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Enhancing Farm Equipment Accessibility through a Digital Leasing and Rental Platform Using MERN Stack

Dhruv Patwa[1], Aryan Bali[2], Ujjwal Nikam[3], Vishakha Mhaske[4], Prof. Swati Dhadake[5]
Department of Computer Engineering[1,2,3,4]
Project Guide, Department of Computer Engineering[5]
Smt. Kashibai Navale College of Engineering, Pune, Maharashtra, India

Abstract: *Agriculture continues to be the backbone of the majority of developing economies, but the sector still faces serious challenges concerning mechanization, use of resources, and financial constraints among small and marginal farmers. One of the significant constraints is the extremely high cost of farm machinery like tractors, harvesters, seed drills, and ploughs, leading to technology underuse and a perpetual yield gap. This study envisions and develops a digital solution—a web-based equipment leasing and rental platform—to mitigate these issues by applying the principles of the sharing economy and the power of contemporary cloud-hosted web technologies. Built on the MERN (MongoDB, Express.js, React.js, Node.js) stack and deployed on Amazon Web Services (AWS), the platform enables hassle-free interaction among equipment owners and renters. The system includes significant features like user authentication, real-time listing and booking of equipment, availability calendars, location-based search, secure payment infrastructure, and a dynamic chatbot assistant. The chatbot, which has been trained using Natural Language Processing (NLP) methods, offers 24/7 assistance to users, helping them navigate, select equipment, booking processes, and troubleshooting, thus improving user experience and platform usability.*

By enabling farmers to rent or lease equipment on short-term basis, the platform offers a financially sustainable substitute for ownership as well as enabling equipment owners to earn passive income during off-seasons. The research explores the technical infrastructure, integration of chatbots, backend scalability, and business logic enabling trust establishment and conflict resolution. A prototype was tested with a purposive sample of farmers, and findings were obtained on usability, accessibility, chatbot performance, and economic benefits. Findings suggest that the digital platform, supplemented with conversational AI support, can democratize access to mechanized agriculture, optimize the utilization of resources, and enable a collaborative farming culture. The current research contributes to the digital agriculture debate by showcasing how cloud-native applications, AI-driven user support, and open-source development frameworks can drive innovation and empowerment in rural economies. The research concludes by considering an analysis of system performance, the primary limitations, and potential areas for scaling the platform with intelligent recommendation systems, multilingual support, and a mobile-first design strategy.

Keywords: Artificial Intelligence, Smart Agriculture, Machine Learning, Internet of Things, Equipment Rental, Digital Platforms, Farmers' Well-Being, Precision Agriculture

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