

AN INTEGRATED AGRICULTURAL INFORMATION MANAGEMENT SYSTEM
SMALL-SCALE FARMERS IN UGANDA

BY

WABUSA PRINCE WILLIAM

REG. NO. BU/UP/2023/1862

0758776396

wabusapricewilliam4@gmail.com

A PROJECT REPORT SUBMITTED TO THE COMPUTER STUDIES DEPARTMENT IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF
SCIENCE IN SCIENCE EDUCATION OF BUSITEMA UNIVERSITY AT FACULTY OF
SCIENCE AND EDUCATION.

SUPERVISORS

DR. ANGOLE RICHARD OKELLO

&

MR. MUSANA EDDIE

AUGUST, 2026

DECLARATION

I, WABUSA PRINCE WILLIAM, Registration Number BU/UP/2023/1862, declare that this project report entitled "Design and Implementation of an Agricultural Information Management System for Ugandan Farmers" is my original academic work and has not been submitted to another institution for the award of a degree or other academic qualification.

Signature: *W. Prince William*

Date: *3rd September 2026*

APPROVAL

This project report entitled "An Agricultural Information Management System for Ugandan Farmers" was carried out by Wabusa Prince William, Registration Number BU/UP/2023/1862, under the supervision of Dr. Angole Richard Okello and Mr. Musana Eddie is submitted for examination with my approval.

Supervisor's Signature: 

Date: 2/09/2026

DR. ANGOLE RICHARD OKELLO

Department of Computer Studies, Faculty of Science and Education – Busitema University

Supervisor's Signature: 

Date: 03/09/2026

MR. MUSANA EDDIE

Department of Computer Studies, Faculty of Science and Education – Busitema University

DEDICATION

First and most importantly, I thank the Almighty God who has enabled me to complete this report with all the divine wisdom and sound mind.

I then dedicate this report to the most wonderful woman in the world, my mum, MRS. NAFUNA IRENE. Thank you so much for the support and may the Almighty reward you abundantly. And to my lovely sister KWAGALA QUEEN ESTHER, as an inspiration and motivation to your future career.

I also dedicate this report to my dear supervisors DR. ANGOLE RICHARD OKELLO and MR MUSANA EDDY who guided me throughout the process of making this report a successfully. Thank you so much sir for imparting knowledge in me.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to God Almighty for the strength, wisdom, and perseverance to complete this project.

I am profoundly indebted to my project supervisors, Dr. Angole Richard Okello, and Mr. Musana Eddy for your invaluable guidance, constructive feedback, and unwavering support throughout the duration of this research. Their expertise and patience were pivotal in shaping the direction and quality of this work.

My sincere appreciation also goes to university for providing the necessary resources, facilities, and an enabling environment to conduct this study.

To my family, especially Mummy, my lovely sister Esther, thank you for your endless encouragement, sacrifices, and belief in my abilities. Your emotional and moral support kept me motivated even during challenging phases.

I am also grateful to my friends and colleagues, Ouma Emmanuel, Musitwa Amos, and Apio Priscilla, for your guidance and encouragement that enriched this project.

TABLE OF CONTENTS

DECLARATION	i
DEDICATION	iii
ACKNOWLEDGEMENTS	iv
ABBREVIATIONS	ix
ABSTRACT	x
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the Study	1
1.2 Problem Statement	1
1.3 Purpose of the Study	1
1.4 Main Objective.....	2
1.5 Specific Objectives	2
1.6 Significance of the Study	2
1.7 Scope of the Study	2
1.7.1 Content Scope	2
1.7.2 Geographical Scope	3
1.7.3 Time Scope	3
CHAPTER TWO: LITERATURE REVIEW	4
CHAPTER THREE: METHODOLOGY	7
3.1 Introduction	7
3.2 Research Design.....	7
3.3 Area of Study	7
3.4 Study Population	7
3.5 Sampling Technique	7
3.6 Data Collection Methods	7
3.7 System Development Methodology.....	8
3.8 System Analysis and Design.....	8
3.9 System Implementation	8
3.10 System Testing and Validation	8
3.11 Ethical Considerations	8
3.12 Limitations of the Methodology	8
CHAPTER FOUR: FIELD STUDY AND SYSTEM DESIGN.....	9

4.1 Introduction.....	9
4.2 Background Information.....	9
4.3 Strengths of Existing Practices	9
4.4 Weaknesses of Existing Practices.....	9
4.5 Strengths of the Implemented AIMS	9
4.6 System Requirements.....	10
4.6.1 Functional Requirements	10
4.6.2 Non-Functional Requirements.....	10
4.6.3 Hardware Requirements.....	11
4.6.4 Software Requirements.....	11
4.7 System Design.....	11
4.7.1 System Architecture.....	11
4.7.2 Context Diagram.....	12
4.7.3 Entity Relationship Diagram.....	13
4.7.4 Use Case Diagram.....	13
4.7.5 Use Case Description.....	14
4.8 User Interface Design	15
4.9 System Documentation and Training.....	15
CHAPTER FIVE: SYSTEM IMPLEMENTATION AND TESTING	16
5.1 Introduction.....	16
5.2 Interface Design	16
5.3 System Testing and Validation	30
CHAPTER SIX: DISCUSSION, CONCLUSION, RECOMMENDATIONS AND FUTURE WORK	31
6.1 Introduction.....	31
6.2 Discussion	31
6.3 Conclusion	32
6.4 Recommendations.....	32
6.5 Limitations and Future Work.....	33
REFERENCES	34
APPENDICES	35
APPENDIX A: INTERVIEW GUIDE FOR SMALL-SCALE FARMERS	35
APPENDIX B: INTERVIEW GUIDE FOR AGRICULTURAL SERVICE PROVIDERS.....	35

APPENDIX C: PROJECT TIME SCHEDULE	36
---	----

LIST OF FIGURES

Figure 1: System Architecture	12
Figure 2: Context Diagram	12
Figure 3: Entity Relationship Diagram	13
Figure 4: Use Case Diagram	14
Figure 5: AIMS Home Page	16
Figure 6: Register page	17
Figure 7: Log in page.....	18
Figure 8: Role-Based Dashboard.....	19
Figure 9: Market Prices Module	19
Figure 10: Messaging Module	20
Figure 11: Five days Weather forecast.	21
Figure 12: Weather and Farming Intelligence Module.....	22
Figure 13: Transport Providers module	23
Figure 14: Storage Providers module	24
Figure 15: Financial Services module.....	25
Figure 16: Administrator Dashboard	26
Figure 17: Administrator User Management	27
Figure 18: Administrator Financial Institute Management.....	28
Figure 19: Administrator Financial Institute updating.....	29

ABBREVIATIONS

Abbreviation	Meaning
---------------------	----------------

AIMS	Agricultural Information Management System
DFD	Data Flow Diagram
ERD	Entity Relationship Diagram
FAO	Food and Agriculture Organization
FSD	Financial Sector Deepening
ICT	Information and Communication Technology
PHP	PHP: Hypertext Preprocessor
SQL	Structured Query Language
UAT	User Acceptance Testing
UCC	Uganda Communications Commission
UBOS	Uganda Bureau of Statistics

ABSTRACT

Agriculture is a major component of Uganda's economy and provides livelihoods for a large proportion of the population. However, small-scale farmers continue to experience challenges related to access to reliable markets, market prices, transport and storage services, timely weather information and formal financial services. The approved proposal identified fragmentation of digital agriculture services as a key problem and proposed an integrated web-based Agricultural Information Management System (AIMS) for Ugandan farmers.

The project adopted a qualitative research design and a Design Science Research orientation. Requirements were informed by interviews, observation and secondary literature as described in the approved proposal. The Waterfall Model was adopted for system development. The implemented system uses HTML, CSS and JavaScript for the presentation layer, PHP for server-side processing, MySQL/MariaDB for data storage and Apache/XAMPP as the local web-server environment.

The supplied AIMS system contains role-based access for farmers, buyers, transport providers, storage providers and administrators. Implemented functions include user registration and authentication, farmer produce listing, market selling and buying prices, farmer–buyer messaging, transport and storage provider profiles, weather information and five-day forecast functionality, farming recommendations, financial-service information and administrative user management. The supplied database dump contains the core tables for users, produce, buying prices, messages, transport profiles, storage profiles and financial services.

The system was fully implemented and tested. Static application pages returned successfully during local verification, and all supplied PHP files passed PHP syntax validation. The supplied SQL dump also contains working sample records for users and the major functional modules, providing evidence that the system had been exercised during development. The report concludes that the implemented AIMS prototype provides a practical integrated platform for agricultural information and coordination and provides a foundation for future deployment, stronger security, broader data integration and wider rural accessibility.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Agriculture is the backbone of Uganda's economy, employing over 70% of the population and contributing significantly to GDP and export earnings (Uganda Bureau of Statistics, 2020). However, small-scale farmers continue to face challenges that constrain productivity and livelihoods. These challenges include limited access to reliable and competitive markets, high post-harvest losses, inadequate logistics and storage infrastructure, lack of timely weather information and financial exclusion.

The approved proposal notes that smallholder farmers frequently depend on informal market channels dominated by middlemen, which can contribute to income instability and price exploitation. It also identifies post-harvest losses of up to 30% associated with poor storage and delayed transportation, particularly for perishable produce. Existing digital agriculture platforms are often fragmented, providing individual services such as weather updates, input directories or extension messaging rather than an integrated information environment.

The project therefore proposes an integrated web-based platform that brings together market price information, farmer-buyer interaction, coordination information for transport and storage providers, weather information and financial-service information. The implemented AIMS system supplied with this report extends those requirements with role-based accounts, messaging, produce listing, buying-price management and farming recommendations.

1.2 Problem Statement

Small-scale farmers in Uganda face limited access to reliable markets, timely market price information, logistics and storage services, weather updates and formal financial services. Existing digital agriculture platforms provide fragmented solutions that do not integrate these critical services. As a result, farmers may experience exploitation by middlemen, income instability, post-harvest losses and reduced productivity. The approved proposal therefore identifies the need for an integrated web-based Agricultural Information Management System that provides agricultural information and coordination support through one platform.

1.3 Purpose of the Study

The purpose of the project was to develop an integrated Agricultural Information Management System that provides small-scale farmers with centralized access to agricultural market information,

farmer–buyer interaction, logistics and storage information, weather information and financial-service guidance.

1.4 Main Objective

To develop an integrated Agricultural Information Management System that provides market, advisory, logistics coordination and financial information services to small-scale farmers in Uganda.

