AgroBridge: Farmer-to-Farmer Equipment Sharing System

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Abstract*—Agriculture plays a vital role in India's economy, yet many small and marginal farmers face difficulties accessing modern farming equipment due to high purchase costs, seasonal demand, and limited availability. Expensive machinery like tractors, harvesters, or threshers often remains idle for most of the year, while other farmers depend on local brokers or informal sharing networks that lack transparency and reliability. This results in underutilization of equipment, financial losses for owners, and reduced productivity for those unable to access tools when needed. Aerobridges are developed as a farmer-to-farmer equipment sharing system that addresses these issues through a secure, transparent, and technology- driven platform. It allows equipment owners to list idle machinery and lets nearby farmers discover and book them based on location, availability, and pricing preferences. The system integrates modules for user verification (KYC), digital payments with escrow protection, and a rating-based reputation model to promote trust and accountability between users. The platform also includes features such as vernacular language support, offline-first access for rural connectivity, AI-assisted price guidance, and real-time logistics tracking. Through these functionalities, Aerobridges ensures inclusivity and ease of use even for users with limited technical experience. The system is built using scalable web and mobile frameworks, secure APIs, and a microservice architecture for efficient data handling and smooth user experience. By improving machinery utilization and enabling affordable access to advanced tools, Aerobridges helps reduce the capital burden on smallholders while improving productivity and profitability. It bridges the gap between technology and agriculture by promoting digital collaboration and sustainability within the farming community.

I. INTRODUCTION

The main goal of this project is to develop a digital platform that bridges the gap between equipment owners and farmers who require agricultural machinery for short- term use. The following objectives define the scope and intent of the system:

- To enable peer-to-peer rental and sharing of farm equipment with transparency, trust, and security.
- To provide farmers with an easy interface for discovery, booking, scheduling, and payment management.
- To ensure fair pricing and reduce dependency on intermediaries through algorithm-based pricing guidance.
- To support rural accessibility with vernacular language options, offline first functionality, and low-data usability
- To introduce a reputation-based feedback system that builds trust among users and ensures equipment reliability
- To improve overall machinery utilization and reduce idle time for equipment owners.

The purpose of AgroBridge is to provide a unified platform that simplifies the process of equipment sharing and rental between farmers. It serves as a single window for listing machinery, verifying ownership, scheduling rentals, coordinating logistics, and handling secure digital payments.

II. PROBLEM STATEMENT

In rural India, equipment sharing is typically done through manual arrangements, local brokers, or WhatsApp groups, which lack structure and accountability. This leads to issues such as:

- Unclear or unfair rental pricing.
- Lack of verified information about owners or machines.
- Poor traceability of transactions and frequent payment disputes. • Equipment misuse and delayed returns due to lack of tracking or monitoring. To address these issues, AgroBridge introduces a digital solution that ensures secure transactions, transparent workflows, and verified user interactions through automation and digital record-keeping.

III. LITERATURE SURVEY

Agriculture today is increasingly supported by digital innovations that help improve resource utilization, productivity, and transparency. However, despite the rise of Agri-tech solutions, most small and marginal farmers still struggle with access to affordable mechanization. Various studies and projects have explored platforms and technologies that attempt to address this gap in different ways. Several research works have focused on developing digital agriculture marketplaces and service- sharing platforms. These systems enable farmers to rent or buy agricultural equipment, seeds, fertilizers, and services online. Platforms like Trringo, EM3 Agri Services, and Mahindra's Smart Shift introduced digital interfaces for equipment rental, but their reach is limited due to poor internet accessibility, high brokerage fees, and the lack of localized language support. The sharing economy model, popularized by companies like Uber and Airbnb, inspired similar approaches in agriculture sometimes referred to as the "Uberization of farming." Research on peer-to-peer (P2P) equipment sharing suggests that decentralized models can help smallholder farmers reduce costs by enabling them to rent tools only when needed, instead of owning them outright. However, such systems require strong trust mechanisms, real- time communication, and transparent payment systems, which are often missing in existing rural implementations. Other studies have explored machine learning and data analytics for price prediction and demand forecasting in agriculture. Timeseries models and regression- based forecasting techniques have been used to estimate optimal rental prices and predict seasonal demand for farm machinery. Similarly, research into computer vision (CV) and Internet of Things (IoT) technologies has introduced automated condition monitoring and quality inspection of agricultural equipment, which can reduce disputes and improve transparency in sharing systems. Despite these advancements, many existing platforms face limitations related to low internet reliability, lack of vernacular interfaces, unverified user identities, and unstructured payment handling. Farmers in rural areas still rely on informal networks, manual brokers, and word-of-mouth arrangements, which often lead to inconsistent pricing, double-booking, or fraudulent listings. Therefore, there is a strong need for a unified, user-friendly, and trust-driven platform that can operate efficiently in low-resource environments.

