AI BASED FARM ACCOUNT TRACKING AND PREDICTION SYSTEM

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IN PARTIAL FULFILLMENT OF THE AWARD OF BACHELOR OF SCIENCE (B.Sc.), DEGREE IN COMPUTER SCIENCE.

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JUNE, 2026.

APPROVAL PAGE

The Project "AI Based Farm Account Tracking and Prediction System" has been reviewed and approved by The Department of Computer Science and Mathematics Committees of The Faculty of Computing and Information Technology at Godfrey Okoye University, Enugu, Nigeria.

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CERTIFICATION

I certify that the investigation submitted on the present paper has been accomplished to the best of my knowledge, that it is primarily based on personal observations and investigation. In this respect, I pledge my compliance with the university decision, should I be found guilty of cheating.

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DEDICATION

This project is dedicated to almighty God, through whom all strengths and wisdom were attained, who directed all my steps through the course of this work and to my loving family; Thank you for all the sacrifices you made for my career to make my study become a reality, your love and trust have been my motivation.

ACKNOWLEDGEMENTS

To my esteemed supervisor Engr. Dr. Lucy Ezigbo on his unwavering support, intellectual input, criticisms, corrections, patience, and expertise that guided the work in its journey towards completion and its overall quality. May the Almighty continue to guide and strengthen him.

I pay special tribute and my humble appreciation to the Head of Department, Dr. Frank Okebanama, and the academic staff in the Department of Computer Science and Mathematics, Godfrey Okoye University; their efforts, teachings, training and discipline in the over years built the academic structure on which this work stands. I want thank my teachers, lecturers, and mentors whose imprints can never be effaced.

To my dear parents, for the continuous and unwavering financial support, prayers and encouragements that powered my academic pursuits. Your sacrifices are a veritable testament of your unconditional love for me, and your encouragement and belief in my capabilities spurred me on to persevere especially during moments of frustration. My thanks goes to my family and colleagues for offering necessary and helpful suggestions, contributions, encouragement and motivational assistance that facilitated the progress and eventual success of this project.

Finally, I express my deep appreciation to all authors and researchers whose works serve as references and a guide to this project.

ABSTRACT

The increased need of efficient farm monetary management also signifies the incapability of older techniques in keeping farm's financial records. Majority of farmers keeping their accounts by a piece of paper and by diary. This technique results in numerous mistakes like mathematical errors, lost documents, messy and unstructured data and poor planning of agricultural ventures. However most of the farmers rely upon their intuition to predict future investment and earn. Therefore the study on risk is also higher. This project design and development of AI-Based Farm Account Tracking and Prediction System, to enhance effective financial management among crop farmers. The system is capable to store the financial details of the farm, such as cost of input and profit. The project automates the process of calculating profit and loss, generation of report, and predicts the farm's future profit based on AI techniques. This project implemented using the client-side framework HTML, CSS, JavaScript as user interfaces while server side frame work, such as flask, python as backend, MySQL for the database, and Scikit-learn as the Machine learning Model. Based on a supervised learning-based approach which involved regression models was utilized to investigate patterns in past farm data for the purposes of predicting future earnings. To make sure of the success of this project, performance of the system was evaluated. Which is tested and assessed using; System Testing: to ensure the validity of software's functionality in expenses and profits calculation and report generation, Model Evaluation: to evaluate the performance of the machine learning models used to predict the farm's income, using statistical measurements of error like the Mean Absolute Error, and R-squared metrics. User Testing: To measure the system's usability by the end users who actually are crop farmers. The system's testing and evaluation results clearly indicated a successful record of the entire process of expenses and income management of the farm and also proven its efficiency to calculate profit and loss, create reports and accurately predict farm's income with greater degree. From the outcome, it can be concluded that AI-Based Farm Account Tracking and Prediction System helps to boost the recording quality of the farmers in their respective farms and to take accurate decisions to reduce investment risk for more sustainability crop cultivation and farming system.

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INTRODUCTION

1.1 Background to the Study

Food security and a nation's economic well-being is hugely dependent on agriculture. The sector is of vital importance in a lot of countries in development, and is critical to people living in countries like Nigeria, who are most dependent on this profession (Vassiliades et al., 2024). Small and medium agriculture scale farming is a source of employment in the rural areas and meets a significant number of food requirement (Vassiliades et al., 2024). But contrary to expectations, even with the farmers' diligence and hardworking effort, most smallholders had historically continued to carry out the accounting operations and recordkeeping process in the traditional and time-worn methods (Zarei et al., 2024). Within their scope of operations in the rural settings, expenditure and income are typically recorded on loose notes, books or, at times, not kept in records at all. A large number of poor smallholder farmers were characterized by inability to keep adequate financial and operational data which will help in knowing if they make gains or losses on their farms (Zarei et al., 2024). Inadequate and unreliable resource access (Zarei et al., 2024), coupled with use of rudimentary tools affect their performance. Digital agriculture technologies are transforming how farms are run through innovative methods. Farm management system (FMS) has begun to be adopted by farmers as a method of digitally managing records and facilitating tracking and generation of reports, which will help organize data and prevent loss (Javaid et al., 2023). Nevertheless, current FMS are either too complicated to grasp, unaffordable for a good percentage of the smallholders, not tailored for use in the small-scale crop farming environments (Javaid et al., 2023; Vassiliades et al., 2024). Many would have problems working with these FMS due to a variety of issues, such as lack of digital literacy and skills among these farmers

(Vassiliades et al., 2024). Besides that, the low internet coverage and unreliability of internet access in remote area can also be a constraint in implementing such technological advances (Vassiliades et al., 2024; Zarei et al., 2024). Beyond financial and operations recordkeeping challenges, what poses to be another very big issue to smallholders is the prediction of future returns from expenses on resources for cultivation, such as seeds, fertilizer, laborers. Lack of adequate future financial planning on the farmer's part due to high uncertainty can lead to significant financial loss (Zarei et al., 2024). Poor actual yield performance as influenced by uncertainty of natural condition results in estimation difficulty in forecasting their actual returns in future (Zarei et al., 2024). AI and ML have recently contributed to a number of incredible advancements, which include using data to build future predictions and uncover patterns in large and vast datasets (Javaid et al., 2023; Zarei et al., 2024). For example, in farming AI and ML can be used to accurately predict the output yield, crop yield price and the future income earned from the farm (Zarei et al., 2024). By way of illustration, time series methods can forecast time-varying behavior of a sequence over time (Zarei et al., 2024). A prediction model can be embedded in the FMS to support farmers to moving from estimation-based planning to more data-centric decision making (Javaid et al., 2023). This study therefore focuses on designing and developing an AI tool for input recording and revenue forecasting for crop farmers. Farm management technologies for smallholder farmers enable access to informative data for farm management (Javaid et al., 2023; Vassiliades et al., 2024).

1.2 Statement of the Problem

Every business needs strong financial planning to flourish. Similarly, the crop farmers need financial plans to survive for success, but the crop farmers encounter problems while keeping their records regarding expenses and figuring out their profit in real. Most of the farmers have handwritten records of their expenditure where often they left many data blank, they do not check for math errors and also miss some financial records. Moreover, they may not have access to proper advice. Inefficiencies in financial planning and also the use of resources have been the challenge faced by the farmers (Javaid et al. 2023). Lack of predictive tools: Many farmers lack the facility to estimate financial outcomes and have access to predictive tools to examine the existing data and predict the financial outcome. The farmers have to plan their investments in seeds, fertilizer, labor, irrigation system, without any idea of their respective yields and income from them. There is deficiency in financial planning by crop farmers as it makes budgets hard and increasing the risk (Vassiliades et al. 2024). Investing in agricultural may go poorly if planning isn't perfectly aligned with actual costs and outputs. (Zarei et al. 2024) Deficiency of smart digital tools: Most of the digital farm solutions focus on the storage and generation of simple reports and lack a predictive capability. As there is no predictor, the crop farmers cannot extract significant information or prediction from their data. There is a high necessity to develop a smart system which record the income and expenses and further predict future income using predictive tools. This will help in making correct financial decisions, reduces the risks and increase the profitability and output of the crops (Vassiliades et al. 2024; Zarei et al. 2024).

1.3 Aim and Objectives of the Study

Aim

To build an AI-powered farm tracking and prediction system to assist crop farmers in planning.

Objectives

I. Developing an expense tracking and management system in crop farming to include expenditures on seeds, fertilizers, labor, rent, etc (Zarei et al., 2024).

II. Building a profit / loss calculator by tracing expenses, tracking crop yields, estimating harvest values and tracing crop revenue in sales and by products.

III. Constructing a prediction machine learning model by analyzing the effect of crop types and farm expenses on probable income in the next years (Zarei et al., 2024).

IV. Creating a set of reports by using farm spending, sales, yield and crop type to demonstrate the performance of a crop farm on the basis of farm's profit and loss over time.

V. A tool that provides decision and risk analysis by providing a deep analysis about the crop farming based on farm expenses, sales, yields, soil analysis (if available) etc. (Javaid et al., 2023; Vassiliades et al., 2024).

1.4 Research Questions

This study seeks to answer the following questions:

i. How can a computerized system effectively record crop farming expenses and income?
ii. How can a system accurately calculate profit or loss from saved farm data?
iii. How can Artificial Intelligence predict farm earnings based on input expenses?
iv. How much can the new system improve financial planning for crop farmers?
v. How user-friendly and reliable is the AI system for small and medium-scale farmers (Vassiliades et al., 2024)?

1.5 Significance of the Study

To Crop Farmers

With the system, the farmers are able to maintain the books precisely, the profitability of the farm can be monitored and the farmers know their potential returns even before making the investment. The use of AI system minimizes risks and enhances predictability. Uncertainty is lowered, so the success rate and profitableness are increased.

To Agricultural planners and Extension Workers

The findings in the research reveal the role of modern technologies like Artificial intelligence (Javaid et al.2023) which facilitate agricultural extension service through effective targeting of farmer through providing tailored, time sensitive advice to them in need of assistance (Javaid et al 2023).

To Researchers and Students

This research will expand the academic knowledge by the fusion of agriculture, finance, and intelligence system knowledge. Studies on Bibliometrics have revealed that AI on agriculture has an expanding body of research that identified future directions and present research trends (Ofori et al., 2023).

To the Agriculture Sector

This system encourages digital technologies to farming, and digital innovation is the core element for Agriculture 4.0. Agriculture 4.0, to promote digitalization across the agriculture sector and the increased productivity, resource efficiency and sustainability of Agriculture 4.0 (Vassiliades et al., 2024).

1.6 Scope of the Study

This research is the design and construction of an AI system for finances management for the crop farmers with a predictive function. The system would record farm expenditures and earnings, analyze profit and loss, forecast income using simple predictive machine learning, then generate simple financial reports.

It is only applicable to crops, but not on livestock. The first area of application where it is possible to have a full-scale and effective utilization of AI in the agriculture is crop production, which has led to an extensive amount of research focused exclusively on this type of production (Vassiliades et al., 2024). Past crop data and particular input parameters such as materials expenses and the crops that will be cultivated in each season will be given as inputs to prediction model. The predicted data may be then obtained with the utilization of ML that utilizes existing data to learn and create a prediction.