1.5 Specific Objectives

- To review relevant literature and identify the functional and non-functional requirements of an Agricultural Information Management System for small-scale farmers in Uganda.
- To analyse and design an Agricultural Information Management System that provides timely agricultural information to small-scale farmers in Uganda.
- To implement the designed Agricultural Information Management System for small-scale farmers.
- To test and validate the designed Agricultural Information Management System that provides timely information to small-scale farmers in Uganda.

1.6 Significance of the Study

- Farmers: improved access to market information, buyers, transport and storage services, weather information and financial-service information.
- Buyers and traders: improved visibility of farmer produce and communication with producers.
- Transport and storage providers: a structured profile through which their services and capacities can be viewed by farmers.
- Financial-service providers: an additional channel through which farmers can discover information about relevant financial products.
- Academic community: an example of applying web technologies and database systems to an agricultural information problem.
- Policy and development stakeholders: a prototype that demonstrates how integrated digital information services can support agricultural coordination.

1.7 Scope of the Study

1.7.1 Content Scope

The project covers user registration and authentication, role-based dashboards, produce listing, market selling and buying prices, farmer–buyer messaging, transport and storage service information, weather information and forecast, farming recommendations, financial-service information and administrative user management.

1.7.2 Geographical Scope

The study focuses on small-scale farmers in Uganda. The prototype is designed to be scalable to additional districts and agricultural communities.

1.7.3 Time Scope

The approved proposal schedules the project from January 2026 through June 2026, covering proposal writing, literature review, requirements analysis, system design, implementation, testing, report writing and final submission/presentation.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews existing literature on the use of digital technologies in agriculture, with a focus on Uganda. It examines how Information and Communication Technologies (ICTs), particularly web-based and digital platforms, have been applied to address challenges faced by small-scale farmers. Key thematic areas include market access, post-harvest management, financial access facilitation, weather information services, and digital inclusion. The chapter also highlights limitations of existing digital agriculture solutions and identifies gaps that justify the development of the proposed Agricultural Information Management System.

2.2 Digital Agriculture in Uganda

Digital agriculture is increasingly recognized as a driver of agricultural transformation in Uganda due to the growing penetration of mobile phones and supportive national ICT policies. The Ministry of ICT and National Guidance (2021) emphasize using digital technologies to improve service delivery in critical sectors such as agriculture. Despite this progress, most digital agriculture initiatives remain fragmented, often addressing isolated challenges such as extension messaging or market information without integrating the entire agricultural value chain.

Several platforms, including AgroMall, EzyAgric, and m-Omulimisa, aim to support farmers by providing information on markets, inputs, and advisory services. However, these platforms often lack comprehensive integration and are limited in functionality, particularly for farmers with low digital literacy or those using basic feature phones (Kansiime et al., 2020). This underscores the need for inclusive digital platforms that provide integrated services through accessible web-based solutions.

2.3 Market Access and the Role of Middlemen

Small-scale farmers in Uganda largely depend on informal agricultural markets where pricing is often controlled by middlemen. Studies by SNV Uganda (2019) and Nangoli et al. (2021) indicate that limited access to transparent market information reduces farmers' bargaining power, resulting in low farm-gate prices and unstable incomes.

Digital platforms that provide real-time market prices and enable direct farmer-to-buyer interactions have been identified as effective tools for improving market transparency and farmer incomes. Such systems reduce dependency on middlemen and empower farmers to make informed marketing decisions. However, most existing platforms do not adequately reach rural farmers due to limited device compatibility and connectivity constraints.

2.4 Post-Harvest Losses and Logistics

Post-harvest losses remain a major challenge in Uganda, particularly for perishable produce. According to FAO (2019), up to 30% of agricultural output is lost due to poor storage facilities, delayed transportation, and weak logistics coordination. These losses significantly reduce farmer incomes and threaten food security.

ICT-enabled logistics coordination can help reduce these losses by providing information on available transport services, storage facilities, and delivery scheduling (Nakayima et al., 2020). However, most existing solutions focus primarily on operational management and do not offer accessible coordination services suitable for small-scale farmers.

2.5 Financial Exclusion in Agriculture

Access to formal financial services remains limited among small-scale farmers in Uganda. Many farmers rely on informal savings groups and lack access to formal credit due to insufficient collateral, limited financial records, and low financial literacy (FSD Uganda, 2020). Although mobile money platforms such as MTN Mobile Money and Airtel Money have expanded financial access, their use for structured agricultural financing remains low.

Digital platforms can play a critical role in facilitating access to financial services by providing structured information on financial products, eligibility requirements, application procedures, and referral pathways to banks, SACCOs, microfinance institutions, and mobile-based financial services (Nanyonjo & Waiswa, 2021). Rather than directly processing transactions, these platforms act as intermediaries, improving financial awareness and inclusion while remaining feasible for small-scale digital systems.

2.6 Weather Information Services in Digital Agriculture

Agricultural advisory services in Uganda are traditionally delivered through physical weather information platforms, but the ratio of platforms to farmers is very low. Uganda Bureau of Statistics (2020) reports that one extension worker may serve over 1,500 farmers, leading to delayed and inadequate support.

Digital weather information platforms such as CropMon and EzyAgric provide farming tips and forecasts, enabling farmers to make better production decisions. However, most of these platforms require internet-enabled smartphones, which may limit accessibility for some small-scale farmers (Bukenya et al., 2019).

2.7 Digital Inclusion and Infrastructure Challenges

Despite increasing mobile phone ownership in Uganda, digital inclusion challenges persist, particularly in rural areas. Internet penetration remains low in rural regions, limiting the adoption of web-based agricultural platforms. Additionally, low digital literacy and language barriers further hinder effective system use (UCC, 2020).

2.8 Literature Gap

The reviewed literature shows that while several digital agriculture solutions exist in Uganda, most address isolated challenges such as market information, advisory services, or financial awareness. There is limited evidence of integrated platforms that combine market access, post-harvest management, advisory services, and financial access facilitation into a single, unified system. This gap justifies the development of an Agricultural Information Management System that provides an integrated, web-based solution tailored to the needs of small-scale farmers in Uganda.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter describes the research and system-development methods used in the project, including research design, study population, sampling, data collection, system design, implementation, testing and ethical considerations.

3.2 Research Design

A qualitative research design was adopted to understand the information needs and challenges of small-scale farmers and related agricultural stakeholders. The project also followed a Design Science Research orientation because the central output was a working information-system artefact designed to address an identified practical problem.

3.3 Area of Study

The study targeted agricultural communities in Uganda, with emphasis on small-scale farming contexts where access to markets, logistics, weather information and financial services is relevant.

3.4 Study Population

The intended population included small-scale farmers, agricultural transport and storage service providers, produce buyers/traders and representatives of financial institutions. The approved proposal describes farmers as the primary intended users and the other groups as stakeholders who contribute to requirements and validation.

3.5 Sampling Technique

Purposive sampling was selected because participants with direct knowledge of agricultural production, marketing, logistics, storage and financial services are most useful for identifying system requirements.

3.6 Data Collection Methods

- Interviews: open-ended questions were asked to obtain user needs, challenges and expectations.
- Observation: examination of existing agricultural information-sharing and service-coordination practices was conducted.
- Secondary data: review of books, journals, government documents, policy material and related digital agriculture systems was carried out.

3.7 System Development Methodology

The approved proposal selected the Waterfall Model. The stages are requirements analysis, system design, implementation, testing and validation. The model provided a structured sequence suitable for an academic project.

3.8 System Analysis and Design

System analysis translated user and project requirements into functional modules and database structures. System Architecture, Context Diagram, and Entity Relationship Diagram were used to model the solution.

3.9 System Implementation

The system was implemented as a PHP/MySQL web application. The source package contains HTML entry pages, PHP modules, an SQL database dump, authentication functions, configuration files and weather-service integration. The database dump identifies MariaDB 10.4.32 and PHP 8.2.12 as the development/export environment. The application configuration connects to a local MySQL-compatible server named aims.

3.10 System Testing and Validation

Testing was performed after implementation. Unit-level validation was supported by syntax checking of the supplied PHP files. Integration-level testing was supported by examining the interaction among authentication, database operations, produce management, market prices, messaging, service providers, weather and finance modules. Static pages were also checked through the local PHP server.

3.11 Ethical Considerations

- Participants were informed about the purpose of data collection and their voluntary participation.
- Personal information collected for the study was treated confidentially.
- Information obtained was used for academic purposes.
- System credentials and passwords are not exposed in the final report.

3.12 Limitations of the Methodology

The approved proposal identifies time, sample-size and rural connectivity constraints. In addition, the present report is based on the supplied project materials and implementation package; no independent survey dataset or numerical field-study dataset was supplied with the materials used to generate this final report.

CHAPTER FOUR: FIELD STUDY AND SYSTEM DESIGN

4.1 Introduction

This chapter presents the analysis of the agricultural information environment and the design of the implemented AIMS solution.

4.2 Background Information

The project problem is characterized by fragmented agricultural information, difficulty accessing market information, transport and storage coordination challenges, weather-information needs and limited financial-service information. The system requirements were therefore organized around a centralized web application.

4.3 Strengths of Existing Practices

- Farmers already use informal market networks and agricultural service providers.
- Existing digital agriculture initiatives demonstrate the feasibility of digital information delivery.
- Mobile and internet technologies provide channels for rapid communication.
- Financial institutions and service providers already have agricultural products and services that can be referenced.

4.4 Weaknesses of Existing Practices

- Information is distributed across different channels.
- Farmers may lack transparent and timely market-price information.
- Transport and storage providers are difficult to identify and compare.
- Weather information may not be integrated with other agricultural services.
- Financial-service information is not centralized for farmers.

4.5 Strengths of the Implemented AIMS

- Centralized agricultural information platform.
- Role-based access for five user categories.
- Farmer produce listing and buyer browsing.
- Selling and buying market-price information.
- Direct user-to-user messaging.
- Transport and storage provider profiles.
- Current weather and five-day forecast interfaces.
- Financial-service information and links.
- Administrative user management.

