

Uplifting a Farmer through Connected Ecosystem

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Abstract- This project focuses on developing a comprehensive platform that bridges the gap between farmers and consumers, allowing users to purchase agricultural products directly from farmers. The application provides seamless online payments, user and farmer profile management, and real-time inventory updates. Administrators play a key role in fostering trust by onboarding verified farmers and uploading schemes that are beneficial to them. Future expansions include vehicle and land renting functionalities as well as fertilizer management to support farmers further. This app allows farmers to effortlessly rent agricultural machinery, such as tractors and harvesters, at nominal costs, empowering them with technology that was previously out of reach. Through user-friendly interfaces and robust backend support, farmers can connect with rental providers, manage bookings, and access real-time updates. Administrators oversee the system, ensuring transparent transactions and efficient dispute resolution, while users can explore and contribute to the ecosystem. Our goal is to uplift the agricultural community by reducing operational costs, enhancing productivity, and fostering collaboration. By leveraging digital tools, this app bridges the gap between modern technology and traditional farming practices, paving the way for a sustainable and prosperous agricultural future.

Index Terms- Farm-to-Consumer, Agriculture, Payment Gateway, UPI, Scheme Management, Vehicle Renting, Fertilizer, Land Renting

I. INTRODUCTION

The agricultural sector has long faced challenges with transparency, efficiency, and market accessibility, leaving farmers without direct avenues to reach consumers and maximize their profits. The motivation behind this project is to empower farmers by bridging the gap between them and consumers, creating an ecosystem that ensures fairness, trust, and accessibility. By integrating technology[5] with agriculture, this platform provides farmers with tools to manage their products, streamline payments, and access beneficial schemes. This will uplift farmers' livelihoods and foster a sustainable farm-to-consumer relationship, enhancing the overall agricultural economy.

This project aims to empower farmers by providing an affordable platform to hire essential farming equipment, addressing challenges in accessibility and affordability. Many small-scale farmers cannot afford to purchase expensive tools like tractors, which are vital for efficient agricultural operations. This app aims to bridge that gap by creating a digital platform where farmers can hire the equipment they need at an[7] affordable cost. By fostering a connected ecosystem, it ensures that even resource-limited farmers can benefit from modern mechanization, leading to increased productivity and improved agricultural outcomes.

II. RELATED WORKS

Pranav Shiram;[1] Sunil Mhamane, "Android Application to Link Farmers with Retailers and the Food Processing Industry," presented at the conference, 15-16 November 2018. Mobile internet provides farmers with a platform to connect directly with consumers and food processing industries, enabling them to sell their products more effectively. This paper discusses a mobile application designed to offer farmers easy access to market information through a user-friendly interface. The application serves as a quick and up-to-date system for delivering essential data to farmers, featuring support for native languages to facilitate seamless transactions. Farmers can utilize the application both as sellers and buyers, allowing them to trade agricultural goods and products efficiently. The application leverages market price data sourced from data.gov.in to maintain a fair balance between selling and buying prices. To enhance usability, the system includes various filters that simplify browsing through the wide range of available products. By addressing the challenges farmers often face in selling their goods, this system aims to provide a convenient and engaging solution. It enables farmers to sell their products at reasonable prices, fostering a fair and transparent business environment. Consumers also benefit from this system, as it offers a diverse selection of agricultural products. Users can filter products based on price, location, and other preferences to meet their

specific requirements. The location feature ensures that both buyers and sellers can find products within their proximity, promoting convenience and efficiency. The primary goal of this system is to cater to the needs of all users, creating a fair and transparent platform for agricultural business while fulfilling the requirements of both farmers and consumers.

L.A. Imalka;[2] K.G.A. Gunawardana, K.M.S.K. Kodithuwakku, H.K.E. Arachchi, and S.M.B. Harshanath, "Farming Through Technology-Driven Solutions for the Agricultural Industry: The Ceylon E-Agro Mobile Application - Finding Technology-Based Solutions for Agricultural Challenges," presented at the conference, 16-18 September 2022.

