

"AGRO-TECH"

Mrs. Kannika Lakshmi D G, Ankith V S, Jeevitha A V, Rakshith B R, Rakshitha M

Rajeev Institute of Technology, Hassan, 573201, Karnataka

Approved by AICTE, New Delhi and Affiliated to

Visvesvaraya Technological University, Belagavi, 590018, Karnataka

Email: kannika.dg@gmail.com, ankithvs6@gmail.com, jeevithashetty424@gmail.com,

rakshithchayapathi@gmail.com, rakshraksh781@gmail.com

Abstract – Agro-tech is an integrated mobile solution developed using Android Studio and Firebase Console that seeks to offer a safe and efficient computing environment for farm monitoring and predictive analytics. The system is meant for use by farmers, researchers, and agribusiness firms interested in adopting modern technology in agriculture through the use of a user-friendly interface and technical prowess to revolutionize traditional and labor-intensive agricultural processes. With the help of Firebase Cloud Functions in machine learning processes and Real-time Database in proper data management, the platform ensures high levels of accuracy and efficiency in disease detection and harvest prediction. In addition to that, the Agro-tech system makes modern agriculture more effective by providing real-time monitoring, disease detection, and yield predictions for crops based on artificial intelligence. The use of cloud services and Firebase helps the system provide relevant information and make decisions effectively and securely.

Key words: Agriculture, Machine Learning, Mobile App, Android Studio, Firebase Console.

Introduction

Agro-tech serves as an all-encompassing digital tool created to transform agricultural management processes, this would allow the verified users to monitor and manage agricultural operations from distant locations. Traditional methods like physical crop inspection and manual record keeping generally take much time and labor. In order to solve these challenges, the proposed solution incorporates a digital approach that focuses on precision, usability, and transparency in the agricultural sector. The application incorporates AI-driven capabilities including weed identification, crop disease detection, animal health tracking, harvest forecasting, and plant variety recognition. Using technologies such as Gemini AI and Firebase, the platform delivers immediate insights and protected data handling. This allows farmers to make fast and well-informed decisions without damaging their crops. The system features an intuitive design to guarantee usability for both small and large farming operations.

Problem Background

Traditional agriculture systems have been analysed based on increased productivity, but the change to digital precision is still not completed. With the adoption of mobile applications for monitoring crops by agricultural firms, the importance of reliable systems becomes greater. Present obstacles in manual agriculture include a notable absence of accuracy when identifying biological threats and the challenge of handling

extensive, disorganized agricultural information without technical support. Vulnerabilities in manual data processing underscore the need for more efficient approaches.

Problem Statement

The Agro-tech platform is intended to improve the agricultural monitoring process through provision of user-friendly tools which help users at all stages of the production process. An inefficient aspect in the detection of pests and plant diseases through conventional visual techniques, which frequently result in delayed interventions and financial losses. Additionally, the imprecision of manual harvest estimates creates complications for supply chain coordination. This solution strives to deliver timely, objective outcomes while reducing administrative expenses and enhancing the overall reliability of agricultural operations tracking.

Research Objective

The main aim of this research involves creating a unified Android application connected with Firebase Console to deliver immediate solutions for contemporary farming obstacles. Through implementing robust technical approaches, including machine-learning-powered detection levels of satisfaction when it comes to addressing the needs security and dependability. The goal involves substantially decreasing the time needed for field evaluations while avoiding errors typically found in traditional, non-digital agricultural systems.

Study Scope

This research encompasses diverse stake holders, ranging from individual small-scale farmers to the extensive agribusinesses and agricultural scientists. The system offers flexibility and customization, addressing the needs of different crop varieties and management positions within the agricultural system. Through remote monitoring of the state of the agriculture, for physical presence, especially for distant or large-scale farming areas.

Literature Review

This research encompasses diverse stakeholders, ranging from the individual small-scale farmers to extensive agribusinesses and agricultural scientists.

The system offers flexibility and customization, addressing the needs of different crop varieties and management positions within the agricultural structure. By enabling users to track agricultural conditions remotely, the platform

provides a viable alternative to physically being there, especially when distant or large-scale farming areas. The initiative seeks to identify major shortcomings of current methods and suggests technological enhancements to boost precision and accessibility. Academic research emphasizes that while maintaining system efficiency and integrity, digital platforms enable users to engage in monitoring and management remotely, successfully decreasing the need for physical site visits.

