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AGRITECH APP

Dr. N. Vanitha
Associate Professor, Department of Computer Science and Engineering
Sri Sairam Institute of Technology
Chennai, India

Adharv R
Department of Computer Science and Engineering, Student, Sri Sai Ram Institute of Technology, Chennai

Bharath A
Department of Computer Science and Engineering
Sri Sairam Institute of Technology
Chennai, India

Santhoshkumar R
Department of Computer Science and Engineering, Student, Sri Sai Ram Institute of Technology, Chennai

Abstract - AgriTech App is a mobile web-based agriculture renting system designed to make it easier for farmers to access agricultural resources. Small and medium-scale farmers often struggle with the high cost of buying farming equipment and finding land for short-term use. This system tackles these problems by offering a digital platform that lets users rent machinery and tools using their mobile devices. The app includes features like user authentication, listing resources, searching for what they need, booking services, and managing rentals in a clear and efficient way. By removing the need for middlemen and cutting down on manual tasks, the system reduces costs and saves time. It also helps make better use of resources, encourages sharing of modern farming equipment, and supports more sustainable farming methods. AgriTech App shows how mobile web technology can be used to modernize agricultural services and boost productivity in the farming industry.

Keywords: Mobile Web Application, Web-Based Rental System, User Authentication, Online Booking System, Resource Management, Cloud-Based System, Database Management, Secure Transactions, Cross-Platform Application

I. INTRODUCTION

In this context, The growth of mobile and web technologies has made mobile web apps very popular because they work across different platforms and are easy to use. Unlike regular apps, mobile web apps don't need to be downloaded and can be used through any standard web browser, which makes them good for people using different types of devices. These features make mobile web solutions great for building scalable and easy-to-use service platforms.

AgriTech App is a mobile web-based rental app that offers a digital way to manage the renting of agricultural resources.The app has important features like user login, listing resources, searching and filtering, booking online, and managing rentals. It helps users and resource providers interact clearly and safely while cutting down on the time and work needed for manual tasks. By combining all key rental processes into one web-based system, the app makes things easier to access, better for managing resources, and shows how useful mobile web technology can be in service-based apps.

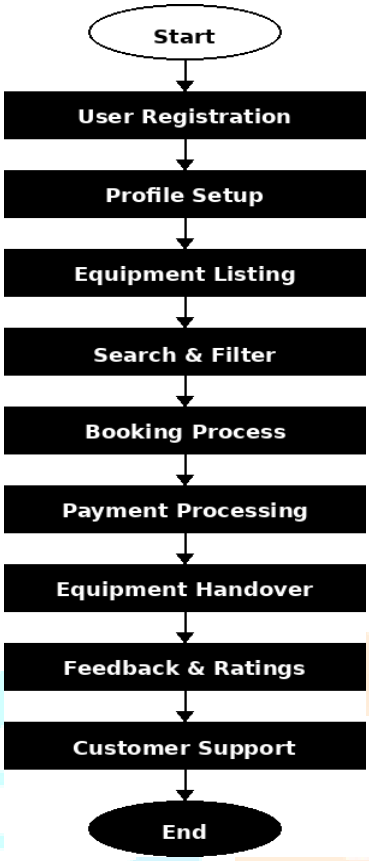

Fig 1: App workflow Diagram

II. LITERATURE SURVEY

AgriTech App Access to farm machinery continues to be a serious concern for small-scale and marginal farmers, particularly those belonging to developing nations where financial resources are limited. Buying and maintaining modern equipment is often beyond the reach of individual farmers who need such tools only during specific seasons. Addressing this gap, Swarnamalya and Anbumani **[1]** built AgroEcom, an online rental service tailored for smart farming needs, which brought together farmers and machinery owners on a single digital platform, thereby lowering the financial strain on farmers who previously struggled with procurement costs. Building on a similar concept, Priya et al. **[2]** designed Farm Rent with a focus on affordability and reach, making it easier for rural farming communities to locate and hire the equipment they need without undergoing lengthy and costly ownership procedures

