represents a significant advancement in supporting the sustainability and competitiveness of small market piggeries in the Philippines. By leveraging technology to address longstanding challenges, PigConnect aims to

empower farmers, improve productivity, and create a more transparent and efficient marketplace for pigs, benefiting both producers and consumers alike.

Review of Related Literature

In the realm of pig farming, challenges such as inefficient resource use, suboptimal feeding practices, and ineffective management strategies have long hindered farm productivity and profitability (Feng & Qian, 2019). These issues not only affect the economic viability of farms but also impact sustainability and the ability to meet market demands consistently. Recent research underscores the potential for improvement through the application of mathematical models aimed at optimizing feeding schedules and task allocation. Such approaches have been shown to significantly enhance overall farm performance, leading to better economic outcomes for farmers (Feng & Qian, 2019). PigConnect represents a forward-looking initiative poised to integrate these research insights into practical farm management. By harnessing data-driven management tools and real-time analytics, PigConnect aims to revolutionize how pig farms operate. These technologies will empower farmers with actionable insights derived from detailed data analysis, enabling them to make informed decisions in areas such as feed formulation, resource allocation, and disease management. This capability not only improves operational efficiency but also enhances the ability to adapt quickly to market fluctuations and mitigate risks associated with disease outbreaks or environmental factors. Furthermore, the adoption of advanced management practices through PigConnect aligns with broader agricultural goals of sustainability and resilience. By optimizing resource use and minimizing waste, the system promotes environmentally responsible farming practices. It also strengthens the economic foundation of small-scale pig farmers by enhancing productivity and profitability, thereby supporting livelihoods and rural communities dependent on pig farming. In essence, PigConnect represents more than just a technological upgrade; it signifies a strategic shift towards a more efficient, sustainable, and resilient pig farming industry in the Philippines. By bridging the gap between research findings and practical implementation, PigConnect aims to elevate standards in farm management, foster innovation, and ensure the long-term viability of pig farming as a cornerstone of the Philippine agricultural economy. In the paper "Integrated application of standardization technology and e-commerce in livestock and poultry safe production - take pig as an example," authors X. Xu and C. Chen explore the enhancement of safety and efficiency in livestock and poultry production through the integration of standardized technology and e-commerce, focusing specifically on pig farming. The study emphasizes the critical role of standardization technology in ensuring consistent quality and safety standards by implementing uniform procedures and protocols for breeding, feeding, and health monitoring. This approach significantly reduces the risks associated with inconsistent practices. Additionally, the integration of e-commerce platforms facilitates direct connections between producers and buyers, streamlining the sales process and improving market access. By combining standardized production practices with e-commerce, consumers are assured of receiving products that meet stringent safety and quality standards. Furthermore, the Internet of Things (IoT) technology is highlighted for its role in enhancing

traceability and monitoring of livestock. Through the use of sensors and data collection devices, real-time tracking of health, growth, and environmental conditions of pigs is made possible, ensuring adherence to safety protocols and enabling timely adjustments. The case study presented in the paper illustrates the practical application and benefits of these technologies in achieving safer and more efficient production processes. The authors conclude that the integration of these technologies represents a significant advancement in the livestock industry, meeting the growing demands for safe and high-quality food products more efficiently and transparently.