Agriculture is a cornerstone of the economy in many developing nations, with over 60% of the population relying on this sector for their livelihoods. This project focuses on improving maize cultivation, an important agricultural activity. In Sri Lanka, farmers face numerous challenges related to maize farming. This mobile application is designed to assist maize farmers in overcoming these obstacles while meeting the growing consumer demand for maize. The app provides solutions for common problems such as pest infestations, diseases, and fire threats on the farm. An AI-powered Agricultural Assistant will deliver real-time recommendations to help farmers address these issues. The platform will also connect farmers directly with buyers, facilitating smoother transactions. Additionally, the app will feature tools for price forecasting and a price index, allowing farmers to stay informed about market trends. To further enhance farming practices, the app incorporates IoT-based smart farming technologies that monitor soil moisture and assess soil quality, ensuring optimal conditions for maize cultivation. This integrated approach aims to improve both the efficiency and sustainability of maize farming.

R. Ranjana; T. Subha;[3] Pravin Kumar P, Sneka L, Varsha S, and Jothishree N, "Agreliance: An Integrated Application for Farmers," presented at the conference, 16-17 December 2021
In today's world, advancements in telecommunication technology have revolutionized connectivity, enabling people separated by thousands of miles to communicate seamlessly via the internet. A specially designed integrated mobile application aims to improve the lives of farmers, not just financially but also mentally. During the Covid-19 pandemic, telehealth systems emerged as an effective alternative for providing healthcare. Through video conferencing technology, farmers facing emotional and mental challenges can receive virtual counseling from healthcare professionals, which has been proven to be as effective as in-person sessions. In addition to supporting farmers' mental well-being, the app addresses the health of crops, which are susceptible to various diseases. To manage such challenges, agricultural experts will offer consultation services, which farmers can access by

scheduling appointments. The economic slowdown caused by the global pandemic has significantly impacted farmers. By facilitating the online sale of agricultural goods directly to consumers, the app helps boost economic growth and reduces the reliance on intermediaries, ultimately lowering prices for consumers. The application also provides information about loan facilities available in the farmers' vicinity, empowering them with financial resources critical for sustaining their agricultural activities. This multi-faceted solution supports farmers in navigating the challenges of modern agriculture while enhancing their economic stability and overall quality of life.

Niket Chauhan; M. Krishnakanth;[4] G. Praneeth Kumar, Prerna Jotwani, and Utkarsh Tandon, "Crop Shop – An Application to Maximize Farmers' Profit," presented at the conference, 30-31 March 2019.

For many years, farmers in India have faced restrictions in selecting markets and buyers for their agricultural produce. In all but three states, laws mandate that the marketing and selling of farm goods must go through state-operated mandis—retail markets where intermediaries, or middlemen, often exploit farmers to maximize their own profits. According to Goldman Sachs, these intermediaries have become dominant players in the agricultural sector, exerting control over farmers and monopolizing profits. Farmers work tirelessly to achieve a good harvest, investing heavily in seeds, fertilizers, and other resources, often through loans. They deserve to retain the full value of their hard-earned income. To address this issue, we propose a system that directly connects farmers with retailers and customers, eliminating the need for middlemen. Intermediaries often claim up to 70% of the profits, leaving farmers with very little, which perpetuates their financial struggles. The proposed system is a mobile application designed to act as a platform for farmers to sell their produce directly to retailers or consumers. This approach ensures that farmers receive a fair price for their products while enabling buyers to purchase fresh produce at a cost lower than market rates. By bypassing middlemen, this system aims to create a win-win scenario, empowering farmers and offering affordability to buyers.

Aina Marie Joseph; Nurfaeza Jali; [5] Amelia Jati Robert Jupit; Suriati Khartini Jali | eMarket for Local Farmers | 23-25 November 2021

The Covid-19 pandemic has emerged as a global health crisis, significantly impacting various sectors, including agriculture. Local farmers have faced challenges in maintaining their income due to limited access to customers, while consumers have struggled to find high-quality fresh produce outside of supermarkets. This paper aims to address these issues through a twofold approach: firstly, by analyzing the traditional and

existing methods consumers have used to acquire fresh produce during the pandemic; and secondly, by designing, developing, and evaluating a mobile application to serve as an online marketplace for local farmers. The shift towards mobile applications has transformed the way people obtain essential goods during the pandemic.