4.6 System Requirements

4.6.1 Functional Requirements

No.	Functional Requirement
-----	------------------------

- | | |
|----|--|
| 1 | Register users with name, email, district and role. |
| 2 | Authenticate users using password-based login. |
| 3 | Provide role-based dashboards. |
| 4 | Allow farmers to add, edit and delete produce listings. |
| 5 | Allow buyers to view farmer produce. |
| 6 | Display and filter selling and buying market prices. |
| 7 | Allow users to send and receive messages. |
| 8 | Display transport and storage provider information. |
| 9 | Allow service providers to manage profiles/capacity information. |
| 10 | Display current weather and farming recommendations. |
| 11 | Display five-day weather forecast information. |
| 12 | Display financial services and optional external links. |
| 13 | Allow administrators to manage non-admin users. |

4.6.2 Non-Functional Requirements

Attribute	Requirement
Usability	Simple navigation and understandable service categories.
Security	Authentication, role checking and password hashing.
Performance	Reasonable response time for common database operations.
Reliability	Consistent operation and error handling during normal use.
Maintainability	Separate PHP modules and centralized database configuration.
Compatibility	Browser-based access on computers and mobile-sized screens.
Scalability	Database structure and modular PHP pages permit future expansion.

4.6.3 Hardware Requirements

Hardware	Minimum/Recommended Use
Computer	Development and administration
RAM	At least 4–8 GB recommended for local XAMPP development
Storage	At least 100 GB recommended
Network	Internet connection for weather service and deployment
Power	Stable electricity or backup power

4.6.4 Software Requirements

Software	Purpose
PHP	Server-side programming
MySQL/MariaDB	Relational database
Apache/XAMPP	Local web-server environment
HTML/CSS/JavaScript	Web interface
Web Browser	System access and testing
OpenWeather API	Weather information and forecast

4.7 System Design

System design is the process of defining the architecture, interfaces, and modules for the system to realize functionality of the requirements. This was through the use of system design tools such as system architecture, context diagram, Entity Relationship Diagram and User Case modelling table to help to know how different processes interact with each other and their relationships.

4.7.1 System Architecture

System architecture is a conceptual model that defines the structure and interaction of system components. The proposed Agricultural Information Management System adopted a three-tier architecture, comprising the presentation layer (web interface), application layer (business logic), and data layer (database). This architecture enhances scalability, maintainability, and system performance.

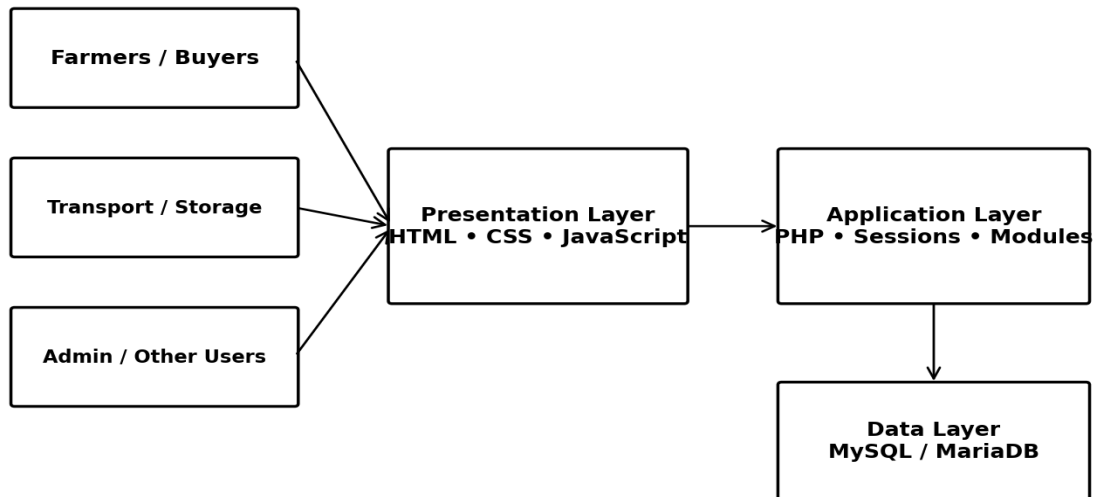


Figure 1: System Architecture

4.7.2 Context Diagram

The context diagram was used to show the interaction between the Agricultural Information Management System and external entities such as farmers, buyers/traders, transport and storage providers, weather service, and financial institutions. It provides a high-level view of system boundaries and data exchanges.

Context Diagram - Agricultural Information Management System

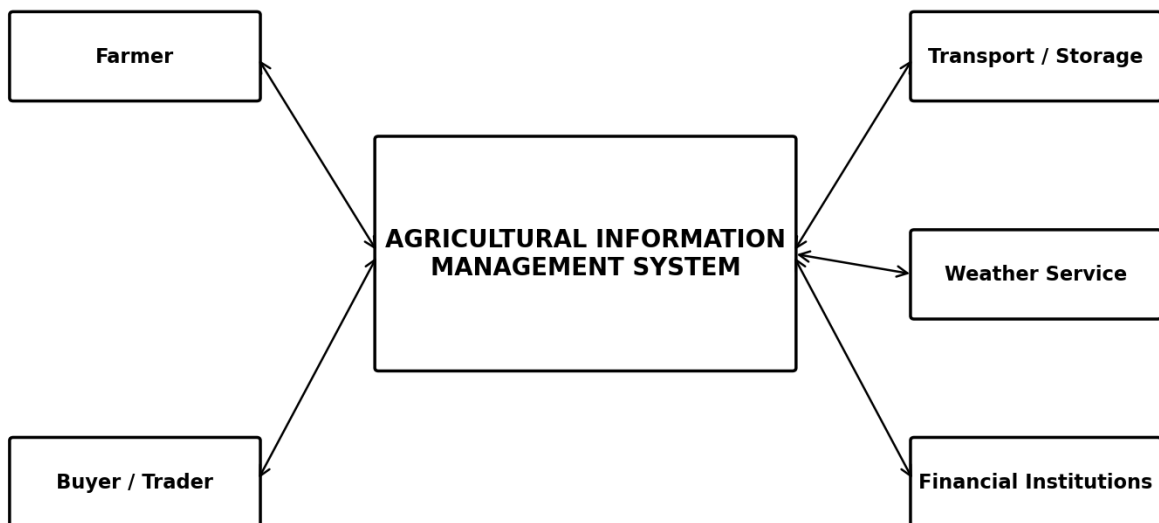


Figure 2: Context Diagram

4.7.3 Entity Relationship Diagram

An Entity Relationship Diagram (ERD) is a graphical representation of a database structure of a proposed system. The AIMS consists of several entities that interact with one another to support the major functions of the system. The major Entities identified in the system include: Users, Produce, Messages, Buying_prices, Financial_services, Storage_profile, Transport_profile.

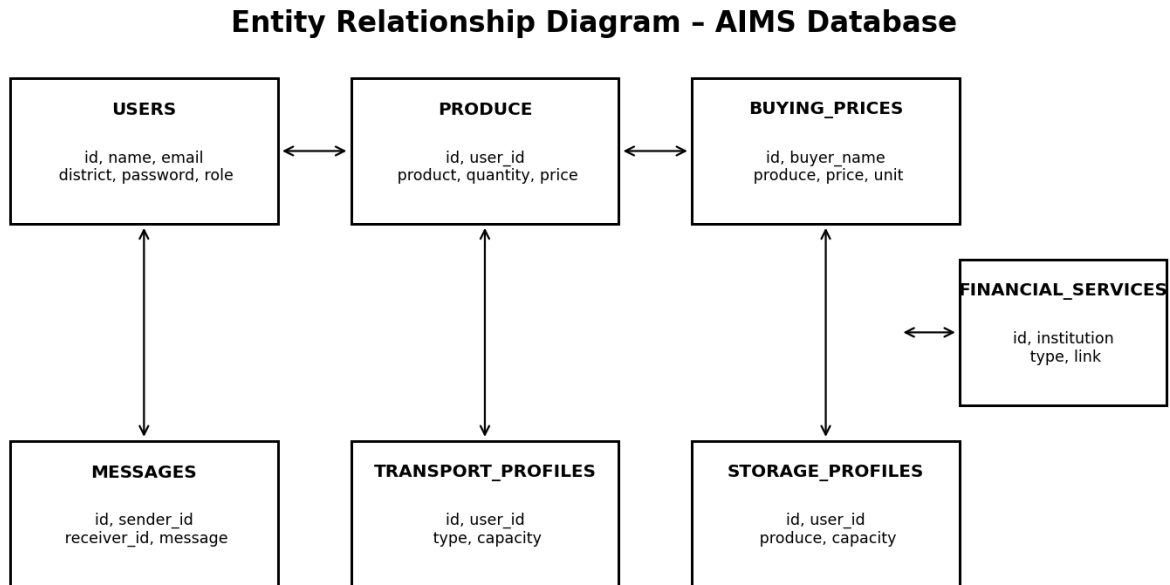


Figure 3: Entity Relationship Diagram

4.7.4 Use Case Diagram

The Use case diagram represents the activities of the users with special functionalities of the system. Use case diagram model is what the system is expected to do and to view externally the use of the system from the user's perspective rather than internally.

The use case module partitions the system's behaviour into transactions so that each of the transactions performs some practical action. All these are accomplished from the user's view.