1.7 AI Implementation for Income Forecasting (Conceptual Explanation)

Integration of AI

With machine learning methods, including regression models to predict future income from farming based on its current results, the system predicts future potential earnings in farming. Machine learning methods such as regression involve finding the relationship between the independent and dependent variables (Vassiliades et al, 2024). Traditional time series and regression are utilized to predict future from historical data (Zarei et al, 2024).

Input Data (features)

i. Cost of seeds.
ii. Cost of fertilizers (Zarei et al., 2024).
iii. Labor cost.

iv. Irrigation cost (Zarei et al., 2024).
v. Crop type (e.g., maize, rice, cassava).
vi. Farm size (optional).

Output

i. Predicted revenue.
ii. Possible profit or loss.

Operational Process

I. The data from previous years are collected and stored in database.
II. The system trains an algorithm, for instance Linear Regression or Decision Tree, based on the previous expense and profit data (Zarei et al., 2024).
III. The farmer input possible future expenses into the system.
IV. The system utilizes the training model to analyze data and make a prediction of earnings that could be used in decision making (Javaid et al., 2023).
V. By adopting these steps, the AI is kept relatively simple and interpretable, ideal for this project. In agricultural field, the decision trees are typically utilized for classifying and predicting tasks because they are comparatively easy to build and understand (Zarei et al., 2024).

1.8 Definition of Terms

i. **Agriculture Farming:** The act of cultivating common crop foods such as maize, rice, and cassava on the field for both commercial and subsistence purposes.
ii. **Farming Cost:** Sum of money utilized in cultivating a particular plant crop, seed, fertilizer and labor costs are inclusive.

iii. **Income:** profit gained by an individual when total revenue is much higher than total cost.

iv. **Artificial Intelligence:** A field that encompasses building of computational systems to execute task that normally require human intelligence to performs such task as problem solving and decision taking (Vassiliades, et al. 2024).

v. **Income Forecasting:** Guessing future earnings based on past data and current inputs (Zarei et al., 2024).

vi. **Machine Learning:** A branch of AI that allows systems to learn patterns from data to make predictions and improve over time (Vassiliades et al., 2024; Zarei et al., 2024).

1.9 Limitations of the Study

i. The accuracy of the predictions depends completely on the availability and quality of past data. A major limitation of AI in agriculture is its heavy reliance on high-quality data, which is often uneven or missing (Zarei et al., 2024).

ii. The system cannot account for unpredictable events like extreme weather, pest attacks, or sudden market changes (Zarei et al., 2024).

iii. The study focuses only on crop farming and does not include livestock management (Vassiliades et al., 2024).

iv. Advanced AI models are not used because of limited time and resources (Vassiliades et al., 2024).

v. Internet connectivity may be needed for future updates or connecting to outside data. Smallholder farmers in rural areas often face poor internet connectivity, which limits the adoption of digital solutions (Vassiliades et al., 2024; Zarei et al., 2024).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter deals with prior studies on farm financial management systems, agricultural information systems, and smart agriculture technologies. We want to find what current solutions lack, where their advantages and disadvantages lie so as to emphasize the necessity of a better system. This literature includes discussions on manual and automated data management, farm management software, and the application of Artificial intelligence (AI) on the farm.

We concentrate on data-driven financial prediction on the crop sector. This analysis highlights current issues in farm management solutions; there are none which directly utilize farm's actual operational data for financial forecasts, thus demonstrating the relevance of an AI powered system for tracking farm expenses and anticipating potential earnings.

2.2Theoretical Background

The History of Farmland Records: The use of farmland records has always been crucial for farming. Before, when we had farmers who only utilized paper notebooks and ledgers, recordkeeping entails storing money details concerning seeds and fertilizers purchased, staff payments, or any kind of profit earned for farming produce but that is difficult as documents may be lost and human errors often arise due to manually performing computations (Basir et al., 2024). In that respect, agriculture altered due to technological advancements which kick off into what we call to be "Smart Farming". Modern agriculture uses different complex technological gadgets, such as FMIS, to handle farm-related data for farms and uses sensors, drones, and weather stations in crop observation. The existing, state-of-the-art, automated farms keep a log of their raw materials as well as of their machines' wellness but most do not give a 360 deg. View of the financial standing due to separate operations.

Data Management: The theory of systems integration: As discussed, it is a theory on how separate computer systems come together through the concept of the System of systems to integrate sensors, drones, farm machinery, and farming apps to combine the various pieces of data by integrating various operations, applications, data and network applications through cloud computing technologies, Web of Things, semantic technology or through other methods (Ahoa et al., 2025) Semantic Integration The concept has specialized data standard or schema used to give the common representation across distinct systems or technologies for machines.

Data integration: This theory combines both systems integration and semantic integration concepts to manage a group of systems or components as a cohesive system for achieving global consistency.

Multiagent systems and knowledge representation: The theory utilizes the approach of intelligent agents that come together to carry out these duties without an overwhelming set of training information for its components. They combine data with context and meaning through knowledge graphs with the intention of organizing them together for distinct domain categories like animal healthcare or specific crops needs. By integrating a variety of context sources using a common layering structure to integrate disparate data types while sustaining precise semantics of different parts. It supports multi-source evidential information fusion that integrates information of both textual information and visual information, forming a single unified source of truth (Zhang et al., 2026).

The Five Tiers of agroecological transition: The current research draws on the theory of ecological transition and describes a 5-tier transition of farming.

I. Agricultural ecosystems are characterized by an initial reduction in the reliance on inputs.
II. Substitutes synthetic with organic inputs.
III. Restructures entirely the farm to take more diverse flora and fauna.
IV. Sets a new structure of the farm by introducing close and direct farmer-consumer relationships.
V. Transforming the whole of society, including the global food systems.

(Anastasiou et al., 2025)

Theory of FMIS and The Data-Information Life Cycle Framework: This theory is composed of different stages that begin with a series of data inputs that culminate into actual farming decisions and actions; the whole is called as the Life Cycle for Data. The model classifies faring monitoring into environmental, product, and operational. The product can be further separated into a material or production, or when your machine is expected to crash; these can be grouped as machine monitoring, tracking of goods, and logistical management of your products. (Mahmood et al., 2026)

2.3 Review of Related Literature

2.3.1 Agricultural Management Information Systems (AMIS) Agricultural Management Information Systems gather, process and store data on agricultural enterprises. FMIS applications are widely used in crop farming to time planting schedules and track yields. Studies revealed that

FMIS solutions were the most common type of software solutions used among the farmers globally (Paraforos et al., 2016). Web-based platforms were developed to help farmers centralize farm information, including daily activities, finances and sales information (Sivaraman et al., 2026). Field operation monitoring is a central element of this category, providing farmers with real-time field activity updates, such as planting and pesticide application. These tools are mostly designed for commercial farmers; hence they emphasize efficiency rather than financial forecasting ability.

2.3.2 Integration Challenges in Smart Farming Even though digital technologies are widespread in the agricultural sector, there is a lack of interoperability among different smart farming systems. These different platforms utilize various systems for the data generated from sensors, drones, and financial management. Since these platforms are often produced by various companies, it results in data mismatch or incomparability. The study reported that the incompatible digital tools posed the largest technical barrier to adopting smart farming technology (Ahoa et al., 2025). Furthermore, there are also challenges relating to data governance and security, with several researchers suggesting cloud-based integration solutions and clear policies. Basir et al. (2024) also indicated that several agricultural apps provide locked data and require extensive manual entries which could lead to mistakes.

2.3.3 Applications of Artificial Intelligence in Farming AI is being increasingly utilized in agriculture to help make predictions and find patterns by analyzing vast data quantities (Ali et al., 2025). Currently in crop farming, AI is employed for predictive yield, pest monitoring and soil analysis by use of machine learning, deep learning and computer vision approaches (zoul, 2025). For example, AI is used to examine leaf images to detect diseases on tomato and rice plants

(Sivaraman et al., 2026). AI-based tools, which are highly accurate in predicting crop and health conditions, do not pay attention to the economic outcomes that farmers are most interested in.

2.3.4 Generative AI and Localized Extension Services The adoption of generative AI and large language models has recently opened up new pathways for farming knowledge sharing. These models synthesize information from research, climate reports, and various other documents to generate personalized advice. Voice-based applications and chat systems like WhatsApp powered by generative AI deliver localized advice in real time (World Bank Group, 2024). Tools like AgroTutor translate expert knowledge into various native dialects, thereby leveraging localized and inexpensive communication platforms such as WhatsApp to bring tailored and relevant information to smallholders (Nagaraji et al., 2024).

2.3.5 Market Optimization and Inclusive Finance Beyond the farm, AI supports financial products and the optimization of markets. Machine learning-based approaches enhance the access of loans to rural farmers by integrating new forms of data, including cell phone usage and satellite imagery. In insurance, automatic crop insurance uses sensor data for triggering claim payouts in response to extreme weather events without the need for cumbersome field-based verification. Within markets, AI facilitates price forecasting, the optimization of supply chain logistics, and the reduction of food loss (World Bank Group, 2024).

2.3.6 AI-Based Financial Forecasting i.e., the prediction of future financial trends based on past financial data, is also an application in agriculture. Digital tools contribute positively to farm economies through enhanced production efficiency and reduced resource consumption. For example, one study found that combine operational costs with the expected yields could predict future incomes (Paraforos et al., 2016). Few current AI applications are designed with the explicit intent of a simplified tool that integrates these features for farmers. Many are over-engineered or built for much larger farms.

2.3.7 Bibliometric Mapping of AI in Postharvest Agriculture We performed a comprehensive bibliometric mapping of 586 research articles published on artificial intelligence applications in postharvest agriculture between 1994 and 2022. The volume of publications has increased substantially, especially during the last decade, with the main contributing countries being China, the United States, and India. The core, well-established topics include food grading, sorting and quality assessment. On the contrary, cold chain logistics, the Internet of Things, and real-time monitoring emerge as research areas requiring more research efforts. To reduce postharvest losses and ensure global food security, research priorities should be addressed towards these under-developed areas of research (Fadiji et al., 2023).

