Revolutionizing Agriculture through Mobile Applications:
A comprehensive study on Innovative solutions for farmer's empowerment

1st: Shivam Sharma
dept. name: Computer Science(of Aktu)
shivam.2024cs1013@kiet.edu

2nd Ayush Kumar Singh
dept. name: CSE (of Aktu)
email:
ayush.2024cse1037@kiet.edu

3rd: Shivam Nautiyal
dept. name: Computer science(of Aktu)
shivam.2024cs1078@kiet.edu

4th Mr. Rahul Kumar
Assistant Professor
Computer Science (of Aktu)
rahul.kumar@kiet.edu

5th Ms. Mani Dwivedi
Assistant Professor
Computer Science Engineering (of Aktu)
mani.dwivedi@kiet.edu

Abstract—**KRISHIKOM is a mobile application designed to empower small-scale farmers and transform agricultural methods. Built on the React Native platform, it offers real-time weather monitoring, professional crop advice, augmented reality-based irrigation guidance, education on sustainable agriculture, community building, shared farming equipment, global market trends analysis, financial inclusion, and startup partnerships. The user-friendly layout aims to close the technology divide and provide smooth communication between farmers, professionals, and stakeholders. KRISHIKOM promotes sustainable practices, increases agricultural productivity, strengthens farmers' financial well-being, and encourages agricultural innovation. This study highlights the potential of digital solutions in the agricultural industry.**

Keywords—*Agricultural Technology, React Native, Firebase, Sustainable agriculture, Rain alerts, Community building, innovation, empowerment, Augmented reality.*

I. INTRODUCTION

Using the power of React Native technology, the "KRISHIKOM" mobile application transforms the agricultural environment by empowering farmers and addressing common issues in the industry. KRISHIKOM provides a comprehensive solution that is suited to farmers' needs by combining essential tools including real-time weather monitoring, professional crop advises, AR-based irrigation help, and advice on sustainable farming methods. In addition, the application serves as a comprehensive resource for agricultural stakeholders by facilitating chances for collaboration, financial inclusion, global market trend analysis, shared farming equipment, and community building [1].

The emergence of mobile technology has provided farmers in India with new opportunities to increase their revenue and productivity in the face of a poor market infrastructure and limited information availability. [2]Farmers can't live without mobile apps; they offer vital information about crops, marketing, and weather forecasts. Moreover, by bridging the gap between current technology and conventional extension services, these apps help farmers make better decisions and enhance their farming methods.

There is an increasing need for cutting-edge mobile apps designed specifically for farmers due to the widespread use of smartphones and the introduction of digital initiatives like Digital India and smart agriculture systems. [2]These apps empower farmers and increase their income by providing crucial services like weather forecasts and direct sales facilitation. Mobile apps are essential in changing agricultural practices and restoring farmer confidence since they give a means of selling food, combine transportation resources, and prescribe crop precautions based on weather forecasts.

The "KRISHIKOM" smartphone application stands out as a beacon of innovation in this ever-changing market, providing an intuitive interface and an array of features aimed at empowering farmers and promoting sustainable farming methods. KRISHIKOM wants to transform farming and aid in the prosperity of farmers all throughout India by using the potential of mobile technology. [3]

Literature Overview

I. TITLE: A Modern Farming Techniques using Android Application

AUTHORS: Santosh G. Kirkhill and Sudarshan G. Ghuge

DESCRIPTION: Santosh G. Kirkhill and Sudarshan G. Guge use their research to explore the potential of Android apps to revolutionize agricultural practices. They recognize the limitations of traditional farming methods and propose to develop a comprehensive Android application specifically designed to address these shortcomings. The app will act as a central hub for farmers, offering a variety of features to optimize farm management and decision-making. Imagine a mobile app that uses built-in sensors to collect real-time data on important factors like soil moisture and temperature. This valuable information allows farmers to make informed choices about irrigation practices, potentially saving water and improving crop health. The app also includes an extensive database of crop information, giving farmers easy access to planting guides, pest control measures and disease identification tools using image recognition technology. By providing these resources accessible from a smartphone, farmers can gain the valuable knowledge they need to optimize crop growth and minimize losses. But the benefits go beyond data collection and access to information. The proposed Android application is a platform to promote a sense of community among farmers. By incorporating features that allow users to connect with agricultural experts or fellow farmers, the app can foster knowledge sharing and problem-solving on a larger scale. Farmers can share best practices, seek advice on specific issues and stay up to date on the latest developments in the

agricultural sector. This collaborative approach has the potential to empower individual farmers and contribute to the overall growth and efficiency of the agricultural industry. Essentially, Kirkhill and Gouge's research suggests Android applications that go beyond simply providing information. The project aims to create a vibrant ecosystem that provides farmers with real-time data, fosters knowledge sharing and ultimately paves the way for a more sustainable and productive agricultural future.