Drawing from these insights, the PigConnect project aims to leverage similar technologies to enhance pig farming in Bulacan province. The scope of our project includes the development of a comprehensive management system tailored for small market piggeries, incorporating several advanced technological components. The system will feature a user-friendly analytics dashboard providing real-time data and insights into farm progress and productivity, aligning with ISO 9001 standards. This dashboard will include visualization tools for key performance indicators and custom reports. We will employ user-based AI recommendations using collaborative filtering to analyze farm data and match pigs with suitable buyers based on user interactions and preferences, ensuring fair pricing and meeting buyer requirements. Additionally, our platform will incorporate a user feedback and rating system to build trust and transparency, allowing mutual ratings between farmers and buyers. A robust communication platform will facilitate direct interactions between farmers and buyers, supported by an email notification system for timely alerts. Geolocation services will help buyers locate nearby farms and accurately assess farm conditions, while the system's mobile-responsive design will enhance accessibility and user engagement. By concentrating on weather updates, inventory tracking, health monitoring, feeding schedules, and vaccination records, PigConnect aims to improve farm management efficiency, market access, and overall sustainability for small market piggery owners in Bulacan. These integrated technologies will address the longstanding challenges faced by small-scale farmers, leading to improved productivity, better animal welfare, and increased profitability. In the paper "DEMETER Online Marketplace With Data Analytics for Agricultural Products Using Dynamic Programming Algorithm," Cordano, H. Z., Caballero, A. R., & Paraiso, C. M. (2022) addresses challenges in agricultural product supply chains, including inefficiencies and lack of transparency in market transactions. The proposed solution is the development of an online marketplace named DEMETER, which incorporates data analytics and dynamic programming algorithms to optimize the buying and selling processes. The methodology involves using heuristic and software algorithms to analyze data and improve decision-making within the marketplace. This approach aims to enhance the efficiency of supply chains by providing real-time data insights and optimizing transactions. The study's relevance to the PigConnect system lies in its use of advanced algorithms and data analytics to improve market efficiency and transparency, similar to how PigConnect plans to use AI-driven recommendations and real-time analytics to enhance pig farming and market access for small-scale farmers. By leveraging these technologies, PigConnect can address challenges in farm management and market transactions, leading to improved productivity and profitability.

Methodology

The development of the PigConnect system adhered to the Incremental Methodology using a structured iterative process. The chosen approach mirrored a development model that ensured continuous refinement through specific phases: requirements gathering, analysis and design, implementation, testing, and evaluation. The methodology was executed in three primary iterations. After thorough planning, designing, developing and testing the system, it will be sent to deployment to get feedback.

Requirements Gathering and Analysis

Requirements were gathered through surveys and interviews with pig farmers and buyers to ensure the system was designed with real-world needs in mind. Key requirements included secure user authentication, farm management tools, AI-driven recommendations, geolocation services, and communication modules.

Iteration 1

This iteration focused on building the essential framework of the system, establishing a secure and functional foundation. The authentication module, along with the initial farmer and buyer dashboards, was at the heart of this iteration. These components ensured that users could interact with the system securely while laying the groundwork for more complex features in subsequent phases. This initial iteration served as a critical stepping stone, as it provided the system with stability and clarity in design, ensuring that all future developments were built on a robust and reliable baseline.

Iteration 2

The project was taken a step further by addressing the core needs of farm management, which enhanced the system's practicality and relevance. Key features such as feeding schedules, vaccination tracking, expense monitoring, and descriptive analytics transformed the system into an invaluable tool for farmers. These functionalities were designed to be intuitive and aligned seamlessly with the users' daily workflows, ensuring that the system genuinely improved farm operations. This phase also introduced AI-driven recommendations, which made the system smarter and more personalized for buyers, demonstrating a clear focus on user-centric design.

Iteration 3

The researchers brought the PigConnect system to its full potential by integrating advanced and innovative features. Real-time communication between farmers and buyers through the chat module, geolocation for farm discovery, and robust notification systems were pivotal additions that enhanced the system's interactivity and usability. Advanced AI-driven recommendations, tailored to user preferences, made PigConnect stand out as a truly competitive solution in its field. The team's meticulous attention to data security and validation during this phase ensured that the system was not only efficient but also trustworthy.

Results and Discussion

Specific Objective No. 1

To develop a system feature that allows buyers to input their specific preferences—such as pig breed, age, weight,

and price range—is essential for improving the overall efficiency and personalization of the purchasing experience. This feature streamlines the search process by enabling buyers to filter available pigs based on their actual needs and expectations, eliminating the inefficiency of browsing through irrelevant listings. By tailoring search results to each buyer's criteria, the system enhances decision-making, reduces transaction time, and promotes user satisfaction. Moreover, this functionality lays the groundwork for more intelligent system behavior by integrating preference-based inputs into the AI recommendation engine. As buyers continue using the platform, the system refines its suggestions based on prior interactions, contributing to a more dynamic and intuitive user experience. Over time, this data can also support the generation of personalized alerts for new pig listings that match saved preferences, further improving market engagement. Ultimately, this feature contributes to a more responsive and buyer-focused digital livestock marketplace, making the platform not only more useful but also more aligned with real-world agricultural commerce needs.