2.3.8 Challenges, Risks, and Limitations of Existing Systems Although there is clear potential with AI, there are several issues that are hindering the acceptance of the technology by the farmers. The lack of access to necessary technology is a large factor. The digital divide between urban and rural areas limits many of the remote rural regions, suffering from poor internet services, unreliable electricity access, and lack of basic devices (Lakshminarayan et al., 2025). In addition, there is also a widespread problem with bias in these AI models as data used for training is mainly collected from developed countries (World Bank Group, 2024). Some of the pervasive failures of existing agriculture are evident in all these examples:

I. Constant dependence on manual paper-based recording (Basir et al., 2024)

II. Digital solutions unable to interconnect and sharing data due to varied technical standards (Ahoa et al., 2025)

III. Strong dependence on visual monitoring for crop health rather than for predicting revenue

IV. Lack of proper and reliable field-based data, with current AI tested only in labs rather than on field (Lakshminarayan et al., 2025)

2.4 Summary of Literature Review

S/N	Author(s)	Contribution	Technique or Methodology	Limitations
1	Ahoa et al. (2025)	**Topic:** Integration of smart information systems in the agri-food sector. **Data Collection:** 74 scientific papers (2010–2024). **Components:** IoT, FMIS, cloud platforms. **Algorithms/Models:** None strictly developed; conceptual framework. **Results:** Identified 27 integration challenges and proposed cloud and semantic web solutions.	Systematic Literature Review (SLR) using PRISMA.	Fails to address the specific roles of AI in solving integration issues and ignores organizational maturity levels.
2	Zhang et al. (2026)	**Topic:** Automated construction of multi-species livestock health knowledge graphs.	Zero-shot multi-agent framework, LLMs, and multimodal evidence fusion.	Focuses more on text data than rich sensor data; requires ongoing human expert

		Data Collection: 2,478 expert-annotated text samples and 500 image samples. **Components:** Text and image databases. **Algorithms/Models:** FARM multi-agent framework, Qwen2.5-14B-Instruct LLM. **Results:** Successfully extracted 29,064 entities to build a cross-species knowledge base.		updates to maintain accuracy.
3	Anastasiou et al. (2025)	**Topic:** Assessment of crop-related digital tools for agroecology. **Data Collection:** 453 relevant research studies from the Web of Science. **Components:** UAVs, RGB cameras, FMIS, DSS. **Algorithms/Models:** Analysis frameworks for sustainability. **Results:** Showed digital tools greatly improve economic productivity but mostly focus on basic input reduction.	Systematic literature search and mapping using PRISMA methodology.	Relies on only one academic database; impact assessments are subjective based on reviewer interpretations.

4	Mahmood et al. (2026)	**Topic:** Farm-level operational monitoring and classification framework. **Data Collection:** Literature analysis on sensing, processing, and decision-making. **Components:** FMIS, real-time control sensors. **Algorithms/Models:** Conceptual flow mapping. **Results:** Classified operational monitoring into material, logistics, and predictive maintenance.	Conceptual framework design and data-information flow mapping.	Academic understanding remains fragmented; lacks deep integration of AI and edge computing.
5	Özoğul (2025)	**Topic:** AI in farm production and supply chains. **Data Collection:** Images from drones and smartphones, farm condition data. **Components:** Farm machines, robots, cameras, blockchain. **Algorithms/Models:** ML, ANN, Fuzzy Logic, Genetic Algorithms, CNNs.	Computer vision for images, smart robots for harvest, and blockchain tracking.	Poor internet, lack of power, and low tech skills stop farmers from using these tools.

		Results: Better resource use, early plant disease detection, tracked animal health, and lower labor costs.		
6	World Bank Group (2024)	**Topic:** AI for farm advice, money help, and market growth. **Data Collection:** Weather reports, satellite pictures, mobile phone records, research papers. **Components:** Voice systems, WhatsApp, remote sensors. **Algorithms/Models:** Generative AI, LLMs, RAG, Machine Learning. **Results:** Personal advice for farmers, new loan methods, automatic crop insurance payments, and less food waste.	Using RAG to link LLMs with local data; remote sensors for insurance payouts.	AI models are biased by data from rich countries. Poor internet and lack of devices are big problems.
7	Nagaraji et al. (2024)	**Topic:** Local AI farm advice for small farmers. **Data Collection:** Local dialects, farm terms, and science knowledge bases.	Connecting general AI to specific local science facts using RAG and translation tools.	None explicitly mentioned in the text.

		Components: AgroTutor, Farmer.Chat, text-to-speech tools. **Algorithms/Models:** Generative AI, LLMs, RAG. **Results:** Cheap and highly correct farm advice in native languages for farmers in India, Kenya, and Mexico.		
8	Lakshminarayan et al. (2025)	**Topic:** Challenges, risks, and real-world testing of AI in farming. **Data Collection:** Rapid review of 51 peer-reviewed research papers. **Components:** Farm systems in poorer countries. **Algorithms/Models:** Predictive modeling evaluation. **Results:** Showed that most AI tools are tested in labs, not on real farms.	Rapid review of literature to find gaps in real-world testing compared to lab tests.	Language barriers, AI bias, lack of trust, and a lack of real field tests stop widespread use.
9	Ali et al. (2025)	**Topic:** AI for Sustainable Agriculture.	Systematic Literature Review using the PRISMA framework.	Small farms lack the internet and computer power needed. AI

		Data Collection: Review of existing scientific literature. **Components:** Smart farming digital platforms. **Algorithms/Models:** Random Forest, Support Vector Machines, Time Series. **Results:** AI tools improve crop selection and yield predictions but face data privacy issues.		struggles in different weather/soil types.
10	Sivaraman et al. (2026)	**Topic:** Farmer Management System for precision agriculture. **Data Collection:** Farm inputs, sales, and images of plant leaves. **Components:** Web platforms, mobile interfaces, crop cameras. **Algorithms/Models:** Python-based Deep Learning models. **Results:** Web system tracks daily tasks and finds diseases in rice and tomatoes to lower costs.	Web application using Django, PHP, and MySQL; Deep Learning for images.	System requires the user to upload clear images of plant leaves for the AI to work well.

11	Paraforos et al. (2016)	**Topic:** Farm Management Information System (FMIS) using Future Internet. **Data Collection:** Inputs, tasks, and money data over one farming season. **Components:** Cloud software ("ifarma"), mobile devices. **Algorithms/Models:** Financial tracking and profit calculation logic. **Results:** Successfully tracked farm tasks, costs, and profits for a winter wheat crop.	Built using Future Internet technologies, FIWARE, and a MySQL database.	Farmer must enter data by hand; does not automatically pull data from field sensors.
12	Basir et al. (2024)	**Topic:** Comprehensive review of on-farm recordkeeping. **Data Collection:** 29 software programs and 31 mobile apps. **Components:** Digital apps and traditional paper ledgers. **Algorithms/Models:** Proposed future voice-to-text AI models. **Results:** Most apps cost money and lock data away.	Systematic review across research databases, university sites, and app stores.	Most digital farm tools still need a lot of manual typing, leading to mistakes.

		Proposed voice-recording to automate notes.		
13	Fadiji et al. (2023)	**Topic:** Mapping AI research agenda in postharvest. **Data Collection:** 586 Scopus papers. **Components:** AI, ML, DL, NNs. **Results:** Rapid growth since 2009; IoT/cold chain identified as low-development niches; agenda proposed for grading/sorting.	Bibliometric analysis using VOSviewer and Bibliometrix.	Only used Scopus database; exclusion of papers without keywords; citation lag for recent studies.

Table 2.1 Summary of Literature Review

2.5 Research Gap

It can be identified through the analyzed works that a number of systems for management in the fields and surveillance in cultures are already developed, and a great deal is left to do for integrating financial tracking and AI prediction information.

Most systems;

I. Largely concentrate on recording operations data, physical plants, equipment, not on financial outcomes (Mahmood et al., 2026),

II. Difficult to share data with technology constraints, inaccessible data, bad communication lines (Ahoa et al., 2025; Basir et al., 2024).

III. Provide reports on plant diseases, yield with sensors and drones, without direct financial prediction for the farmer (zoul, 2025).

IV. Prioritize the simple input reduction, but lack direct financial outputs and monitoring of profitability.

It is absolutely essential to have a unified platform with efficient farm expense management, straightforward profit analysis and an AI driven forecast on income generation. Such a system can directly bridge information generation with financial management leading to more predictable income generation for farmers by easily identifying financial gains or losses and eliminate the practice of error-riddled record keeping.

CHAPTER THREE

SYSTEM ANALYSIS AND DESIGN

3.1 Introduction

In this chapter, we will be examining how the design and Analysis phase of the AI-based farm expense tracking and income prediction systems was carried out. The chapter focuses on existing systems, limitations found, and then how the developed system was implemented. This will also include details about system architecture, data required and method of implementing AI aspect.

3.2 Analysis of the Existing System

The current practices followed by most crop producers are the result of the "old systems" and mainly depend on manual recording methods such as personal logs, memory, notebooks, or any informal ways to take the records of costs and sales (Basir et al., 2024). Only a minority of farmers employ or access rudimentary technology, for example in using simple software like spreadsheets.

Characteristics of the Existing System

i. Farm expenses and income are recorded manually (Basir et al., 2024).

ii. Use of notebooks or paper-based records

iii. Calculations are done by hand

iv. Little or no use of digital tools

Problems of the Existing System

i. Inaccuracy: There is a high chance of calculation errors (Basir et al., 2024).

ii. Data Loss: Records can easily be lost or damaged

iii. Poor Analysis: It is difficult to track changes or trends over time (Sivaraman et al., 2026).

iv. No Prediction Capability: Farmers cannot estimate future income

v. Time-Consuming: Manual recording and calculations take more time

Based on this, an improved framework system should be developed in the agricultural sector that will help the researchers, practitioners and the farmers get accuracy, time efficiency and decision support which are of higher significance (Basir et al., 2024; Sivaraman et al., 2026).

3.3 Analysis of the Proposed System

The introduced system consists of a system using the current issues and solution on the tracking and analysis of the farm expenses and income prediction using AI. (Basir et al., 2024)

Key Features of the Proposed System

i. Digital recording of farm expenses and income

ii. Automatic calculation of profit or loss (Paraforos et al., 2016).

iii. Storage of farm data in a structured database (Sivaraman et al., 2026).

iv. Generation of financial reports

v. AI-based prediction of expected income (Ali et al., 2025).

Advantages of the Proposed System

i. Improved accuracy with fewer errors

ii. Safe and well-organized data storage (Paraforos et al., 2016).

iii. Faster processing of information

iv. Ability to review and analyze past records

v. Prediction of future income to support better decision-making (Ali et al., 2025).

3.4 System Requirements

3.4.1 Functional Requirements

The system should be able to:

i. Allow users to register and log in

ii. Record farm expenses, such as seeds, fertilizer, and labor (Paraforos et al., 2016).

iii. Record farm income from crop sales
iv. Calculate total expenses, revenue, and profit
v. Generate financial reports
vi. Predict expected income using AI (Ali et al., 2025).
vii. Display prediction results clearly to the user

3.4.2 Non-Functional Requirements

i. Usability: The system should be simple and user-friendly
ii. Reliability: The system should produce accurate results
iii. Performance: Fast response time when processing data
iv. Security: User data should be protected (Sivaraman et al., 2026).
v. Scalability: System should support future upgrades

3.5 System Design

3.5.1 System Design Methodology and Architecture

The system has been designed to provide maintainability, efficiency, manageability and also for making possible future enhancements to the system. This system was designed through object-oriented approach, Three-tier architecture and supervised learning model was used for income prediction, which will be explained later. (Ali, 2025)

3.5.2 Object-Oriented Design Approach

Object-Oriented Design approach is used to implement the system. Object oriented designing approach deals with the concept that, a system consists of a set of related objects and in which a particular object represents the real-life part of farm management processes.

Key entities in the system include:

i. User

ii. Expense

iii. Income

iv. Prediction

All these identified components are modelled as a class with some defined properties and methods which makes the structure of the system more comprehensible, easy to maintain and reuse the code to any part of the system, even extends in future to accommodate any new features.