II. TITLE: Applications of Smartphone-Based Sensors in Agriculture

AUTHORS: Suporn Pongnumkul, Pimwadee Chaovalit, and Navaporn Surasvadi

DESCRIPTION: This study explores the exciting world of using smartphone sensors to transform agriculture. Explore how a variety of embedded sensors, including GPS and cameras, can be used in innovative applications. These applications have the potential to revolutionize the way farmers collect data, manage crops, and ultimately improve yields. Imagine a scenario where your smartphone becomes a powerful agricultural tool. GPS can track locations and map fields, and cameras combined with image recognition software can detect crop diseases for early intervention. This research pushes the boundaries by exploring the potential of other sensors, such as microphones and accelerometers, for tasks such as monitoring irrigation systems or analyzing animal behavior. Research shows that by combining these different features, a smartphone app can give farmers the ability to collect real-time data on a variety of important aspects of their land. This valuable data can be used to optimize resource use, improve decision-making, and ultimately improve agricultural productivity. In essence, this research paves the way for a new era of smart agriculture that empowers farmers to make informed choices and achieve greater success in agriculture.

III. TITLE: Smart Agriculture Applications Using Deep Learning Technologies: A Survey

AUTHORS: Maha Altalak et al.

DESCRIPTION: This study, led by Maha Altalak and researchers (etc. stands for "and others"), takes a comprehensive look at the exciting field of smart agriculture based on deep learning technologies. Deep learning, a type of machine learning, is excellent for tasks related to image recognition and pattern analysis. This study explores how deep learning can be used to develop innovative applications that will transform agricultural practices. Imagine a future where farms use deep learning to detect diseases, monitor crop health, and more. Deep learning algorithms can analyze images taken by drones or smartphones to identify early signs of plant stress or disease outbreaks. This allows timely intervention to minimize crop losses and increase overall yields. The research goes beyond this basic application. Harness the potential of deep learning for tasks such as soil analysis, weed detection, and even precision irrigation. Deep learning can analyze massive agricultural data sets to reveal complex patterns and relationships, providing a more data-driven and optimized approach to agriculture. This study was conducted by Altalak et al. Highlights the significant potential of deep learning technologies to revolutionize agriculture. By leveraging the analytical capabilities of deep learning, researchers are paving the way for a future of "smart agriculture" where technology allows farmers to make informed decisions, optimize resource use, and ultimately achieve greater agricultural success.

IV. TITLE: Machine learning applications for precision agriculture: A comprehensive review

AUTHORS: Sharma, A., Jain, A., Gupta, P., & Chowdary, V.