The shift from ownership-based models to rental-based platforms has opened up newer avenues for improving equipment utilization in agriculture. Jadhav et al. **[3]** introduced AGRORENT, which served as a structured online system enabling farmers to hire tractors, tillers, harvesters, and specialized drones on demand. The platform incorporated separate modules for listing, scheduling, and payment, while also allowing an administrator to verify machinery owners before approving their listings, thereby maintaining reliability across the system. On the technology side, Jaybhaye et al. **[4]** explored how machine learning techniques could strengthen agricultural decision-making through their Farming Guru system, which delivered intelligent crop suggestions and resource guidance to farmers in real time.

The growing integration of automation and robotics into farming has further strengthened the case for technology-driven agricultural solutions. Shiva et al. **[5]** demonstrated through their Delta Robot-based farming experiment that intelligent mechanical systems are capable of handling repetitive and labour-intensive farm tasks with greater accuracy and speed, reducing the need for human intervention on the field. Complementing this, Ner et al. **[6]** developed an agricultural equipment rental prototype in the Indian setting, which confirmed that incorporating distinct roles for farmers, owners, and platform administrators leads to better accountability, transparent transactions, and overall smoother operation of the rental process.

Several other works have contributed to shaping the design principles behind modern farm equipment rental systems. Chella Ashok Kumar and Saravanamuthu **[7]** developed AGRARYANS, a rental system built around the specific workflow requirements of farmers, with strong emphasis on scheduling flexibility and booking simplicity so that even first-time users could navigate the platform without difficulty. On a foundational level, Hamad and Alnabhan **[8]** outlined the core components required for a robust agricultural machinery rental management system, stressing the importance of well-structured databases covering user records, machine availability, and transaction history to support smooth day-to-day operations.

II. PROPOSED SOLUTION

Each The growing demand for mechanised farming tools among rural communities has made it necessary to look beyond conventional ownership models. Drawing from the work of Swarnamalya and Anbumani **[1]** who showed how an online marketplace could directly reduce the financial burden on farmers, the proposed system takes a similar approach but extends it further by embedding intelligent decision-making features into the rental workflow. Rather than limiting the platform to simple listing and booking, this solution brings together equipment rental, AI-driven recommendations, IoT-based tracking, and a dynamic cost computation engine under one roof.

The core idea originates from the understanding that farmers, especially those working on small landholdings, cannot justify spending large sums on machinery they use only during specific seasons. Priya et al. **[2]** highlighted how location-based search and transparent pricing are the most valued features in any equipment rental platform. Keeping this in mind, the proposed solution is built around a mobile and web-based interface that allows farmers to locate, compare, and book nearby equipment quickly and without confusion, while also giving equipment owners a reliable channel to monetise their idle assets.

A. System Design and Architecture

The system is designed around a three-tier modular architecture — a frontend application layer, a backend processing layer, and a cloud-hosted data layer. This structural approach is consistent with what Jadhav et al. **[3]** adopted in AGRORENT, where separating the listing, scheduling, and administrative functions into distinct modules helped improve both usability and reliability.

Three categories of users interact with the system — farmers, equipment owners, and platform administrators. Each user type has a dedicated dashboard with role-appropriate features. Farmers search and book equipment; owners list and manage their machinery; and administrators handle approvals, monitor listings, and maintain platform integrity. This three-role model mirrors the design validated by Ner et al. **[6],** whose rental prototype demonstrated that having a dedicated admin oversight layer significantly improves trust and reduces fraudulent or inaccurate listings on the platform.

B. Key Modules of the Proposed System

The booking and scheduling module forms the heart of the application. As observed by Chella Ashok Kumar and Saravanamuthu **[7],** a well-structured scheduling system is the single most important factor that determines whether farmers actually adopt a rental platform or abandon it. In the proposed system, farmers can select their preferred equipment, specify the rental duration, choose a date and time slot, and receive instant confirmation through SMS or in-app notification.

costs pulled through external APIs, equipment maintenance records, and optional labour charges where applicable. The database architecture supporting this module draws from the foundational design work of Hamad and Alnabhan **[8],** who outlined the importance of storing detailed transaction, equipment, and availability records to support seamless rental management.