3.5.3 System Architecture

This design involves a three-tier architecture for the system, segregating the architecture into three core strata (Sivaraman et al. 2026):

1. Presentation Layer

This is what the farmers interact with on the system. The farmers input details like expenses and income into this interface, view different kinds of report and predictions generated by the AI model. The stack of technology for this is HTML, CSS, and Bootstrap.

2. Application Layer

This is where all the main processing is done. This layer takes in the user inputs, performs calculations, and allows it to integrate with the AI model to produce a prediction on income. The application layer is implemented using a Flask framework.

3. Data Layer

Layer This layer stores the users, expenses and income data. Also, the data that are generated by the prediction engine are stored either at the data layer or application layer (for a brief duration). The data is stored using a MySQL database. This division help in clearly delineating the functional pieces of the application.

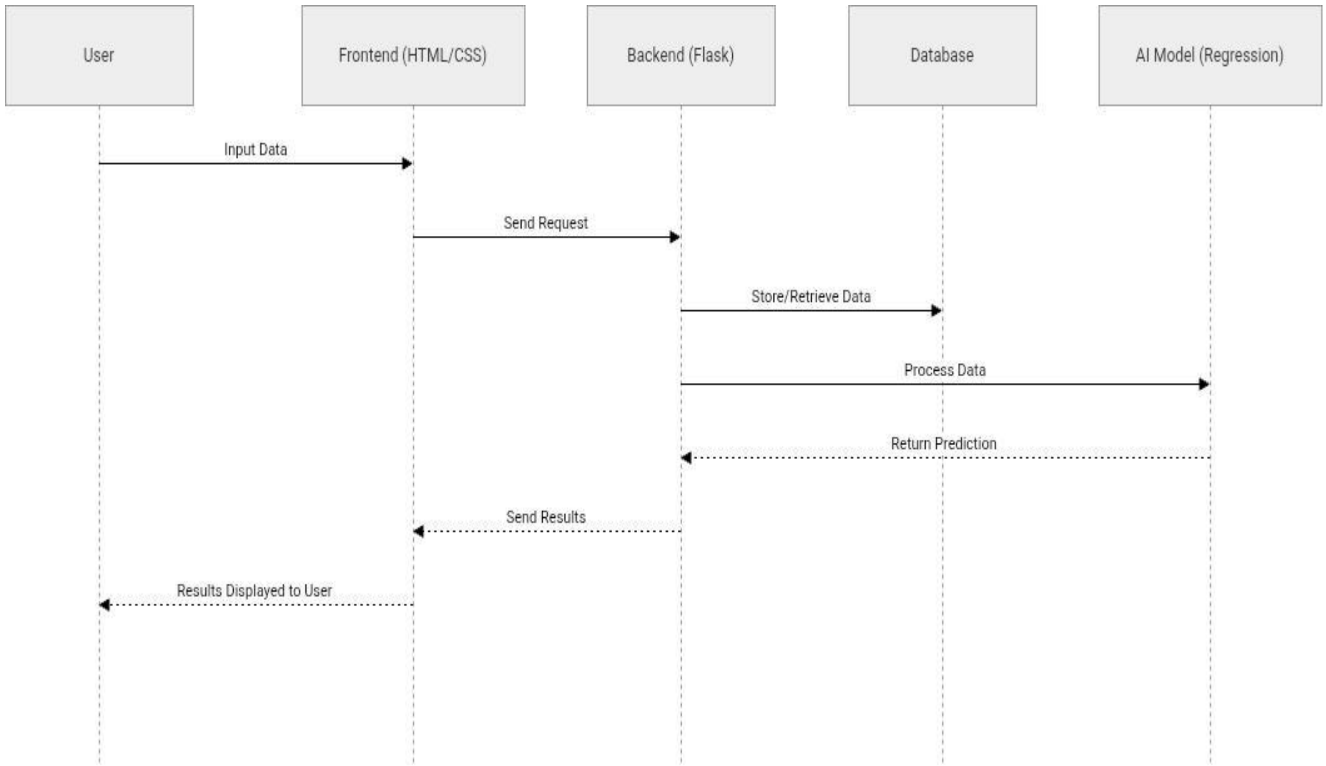

Figure 3.1 System Architecture

3.5.4 System Flow

i. User logs into the system

ii. User inputs farm expenses and income

iii. System stores data in the database

iv. System calculates profit or loss

v. AI model processes data and predicts expected income

vi. Results are displayed to the user

3.6 Data Collection and Preparation

For AI models, data is important for it to perform effectively. Data is essential for its accuracy for predictions. Below is a list of the datasets utilized to train the Model.

i. Historical farm records

ii. Sample datasets (for training purposes)

iii. User-entered data

iv. Data Preparation Steps

v. Cleaning data (removing errors or missing values)

vi. Organizing data into structured format

vii. Selecting relevant features

3.7 AI Model Design

Our model is trained on Machine Learning approach (specifically on Supervised Learning) of type Regression model which predict future Income. Factors that influence income will become the variables for our models to produce desired output. Factors considered:

i. Cost of seeds
ii. Fertilizer cost
iii. Labor cost
iv. Irrigation cost
v. Crop type

This trained model will further take a data of recent recorded expenses and Income of some past farm data and predict its Income.

3.8 System Modeling

To provide an abstract visualization and structural perspective of our entire system & processes, we will make use of the following UML tools in the Design section of our system architecture.

i. Use Case Diagram

ii. Data Flow Diagram (DFD)

iii. Entity Relationship Diagram (ERD)

iv. Flowchart

These tools give a visual depiction of system relations, data transmission, and database design.

3.8.1 Use Case Diagram (Description)

Actors:

i. Farm Manager (Primary User)

ii. AI Model

Use Cases:

i. Register/Login

ii. Record Expenses

iii. Record Income

iv. View Reports

v. Predict Income

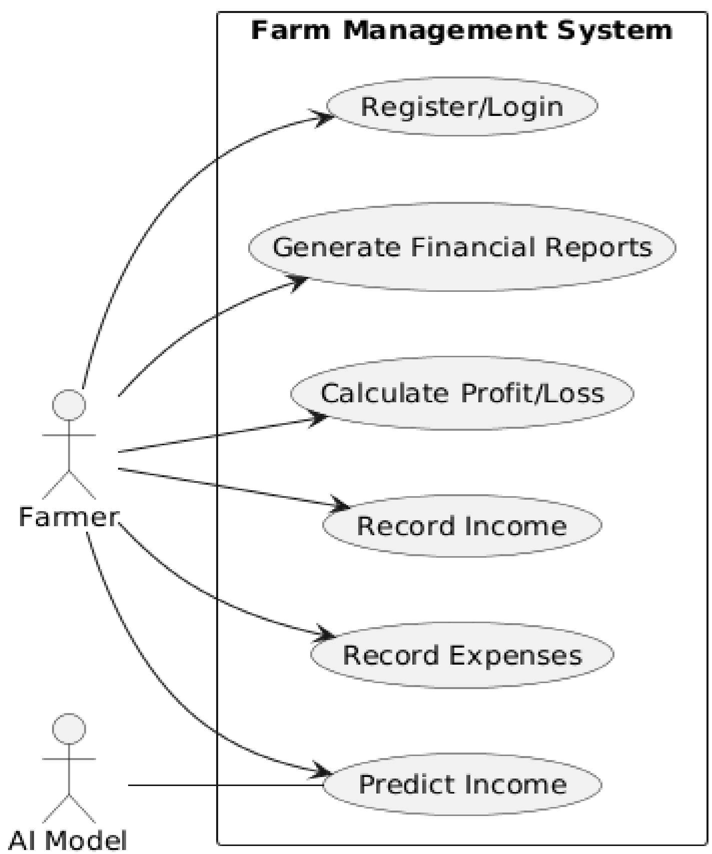

Figure 3.2 Use Case Diagram

3.8.2 Data Flow Diagram (DFD - Description)

Level 0 (Context Diagram):

User interacts with the system

System analyzes input and returns output

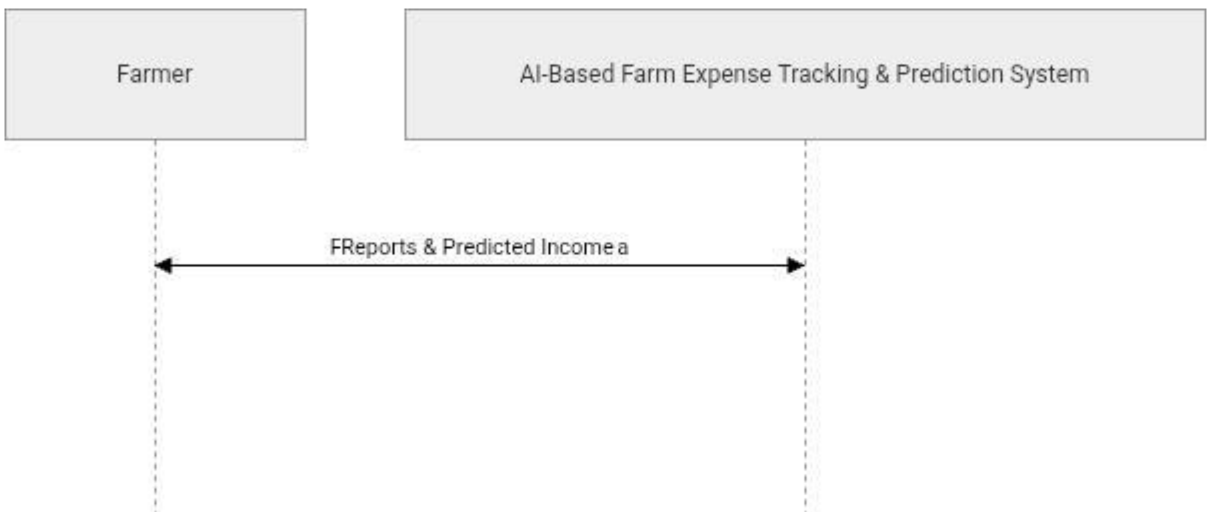

Figure 3.3 Context Diagram(Level 0)

Level 1:

Input Data → Process → Store in Database

Database → AI Model → Prediction Output

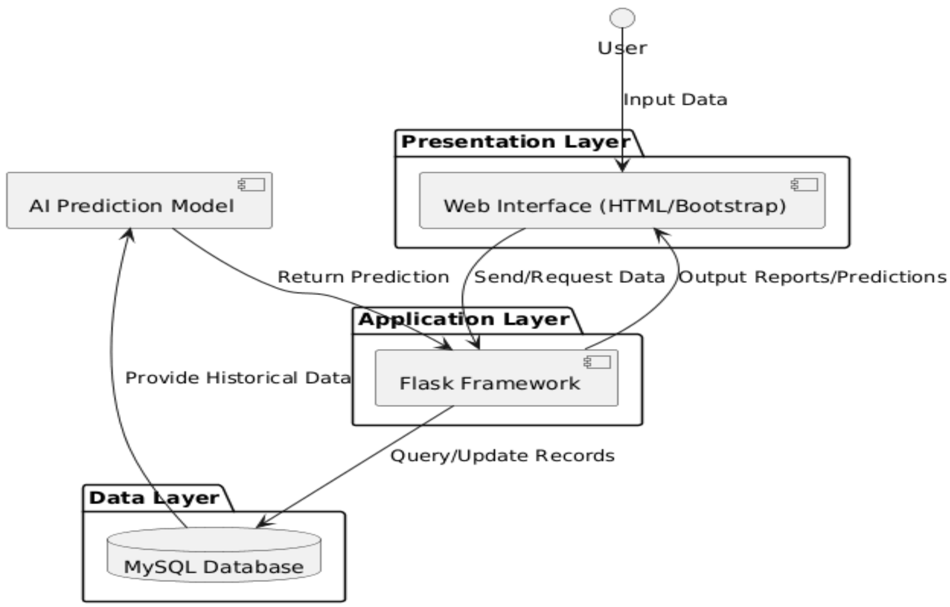

Figure 3.4 Data Flow Diagram (Level 1)