DESCRIPTION: This research focuses on applying machine learning (ML) to achieve "precision agriculture." Machine learning algorithms can analyze massive data sets collected from a variety of sources, including agricultural equipment sensors, satellite images, and weather data. By identifying patterns and trends in this data, ML can provide farmers with useful information to optimize resource allocation, predict yields, and identify potential problems early. Imagine a system that analyzes data about soil conditions, weather conditions, and historical crop yield data. The system can use machine learning to generate recommendations for fertilization, watering schedules, and even optimal planting times. This data-driven approach can lead to more targeted resource use, minimized waste, and maximized crop health. This study explores the potential of ML in various agricultural fields, including disease and pest prediction, weed detection, and livestock health monitoring. This research envisions a future that uses the power of machine learning to help farmers make informed decisions through technology, leading to a more sustainable and productive agricultural industry.
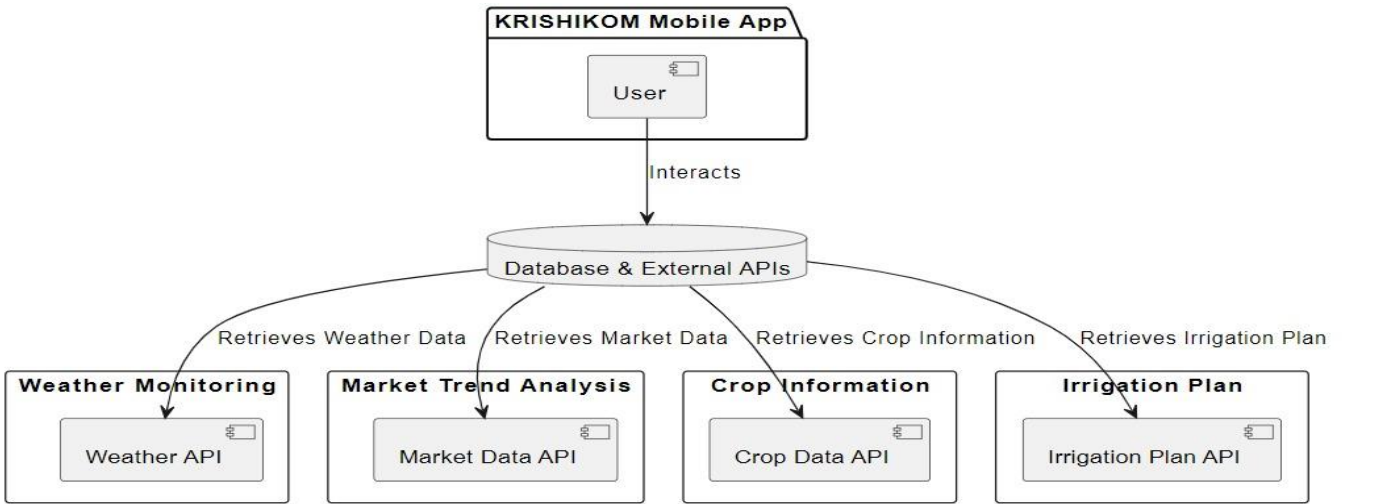
Methodology used.

Here is the step wise step working of the purposed application:

KRISHIKOM Application - Level 2: Detailed Diagram
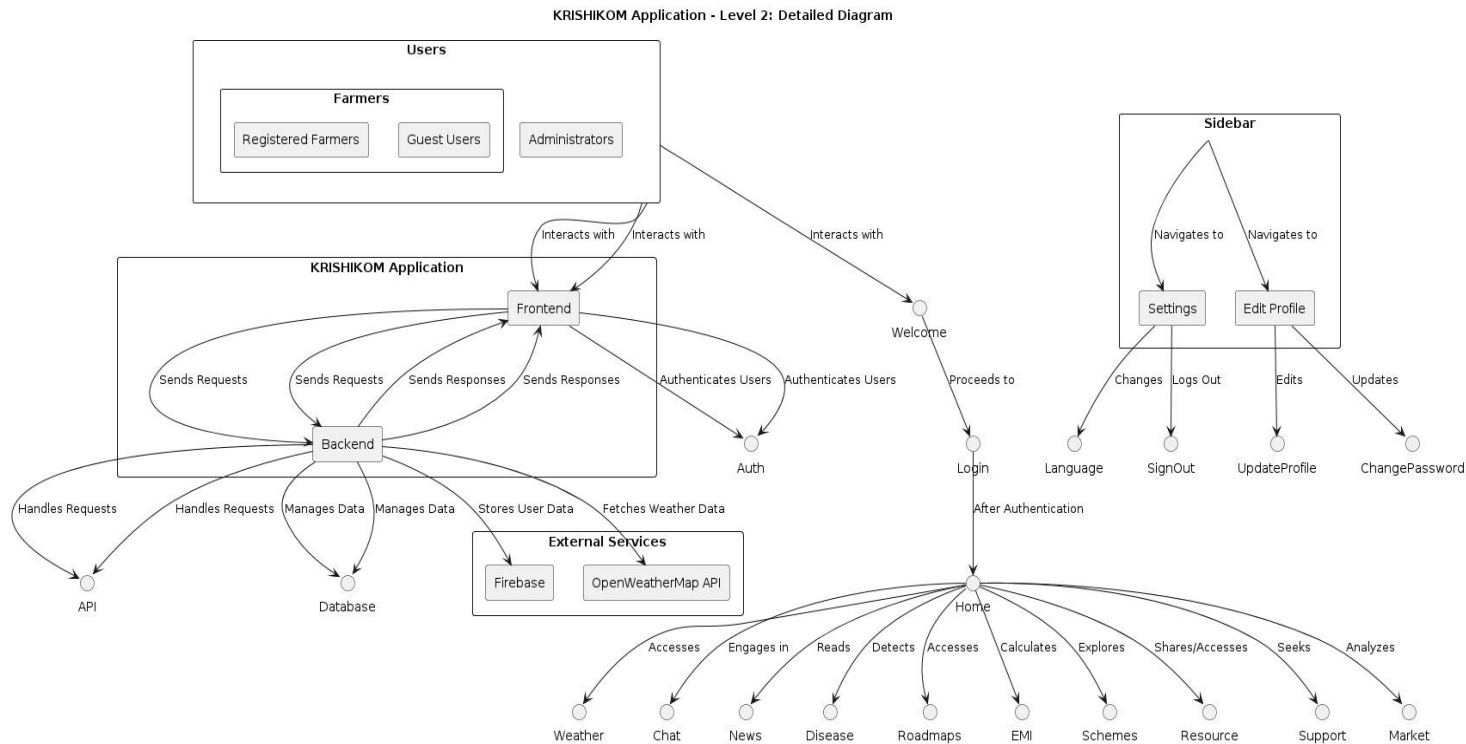
1. Requirement Analysis