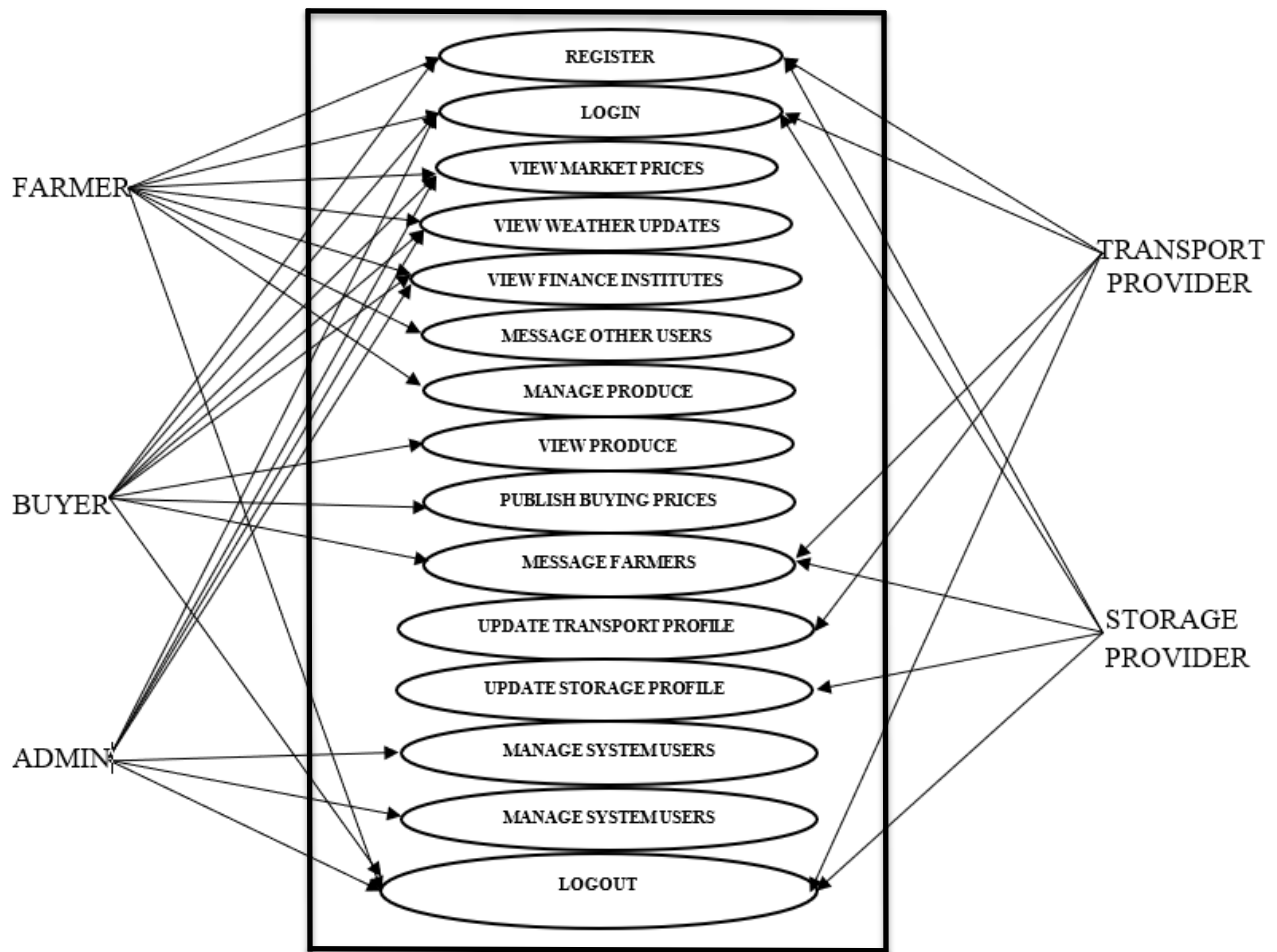


Figure 4: Use Case Diagram

4.7.5 Use Case Description

Actor	Major Use Cases
Farmer	Register/login; manage produce; view market prices; message buyers/providers; view weather; view finance.
Buyer	Register/login; view produce; publish buying prices; message farmers; view market information.
Transport Provider	Register/login; maintain transport profile; communicate with farmers.
Storage Provider	Register/login; maintain storage profile; communicate with farmers.
Administrator	Login; manage registered users; manage financial institutes.

4.8 User Interface Design

The implemented interface uses green agricultural styling, responsive layouts, navigation sidebars and role-specific service cards. The figures in chapter five under interface design represent the implemented interface structure of the AIMS using HTML, JavaScript, and CSS.

4.9 System Documentation and Training

The system was documented after all the tests had been performed to serve as a reference point to the system administrator to maintain the system throughout its productive life and the students. Training of the system users was done after the testing of the system.

CHAPTER FIVE: SYSTEM IMPLEMENTATION AND TESTING

5.1 Introduction

This chapter focused on fulfilling the use of the requirements i.e., functional and non-functional requirement into a working / running AIMS. It furthermore presented implementation of the design presented in Chapter Four.

5.2 Interface Design

The goal of user interface design is to make the user's interaction with the system as simple and efficient as possible, in terms of accomplishing user goals. It is also the way through which a user interacts with an application. It mainly focused on the looks and style of how a system appeared to the user. The functional and non-functional requirements that were implemented for the Agricultural Information Management System include:

The Home page which contains the introductory information about the Agricultural Information Management System.

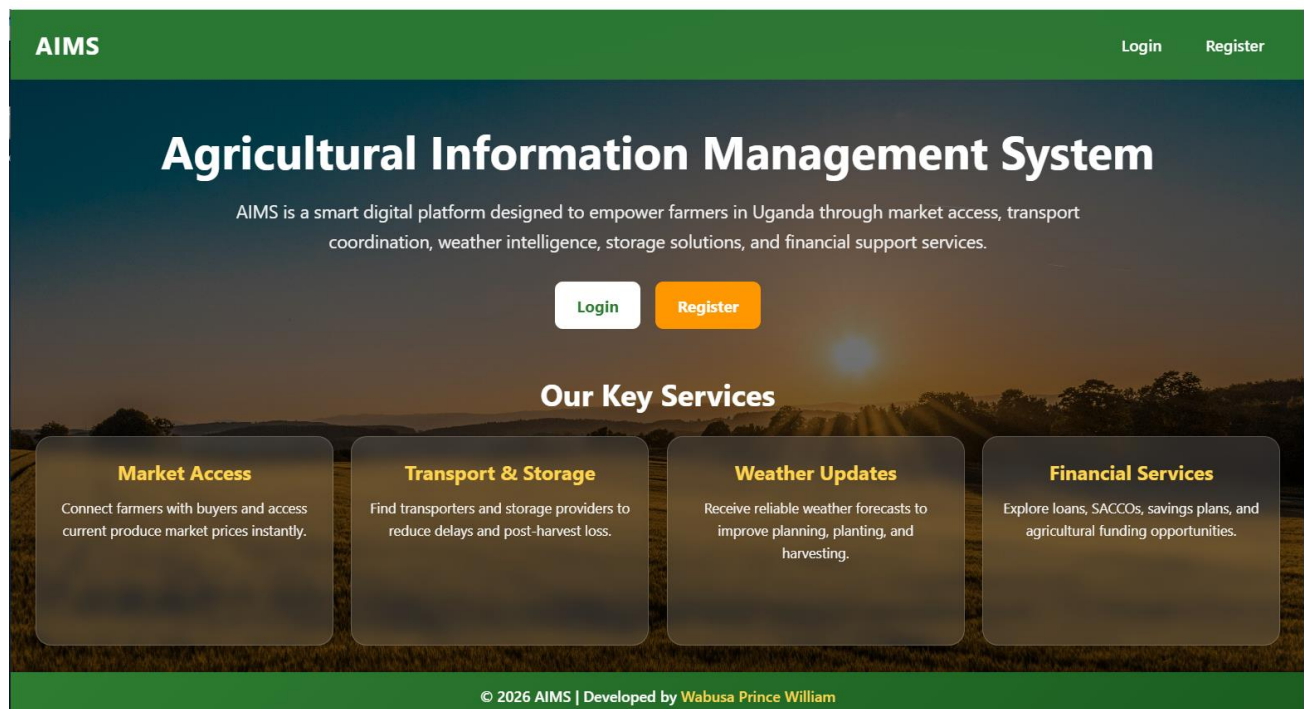


Figure 5: AIMS Home Page

The user can access the login page and the Register page from the home page to register in in the AIMS, as a Farmer, Buyer, Storage provider, or Transport provider

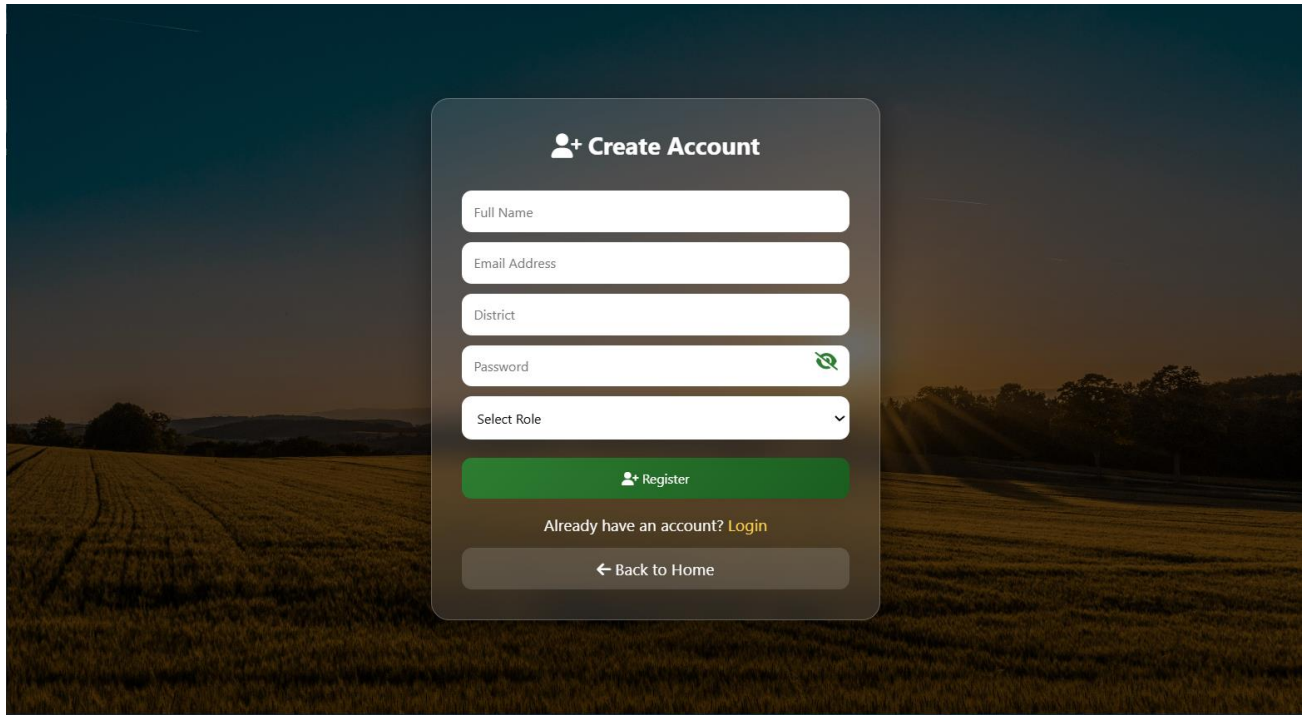
A screenshot of a web application's registration page. The background is a dark, scenic image of a field at dusk. Overlaid on this is a semi-transparent dark grey modal box. At the top of the modal, there is a white user icon followed by the text 'Create Account'. Below this, there are five white input fields stacked vertically: 'Full Name', 'Email Address', 'District', 'Password' (which has a green eye icon for toggling visibility), and a dropdown menu labeled 'Select Role'. Below the input fields is a prominent green button with a white user icon and the text 'Register'. Underneath the green button, there is a line of text: 'Already have an account? Login', where 'Login' is in a yellow color. At the very bottom of the modal is a grey button with a left-pointing arrow and the text 'Back to Home'.