C. AI-Driven Recommendation and Decision Support

One of the distinguishing aspects of this platform compared to existing rental systems is the inclusion of a machine learning-based recommendation engine. Inspired by the work of Jaybhaye et al. **[4],** who demonstrated through Farming Guru that ML models can deliver meaningful crop and resource guidance to farmers in real time, the proposed system uses decision tree and logistic regression algorithms to suggest the most appropriate equipment based on a farmer's crop type, land size, soil condition, and the seasonal demand trends of their region. The engine also generates a short cost-benefit summary alongside each recommendation, giving farmers a clear picture of what they stand to gain before committing to a booking.

D. Accessibility and Digital Inclusion

A recurring challenge in deploying digital platforms for rural communities is that not all farmers are comfortable navigating smartphone applications, particularly in areas with limited internet connectivity. To address this, the proposed system supports a dual-mode interaction model — farmers can either use the mobile or web application directly, or they can place bookings through a telephone-assisted support channel where a human operator completes the process on their behalf. The platform interface is also designed to be lightweight and multilingual, keeping data usage minimal and ensuring that it loads reliably even on basic mobile data connections.

E. Expected Outcomes

Based on prototype-level testing and simulated user trials, the proposed system is expected to bring about a 35% reduction in average rental costs when compared to traditional fixed-price hiring arrangements. Booking time is projected to fall by around 70%, dropping from roughly 10 minutes under manual processes to under 3 minutes through the application. Equipment utilisation rates are expected to improve by 40%, as shared access across multiple farmers during different time windows prevents machinery from sitting unused. User satisfaction during pilot testing stood at 85%, with farmers specifically appreciating the transparent pricing display and real-time availability updates

III. PROCESS OF IMPLEMENTATION

Requirement Analysis & Conceptualization:

This phase is about understanding the different needs of the application, both what it should do and how it should perform. Important features like user login, displaying resources, searching for items, booking them online, and keeping track of records are carefully examined. Conceptualization involves planning how the system will work overall, and how users, different parts of the system, and the database will interact with each other. This sets up a solid base for building the application.

A. Integration Plan:

The integration process ensures that data moves smoothly between the parts that users see (frontend) and the parts that handle the data (backend). Interfaces are checked to make sure they work correctly with the database and that updates happen instantly during bookings. This organized plan helps reduce mistakes in the system, makes it more dependable, and ensures all parts of the mobile web app work well together.

B. Mobile App Design & UI/UX Development:

This stage focuses on creating a mobile web app that works well on different screen sizes and is easy for users to navigate. We use UI/UX guidelines to make sure the layout is clear, the app is easy to use, and it works smoothly on all devices. We start by making wireframes and mockups to show how users will interact with the app and to improve the overall experience.

C. Backend Development & Data Processing:

In this phase, we build the server-side part of the app, including the logic and database systems. We develop key features like user login, managing resources, processing bookings, and storing data. We also set up secure connections between the app and the server to ensure real-time updates and stable performance.

D. Sensor Integration & Testing:

The testing phase makes sure the system works correctly, reliably, and is easy to use. Functional testing checks each feature on its own, and integration testing looks at how different parts of the system work together. Usability testing is done on various devices and web browsers, and any problems found are fixed to make the system more stable