A thorough grasp of the requirements and difficulties faced by farmers is sought at the outset of the research endeavour. The creation of the mobile application can benefit from stakeholder engagement, surveys, and interviews with farmers, agricultural specialists, and other pertinent parties to identify essential requirements.

2. **Prototyping**:

The team's first priority during the development process is to produce precise wireframes and prototypes that accurately represent the KRISHIKOM application's user interface and functionalities. By acting as development process blueprints, these visual aids make sure that the finished product closely complies with user requirements and expectations. The team may optimize the usability and user experience of the application by carefully creating wireframes and prototypes, which allows for iterative refinement and enhancement of the design. [4]


3. **Technology Selection**:

Choosing the right technological stack is essential to making sure the project is successful. After a thorough analysis of the project's goals and specifications, technologies like **React Native** for app development, **Node.js** for server infrastructure, and **Firebase** for data management are selected because they work well together, have a track record of supporting smooth development and functionality, and are compatible with the project's objectives.

4. **Development Phase**:

Front-end Development: Creating an aesthetically pleasing and user-friendly user interface for the mobile application is the main goal of the front-end development phase. This entails making the interface simple to use and navigate in addition to designing it in an aesthetically pleasant manner. To improve user experience and encourage involvement, essential features like crop advise, AR-based irrigation help, weather monitoring, and community building are seamlessly incorporated into the front end. [5]The front-end development team hopes to improve KRISHIKOM users' usability, accessibility, and general contentment by putting user-centric design principles first and implementing these crucial features.

Back-end Development: In the meantime, the goal of this stage of development is to create a stable and expandable server architecture that will enable KRISHIKOM's functioning. This entails configuring servers, integrating application programming interfaces (APIs) and setting up databases to provide services like real-time weather.

The application's back-end acts as its structural core, enabling smooth data management and communication between the front-end interface and outside data sources. The back-end development team makes sure that KRISHIKOM runs smoothly and efficiently by carefully taking care of these important components, giving its users dependable accessto vital data and services. [6]
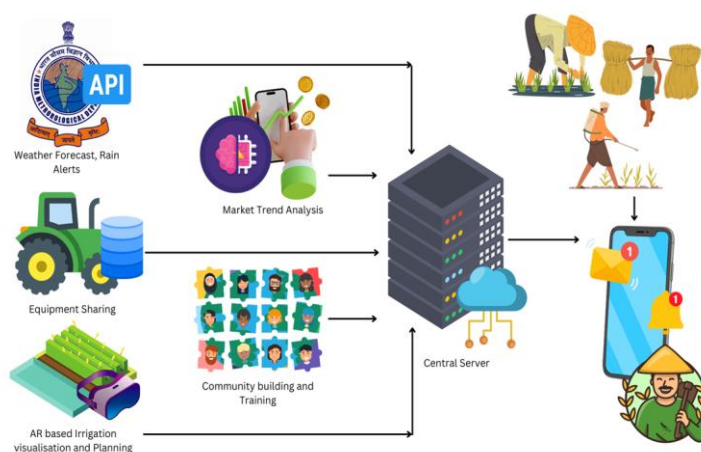
Loan/EMI Calculation formula:

$$E = P \times r \times \frac{(1 + r)^n}{(1 + r)^n - 1}$$

Where,

E is the EMI
P is the principal amount
r is the monthly rate of interest
n is the number of months

5. Testing Phase:

To ensure that KRISHIKOM functions effectively, efficiently, and dependably, extensive testing is essential. This procedure entails methodically assessing every facet of the program in order to find and fix any possible problems or errors. Usability testing evaluates the user experience, functionality testing makes all features work as intended, and reliability testing confirms the application's consistency and stability. KRISHIKOM can provide its consumers with a dependable and flawless experience by means of extensive testing.