Figure 6: Register page

A user logs in using the email or user name and the password to access, a role-based dashboard according to their role as they registered for example, a farmer logs in and accesses a farmer dashboard

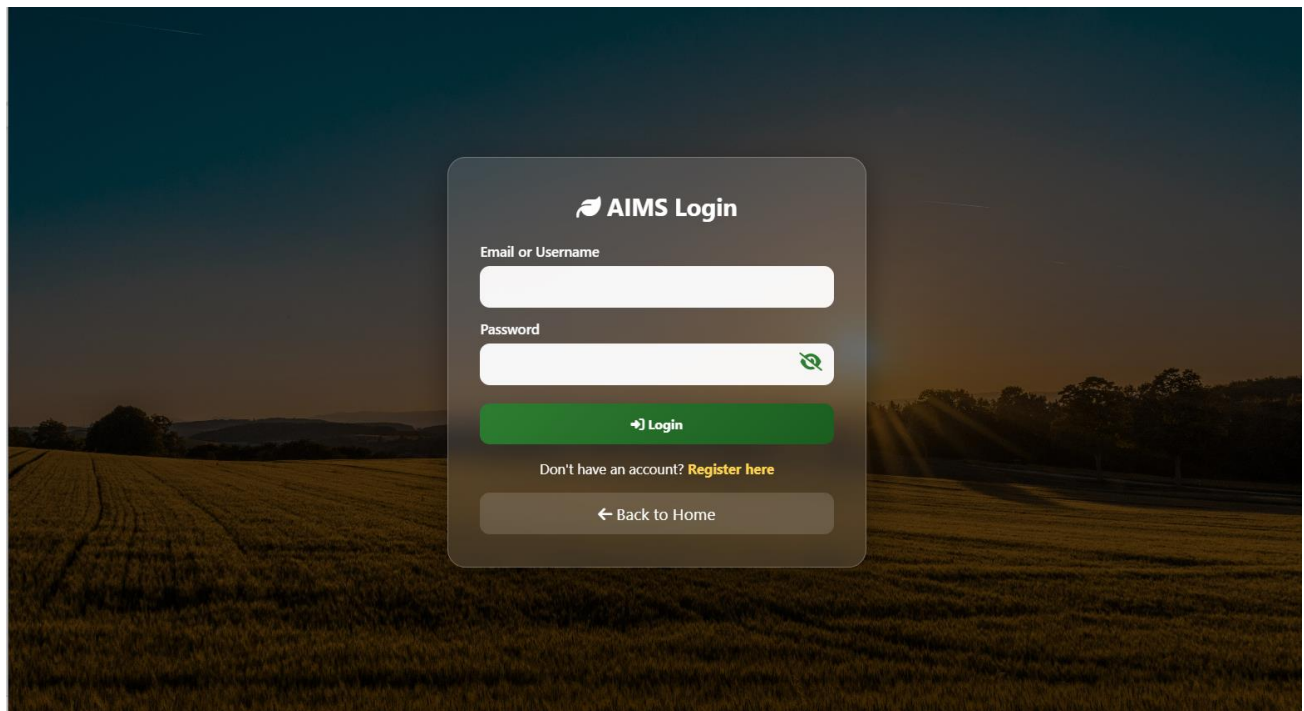


Figure 7: Log in page

After logging in a user access the dashboard according to their role, for example a farmer accesses a farmer dashboard.

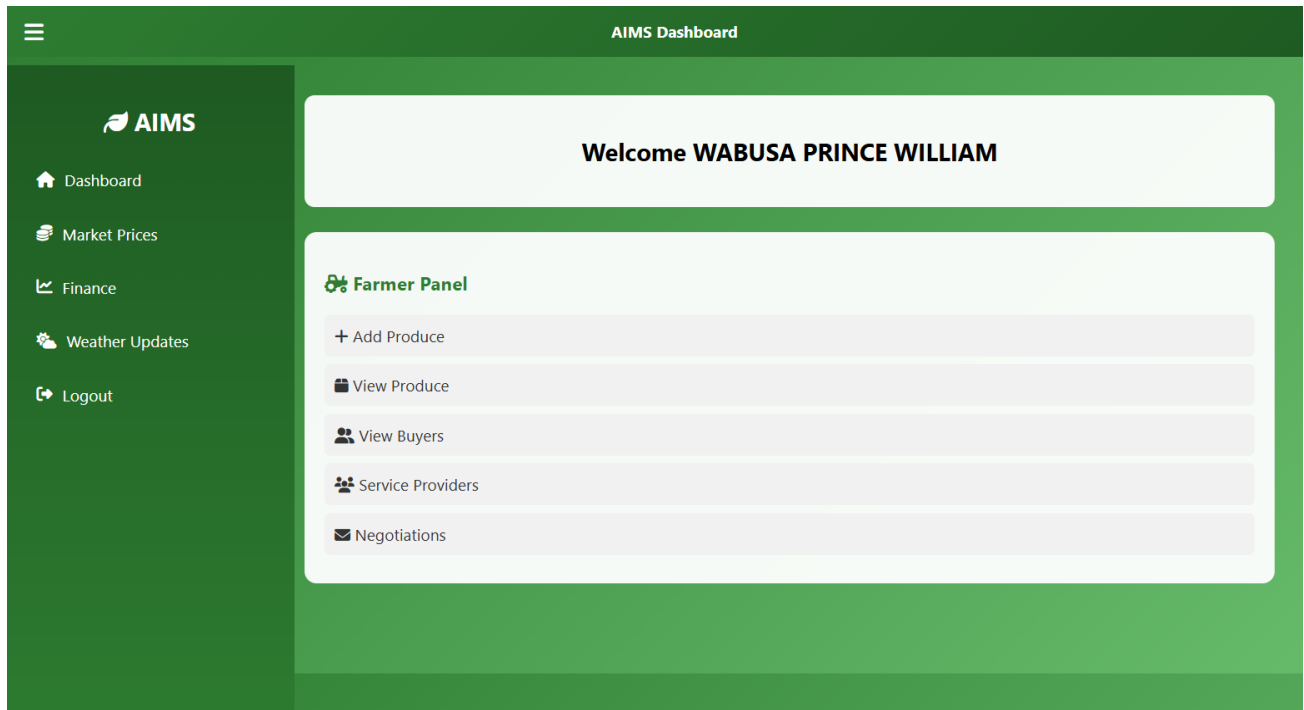


Figure 8: Role-Based Dashboard

All users access Market prices, both the selling prices and the buying prices.

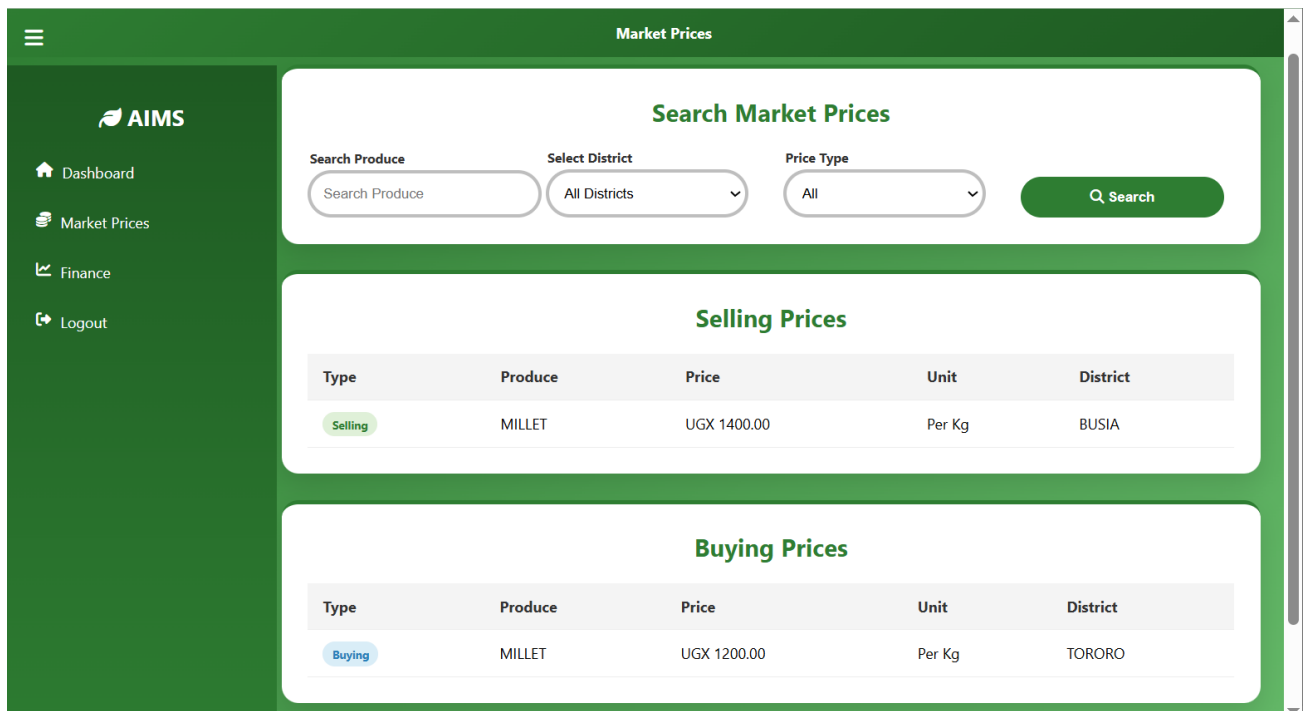


Figure 9: Market Prices Module

Farmers can interact and bargain with the buyers, transporters and storage providers