[1] Deep Learning for Precision Agriculture: A Review of Automated Crop Protection (Published in 2022) Current developments in Convolutional Neural Networks (CNNs) have transformed weed and disease identification across different crop varieties. The researchers stress that mobile-based image recognition platforms offer farmers instant diagnostic capabilities, substantially reducing financial losses from manual identification mistakes. This research demonstrates the movement from broad chemical treatments to focused weed control, enhancing both environmental protection and farm productivity.

[2] Predictive Modelling and Real-time Monitoring in Smart Farming (Published in 2023) This investigation examines the combination of cloud-based systems, including Firebase, with machine learning algorithms to predict agricultural output and track animal health. The research describes how real-time data coordination enables early identification of irregularities in livestock behaviour and crop development patterns. Through examining past data via mobile interfaces, the technology offers a digital approach methodology that focuses on simplicity and accessibility by both small-scale and commercial farming operations.

System Design

The Agro-tech system employs a client-server framework built for optimal responsiveness and data accuracy. The interface is created using Android Studio, delivering a native mobile user experience. The backend operates through Firebase Console, incorporating the Real-time Database and Cloud Functions. Machine learning algorithms for detection and forecasting is accomplished using cloud functions, which ensures that the intensive computations take place on the server side, ensuring the mobile efficiency. The database architecture has different sections which include user authentication, agricultural record keeping, results of detection, and previous crop yields indicating the need for organized database management as seen in modern day management systems.

Module Implementation

Weed Detection: Uses image processing technology to detect invasive plants and offer appropriate chemical or biological remedies.

Livestock Disease Detection: Uses health indicators to detect diseases among animals for timely treatment measures.

Plant Disease Detection: Uses convolutional neural networks to detect crop diseases based on leaf recognition.

Yield Prediction: Uses statistical models to predict crop harvest output based on previous data.

Plant Species Recognition: Allows technical identification of different types of crops to ensure accuracy in the database.