As a result, the concept of creating an online platform for local farmers led to the development of the proposed eMarket application. This paper outlines the use of the Rapid Application Development (RAD) methodology in creating the application. During the pre-development stage, data was collected via a survey conducted through Google Forms, involving twenty local farmers and twenty potential customers. Their feedback was instrumental in shaping the features of the application. Following the development phase, usability testing was carried out to assess the application's functionality and user-friendliness. Ten farmers from the local Matang market and ten university students, representing potential customers, took part in the application's testing phase. The feedback gathered during these evaluations demonstrated that the eMarket application successfully addressed the needs of both farmers and consumers, resulting in a practical and user-friendly solution for connecting farmers with their customers.

III. METHODOLOGY

To uplift farmers effectively, a connected ecosystem integrates digital tools, infrastructure, and collaborative networks. This methodology outlines a step-by-step approach to design, implement, and sustain such an ecosystem: [2],[7]

1. Technology Platform

Develop a mobile application or web-based platform as the central hub for farmers. Key features include:

- **Equipment Rental Services:** Enable farmers to rent tractors and other machinery at affordable rates.
- **Real-time Weather Data:** Provide localized weather forecasts and alerts to optimize farming activities.
- **Crop Advisory Services:** Share best practices, pest control measures, and fertilization schedules through AI-driven recommendations.
- **Market Information:** Offer updates on crop prices and demand trends to aid in decision-making.

2. Resource Sharing

Implement a mechanization sharing economy, allowing farmers to access high-cost tools and machinery without ownership burdens.

Use geolocation services within the platform to connect nearby equipment owners with farmers in need.

3. Financial Empowerment

Collaborate with banks and microfinance institutions to offer microloans, subsidies, and insurance tailored to farmers' needs.

Integrate digital payment systems like mobile wallets to facilitate transactions securely and efficiently.

To uplift farmers through a connected ecosystem, it is crucial to integrate technology, resources, and collaborative networks effectively. The foundation of this approach lies in understanding farmers' challenges, such as limited access to machinery, market uncertainties, and financial barriers. A centralized digital platform, such as a mobile application, serves as the ecosystem's backbone, offering services like equipment rentals, real-time weather updates, crop advisory tools, and access to market prices. By establishing a mechanization-sharing economy, farmers can access high-cost machinery without ownership burdens, while partnerships with financial institutions provide microloans and insurance tailored to their needs. Digital marketplaces further enable direct connections between farmers and buyers, ensuring fair prices and reducing reliance on intermediaries. Community engagement through training programs and peer-to-peer networks enhances knowledge sharing and technology adoption. This methodology emphasizes pilot testing to refine services, scaling to new regions with localized adaptations, and sustainability through revenue models, local leadership, and environmentally friendly practices. By addressing these critical aspects holistically, a connected ecosystem empowers farmers, improves productivity, and promotes socioeconomic growth[3],[5],[8]

Developing an Android app for uplifting farmers through a connected ecosystem involves creating a platform that bridges gaps in resources, technology, and market access. The app empowers farmers by providing essential tools and services, enhancing their productivity and income. Here's a detailed breakdown:

Developing an Android app to uplift farmers through a connected ecosystem focuses on bridging gaps in resources, technology, and market access. The app serves as a platform for farmers to access essential tools and services, empowering them to enhance productivity and income. Key features include an equipment rental system that allows farmers to locate and rent agricultural machinery nearby, a digital marketplace for selling crops directly to buyers, and AI-driven crop advisory tailored to local conditions. The app also integrates real-time weather updates, financial tools for loans and digital payments, and community forums for knowledge sharing. Built using Kotlin or Java for front-end development and Firebase or a custom server for back-end operations, the app ensures scalability, real-time data management, and offline capabilities to address connectivity challenges. By

supporting regional languages and offering intuitive interfaces, the app caters to diverse user needs, improving accessibility even for farmers with limited digital literacy. Ultimately, this solution not only enhances productivity and economic growth but also fosters community collaboration, creating a sustainable and inclusive agricultural ecosystem.