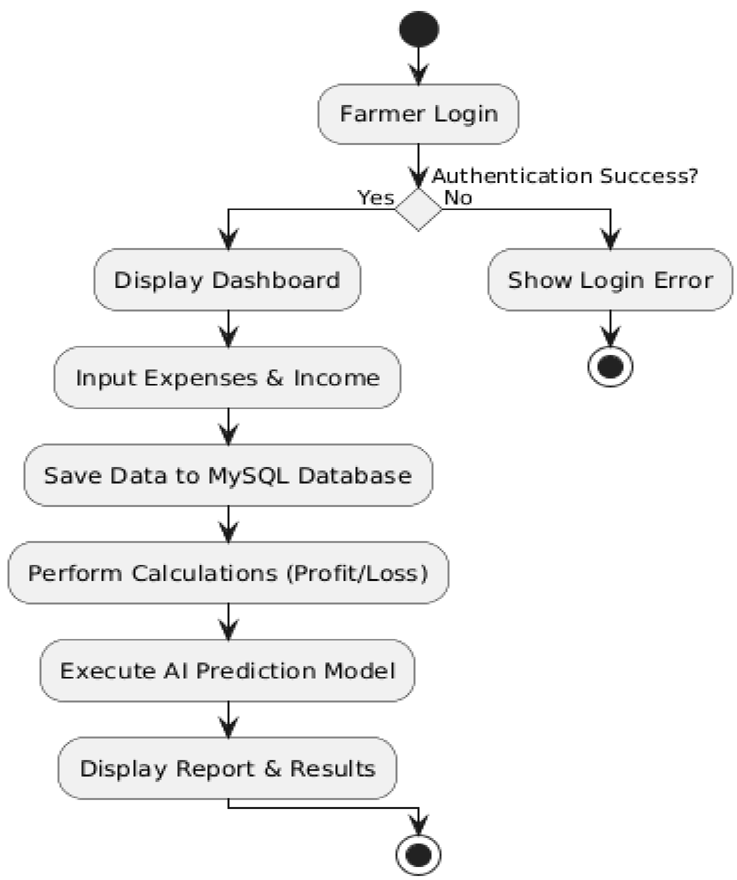

Figure 3.5 Flowchart

3.9 Development Methodology

The system is developed using the Waterfall Model, which follows a sequential process:

Requirement Analysis

System Design

Implementation

Testing

Deployment

This methodology is suitable for the project because the requirements are clearly defined, and it allows for proper documentation at each stage.

3.10 Database Design

Table 3.1: User Table

Field Name	Data Type	Key/Constraint	Description
user_id	INT	Primary Key, Auto Increment	Uniquely identifies each registered user
name	VARCHAR(100)	NOT NULL	Stores the full name of the user
email	VARCHAR(150)	UNIQUE, NOT NULL	Stores the user’s email address
password	VARCHAR(255)	NOT NULL	Stores the encrypted or hashed user password

Table 3.2: Expense Table

Field Name	Data Type	Key/Constraint	Description
expense_id	INT	Primary Key, Auto Increment	Uniquely identifies each expense record
user_id	INT	Foreign Key, NOT NULL	Identifies the user who recorded the expense
seed_cost	DECIMAL(12,2)	DEFAULT 0.00	Stores the amount spent on seeds
fertilizer_cost	DECIMAL(12,2)	DEFAULT 0.00	Stores the amount spent on fertilizer

labor_cost	DECIMAL(12,2)	DEFAULT 0.00	Stores the amount spent on labour
irrigation_cost	DECIMAL(12,2)	DEFAULT 0.00	Stores the amount spent on irrigation
date	DATE	NOT NULL	Stores the date the expense was recorded

Table 3.3: Income Table

Field Name	Data Type	Key/Constraint	Description
income_id	INT	Primary Key, Auto Increment	Uniquely identifies each income record
user_id	INT	Foreign Key, NOT NULL	Identifies the user who recorded the income
amount	DECIMAL(12,2)	NOT NULL	Stores the income received from farming activities
crop_type	VARCHAR(100)	NOT NULL	Stores the type of crop associated with the income
date	DATE	NOT NULL	Stores the date the income was recorded

3.11 System Implementation Tools

Software Tools

Frontend: HTML, CSS, JavaScript

Backend: PHP / Node.js / Python

Database: MySQL

AI Model: Python (Scikit-learn)

Hardware Requirements

Computer system

Minimum 4GB RAM

Storage device

CHAPTER FOUR

SYSTEM IMPLEMENTATION, TESTING AND OUTPUT

4.1 Introduction

This chapter presents the implementation of the AI-Based Farm Account Tracking and Prediction System. It discusses the development environment used, implementation techniques, programming modules, system requirements, software testing procedures, and the outputs generated by the system.

This was developed to enable farmers manage their farm expenditures, record income and generate reports, forecast their income using the artificial intelligence and many more.

4.2 Choice and Justification of Development Environment

The system requires development tools that include software programming language, framework and database.

Python

It was used as the main programming language for the AI part of system and it also played the role of the backend functionality for the system due to its relative ease and simplicity in use. There are many modules within the Python program which helped in ease of implementation such as; Scikit learning module for the prediction system.

Flask Framework

The system required a web framework to handle the user's queries and interact with the database. Flask web framework is a lightweight, versatile WSGI- compliant web framework and it is ideal for developing web applications since it allows simple integration with other libraries or modules which were required in the system such as the database management and prediction components.

HTML

It used to develop the webpage and structure for the user application.

CSS

It is used for the styling of the webpage.

JavaScript

It was also incorporated to increase the dynamism and usability of the system by providing some interactivity within the user interface.

MySQL Database

MySQL was incorporated into the system to manage store the user data and the data input by the user such as income, expenses and generated reports.

Scikit-learn

It was employed in machine learning algorithms, to create an accurate and efficient prediction of future income for farm based on historical data input by the farmer.

Visual Studio Code

It is use to write code.

Justification of Development Environment

The reason for choosing this environment is because:

i. It is easy to develop and maintain.

ii. It supports fast processing of data.

iii. It allows integration of artificial intelligence features.

iv. It provides a responsive and user-friendly interface.

v. It supports future improvements and expansion of the system.

4.3 Implementation Techniques

In implementation the actual system design was transformed into the software to achieve functionality in application form. The system was implemented with modular design to give each module to its own functionality and responsibilities; and yet to communicate with other modules. The application uses three-tier architecture, which consists of:

Presentation Layer

This layer enables interaction between the user and the system. Functions include:

i. User registration
ii. User login
iii. Expense entry
iv. Income entry
v. Report viewing
vi. Prediction viewing

Application Layer

This layer contains the business logic of the system.

Functions include:

i. Data validation
ii. Profit calculation
iii. Report generation
iv. AI prediction processing
v. User authentication

Data Layer

System data is maintained here in this system.

Functions include:

i. Data storage
ii. Data retrieval
iii. Data update
iv. Data backup

4.3.1 Programming Module Specification

User Management Module

Purpose:

Managing registration, user login, and authentication.

Functions:

i. User registration
ii. User login
iii. Password verification
iv. Session management

Expense Management Module

Purpose:

For entering and organizing the expenses of the farm.

Functions:

i. Add expense records
ii. Edit expense records
iii. Delete expense records
iv. View expense history

Income Management Module

Purpose:

To account for sales of farm crops and other farm income.

Functions:

i. Add income records
ii. Update income records
iii. View income history

Profit Calculation Module

Purpose:

Determines the profit on farming business.

Functions:

i. Calculate total expenses
ii. Calculate total income
iii. Calculate profit or loss

AI Prediction Module

Purpose:

To calculate possible farm earnings.

Programming Language:

Python

Machine Learning Library:

Scikit-learn

Technique Used:

Supervised Learning (Regression Model)

Functions:

i. Data preprocessing
ii. Prediction generation
iii. Forecast display
iv. Decision support

Report Generation Module

Purpose:

Generates reports of farm income and expenses

Functions:

i. Generate expense reports
ii. Generate income reports
iii. Generate profit reports
iv. Generate prediction reports

4.3.2 Computer Minimum Requirements

Table 4.1 Hardware Requirements

Component	**Minimum Requirement**
Processor	Intel Core i3 or equivalent
RAM	4 GB
Storage	50 GB Free Space
Monitor	1366 × 768 Resolution
Keyboard	Standard Keyboard
Mouse	Standard Mouse
Internet	Required

Table 4.2 Software Requirements

Software	Requirement
Operating System	Windows 10 or Higher
Web Browser	Chrome, Firefox or Edge
Python	Version 3.8 or Higher
Flask	Latest Stable Version
MySQL	Latest Stable Version
Visual Studio Code	Latest Version

4.4 Software Testing

To make sure that the system did what it was supposed to, a series of software testing was conducted. A number of tests were done on several modules of the system.

Table 4.3 User Registration Test

Test Case	Expected Result	Actual Result	Status
Register new user	User account created	Successful	Pass
Missing required fields	Error message displayed	Successful	Pass

Table 4.4 Login Test

Test Case	Expected Result	Actual Result	Status
Valid login details	User gains access	Successful	Pass

Invalid login details	Access denied	Successful	Pass

Table 4.5 Farm Record Test

Test Case	Expected Result	Actual Result	Status
Add farm record	Record saved successfully	Successful	Pass
Update farm record	Record updated successfully	Successful	Pass

Table 4.6 Expense Entry Test

Test Case	Expected Result	Actual Result	Status
Add expense	Expense saved	Successful	Pass
Update expense	Expense updated	Successful	Pass

Table 4.7 Income Entry Test

Test Case	Expected Result	Actual Result	Status
Add income	Income saved	Successful	Pass
Update income	Income updated	Successful	Pass

Table 4.8 Profit Calculation Test

Test Case	Expected Result	Actual Result	Status
Calculate profit	Profit displayed	Successful	Pass
Calculate loss	Loss displayed	Successful	Pass

Table 4.9 Prediction Test

Test Case	**Expected Result**	**Actual Result**	**Status**
Generate prediction	Prediction displayed	Successful	Pass
Analyze farm data	Analysis completed	Successful	Pass

Table 4.10 Report Generation Test

Test Case	**Expected Result**	**Actual Result**	**Status**
Generate report	Report displayed	Successful	Pass
View report	Report displayed	Successful	Pass

Test results have proven that the system works properly to deliver on all the goals of the project.