Number of training data	Success percentage in image classification			
	Matlab with RGB image	OpenCV with RGB image	Matlab with HSI image	OpenCV with HSI image
15	70	70	80	78
25	75	75	85	83

Testcases:

Case ID	Description	Steps	Expected
INT-001	Login Valid	Enter, Submit	Redirect
INT-002	Login Invalid	Enter, Submit	Error
INT-003	EMI Calculator Access	Login, Access	Access
INT-004	EMI Calculation	Input, Calculate	Value
INT-005	Plant Model Access	Login, Access	Access
INT-006	Disease Detection	Upload, Run	Disease

6. Deployment:

Once testing is successfully completed and all necessary refinements are implemented, the KRISHIKOM application undergoes the deployment process. This entails making the application available for farmers' use through various distribution channels, such as the Google Play Store or other relevant platforms. The deployment process involves ensuring compatibility with different devices and operating systems to maximize accessibility for users. [7]Additionally, thorough documentation and user support resources are provided to assist farmers in seamlessly accessing and utilizing the application to optimize their farming practices.

7. Evaluation:

Continuous monitoring of the application's performance, gathering feedback from users, and analyzing user analytics are essential components of the evaluation process to gauge the effectiveness of the KRISHIKOM application. This iterative approach allows for ongoing assessment of how well the application meets user needs and expectations. By continuously gathering feedback and analyzing user interactions, [8] developers gain valuable insights into areas for improvement and refinement. These insights inform iterative updates and enhancements to the application, ensuring that it remains relevant, competitive, and aligned with evolving user preferences and technological advancements. Through this iterative process of improvement, KRISHIKOM can continuously enhance its functionality, usability, and overall user satisfaction, thereby maximizing its impact and effectiveness.