Kotlin, as a modern and officially supported language for Android development, plays a pivotal role in developing an app that uplifts farmers through a connected ecosystem. Its concise syntax, safety features, and seamless integration with Android Studio make it an ideal choice for building scalable, user-friendly, and efficient solutions tailored to farmers' needs. The app can be developed using Kotlin to offer key features that bridge critical gaps in agriculture. Equipment rental systems can be implemented to allow farmers to find, book, and pay for machinery through location-based services, built using Kotlin's powerful APIs and libraries. The app can also feature a digital marketplace, enabling farmers to sell their produce directly to buyers, with Kotlin ensuring smooth navigation and a reliable back-end for secure transactions. Using Kotlin coroutines, asynchronous programming becomes more efficient, enabling real-time updates for weather alerts, crop advisory, and market price changes, even in low-connectivity regions.

Kotlin's interoperability with Java allows the integration of existing agricultural databases and APIs for weather forecasts, payment systems, and government schemes. By leveraging libraries like Retrofit for API calls and Room for local storage, developers can create a robust app that remains functional offline and syncs seamlessly when connected. Furthermore, Kotlin's support for Material Design components ensures the app is intuitive, accessible, and visually appealing, with support for regional languages to cater to diverse farmer communities. In essence, Kotlin empowers developers to create a connected ecosystem that improves productivity, financial inclusion, and market access for farmers, driving sustainable agricultural growth and socioeconomic development.[7]

IV. SYSTEM

1. Design

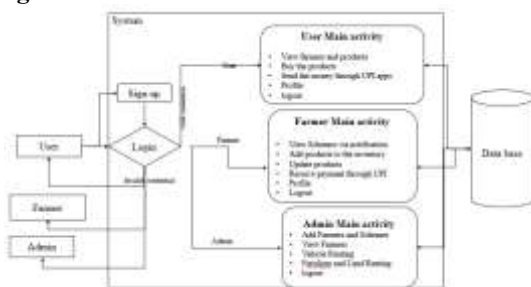


Fig-1: Architecture

Input design serves as the interface between the user and the information system. It involves creating specifications and procedures for data preparation, ensuring that transaction data is transformed into a format suitable for processing. This can be achieved through methods like scanning written or printed documents, or by allowing users to directly enter the data into the system. The primary focus of input design is to manage the volume of input needed, minimize errors, prevent delays, avoid unnecessary steps, and streamline the process. Additionally, input design is crafted to ensure security, ease of use, and privacy protection while maintaining user convenience.

Implementation

Implementation of a connected ecosystem to uplift farmers involves a structured approach that begins with understanding their needs through surveys and interviews, identifying challenges such as limited resource access, market connectivity, and financial inclusion. After defining the objectives, the structure of the ecosystem is developed, emphasizing essential components like equipment rental services, an online marketplace, weather updates and crop guidance, as well as financial features including loan options and digital payment systems. The development phase involves setting up the Android app using Kotlin for front-end development, Firebase for real-time database management, and integrating APIs for weather updates, payment gateways, and geolocation services. After the app is built, pilot testing is conducted with a selected group of farmers, gathering feedback to refine features and ensure usability. Following successful testing, the app is deployed on the Google Play Store, accompanied by awareness campaigns and partnerships with local organizations. Monitoring key performance indicators, such as active users and income impact, ensures continuous improvement. As the app scales to new regions, it is localized to include regional languages and specific agricultural practices, with advanced features like AI-driven insights and blockchain integration for transparency. The sustainability of the ecosystem is supported through revenue models, community ownership, and a focus on eco-friendly farming practices, ultimately promoting long-term agricultural growth and socioeconomic development.

Testing

Testing plays a vital role in the development of any application, particularly those designed to support farmers through a connected ecosystem. The primary objective of testing is to confirm that the app functions as expected, offers a smooth user experience, and performs all necessary tasks without issues. For an Android app targeting farmers, testing should be thorough, addressing both the technical and user experience components. It is a continuous process that ensures the app's functionality, performance, and security meet the needs and expectations of users. By conducting these detailed testing procedures, the app will become more dependable,

user-friendly, and effective in supporting farmers within the connected ecosystem.