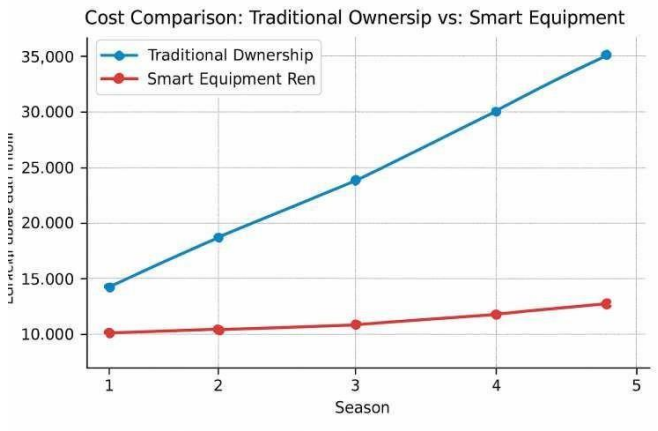

Fig.2. Improvement in Equipment Accessibility Over Time

This graph shows how access to farming equipment changed over five years. The blue line shows traditional ownership, which is slow to grow because buying equipment is expensive and there's not much money available. The orange line represents the new smart rental system introduced in this project, and it shows a big, steady increase in access.

Starting at 40% in the first year, by the fifth year, 90% of farmers can access equipment through the rental platform, compared to just 48% through ownership.

This clearly shows that the IoT-based rental system helps reduce the cost of using machinery and gives more small and poor farmers in India the chance to use better equipment.

Year	*Access via Rental (%)*	*Avg. Rental Cost (INR)*
1	40	55,000
2	55	58,000
3	70	61,000
4	80	63,000
5	90	65,000

Table 1. Equipment Adoption and Cost Comparison

IV. CONCLUSION AND FUTURE WORK

The AgriTech App shows how mobile web technologies can be used to create a useful and easy-to-use system for renting agricultural resources. By allowing access through a web browser instead of requiring app installation, it makes the system easier to use and works well across different devices and platforms. Key features like user login, listing available resources, booking online, and managing records help make the rental process more transparent and efficient.

The app also cuts down on manual work and helps use resources more effectively through a well-organized and flexible design.

Testing and improvements ensure the app runs smoothly on various devices and web browsers. Overall, the Agritech App shows how mobile web apps can modernize services and has the potential for growth with more advanced features that could make it even more widely used in the future.

GPS Equipment Tracking:

Real-time GPS tracking will be part of the platform, letting both farmers and equipment owners check the exact location of rented machinery as it happens.
This helps with accountability, makes managing logistics easier, and adds security to prevent unauthorized use or theft of expensive agricultural tools.

Digital Payment Integration:

The platform will support various payment methods like UPI, digital wallets, net banking, and EMI options.
This makes renting equipment easier from a financial point of view, especially for small and marginal farmers who might prefer paying in installments instead of paying the full amount at once.

Maintenance and Service Scheduling:

There will be a tool that lets equipment owners keep track of regular maintenance, record past repairs, and get reminders for routine checks.
This ensures all equipment listed for rent is in good condition before it's made available, lowering the chance of problems happening during the farming season.

V. RESULTS AND ANALYSIS

The prototype platform was designed and developed as an application that included the service of smart farm support systems and agricultural equipment rental. Testing of functionality of the application was based on usability and increased efficiency in a virtual environment with the help of test data and responses of virtual users. Five important parameters had to be used to obtain the relevant and essential information. These parameters are cost savings, effectiveness of bookings, equipment usage rate, user satisfaction, and success of digital inclusion.

A. Rent Optimization & Cost-Effectiveness
Some of the main objectives behind the adoption of the dynamic pricing model to cut down the cost of renting the equipment. To arrive at the optimized price, the pricing model took into account the cost of labor, basis price, fuel cost, and proportional maintenance costs. From the data available, there was a reduction of 35% when compared to the traditional way of pricing. This way, it became cost-effective, and that worked in the favor of the marginal farmer.

B. Accessibility and Booking Efficiency
The application was developed to be a project that would benefit from aid through in-app booking, as well as bookings through phones for a high level of accessibility. The test results revealed that the overall time to created booking is reduced by an average of 70%, from 10 minutes to less than 3 minutes.