Specific Objective No. 2

To implement an AI-driven filtering mechanism that analyzes buyer preferences and intelligently matches them with available pigs is crucial for delivering a more targeted and relevant user experience. This feature is designed to process input such as breed, age, weight, and price range, and dynamically compare those preferences with the pigs listed by farmers on the platform. By doing so, it ensures that buyers are presented with the most suitable options based on their specific needs, eliminating unnecessary browsing and reducing decision fatigue. The integration of AI into the filtering process allows the system to learn from user interactions over time. Through techniques such as collaborative filtering and preference analysis, the recommendation engine continuously improves its ability to generate accurate and personalized results. This not only increases buyer satisfaction but also enhances the visibility of farmer listings that might otherwise be overlooked. As more data is collected, the algorithm's precision improves, supporting long-term optimization of the matchmaking process. Ultimately, this intelligent feature strengthens the platform's usability and impact by bridging the gap between buyer intent and farmer offerings—making the experience more efficient, user-centered, and scalable in the evolving landscape of digital livestock commerce.

Specific Objective No. 3

To provide a feature that displays the location of pigs for sale and enables buyers to directly engage with farmers is vital in creating a more seamless, transparent, and efficient livestock transaction process. By integrating geolocation services into the system, buyers can visualize the physical locations of farms and assess proximity, helping them make informed decisions based on logistics, accessibility, and delivery convenience. This added transparency not only builds buyer confidence but also promotes trust in the legitimacy of the seller. Furthermore, combining location-based visibility with a direct purchasing channel fosters smoother transactions. Buyers no longer need to rely on third-party communication or external arrangements—within the system, they can view listings, evaluate the farm's credibility through ratings and profiles, and send inquiries or negotiate directly through the built-in messaging feature. This streamlined process reduces friction, speeds up deal-making, and supports both small-scale farmers looking to reach a broader market

and buyers seeking efficient ways to source livestock. Overall, the integration of mapping and direct transaction capabilities empowers users with the tools to make smart, location-conscious decisions, while reinforcing the system's goal of making pig farming commerce more accessible, traceable, and modern.

Major Finding 1

The target users, pig farmers and buyers, found the functionality of PigConnect highly effective in managing farm operations and facilitating buyer-seller interactions. Features such as pig inventory tracking, health management, and AI-driven recommendations proved to be valuable in addressing common challenges like record-keeping, marketing, and monitoring pig health. The system's ability to provide real-time geolocation updates and personalized insights significantly enhances decision-making processes for both farmers and buyers, aligning well with their operational needs. efficient system capable of streamlining CESO's operations. It meets both the technical and user-centered goals of the project, with minor areas identified for improvement in feedback-related modules and UI refinements. Its successful integration of automation and AI functionalities positions it as a valuable tool for managing community outreach activities and enhancing institutional efficiency.

Major Finding 2

Farmers and buyers found the system intuitive and easy to navigate, allowing them to complete necessary tasks such as updating records for pigs, managing schedules and reviewing analytics with minimal training and support needed. The users who were not very into tech did have a bit of a learning curve, especially with the initial onboarding. Providing additional support or simplified onboarding tools would ensure that these users adopt the service in a way that is less disruptive to their experience as well as make the application even more approachable to a wider audience.

Summary, Conclusions, and Recommendations

The evaluation of the PigConnect system highlighted its strong alignment with the needs of both pig farmers and buyers, particularly in improving the management and monitoring of farm operations. Designed with a focus on health tracking, breeding schedules, feeding logs, and inventory control, the system effectively streamlines core farm tasks while enhancing productivity and supporting animal welfare.

One of the key findings was that users—especially farmers and buyers—found the system highly functional in day-to-day use. Features such as AI-driven pig recommendations, geolocation tracking, and health monitoring tools addressed long-standing challenges in record-keeping, marketing, and decision-making. These tools allowed for better communication between buyers and farmers, and helped both parties make more informed choices through real-time data and analytics. While some areas, such as the feedback and UI modules, were flagged for minor refinement, the system overall met its intended technical and operational goals. Additionally, the system's user interface was generally well-received for its simplicity and ease of navigation. Most users were able to complete tasks like updating pig records, managing schedules, and interpreting analytics with minimal support. However, a learning curve was noted among users with limited tech experience, particularly during onboarding. Providing a simplified introduction or additional guidance tools was identified as a potential improvement to ensure wider adoption and a smoother

transition for less tech-savvy users. Despite these minor hurdles, PigConnect proved to be a practical and efficient tool for modernizing pig farming operations and buyer engagement.