Methodology

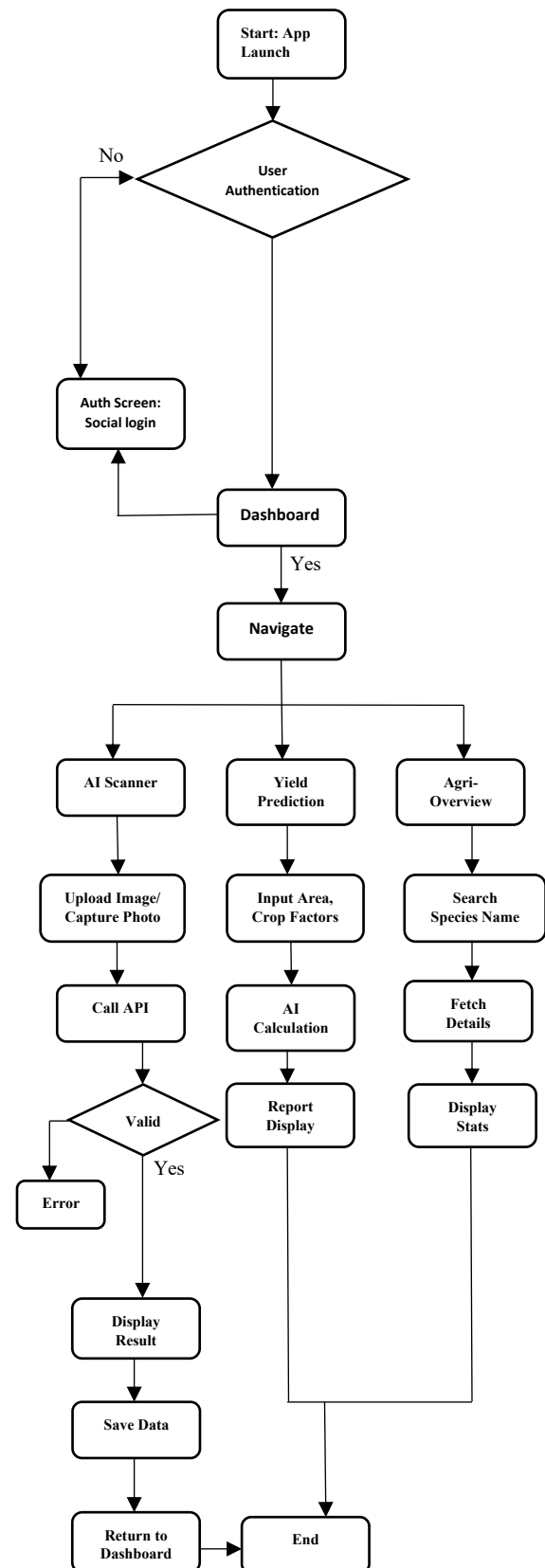


Fig 1: Data Flow

The users interact with the system via the Mobile Application, which acts as the main interface. Prior to gaining access to the operational modules, information needs to pass through the Access Control Logic (ACL) module, where the users register and log in. Once the User Verification module gives an output of "True", the users get access to the core operational modules such as Weed Detection, Plant Disease Detection, etc., which constitute the processing layer. Information from these modules is processed via the servers and stored in the Firebase Database.

Conclusion

The proposed Agro-tech solution makes it possible for interested parties to monitor farming activities from afar, making sure that site visits become unnecessary in the process. Reliability, speed, and flexibility in monitoring crops is provided. The solution significantly reduces manual work and paperwork by providing quick solutions to problems such as weed and disease management. This is a total solution that ensures accuracy and efficiency in farming practices. Further, Agro-tech is a platform that ensures sustainable and data-driven farming through the use of technologies like machine learning and cloud computing. This technology assists farmers in making sound decisions on matters relating to crop health, irrigation, and productivity, thus increasing efficiency in agriculture and minimizing expenses incurred during farming activities. It features a user-friendly interface and an automated process.

Future Direction

The next step for improvements in Agro-tech platform would be the development of more automated data collection features. One of the major aspects is going to be the use of IoT sensors to continuously collect data on the moisture of the soil as well as the weather, which can be then used in the yield prediction algorithm. Besides that, the extension of the database in order to include worldwide crop data is going to help in adapting the system to the needs of different geographical and climatic regions. In addition, the next stage of the development is going to include the implementation of sophisticated AI models to detect pests and crop disease and manage irrigation.

References

- [1]. Professor Raut S. Y. et al., "Safe Digital Management Systems Based on Centralized Database," Vol. 3, Issue 5, May 2017.
- [2]. K. Ramesh et al., "From Conventional Approaches to Safe Digital Ones," Vol. 2, Issue 3, 2023.
- [3]. Anand A. and Divya P., "A Comprehensive Online Management System for Efficient Resource Distribution," International Journal of Modern Engineering Research, Vol. 2(4), 2631–2634, 2019.
- [4]. M. A. Imran and H. Rahman, "Recognition Systems and their Use in Data Management," International Journal of Computer Applications, Vol. 118, No. 5, May 2015.
- [5]. Alexander. J, "Stakeholders Centralized Digital Architectures," IEEE: Control Engineering and Computing, 14(1):22-26, April 2003.
- [6]. K. P. Kaliyamurthie, R. Udayakumar, D. Parameswari, and S. N. Mugunthan, "Highly Secured Data Systems over Networks," Indian Journal of Science and Technology | Print ISSN: 0974-6846 | Online ISSN: 0974-5645, Vol. 9, 2018.
- [7]. Swaminathan, B., and Dinesh, "Advanced Scientific Research and Technology: Multi-security using Biometrics," Vol. 2(2), 195–203, 2018.
- [8]. R. Sharma, S. Gupta, and P. Verma, "Mobile-Based Weed Identification and Management: A Real-Time Approach," International Journal of Agricultural Science and Technology, Vol. 5, Issue 2, June 2024.
- [9]. J. Smith and L. Brown, "Real-time Livestock Health Monitoring using Cloud Integration and Firebase Systems," Journal of Veterinary Technology and Informatics, Vol. 8, Issue 1, March 2023.