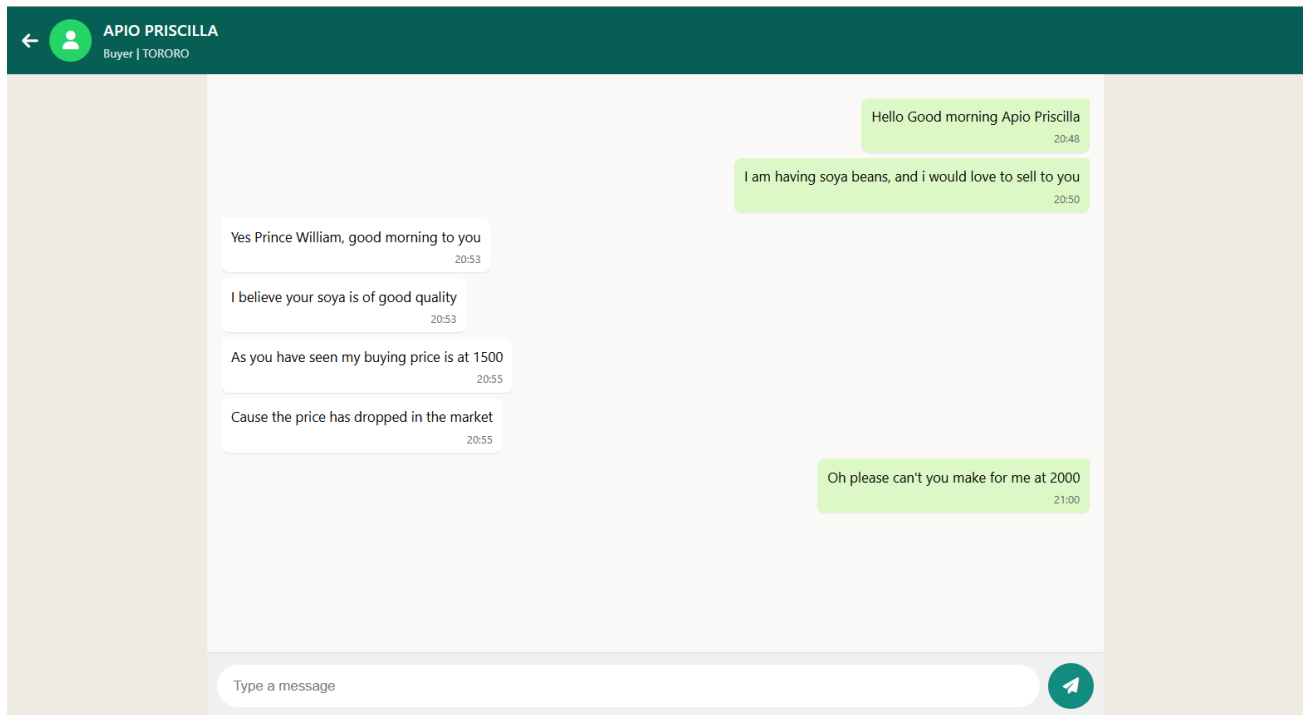


Figure 10: Messaging Module

All system users can access weather forecast up to five days

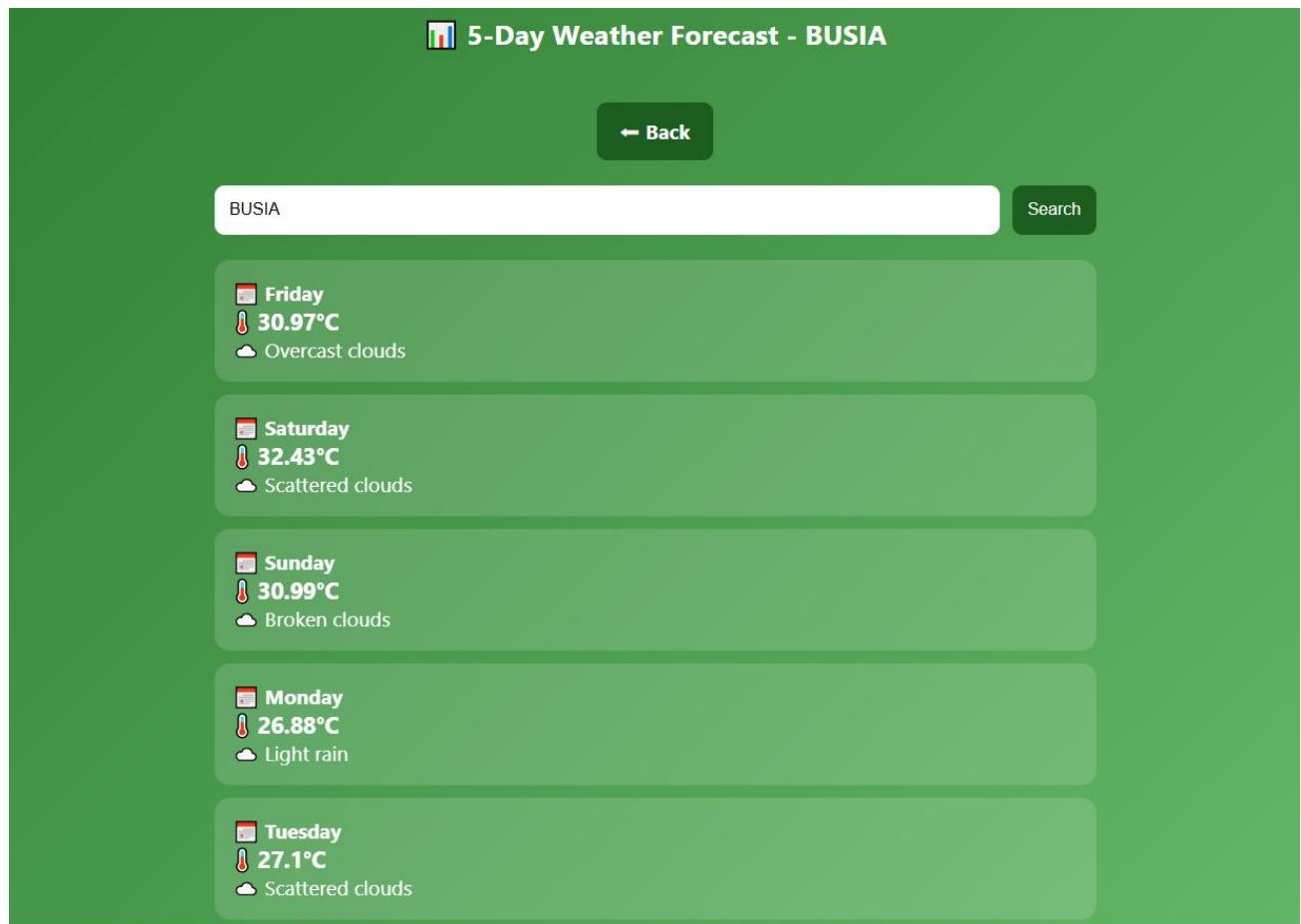


Figure 11: Five days Weather forecast.

System users can also, access daily weather forecast plus farming tips and advice depending on such weather

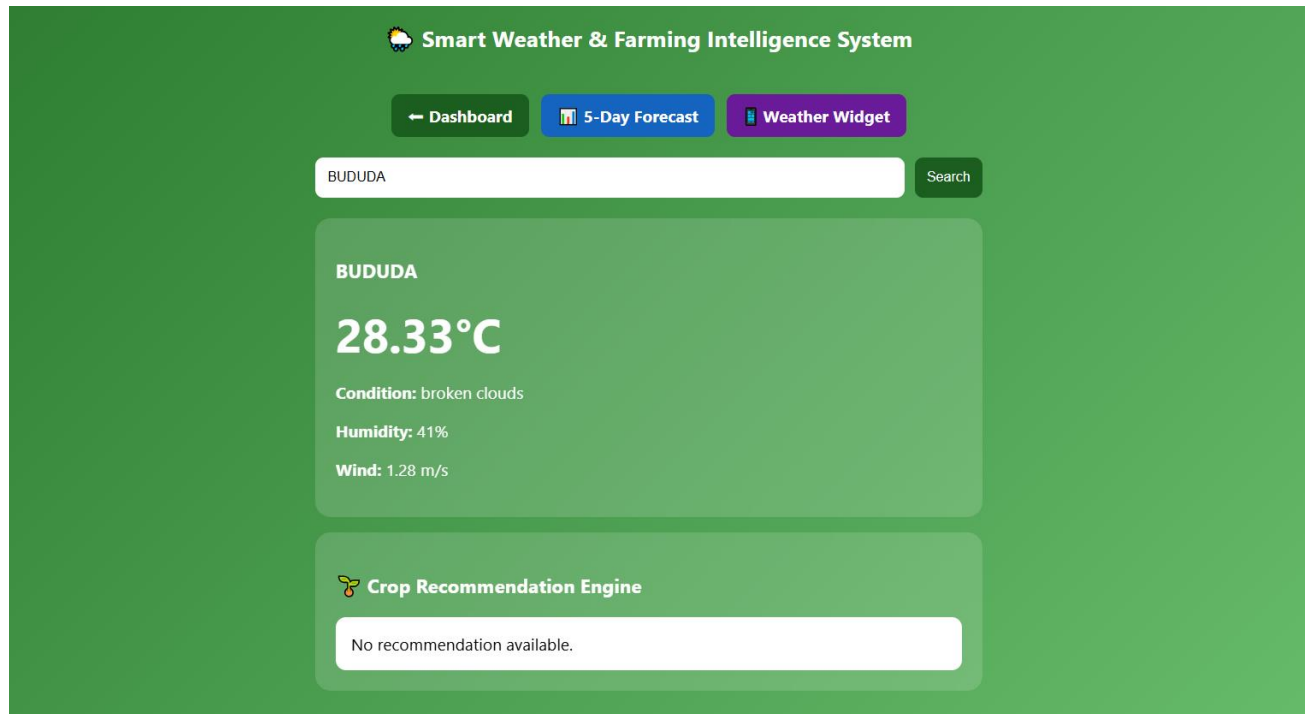


Figure 12: Weather and Farming Intelligence Module

Transport providers access the system and update their profile on the transport services they provide and their details to be accessed by farmers on the system

AIMS

- Dashboard
- Market Prices
- Finance
- Logout

Transport Profile

Manage Transport Units

Transport Facility (e.g Truck, Van)

Capacity (e.g 1 ton, 2 tons)

Add Transport

My Transport Units

#	Transport	Capacity	Action
Transport 1	TRUCK	1000 Kg	Edit
Transport 2	PICKUP	500 Kg	Edit

Figure 13: Transport Providers module

Storage providers access the system and update their profile on the storage services they provide and their details to be accessed by farmers on the system

The screenshot displays the 'Storage Profile' module. The sidebar on the left contains the AIMS logo and navigation links: Dashboard, Market Prices, Finance, and Logout. The main content area is divided into two sections. The 'Manage Storage Units' section features two input fields: 'Produce Stored' and 'Capacity (e.g. 50 crates)', followed by a green 'Add Store' button. The 'My Storage Units' section contains a table with the following data:

#	Produce	Capacity	Action
Store 1	BEANS	1000 Kg	Edit
Store 2	RICE	1000 Kg	Edit

Figure 14: Storage Providers module

Farmers, and other system users can access financial service providing institutes from AIMS