References

Philippine Statistics Authority. (2020). *Agricultural Indicators System: Swine Industry*.

Food and Agriculture Organization of the United Nations. (2019). *FAO Statistical Yearbook*. Rome: FAO.

Bautista, O. K. (2019). *Piggery Production and Management in the Philippines*. Manila: University of the Philippines Press.

Salazar, C., & Rola, A. (2019). Adoption of Technology in Small-Scale Pig Farming. *Philippine Journal of Agricultural Economics, 34*(2), 85-98.

Caballero-Anthony, M., & Lee, Y. (2021). Challenges in the Philippines Swine Industry. *Journal of Agriculture and Food Information, 16*(1), 19-32.

World Bank. (2020). *Transforming Philippine Agriculture: Policies and Investments*. Washington, D.C.: World Bank Publications.

National Economic and Development Authority. (2021). *Philippine Development Plan 2017-2022*.

Feng, Q., & Qian, S. (2019). Research on management of pig farms. In *2019 3rd International Conference on Data Science and Business Analytics (ICDSBA)* (pp. 57-60). Istanbul, Turkey.

Trujillo-Diaz, J., Diaz-Piraquive, F. N., Herrera, M. M., Gomez, J., Rodriguez, J. A., & Sarmiento, H. R. (2019). Design of theoretical dimensions for a knowledge management model applied to the Colombian Swine Industry. In *2019 Congreso Internacional de Innovación y Tendencias en Ingenieria (CONIITI)* (pp. 1-6). Bogota, Colombia.

Razzak, M.A. "An Empirical Study on Lean and Agile Methods in Global Software Development." In *2016 IEEE 11th International Conference on Global Software Engineering Workshops (ICGSEW)*, pp. 61-64, 2016.

Carole, K. S., Theodore Armand, T. P., & Kim, H. C. (2024). Enhanced experiences: Benefits of AI-powered recommendation systems. In *2024 26th International Conference on Advanced Communications Technology (ICACT)* (pp. 216-220). PyeongChang, Korea, Republic of. 918Cha, N., Cho, H., Lee, S., & Hwang, J. (2019). Effect of AI recommendation system on the consumer preference structure in e-commerce: Based on two types of preference. In *2019 21st International Conference on Advanced Communication Technology (ICACT)* (pp. 77-80). PyeongChang, Korea (South).

Fidan, H., Teneva, A., Stankov, S., & Dimitrova, E. (2018). Consumers' behavior of restaurant selection. In *2018 International Conference on High Technology for Sustainable Development (HiTech)* (pp. 1-3). Sofia, Bulgaria.

Ujakpa, M. M., Kamati, E., Ngola, S. T. G. A., Sheepo, T. A., & Ilonga, J. (2022). The development of a livestock farm management information system (LFMIS). In *2022 IST-Africa Conference (IST-Africa)* (pp. 1-11). Ireland.

Joseph, A. M., Jali, N., Robert Jupit, A. J., & Khartini Jali, S. (2021). eMarket for local farmers. In *2021 IEEE 19th Student Conference on Research and Development (SCOReD)* (pp. 30-35). Kota Kinabalu, Malaysia.

Saha, J. (2023). A Survey on Artificial Intelligence (AI) based Job Recommendation Systems.

Goehr, L. (2022). An Intelligent Recommendation System Using Market

Segmentation. In Smart Innovation, Systems and Technologies.

Stępień, S., Smędzik-Ambroży, K., Guth, M., Muntean, A., Ștefania, S., Maican, S., & Pastiu, C. A. (2022). The importance and determinants of market integration of small family farms in selected countries of Central and Eastern Europe.

Ernesto, M., & Pernia, A. (1983). Small-scale industry promotion: Economic and social impact analysis. *Research Papers in Economics*.