4.5 System Output

Based on activities the system presents a certain output to the end-user, after analyzing the context through Artificial intelligence.

Home Page Output

Users will find general information and access their navigation on the homepage.

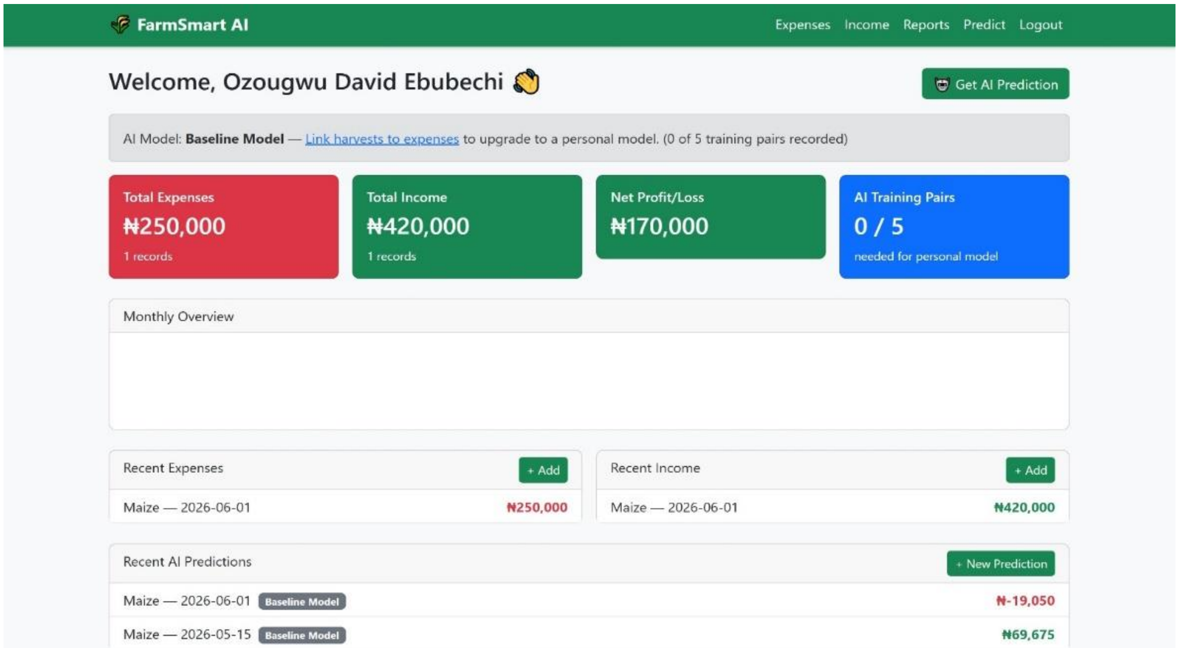

Figure 4.1: Home Page

Registration Page Output

Registration form used for account creation by new users.

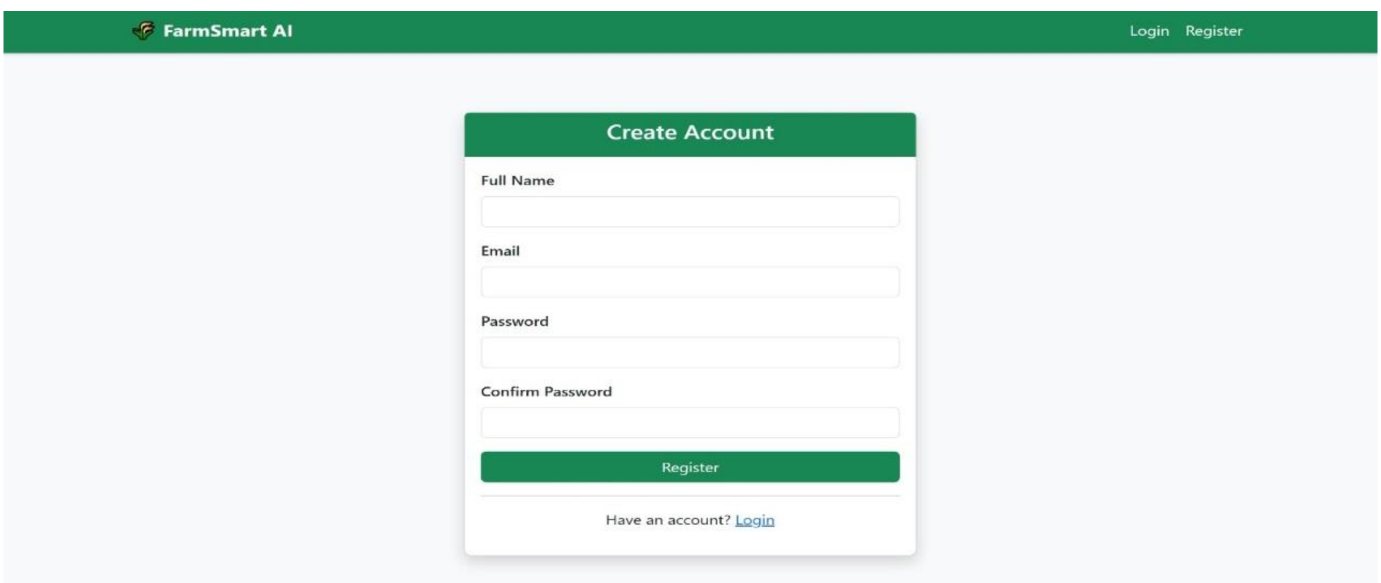

Figure 4.2: User Registration Page

Login Page Output

Existing customers are logged in through the login screen.

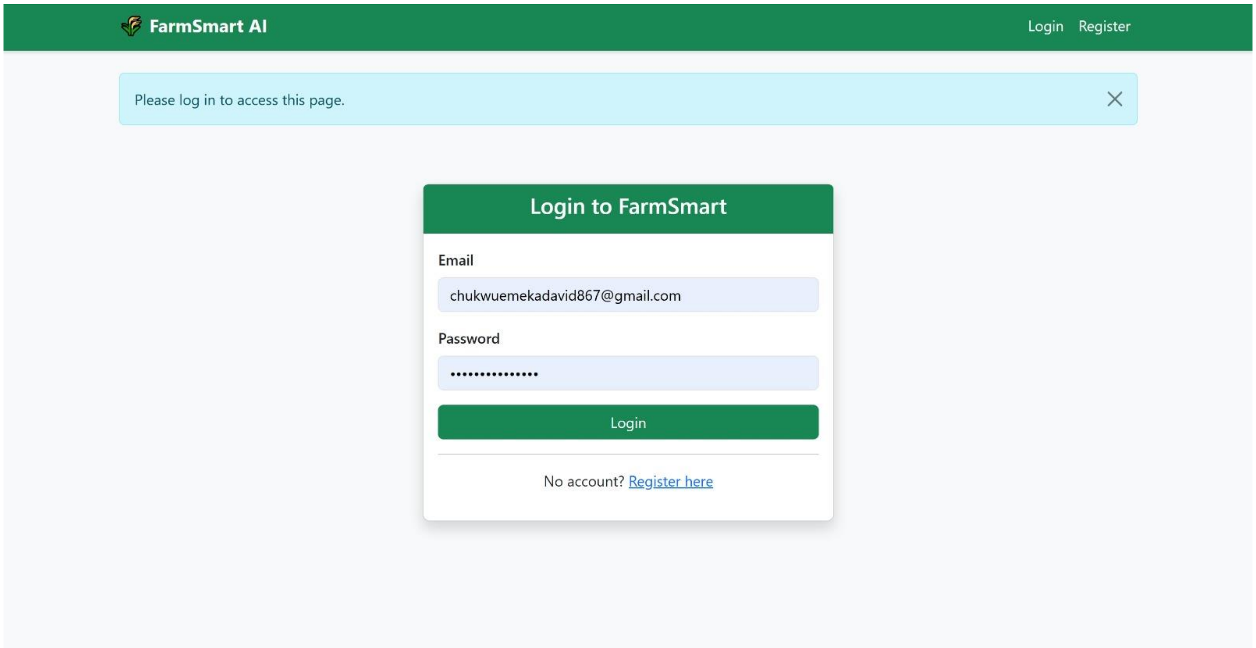

Figure 4.3: User Login Page

Expense Management Output

A log shows any farm expenses you entered.

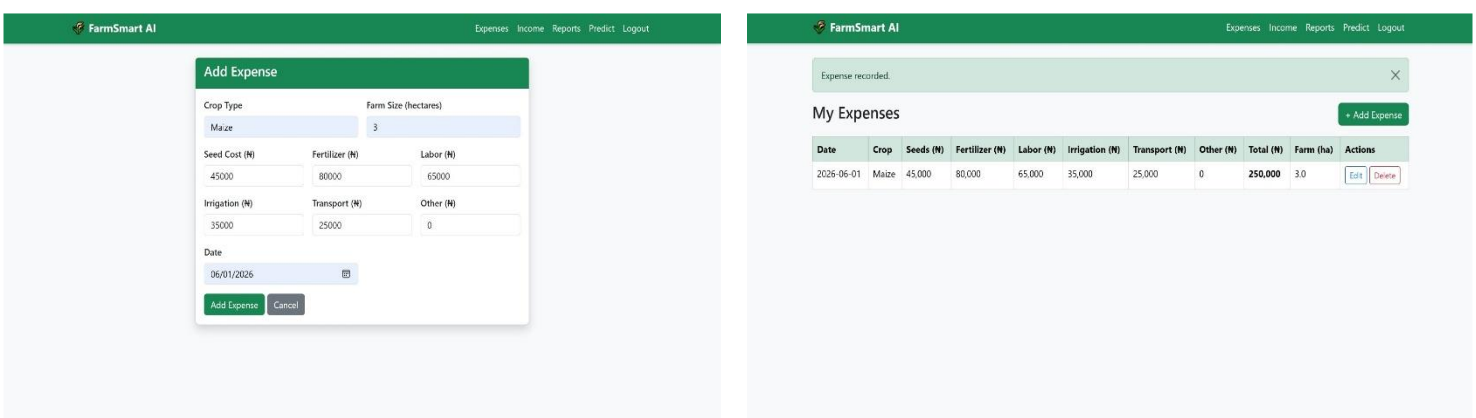

Figure 4.5: Expense Management Page

Income Management Output

Shows the history of income and sales made.