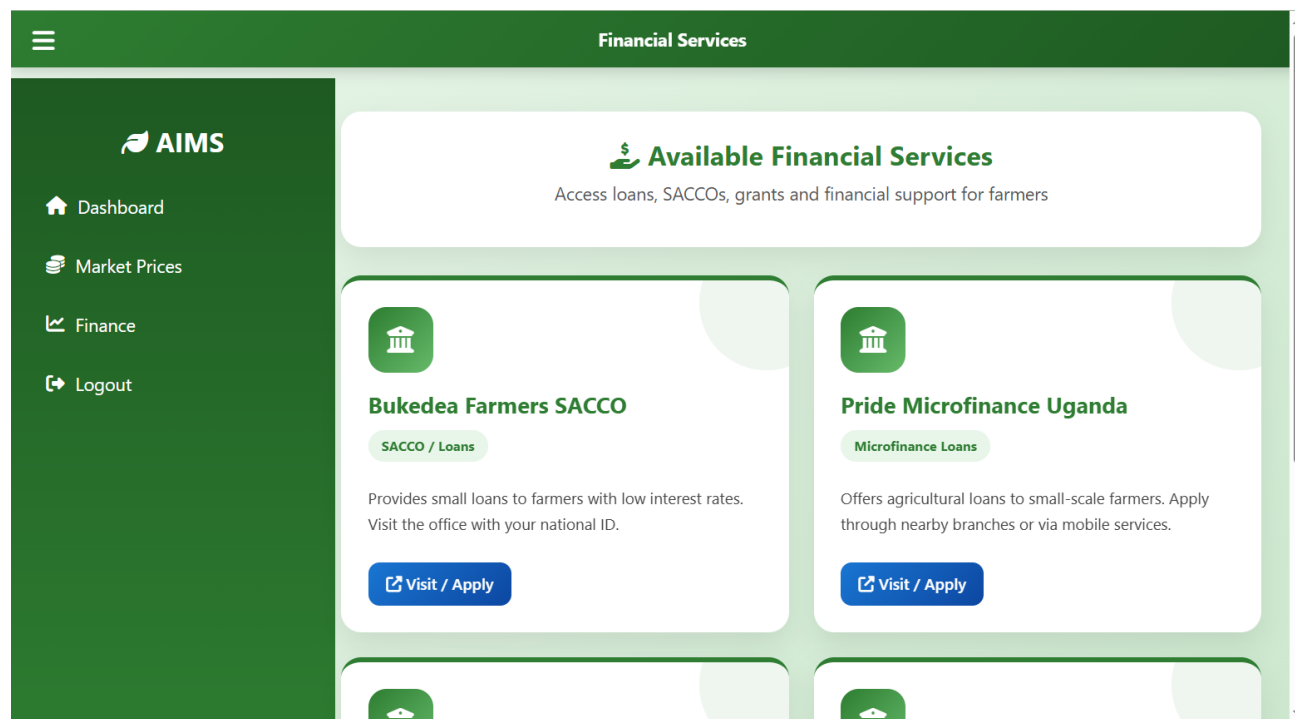


Figure 15: Financial Services module

System Administrator manages users and financial institutions on the AIMS by accessing the Admin Dashboard.

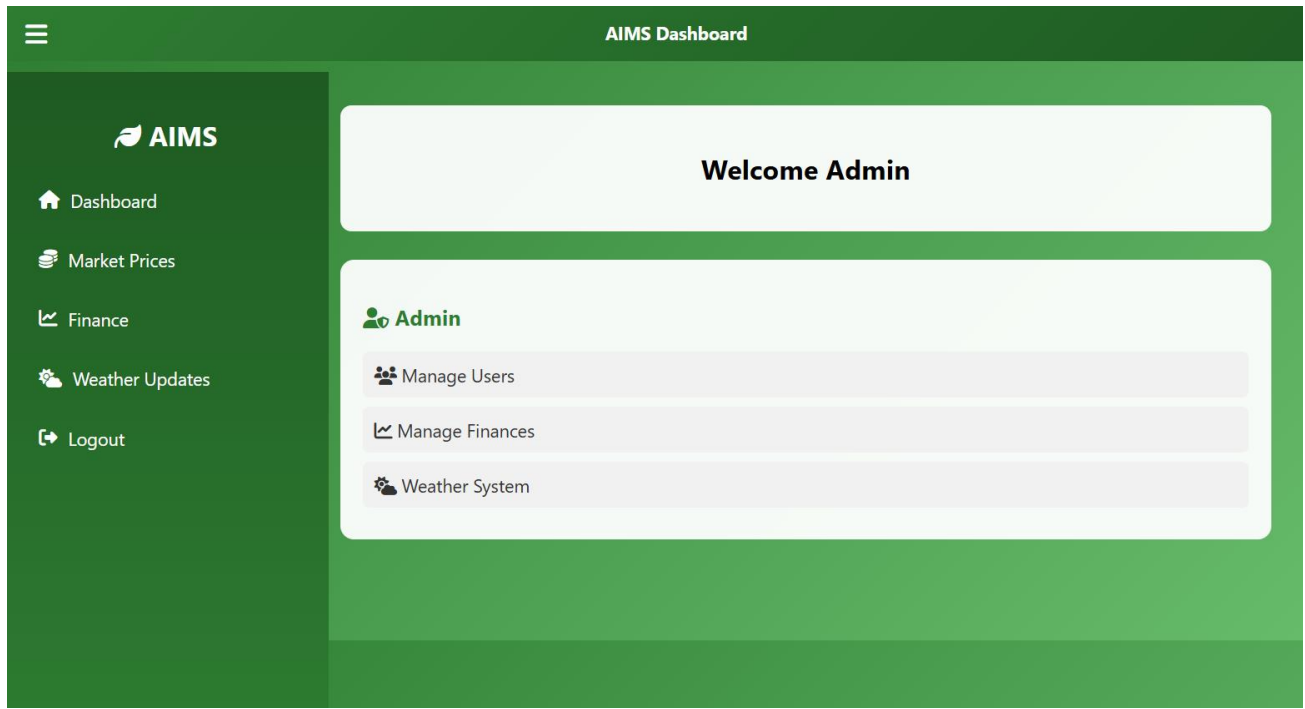


Figure 16: Administrator Dashboard

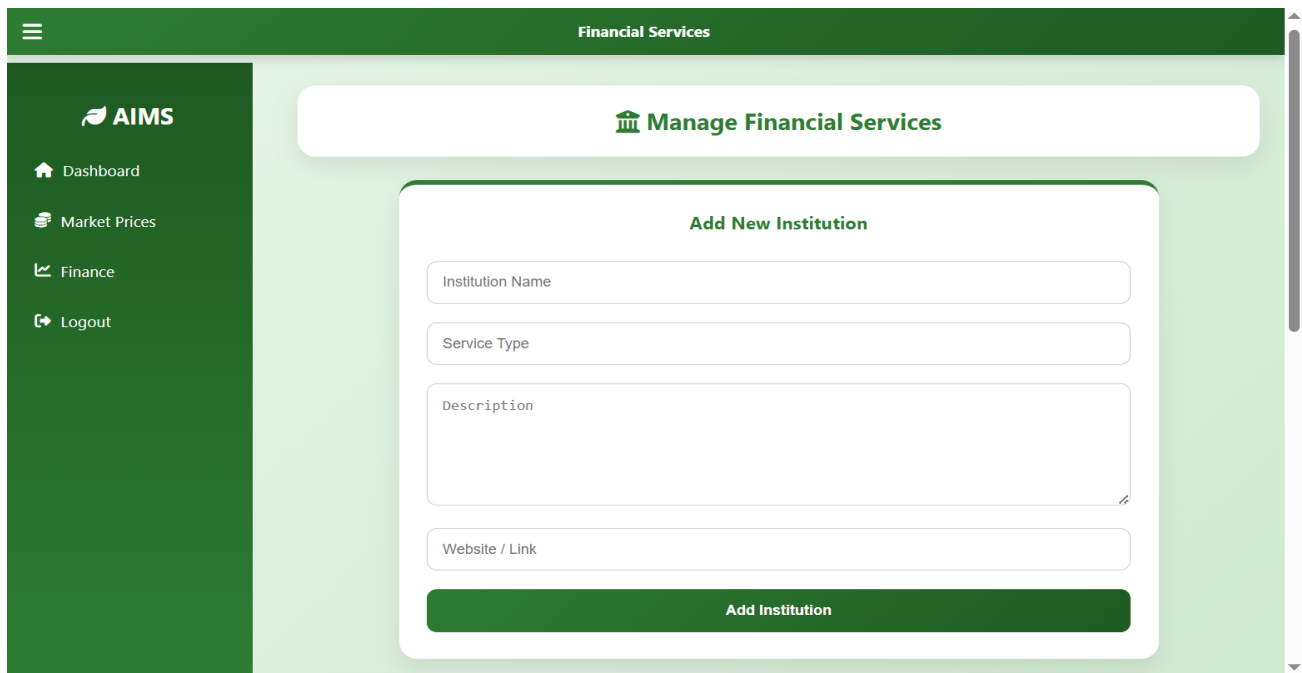
Admin can delete users from the system to manage user functionality

Manage Users			
Name	Email	Role	Actions
KWAGALA QUEEN ESTHER	queen@gmail.com	storage	Delete
AKUMU BLESSING BRENDA	akumu@gmail.com	transport	Delete
APIO PRISCILLA	apio@gmail.com	buyer	Delete
WABUSA PRINCE WILLIAM	wabusaprincewilliam4@gmail.com	farmer	Delete
Admin	admin@gmail.com	admin	SYSTEM ADMIN

[← Back to Dashboard](#)

Figure 17: Administrator User Management

Admin can add, and edit a financial Institute in the System



The screenshot displays the AIMS Financial Services interface. On the left is a dark green sidebar with the AIMS logo and navigation links: Dashboard, Market Prices, Finance, and Logout. The top header is dark green with the text 'Financial Services'. The main content area has a light green background and features a white card titled 'Manage Financial Services' with a bank icon. Inside this card is a white form titled 'Add New Institution'. The form contains four input fields: 'Institution Name', 'Service Type', 'Description' (a larger text area), and 'Website / Link'. At the bottom of the form is a dark green button labeled 'Add Institution'.