Aditya, K., Shastry, H. A., & Sanjay, A. (2020). Data analysis and prediction using big data analytics in agriculture. *doi: 10.1007/978-981-15-0663-5_10*

Zhang, J., & Cheng, J. (2024). Design of Personalized Recommendation System for E-commerce Based on Artificial Intelligence. In 2024 IEEE 7th Eurasian Conference on Educational Innovation (ECEI) (pp. 152-155). Bangkok, Thailand. IEEE.

Cha, N., Cho, H., Lee, S., & Hwang, J. (2019). Effect of AI Recommendation System on the Consumer Preference Structure in e-Commerce: Based on Two types of Preference. In 2019 21st International Conference on Advanced Communication Technology (ICACT) (pp. 77-80). PyeongChang, Korea (South). IEEE.

Li, L., & Wei, X. (2009). Study on the Supply Chain Management of Agriculture Product under E-Commerce Environment. In 2009 Second International Conference on Intelligent Computation Technology and Automation (pp. 333-337). Changsha, China. IEEE.

Zhang, Y., & Lu, Y. (2018). Research on the Problems and Strategies of Rural E-Commerce in the Age of Internet + Agriculture. In 2018 14th International Conference on Semantics, Knowledge and Grids (SKG) (pp. 257-260). Guangzhou, China. IEEE.

Carole, K. S., Theodore Armand, T. P., & Kim, H. C. (2024). Enhanced Experiences: Benefits of AI-Powered Recommendation Systems. In 2024 26th International Conference on Advanced Communications Technology (ICACT) (pp. 216-220). PyeongChang, Korea, Republic of. IEEE.

Liu, Y., & Tong, S. (2022). Research on Personalized Tourism Intelligent Recommendation System Based On Data Analysis Algorithm. In 2022 International Conference on Artificial Intelligence of Things and Crowdsensing (AIoTCs) (pp. 504-508). Nicosia, Cyprus. IEEE.

Apichottanakul, A., Goto, M., Piewthongngam, K., Pathumnakul, S., & Ramirez, F. J. (2021). Customer behaviour analysis based on buying-data sparsity for multi-category products in the pork industry: A hybrid approach. Cogent Engineering, 8(1).

Fu, S., Ma, R., He, G., Chen, Z., & Liu, H. (2023). A study on the influence of product environmental information transparency on online consumers' purchasing behavior of green agricultural products. Frontiers in Psychology, 14.

Stampa, E., Schipmann-Schwarze, C., & Hamm, U. (2020). Consumer perceptions, preferences, and behavior regarding pasture-raised livestock products: A review. Food Quality and Preference, 82, 103872. https://doi.org/10.1016/j.foodqual.2020.103872

Aoki, K. (2020). Consumer Behavior for Information on Food Products. In T. Shimmura, T. Nonaka, & S. Kunieda (Eds.), Service Engineering for Gastronomic Sciences (pp. 161-172). Springer.

Kasihma, T., Matsumoto, S., & Hasuike, T. (2019). A Practical Study on the Information Sharing System for Producers. In S. Yamamoto & H. Mori (Eds.), Human Interface and the Management of Information. Visual Information and

Knowledge Management. HCII 2019 (Vol. 11569, pp. 408-421). Springer.

Foti, V. T., & Timpanaro, G. (2021). Relationships, sustainability and agri-food purchasing behaviour in farmer markets in Italy. British Food Journal, 123(13), 428-453.

Lazaroiu, G., Andronie, M., Uţă, C., & Hurloiu, I. (2019). Trust Management in Organic Agriculture: Sustainable Consumption Behavior, Environmentally Conscious Purchase Intention, and Healthy Food Choices. Frontiers in Public Health, 7, 340.

Sarwar, B., Karypis, G., Konstan, J., & Riedl, J. (2001). Item-based collaborative filtering recommendation algorithms. In Proceedings of the 10th International Conference on World Wide Web (WWW '01) (pp. 285-295). Association for Computing Machinery.

Liu, H. (2022). Implementation and Effectiveness Evaluation of Four Common Algorithms of Recommendation Systems - User Collaboration Filter, Item-based Collaborative Filtering, Matrix Factorization and Neural Collaborative Filtering. In 2022 International Conference on Cloud Computing, Big Data Applications and Software Engineering (CBASE) (pp. 224-227). Suzhou, China. IEEE.