Deployment

Deployment marks the final phase of the app development process, where the application is made available to users. For an Android app designed to support farmers within a connected ecosystem, this stage includes several important steps to ensure the app is delivered smoothly, functions correctly, and provides a user-friendly experience for its intended audience. Before deployment, ensure that the app has gone through thorough testing, including functional, usability, performance, and security tests. Optimize the app for performance, fix any bugs or issues that were identified during the testing phase, and ensure it is compatible across a wide range of Android devices and versions.

Maintenance

Maintenance is an ongoing and critical phase after the deployment of an Android app, ensuring its smooth operation, user satisfaction, and continuous improvement. For an app aimed at uplifting farmers through a connected ecosystem, regular maintenance helps address issues, add new features, and adapt to evolving user needs. In conclusion, maintaining an Android app for farmers demands a comprehensive strategy that includes resolving bugs, optimizing performance, updating security, enhancing features, and providing user support. By consistently addressing challenges, improving functionality, and expanding the app, the ecosystem will stay effective and sustainable, empowering farmers in the long run.[7]

V. RESULT

User Module

Users will sign up, log in, and browse a list of farmers and their products. After selecting products, users can purchase them and complete payments through a UPI-like dummy payment gateway. Users can manage their profiles, track orders, and view their order history.



Figure 2 User can login in the into the app using this page along with farmer and admin

Admin Module

Admins will onboard trusted farmers, creating a verified environment for users. They will upload and manage schemes that are beneficial for farmers. Admins will also be responsible for suggesting and providing references for applying to these schemes, fostering an efficient farming ecosystem. They can also monitor platform performance and manage system operations.