Figure 18: Administrator Financial Institute Management

Admin can edit the added financial Institution updating its name, service type, description, and the website link and they can also delete the entire financial institution in case it is not benefitting users

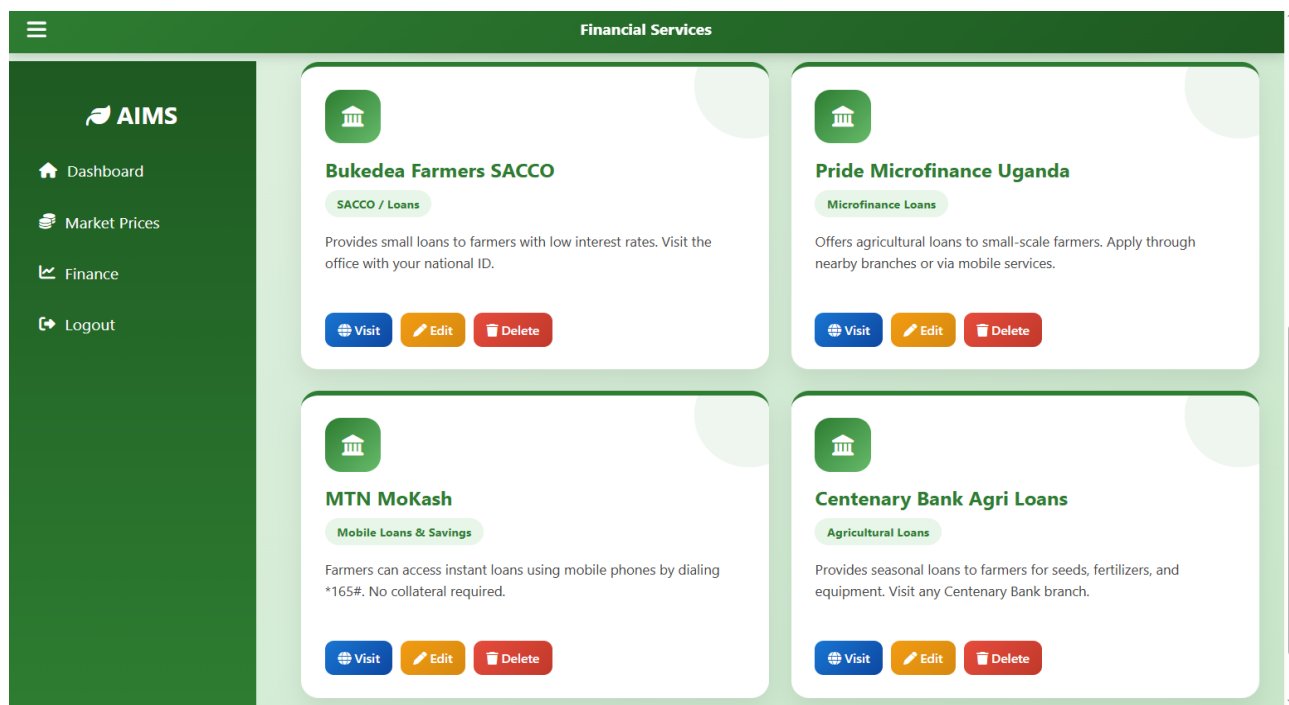


Figure 19: Administrator Financial Institute updating

5.3 System Testing and Validation

The entire system was tested using codes, class modules and modules. This stage of implementation ensured accuracy and efficiency operation of the system before it was given to the users. It required a series of different tests which varied at different system levels. The system tester assumed that if all parts of the system were correct then the goal would have finally been achieved. Testing is the process of executing the program in order to identify errors or bugs. Testing shows the software errors. Therefore, testing was done after completion of the system. This was done in two formats including Unit testing and Integration testing.

Unit Testing

Unit testing was done on individual codes of the system to ensure that they fully yield the functional units. This was done by examining each unit, for example the code for sending a message. This was done to ensure that the message was delivered to the appropriate person without errors.

Successfully achieving that encouraged me to go ahead with integration testing after all the identified errors were worked on individually.

Integration Testing

This was done after all the different modules had been put together to make a complete system. Integration aimed at ensuring that all the modules of the system worked hand in hand and that they could be integrated to form a complete working system.

Validation of the System

Validation of the system was done in order to confirm whether the system met its intended requirements and functionalities as intended. It involved a series of evaluations to ensure that the system is correct, consistent, complete, traceable and secure.

Functional validation was done in order to test the system's core functionalities and ensure they meet the specified requirements. Here 7 members participated in the validation of the system and out of the 7 members, 5/7 of the members agreed that the system meets all the functionalities intended. This shows that 70% of the people agreed that the system is deemed fit for its use.

CHAPTER SIX: DISCUSSION, CONCLUSION, RECOMMENDATIONS AND FUTURE WORK

6.1 Introduction

This chapter discusses the development of the Agricultural Information Management System in relation to the objectives, presents the conclusion, recommendations, limitations and future work.

6.2 Discussion

The discussion of this chapter is based on the theme of objectives stated in chapter one, section 1.5.

Objective One: To review relevant literature and identify the functional and non-functional requirements of an Agricultural Information Management System for small-scale farmers in Uganda.

The literature and approved proposal established that agricultural information challenges are interconnected. Farmers require market information, buyers, logistics and storage services, weather information and financial information. The requirements derived from these needs are reflected in the implemented modules.

Objective Two: To analyse and design an Agricultural Information Management System that provides timely agricultural information to small-scale farmers in Uganda.

The system was analyzed and represented through architecture, context, and ERD models. The three-tier architecture provides separation between presentation, application logic and data management. The relational database supports the principal user and service entities.

Objective Three: To implement the designed Agricultural Information Management System for small-scale farmers.

The system was successfully implemented as a web application using PHP, HTML, CSS, JavaScript and MySQL/MariaDB. The implementation of authentication, role-based dashboards, produce management, market prices, messaging, service-provider profiles, weather information, financial services and administration was successfully done.

Objective Four: To test and validate the designed Agricultural Information Management System that provides timely information to small-scale farmers in Uganda.

The system was fully implemented and tested. The code passed syntax validation and the principal static pages were successfully served in the local verification environment. The database dump

contains populated records in each major functional area, supporting the conclusion that the modules were exercised during development.

6.3 Conclusion

The project achieved its main objective of designing and implementing an Agricultural Information Management System for Ugandan farmers. The resulting AIMS prototype integrates several services that were identified as fragmented in the approved proposal. It gives users a centralized web platform through which they can access market information, manage or view produce, communicate with agricultural stakeholders, identify transport and storage services, view weather information, receive basic farming recommendations and obtain financial-service information.

The implemented system demonstrates that a relatively lightweight PHP/MySQL web architecture can be used to integrate agricultural information services. The project therefore provides a practical foundation for further development and deployment, although production use would require additional security, scalability, data-quality and rural-access measures.

6.4 Recommendations

- Deploy the system on a secure production server with HTTPS and properly protected database credentials.
- Move API keys and other secrets outside publicly accessible source files and use environment variables or server-side secret management.
- Expand market data sources and introduce mechanisms for regular verification and updating of agricultural prices.
- Integrate trusted weather and agricultural advisory data sources and provide clear timestamps for information freshness.
- Improve rural accessibility through low-bandwidth design, mobile optimization and future USSD/SMS/IVR channels.
- Add stronger role and permission management, audit logs and account recovery mechanisms.
- Introduce database backup and recovery procedures before production deployment.
- Conduct broader user acceptance testing with farmers, buyers, transport providers and storage providers in multiple districts.
- Provide training materials and local-language support where necessary.

6.5 Limitations and Future Work

- The prototype is not a national-scale deployment.
- The weather functionality depends on availability of the external weather service and internet connectivity.
- The development configuration contains local credentials and a hard-coded API key that should be secured before deployment.
- Future versions can add mobile applications, USSD/IVR access, notifications, richer analytics, verified service-provider listings, transaction workflows and real-time market feeds.

REFERENCES

- Food and Agriculture Organization of the United Nations. (2019). The state of food and agriculture 2019: Moving forward on food loss and waste reduction. FAO.
- Financial Sector Deepening Uganda. (2020). Digital financial services in Uganda: Gaps and opportunities in agricultural finance. FSD Uganda.
- Kansiime, M. K., Adekunle, A., Mugisha, J., & Naranjo, L. (2020). Digital platforms and agricultural innovation in Uganda: An analysis of farmer adoption. *African Journal of Rural Development*, 5(3), 89–102.
- Nakayiima, M., Kato, E., & Sserunkuuma, D. (2020). The role of ICT in mitigating post-harvest losses in Uganda. *Uganda Journal of Agricultural Sciences*, 21(2), 45–58.
- Nanyonjo, H., & Waiswa, A. (2021). Unlocking agricultural credit through digital finance. Makerere University Press.
- Ministry of ICT and National Guidance. (2021). National ICT policy framework. Government of Uganda.
- SNV Uganda. (2019). Agricultural value chain analysis: Challenges and opportunities for smallholder farmers. SNV Netherlands Development Organisation.
- Uganda Bureau of Statistics. (2020). Annual agriculture survey 2020.
- Uganda Communications Commission. (2020). Annual market performance report 2020.
- Bukenya, J., Mugisha, J., & Twinamasiko, J. (2019). Improving agricultural extension through mobile-based platforms in Uganda. *Uganda Agricultural Research Journal*, 24(1), 33–47.
- Mwesigwa, F., Okello, J., & Namanya, D. (2020). Bridging the digital divide: USSD and IVR solutions in Ugandan agriculture. *Kampala Digital Innovations Review*, 3(1), 12–26.

APPENDICES

APPENDIX A: INTERVIEW GUIDE FOR SMALL-SCALE FARMERS

- What agricultural activities do you mainly engage in?
- How do you currently obtain information about market prices?
- What challenges do you face when looking for buyers?
- How do you arrange transportation and storage after harvesting?
- What challenges do you experience with transport or storage?
- How do you obtain weather information for farming decisions?
- What financial services would be useful to you?
- What challenges do you face when obtaining financial-service information?
- What would you expect from a centralized agricultural information website?
- Which features would make the system easy and useful?

APPENDIX B: INTERVIEW GUIDE FOR AGRICULTURAL SERVICE PROVIDERS

- What services do you provide to farmers?
- How do farmers currently find information about your services?
- What information should farmers see about your transport/storage services?
- What challenges affect coordination between farmers and providers?
- How could a digital platform improve coordination?
- What privacy and security issues should be considered?

APPENDIX C: PROJECT TIME SCHEDULE

Activity	Duration	Deliverable
Proposal Writing	(1 Month)	Project proposal
Literature Review	(2 Weeks)	Literature review chapter
Requirements Analysis	(2 Weeks)	System requirements
System Design	(3 Weeks)	Architecture and design models
System Implementation	(4 Weeks)	Functional prototype
System Testing & Validation	(2 Weeks)	Tested system
Report Writing	(3 Weeks)	Final report
Final Submission & Presentation		Submission and presentation