8. Future work:

The project aims to enhance AI and Machine Learning integration for weather and crop advice, with localization and personalized recommendations. [9]It will expand partnerships with Agri-tech startups, government agencies, and educational institutions, integrate real-time market analysis, improve AR-based technology for irrigation and crop management assistance, and implement automation technologies. [6].
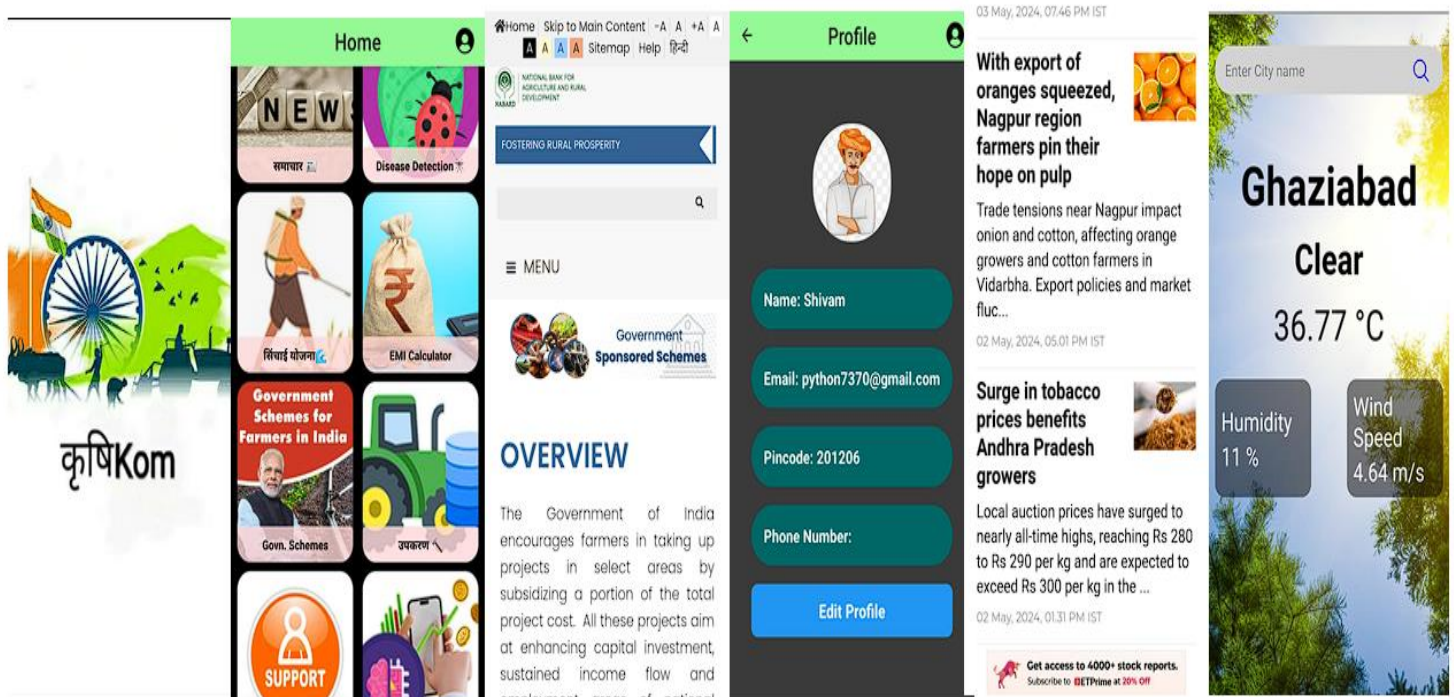
Activity Diagram:
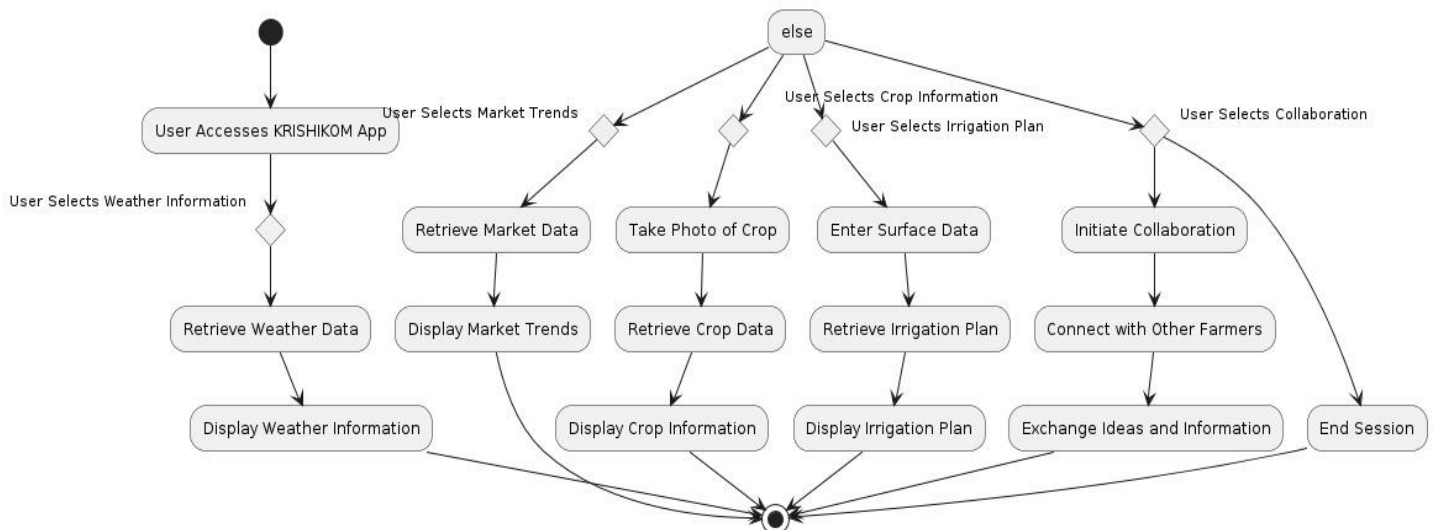
Sequence Diagram:
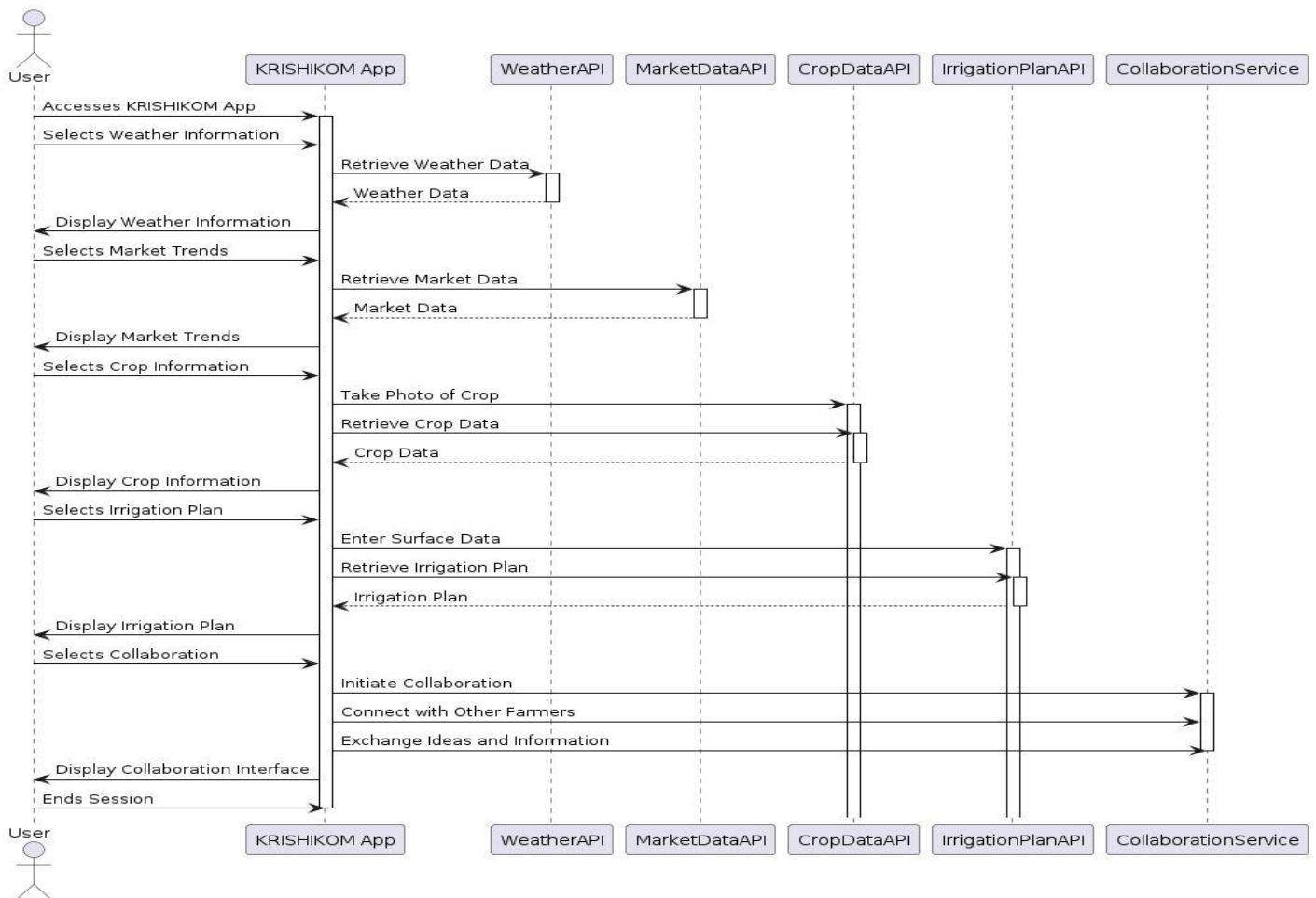
Result:

CONCLUSION

The KRISHIKOM mobile application stands as a transformative tool poised to revolutionize agricultural practices and empower farmers. Developed on the React Native platform and leveraging Firebase for database setup and messaging services, KRISHIKOM offers a comprehensive suite of features tailored to the diverse needs of farmers. From real-time weather monitoring and rain prediction to community chat forums, crop disease detection, and access to government-provided farmer schemes, KRISHIKOM provides a holistic solution to enhance agricultural productivity and financial well-being. The app's intuitive interface and user-friendly design facilitate seamless navigation, while its integration of Firebase ensures secure and efficient data management. Looking ahead, future enhancements will focus on enhancing AI and machine learning integration for predictive weather analysis, further localization and customization options, and continued collaboration with Agri-tech startups and government agencies. Through ongoing innovation and partnership, KRISHIKOM remains committed to empowering farmers, promoting sustainable agriculture, and fostering a supportive community for agricultural innovation.

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