Xu, X., & Chen, C. (2019). Integrated application of standardization technology and e-commerce in livestock and poultry safe production - take pig as an example. In 2019 2nd International Conference on Safety Produce Informatization (IICSPI) (pp. 496-499). Chongqing, China. IEEE.

Cordano, H. Z., Caballero, A. R., & Paraiso, C. M. (2022). DEMETER Online MarketPlace With Data Analytics for Agricultural Products Using Dynamic Programming Algorithm. In 2022 7th International Conference on Business and Industrial Research (ICBIR) (pp. 538-543). Bangkok, Thailand. IEEE.

S. Reddivari, "Visual analytics for software requirements engineering," 2013 21st IEEE International Requirements Engineering Conference (RE), Rio de Janeiro, Brazil, 2013, pp. 389-392,

M. S. Rahman and H. Reza, "A Systematic Review Towards Big Data Analytics in Social Media," in Big Data Mining and Analytics, vol. 5, no. 3, pp. 228-244, September 2022.

Appendix I - Curriculum Vitae

RONN VIRGIL RETURAN

INFORMATION TECHNOLOGY

Technological Institute of the Philippines (TIP) M

Address: **37 Fuse St. Meralco Village, Lias Marilao Bulacan**

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CAREER OBJECTIVE

Motivated BSIT undergraduate seeking an entry-level role opportunity to leverage technical knowledge, problem-solving skills, and a passion for innovation in IT. Eager to gain hands-on experience in IT/Technical Support, programming, and/or database management while contributing to organizational success and further enhancing my skills in a professional environment.

DESIGN PROJECT COMPLETED/ RESEARCH

PigConnect: Web-based Pig Recommendation and Information System
A web-based pig recommendation and farm management system. The development of PigConnect system adhered to the Incremental Methodology using a structured iterative process. Key features include AI-driven buyer recommendations, real-time analytics for farm operations, geolocation services to locate nearby farms, a secure chat system for farmer-buyer communication, and tools for managing feeding schedules, vaccination records, and expenses. The system enhances efficiency, transparency, and decision-making for small-scale pig farmers and buyers.

KNOWLEDGE, SKILLS AND ATTITUDE

Having graduated from TIP with its orientation towards outcome-based education, I have acquired and can demonstrate the following student acquire outcomes (knowledge, skills and attitudes) necessary to the practice of the computing profession:

- *Analyze complex problems and identify and define the computing requirements appropriate for solution.*
- *Use modern techniques and tools of the computing practice in complex activities.*
- *Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.*

SEMINARS AND TRAININGS ATTENDED

- Edge Computing
  TIP Manila
  September 15, 2023

- Data Processing and Analytics
  TIP Manila
  September 29, 2023

- Security Information and Event Management
  TIP Manila
  October 17, 2023

- IOT and Big data: Exploring the Data-Driven Future
  TIP Manila
  October 08, 2023

- On-The-Job Training
  The Manila Hotel (Management Information System Department)
  March 04, 2025 - May 29,2025

OTHER SKILLS

Technical Skills:

- **Programming Languages:** HTML/CSS, Javascript and PHP.
- **Tools and Technologies:** Git, MySQL and Linux.
- **Operating Systems:** Windows and Linux (Ubuntu)
- **Networking:** TCP/IP, DNS and basic network configuration
- Proficient in Excel and Powerpoint
- Proficient in the English language
- Can communicate very well with others

REFERENCE

Jenelyn Aranas
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ANGELO JOAQUIN IBASCO

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CAREER OBJECTIVE

An enthusiastic BSIT undergraduate where I can utilize my TESDA NC II certification and hands-on training in computer systems servicing to provide technical support and grow as an IT professional. Seeking a position that allows me to build on my internship experience, develop my technical abilities, and contribute positively to the team through hard work, adaptability, and continuous learning.