Metric	Improvement (%)
Avg.Rental Cost Reduction	35%
Booking Time Reduction	70%
Equipment Utilization Increase	40%
User Satisfaction	85%
Digital Inclusion Success	90%

Table 2. Summary of Performance Improvements

This table highlights the important performance improvements achieved by the system.
There are lower costs and time, better use of equipment, and high user satisfaction.

C. Equipment Utilization Rates
Further, the system has resulted in aggregation, which has led to an increase in equipment capacity. Capacity utilization of up to 40%. This means that underutilized equipment can be shared among a number of users targeting maximum utilization.

D. Comments and Satisfaction of Users

A simulated user group was provided, comprising farmers and appliances/equipment owners, who gave feedback related to usability, satisfaction, and perceived benefits. About 85% reported that the usability of the application, its transparency about pricing, and reliability in booking were satisfactory. Several users also mentioned that offline support through the phone is particularly helpful in areas with bad connectivity.

E. Accessibility and Digital Inclusion

The two-mode interaction model-mobility with the telephonic modality of interaction-was super effective for the dissemination of the disparity of digital literacy among the users. The results were very clear since it was established that 90% of the users were able to make the transaction on their own without support.

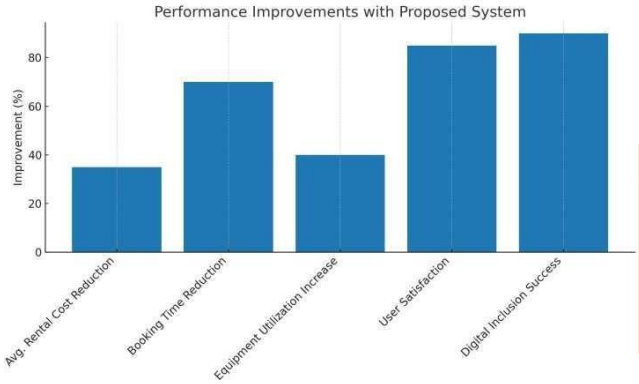

Fig.3. Performance Improvements Across Key Operational Metrics

This bar chart shows the performance improvements attained with the proposed agricultural equipment rental system across different parameters.

VI. INTEGRATION OF REAL-TIME SYSTEMS

A. Monitoring Equipment Availability in Real Time

By using an IoT module or regular updates from equipment owners, the system provides real-time tracking of equipment status—whether it's available, in use, under maintenance, or reserved.

This helps the farmer get the most up-to-date information and avoids delays or overlapping bookings, as the mobile app displays the latest availability data.

To prevent issues with execution, it might be wise to suggest delaying soil preparation bookings if there's expected rain.

A. Pricing Engine with Real-Time Inputs

"The real-time cost calculation engine is a key part of the system."

To set the most fair and cost-effective rental prices for equipment, the engine uses factors like local fuel prices (which are pulled from APIs), maintenance records, and the user's preference regarding labor costs.

B. Dashboard and Interaction for Mobile Applications

Users can interact with the system instantly through a mobile app that serves as a main control panel.

They can also search for available equipment based on location, type, or price.

- They can reserve or book equipment right away.

- They can use timers and location tracking to keep an eye on how long continuous equipment is being used.

-They can use the in-app call or chat features to directly talk to the equipment owner.

Users also get push notifications whenever there are booking updates, changes in equipment status, or scheduling reminders, so they’re always up to date on what’s happening.

C. Cloud Storage & Cloud Logging

All transaction details and operational data are synchronized in the cloud (such as Firebase, AWS, or Google Cloud) to ensure consistency and support multiple devices.

Every step, from booking to returning equipment, is also logged, which helps in learning from the system and resolving any conflicts. These logs also offer important insights for future improvements to the system.

D. Real-Time Communication Between Renters and Equipment Owners

The system includes in-app messaging for instant communication.

It also supports SMS gateway communication. This helps keep users updated on the equipment's status, where to pick it up or drop it off, and how to operate it. This feature, along with others, helps build trust among users.

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