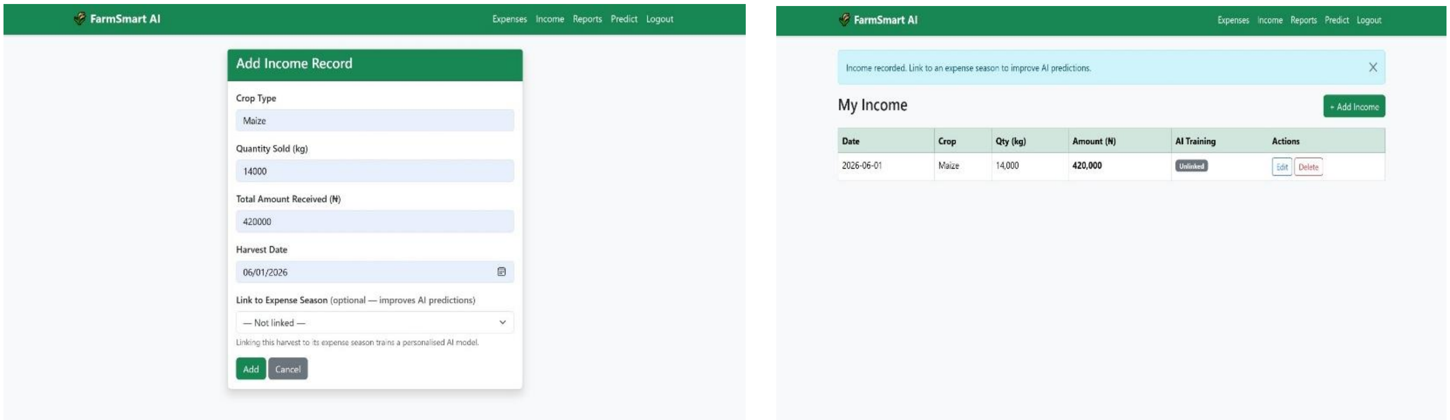

Figure 4.6: Income Management Page

Prediction Output

The system shows the projected revenues of the machine learning model.

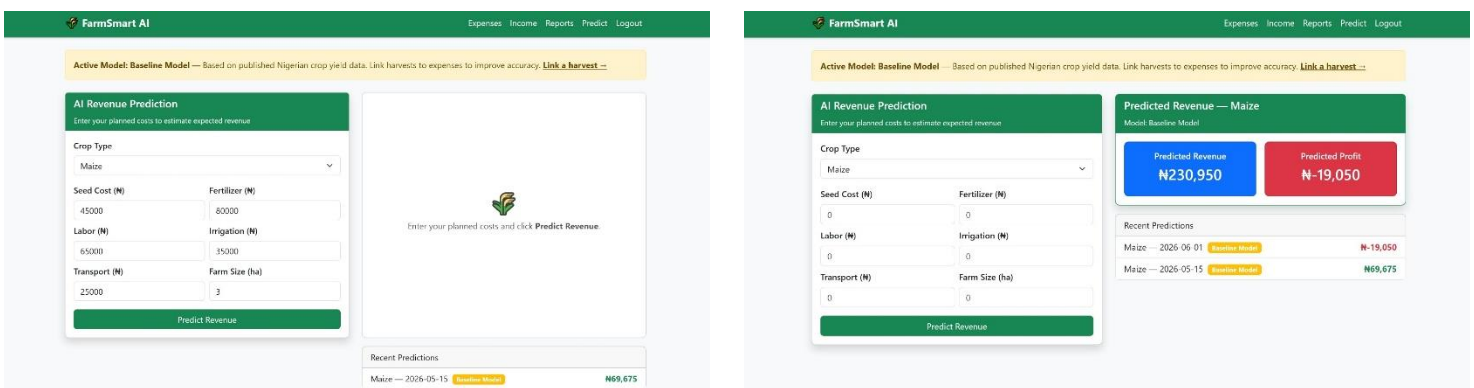

Figure 4.7: Income Prediction Result

Report Output

The report generation functionality gives expense, income, profit and prediction report.

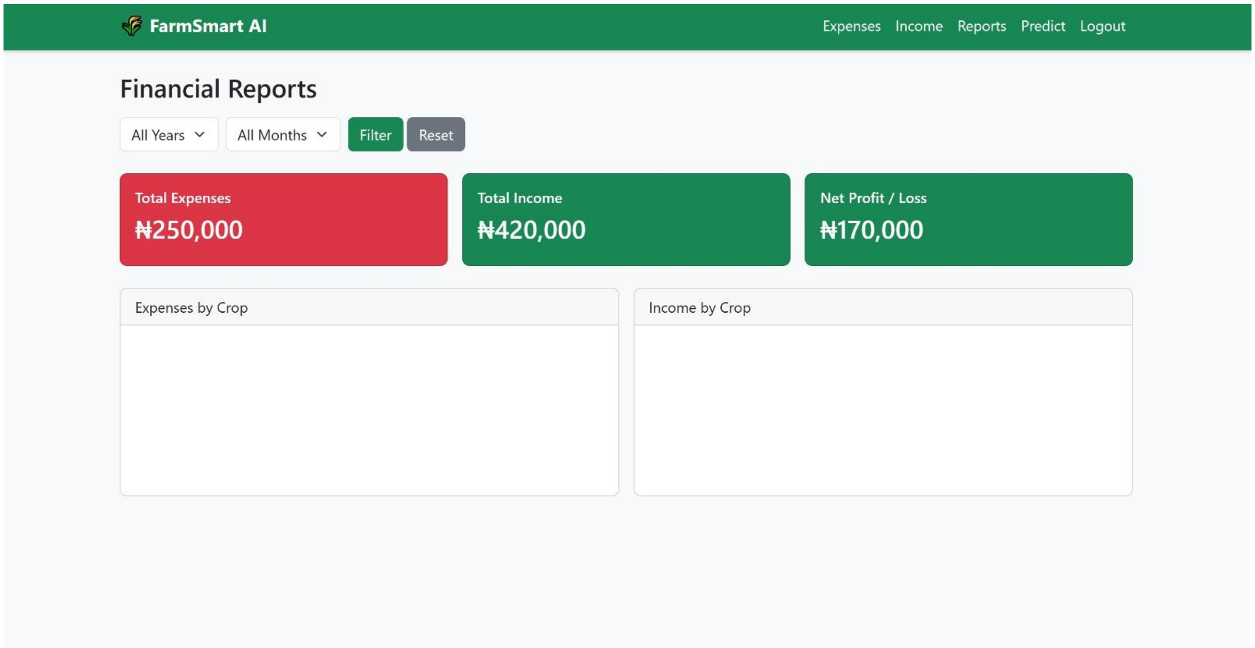

Figure 4.8: Generated Report

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

The design and implementation of an AI Based Farm Account Tracking and Prediction System this project was undertaken in the field of software Engineering with the intention of providing efficient solution to the crop farming business challenges of recording, tracking, controlling income and expenditure. The current way is the use of hard copy (exercise books and ledger books) which generally ends up with manual calculation mistakes and poor records keeping, data wastage, records lost in the process. A computerized solution would resolve these issues. This project provides a system to record the income and expenditure, estimate the overall profit and forecast and predict future income with AI algorithms in a system to be used by users by just registering or logging into the system.

Technologies like HTML, CSS, JavaScript, Python (Flask) for the backend, MySQL for the database and Scikit-learn for the Artificial Intelligence module will be utilized to build this web application. A supervised machine learning regression model used for estimation of future earnings based on historic farm data collected in this database system. It was tested, and in most cases worked as desired.

5.2 Conclusion

The main objective of the study was to design and develop an AI-Based Farm Account Tracking and Prediction System. The system was designed to make farm accounting practices easy and effective, reduce errors in account calculations, increase the accuracy of farm bookkeeping, enhance efficiency, and also enable farmers to access information related to financial aspects of the farm. Furthermore, by using artificial intelligence, this system would make possible for the farmers to estimate projected revenue. This information would be useful for planning before expenses for farming would have to be made.

The design therefore indicated how use of new information and machine learning can be beneficial in enhancing account management practices in farming and that intelligence could guide farmers on best practices that influence income level and overall profitability.

5.3 Recommendations

On the basis of the investigation of this work, the following recommendations are proposed:

1. Digitalization of farm management systems should be encouraged and promoted for farmers so that they can do accounting and financial management.
2. Large data sets should be used for upcoming version development to enhance accuracy in prediction.
3. Different machine learning algorithms such as Random Forest and Decision Tree models should be experimented for performance comparative analysis in prediction.
4. New set of agricultural data from livestock farming should be used for system development in addition to the current crop farming module.
5. Mobile support for the application can also be developed as farmers mostly use smart phones to get the job done.
6. Weather forecasting module should be integrated in system in upcoming days.
7. Data enabled or smart farm management systems should be promoted and encouraged by government departments and organizations.

5.4 Contribution to Knowledge

This research helps fill in the gaps of this research by building an integrated system that includes all three components: tracking farm accounts, predicting future financial performance of a farming, and suggesting possible actions to improve the outcome. Compared with conventional accounting programs that provide merely the accounting features (e.g., the ability to store records, prepare simple financial reports), the system utilizes machine intelligence in its prediction capabilities that enhance financial planning of crop farmers.

5.5 Areas for Further Research

Future Works Further work may involve:

1. Enhancement of prediction accuracy with use of high-profile machine learning models.
2. Incorporating the real-time market price in the prediction process.
3. Including the weather and environmental variables in prediction model.
4. Mobile app development and cloud-based implementation of the system.
5. Extension of system to cater for livestock and crop farming.

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APPENDIX A

Sample Training Dataset

Below is a collection of farm records utilized for training the prediction model and the test set that was developed using this information.

Crop Type	Seed Cost (₦)	Fertilizer Cost (₦)	Labor Cost (₦)	Irrigation Cost (₦)	Revenue (₦)
Maize	30,000	50,000	40,000	20,000	250,000
Rice	50,000	80,000	60,000	30,000	420,000
Cassava	40,000	60,000	50,000	25,000	350,000
Maize	45,000	70,000	55,000	35,000	400,000
Rice	55,000	90,000	70,000	40,000	500,000