DESIGN PROJECT COMPLETED/ RESEARCH

PigConnect: Web-based Pig Recommendation and Information System
PigConnect, an innovative platform tailored specifically for small market piggeries in the Philippines. PigConnect integrates advanced technologies, including AI-driven buyer recommendations and farm information management, to empower farmers and enhance market efficiency. By providing a user-friendly interface for managing farm operations, PigConnect aims to streamline processes such as pig inventory management, feeding schedules, expenses tracking and breeding records. The system's AI algorithms will analyze farm data to provide personalized recommendations to buyers, improving their purchasing experience and promoting fair market transactions.

KNOWLEDGE, SKILLS AND ATTITUDE

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- Analyze complex problems and identify and define the computing requirements appropriate for solution.
- Use modern techniques and tools of the computing practice in complex activities.
- Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.

SEMINARS AND TRAININGS ATTENDED

- Edge Computing
  TIP Manila
  September 15, 2023

- Data Processing and Analytics
  TIP Manila
  September 29, 2023

- Security Information and Event Management
  TIP Manila
  October 17, 2023

OTHER SKILLS

Technical Skills

- Installation and configuration of computer systems
- Setting up and maintaining computer networks (LAN/WAN)
- Basic PC troubleshooting and repair
- Operating system installation (Windows)
- Software installation and configuration
- Basic network cabling and configuration
- Data backup and restoration procedures
- Printer and peripheral device setup
- Network security basics
- Performing preventive maintenance

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CAREER OBJECTIVE

A highly motivated Information Technology professional eager to leverage technical expertise, problem-solving skills, and analytical thinking in a dynamic work environment. Passionate about software development, data management, and innovative solutions, with a strong foundation in outcome-based education and a commitment to continuous learning and career growth.

DESIGN PROJECT COMPLETED/ RESEARCH

PigConnect: Web-based Pig Recommendation and Information System
A web-based system designed to support pig farmers by providing intelligent recommendations for pig selection and farm management. Utilizing data-driven algorithms, the platform analyzes key factors such as breed, health status, and environmental conditions to optimize decision-making, improve farm efficiency, and enhance livestock productivity.

ON-THE-JOB TRAINING/ PRACTICUM/ INTERNSHIP EXPERIENCE

- Data Engineering Intern
  Kyros Technologies PH
  Russia St, Better Living, Parañaque
  March 11, 2025 - June 07, 2025
  Kyros Technologies PH is an IT infrastructure company

KNOWLEDGE, SKILLS AND ATTITUDE

Having graduated from TIP with its orientation towards outcome-based education, I have acquired and can demonstrate the following student acquire outcomes (knowledge, skills and attitudes) necessary to the practice of the computing profession:

- *Analyze complex problems and identify and define the computing requirements appropriate for solution.*
- *Use modern techniques and tools of the computing practice in complex activities.*
- *Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.*

SEMINARS AND TRAININGS ATTENDED

- Unleashing the Power of Data Processing & Analytics
  Zoom
  September 15, 2023

- IoT and Big Data: Exploring the Data-Driven Future
  Zoom
  October 28, 2023

- Blockchain Technology and Cryptocurrency
  Google Meet
  November 24, 2023

OTHER SKILLS

Technical Skills
Programming Languages: Python, Java, JavaScript, PHP
Web Development: HTML, CSS, Bootstrap, React, Vue, Laravel
Database Management: MySQL, MariaDB, Firebase
Networking & Security: Cisco networking, Firewall configuration, Basic penetration testing
Cloud Computing: AWS (basic knowledge)
Version Control: Git, GitHub

Soft Skills
Problem-Solving
Critical Thinking
Adaptability
Communication
Time Management

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Technological Institute of the Philippines (TIP) M

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CAREER OBJECTIVE

To be a part of a dynamic and innovative company where I can utilize my skills and expertise in programming, particularly in web development and software development. I aim to contribute to impactful projects, enhance user experiences through efficient and scalable solutions, and continuously expand my knowledge of emerging technologies to deliver excellence in every endeavor.