IV. SYSTEM OVERVIEW

The AgroBridge system is a digital platform designed to connect farmers who own agricultural equipment with those who need to rent it. The system acts as a bridge between equipment owners and renters, enabling efficient sharing and utilization of farming resources. It reduces the financial burden on small-scale farmers who cannot afford to purchase expensive machinery and increases the income of equipment owners by renting out idle equipment.

The system is developed as a web and mobile-based application where users (farmers) can register, verify their identity (KYC), list their available equipment, browse available listings, and make bookings for required machinery. It also includes payment integration, booking management, and logistics tracking for smooth operations.

The primary goal of the AgroBridge system is to promote resource sharing, reduce agricultural costs, and increase operational efficiency among farmers by leveraging technology for a sustainable and collaborative agricultural ecosystem.

V. PROPOSED SYSTEM

The proposed system, AgroBridge: Farmer-to-Farmer Equipment Sharing System, is designed to overcome the shortcomings identified in the literature by integrating digital technology, transparent communication, and localized accessibility. The core idea is to establish a reliable online platform where equipment owners can list their idle machinery and nearby farmers can rent them safely and efficiently through a structured workflow.

The high-level operational flow of AgroBridge includes five main stages:

1. Onboarding and Verification: Farmers register through the web or mobile app and complete identity verification (KYC) using government. issued IDs. Verified profiles build trust and ensure authenticity of both equipment owners and renters.
2. Equipment Listing: Owners upload details of their available machinery such as tractors, rotavators, threshers, or harvesters along with images, rental rates, and availability schedules.
3. Discovery and Pricing: Renters can search and filter listings based on location, price, equipment type, or availability.

The system provides AI-driven dynamic pricing recommendations based on distance, demand patterns, and seasonal trends.

Booking and Logistics: Once an equipment is selected, the system manages booking confirmations, estimated travel time (ETA), and location tracking using GPS-based route optimization for efficient transportation and reduced waiting time.

5. Payment and Reputation Management: AgroBridge incorporates secure digital payments through UPI or bank integration. An escrow-based system ensures that payments are held until the job is completed. After the transaction, both parties can rate and review each other, improving reliability over time. The system supports multiple languages and an offline-first mode to make it usable even in low- connectivity rural areas. Its microservice architecture ensures scalability and allows integration with third-party APIs for payments, logistics, and government schemes. By combining trust-based design, transparent data handling, and automation, AgroBridge creates a practical and inclusive solution for rural mechanization challenges.

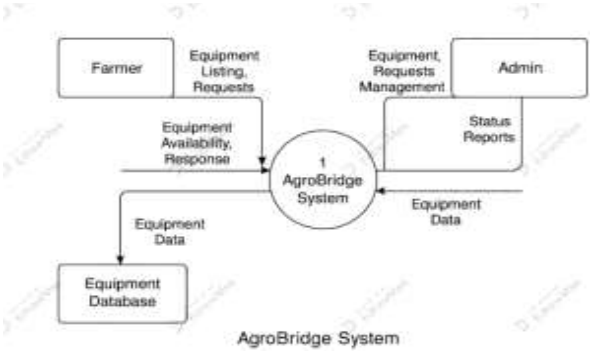

Fig: Proposed System

VI. CONCLUSION

The AgroBridge platform successfully demonstrates a practical and scalable solution for promoting equipment sharing among farmers. By digitizing the equipment rental process, it bridges the gap between machine owners and farmers who need temporary access to modern agricultural tools. The system integrates several critical components from secure authentication and KYC verification to real-time booking, escrow-backed payments, and transparent pricing guidance. The modular design of AgroBridge ensures that it can handle multiple user roles such as equipment owners, renters, and administrators while maintaining a simple and vernacular-friendly user interface. Through features like offline- first access, geo-aware logistics, and trust-based reputation scoring, AgroBridge enhances accessibility even in low-connectivity rural environments. The project also showcases the importance of data-driven decision-making in the agricultural sharing economy

ACKNOWLEGEMENT

We express our heartfelt gratitude to the researchers and publishers for granting access to their valuable resources. We owe a lot to my mentor for his unwavering support and guidance, and the reviewers for their stimulating contributions. We also express our gratitude to the college management for facilitating the necessary infrastructure and support throughout the project.

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