APPENDIX B

System Screenshots

Home page

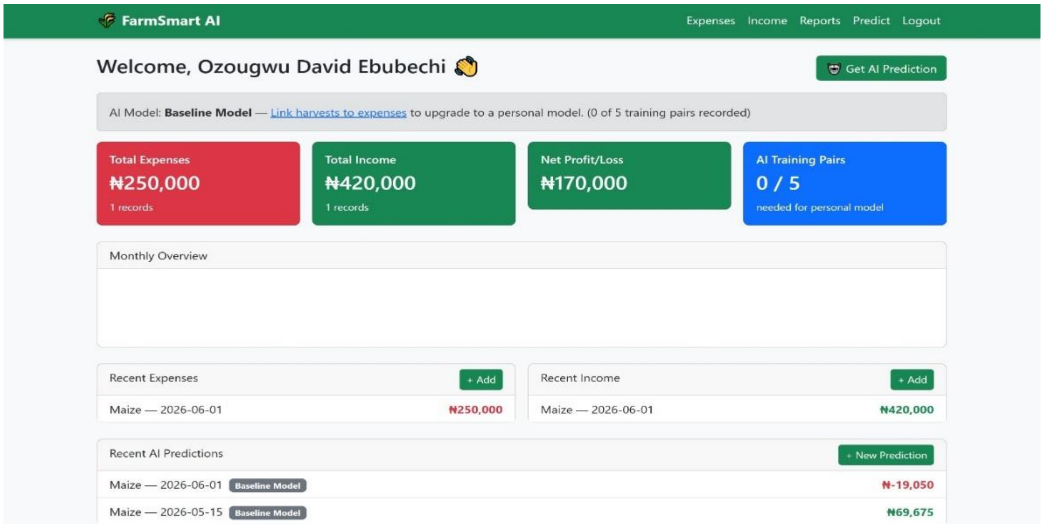


Figure 4.1: Home Page

Registration Page Output

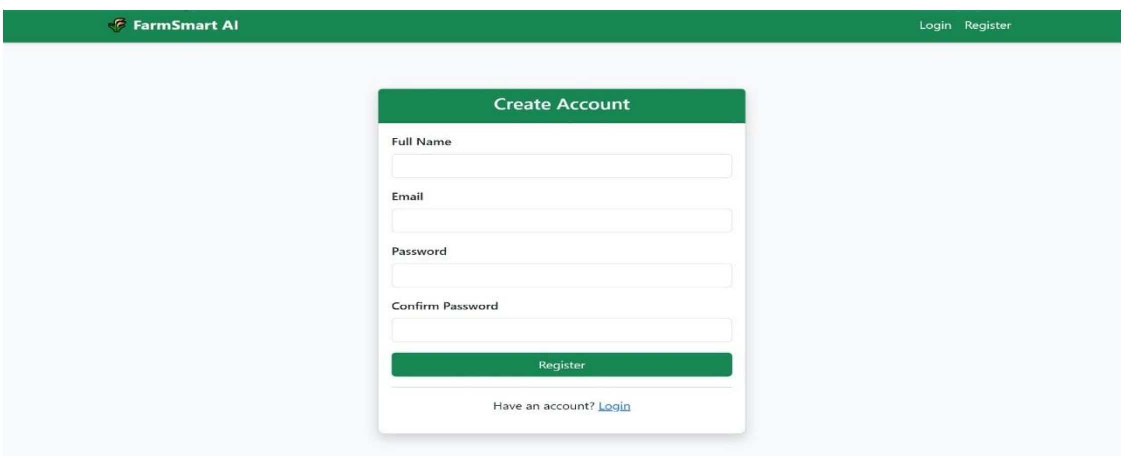


Figure 4.2: User Registration Page

Login Page Output

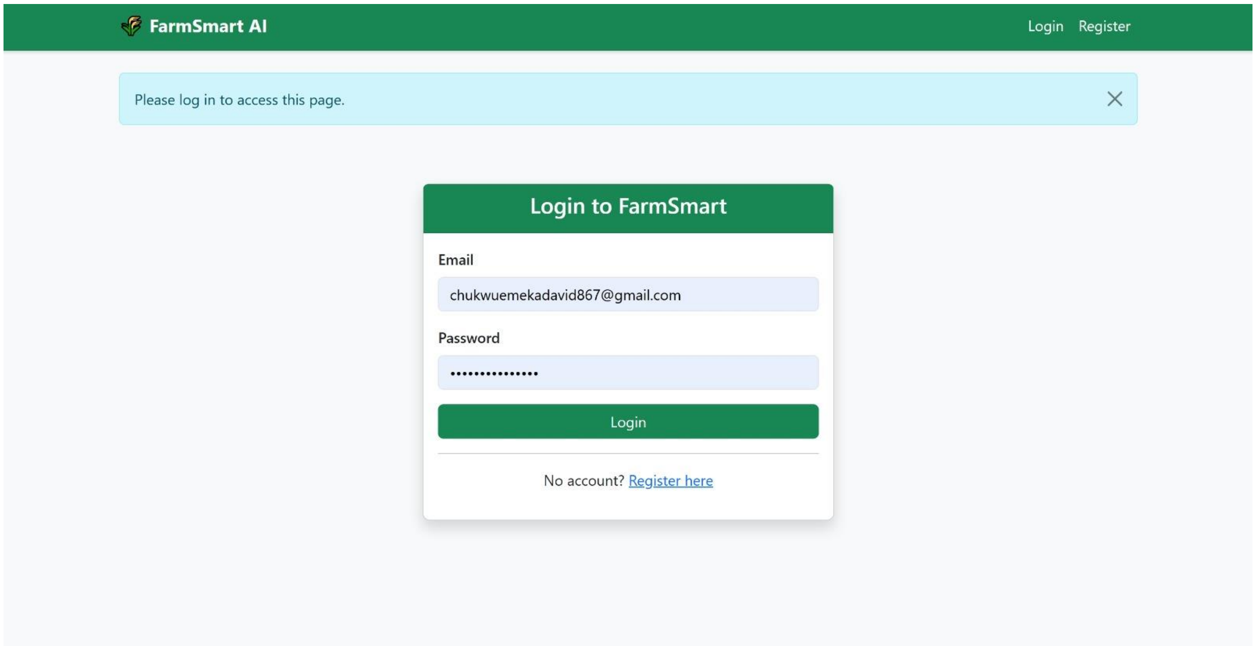
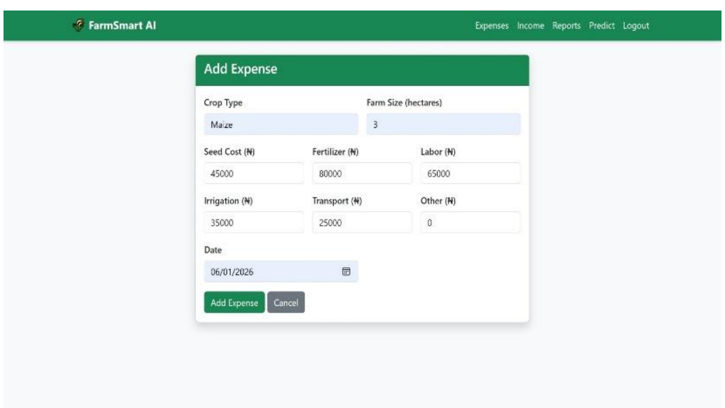


Figure 4.3: User Login Page

Expense Management Output



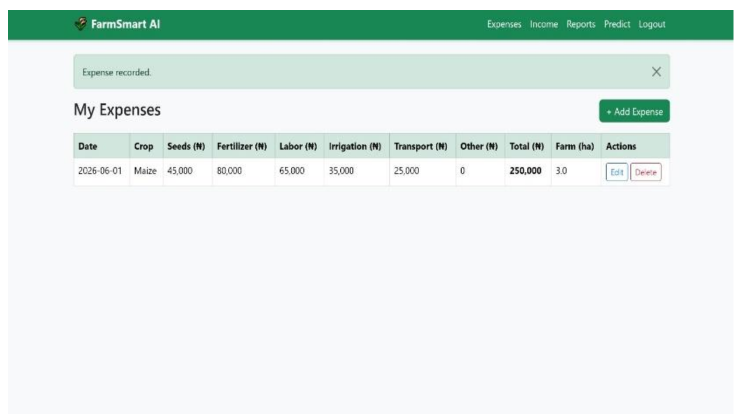


Figure 4.5: Expense Management Page

Income Management Output

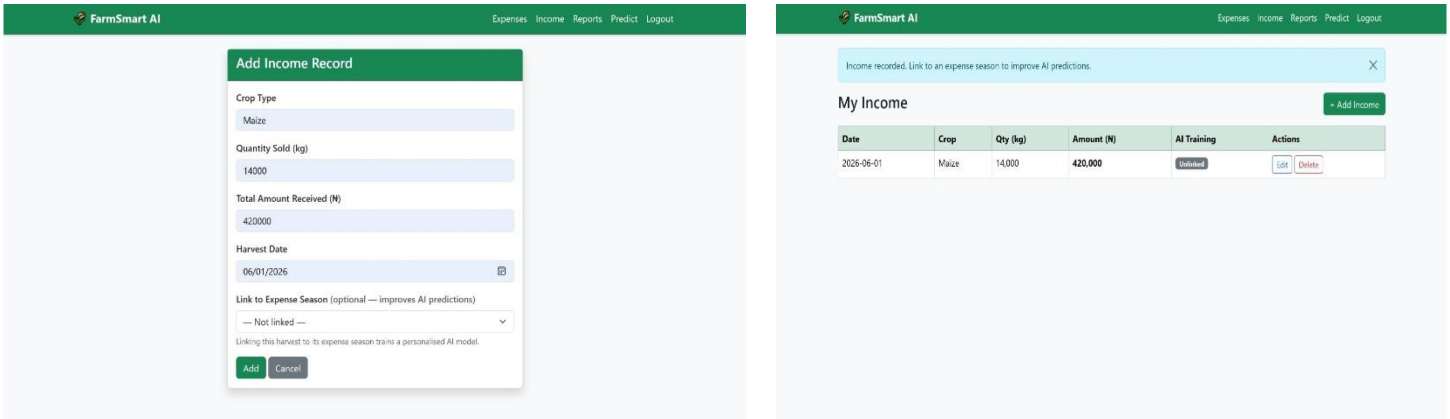


Figure 4.6: Income Management Page

Prediction Output

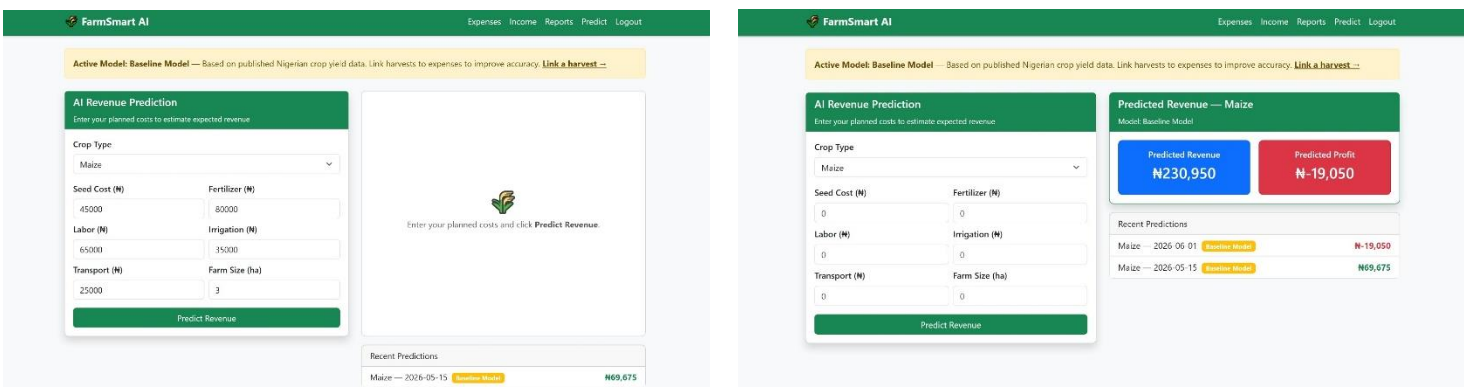


Figure 4.7: Income Prediction Result

APPENDIX C

Sample Test Data Used in the System

Farmer Information

Name: David Chukwuemeka

Farm Size: 3 Hectares

Crop Type: Maize

Expense Information

Item	Amount (₦)
Seeds	45,000
Fertilizer	80,000
Labour	65,000
Irrigation	35,000
Transportation	25,000
Total Expenses	250,000

Income Information

Item	Amount (₦)
Maize Sales	420,000

Profit Calculation

Total Income = ₦420,000

Total Expenses = ₦250,000

Profit = ₦170,000

AI Prediction Result

Predicted Revenue = ₦460,000

Predicted Profit = ₦210,000

Prediction Confidence = 89%