DESIGN PROJECT COMPLETED/ RESEARCH

PigConnect: Web-based Pig Recommendation and Information System
PigConnect is an innovative web-based platform designed to streamline the process of buying, selling, and managing pigs. It leverages advanced technologies to provide personalized recommendations, real-time notifications, and comprehensive information management for pig farmers, buyers, and other stakeholders in the pig farming industry. Technologies Used: Laravel, VueJS, MySQL, Django, FastAPI, OpenAI API, Google Maps API, WeatherAPI, Amazon Web Services EC2, ChartJS. Tailwind-CSS Link: https://pigconnect.shop

ON-THE-JOB TRAINING/ PRACTICUM/ INTERNSHIP EXPERIENCES

- Sales Advisor
  Concentrix
  Mandaluyong
  September 15, 2021 - November 01, 2023

  - Assist customers with their billing, technical and order concerns.
  - Provide above and beyond customer service to make sure the satisfaction of the customers.

- Patient Care Coordinator
  Allsectech Manila Inc
  Taguig City, Metro Manila
  December 29, 2023 - Present

  - Assisting patient in setting up, reschedule and cancel appointment
  - Send message to the doctor's office regarding patient's questions and concerns
  - Providing the best care the the patient by resolving their concerns as quick as possible

- Data Intelligence Analyst
  Kyros Technologies Philippines
  Better Living, Don Bosco, Parañaque City
  March 10, 2025 - May 28, 2025

  Key Responsibilities:

  - Develop and maintain web scraping scripts using tools and languages like Python, Selenium, BeautifulSoup, Scrapy, or similar.
  - Automate data extraction from diverse online sources (websites, APIs, social media, etc.) ensuring data quality and completeness.
  - Transform the collected raw data into JSON format to create a structured and consistent data representation.
  - Save processed JSON data into databases (SQL, NoSQL, or others) for efficient storage and retrieval.
  - Handle large-scale data ingestion by designing scalable scraping workflows and managing efficient data storage.
  - Clean, transform, and preprocess raw scraped data to make it usable for downstream data analysis or machine learning models.

- Implement strategies to avoid scraping blocks, such as rotating proxies, using headless browsers, managing request timing, and simulating human behavior.
- Monitor and troubleshoot scraping pipelines to ensure reliability and timely data delivery.
- Maintain documentation and version control for all scraping tools, workflows, and visualizations.

KNOWLEDGE, SKILLS AND ATTITUDE

Having graduated from TIP with its orientation towards outcome-based education, I have acquired and can demonstrate the following student acquire outcomes (knowledge, skills and attitudes) necessary to the practice of the computing profession:

- *Analyze complex problems and identify and define the computing requirements appropriate for solution.*
- *Use modern techniques and tools of computing practice in complex activities.*
- *Understand professional, ethical, legal, security and social issues and responsibilities relevant to professional computing.*

OTHER SKILLS

- Proficient in **Laravel** for web development.
- Working knowledge of **React**, **Django**, **Express**, **Node.js**, and **Vue.js**.
- Have knowledge in programming languages such as **Java**, **PHP** and **Python.**
- Experienced in designing and implementing **RESTful APIs** within systems.
- Skilled in **HTML**, **CSS**, **Bootstrap**, and **Tailwind CSS** for responsive and modern web design.
- Proficient in using **MySQL**, **MongoDB**, and **JSON** for database management and data manipulation.
- Capable of interpreting complex systems and debugging efficiently to ensure optimal functionality.
- Capable of quickly learning and adapting to new programming languages and technologies required for system development.
- Capable of collaborating with ideas with other people and giving insights on what's best to be implemented to the system.
- Knowledge in web scraping tools and libraries such as Selenium, BeatifulSoup, Scrapy, Undetected-Chromedriver and Request.
- Knowledge in web scraping ideas such as IP rotation, headless-browser, stealth scraping, random delays + actions and reverse engineering or getting the API of the target products.
- Knowledge in AWS Lambda, S3 and Cloudwatch.
- Knowledge in creating data pipelines and scheduling tasks using cronjob and Apache Airflow.
- Knowledge in using data visualization tool such as PowerBI.
- Knowledge in ETL (Extract, Transform, Load) process.

CERTIFICATIONS

- **Data Engineer Certificate**
  DataCamp
  June 26, 2025

- **Associate Data Engineer Certificate**
  DataCamp
  June 12, 2025

- **Tata Group - Data Visualization: Empowering**
  Business with Effective Insights Job Simulation Certificate
  Forage
  March 18, 2025

REFERENCES

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