Figure 3 Admin will navigate to his respective dashboard after successful login

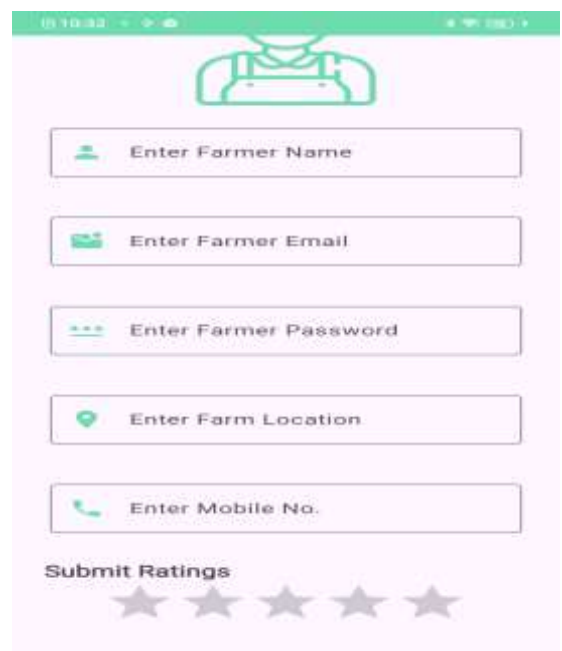


Figure 4 Admin can add the trusted farmers here



Figure 5 Admin will be able to add Farmer schemes here



Figure 6 Admin can view the added farmers here



Figure 7 Admin can view schemes here

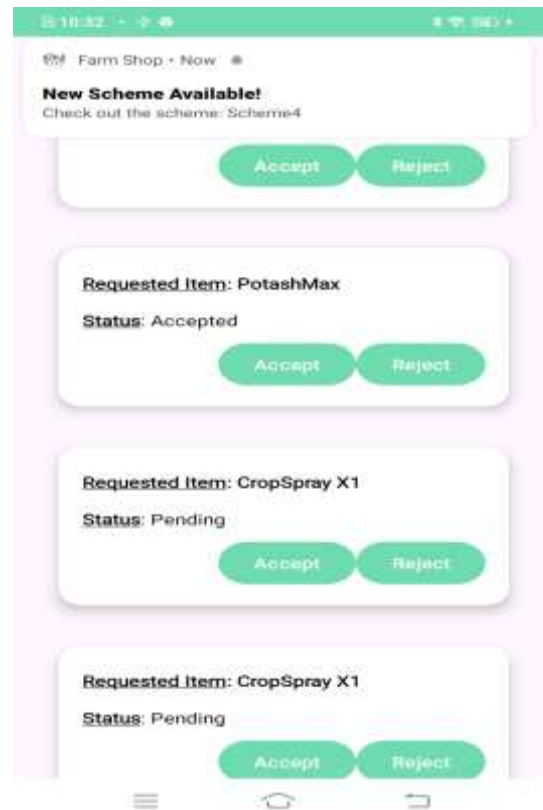


Figure 8 Admin will update the status of request from farmer's here

Farmer Module

Farmers can log in, manage their profiles, and add or update products in the inventory. Farmers will receive notifications for new orders and can fulfil them. Payments will be credited directly to their UPI accounts. Farmers can view schemes uploaded by the admin, with notifications available in the app.



Figure 9 Farmer will be navigating to this dashboard after successful login



Figure 10 Farmers can view inventory products here



Figure 11 Farmer can view his profile here

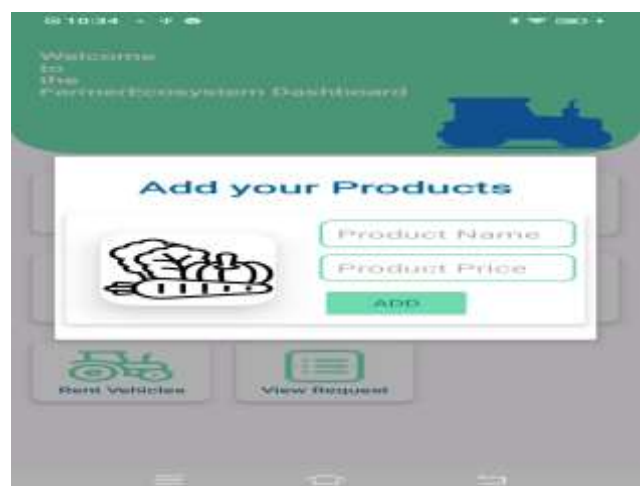


Figure 12 Farmer can add his products here



Figure 13 Farmer will be making request as per his needs



Figure 14 User will be navigate to this page after successful login



V. CONCLUSIONS AND FUTURE WORK

The creation of a connected ecosystem for farmers represents a transformative step in modernizing agriculture and addressing the systemic challenges faced by the farming community. This mobile application is not merely a tool but a gateway to empowering farmers by democratizing access to resources, enhancing operational efficiency, and fostering a collaborative environment.

By providing a platform that integrates machinery rentals, administrative oversight, and user engagement, the app eliminates the traditional barriers of cost, accessibility, and communication. Its user-friendly design ensures inclusivity for farmers with diverse levels of digital literacy, while real-time updates and offline functionality make it reliable even in remote areas with limited internet connectivity.

The app's emphasis on transparency, accountability, and trust through secure transactions strengthens user confidence and encourages adoption. Furthermore, its alignment with government schemes and policies bridges the gap between public sector support and grassroots-level implementation, ensuring that farmers benefit from subsidies, training, and other incentives. Use the platform to disseminate government schemes and updates directly to farmers.

This initiative also has broader implications for sustainable development. By promoting the shared use of machinery, reducing operational costs, and enabling data-driven decision-making, it supports environmentally friendly farming practices, connect farmers directly to buyers, retailers, and distributors. Provide access to solar-powered equipment or irrigation systems. Ensure the app works offline for areas with poor internet connectivity.

Enable logistics tracking for crop transportation. Additionally, the platform creates opportunities for knowledge sharing and community engagement, fostering innovation and resilience within the agricultural sector. Allow farmers to buy seeds, fertilizers, and other farming equipment directly through the app. Encourage adoption by rewarding farmers for completing specific actions.

Acknowledgment

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