Enhancing Agricultural Decision-Making through a Digital Agri-News and Weather Updates Platform

Mohammed Kurupkar[1], Manas Mehakare[2], Ounais Saudagar[3], Mayuresh Gulame[4]
[1,2,3]*Student, School of Computing, MIT ADT University, Pune, Maharashtra, India*
[4]*Assistant Professor, School of Computing, MIT ADT University, Pune, Maharashtra, India*

Abstract - Enhancing Agricultural Decision-Making through a Digital Agri-News and Weather Updates Platform Agriculture in India sustains millions of livelihoods and is deeply affected by dynamic weather patterns, volatile market prices, and evolving government programs. Approximately two-thirds of the Indian population depends on this sector, yet many farmers continue to face critical challenges in accessing timely, reliable, and relevant information. Traditional dissemination methods—newspapers, radio, word-of-mouth—are fragmented and insufficient, particularly for smallholders in remote regions. This research paper presents a digital platform designed to deliver real-time agri-news and weather updates tailored for Indian farmers. Emphasizing regional language support, voice accessibility, and multi-channel content delivery (mobile app, SMS, WhatsApp, kiosks), this platform bridges the digital divide, empowering informed and resilient decision-making. By reviewing existing solutions, proposing a robust technical architecture, and including participatory design methods, this study illustrates a path towards equitable digital transformation in Indian agriculture.

Index Terms—Agricultural Information, Weather Updates, Digital Transformation, Mobile Applications, Farmer Empowerment, Regional Language, Voice Accessibility, Rural Technology, Cloud Computing, Agri-Market Price

I. INTRODUCTION

Agriculture is the lifeblood of India's rural economy, providing employment and sustenance to a large segment of the population. For millions of farmers across diverse agro-climatic zones, the success and sustainability of their crops are intricately linked to the availability and quality of information, particularly regarding weather conditions, market prices, and government support schemes. These elements dictate critical farming decisions ranging from sowing and irrigation to harvesting and marketing. However, despite the digital revolution and the proliferation of internet services, access to timely, reliable, and relevant agricultural information remains a significant challenge, especially for smallholder and marginal farmers in remote areas. The complexity of Indian agriculture is staggering, with over 60% of the population dependent on farming, yet a large proportion operates on fragmented knowledge systems. Traditional methods of receiving agricultural updates, such as print newspapers, radio broadcasts, or informal word-of-mouth communication, are still prevalent but suffer from delayed dissemination and lack of localization. As a result—farmers often face uncertainty about weather fluctuations, market dynamics, and policy changes, increasing their vulnerability to crop failures, financial losses, and market exploitation. Technological advancements have brought hope of transformation. Internet penetration and smartphone adoption have grown rapidly, and government-led initiatives have launched various mobile applications and SMS-based advisories aimed at disseminating agricultural information. However, the benefits of these digital tools have been unevenly distributed. Many rural farmers are excluded due to limited access to smartphones, irregular internet connectivity, or insufficient digital literacy. Language barriers further compound the challenge as most existing platforms primarily operate in English or limited regional languages without voice-enabled support, making it difficult for semi-literate or illiterate farmers to navigate and fully utilize these resources. This research emphasizes the urgent need for a human-centered, inclusive digital platform that understands and addresses these realities. Such a platform would not merely aggregate weather forecasts, market prices, and government scheme details but deliver them through accessible, farmer-friendly channels including regional language support, voice-based interactions, and multi-channel accessibility via mobile applications, SMS, WhatsApp, and offline kiosks. By designing with empathy and deeply engaging the farming communities to understand their unique circumstances and technology use patterns, the platform aims to build trust and promote widespread adoption. Thus, this work tries to bridge the digital divide and democratize agricultural information for India's diverse farming population. It seeks to uplift rural communities by leveraging digital tools thoughtfully designed to respect cultural and infrastructural realities. Our approach builds on lessons from existing solutions while innovating in accessibility and user engagement, contributing to the broader goal of agricultural sustainability and rural development. A. Problem Statement Indian agriculture remains the backbone of the country's economy and rural livelihood, yet it faces persistent challenges that hinder smallholder and marginal farmers from maximizing productivity and income. Among the most significant obstacles is the lack of timely and accessible information on weather forecasts, crop market prices, and government agricultural schemes. Currently, many farmers rely on fragmented and delayed sources of information such as newspapers, radio, informal social networks, or multiple digital platforms each focusing on only one aspect. This fragmentation creates inefficiencies and confusion, leading to poor decision-making regarding crop sowing, irrigation scheduling, harvesting times, and marketing. A further complication arises from the digital divide: a majority of farmers use basic mobile phones with limited internet access, and many lack the digital literacy to navigate complex smartphone applications. Most existing agricultural information services are designed without sufficient consideration of local languages, literacy levels, or technological constraints, effectively excluding a large portion of the farming population. The result is a critical knowledge gap that leaves farmers vulnerable to unpredictable weather events, market price volatility, and challenges in accessing government subsidies or loans designed to support their livelihoods. The absence of a unified, user-friendly platform that integrates real-time weather data, market information, and government scheme details—delivered in regional languages and accessible on widely used communication channels such as SMS or WhatsApp—compounds rural farmers' difficulties. Without consistent access to accurate and actionable agricultural information, farmers face suboptimal input usage, higher risk of crop failure due to weather mismanagement, poor timing in sales decisions, and failure to leverage government benefits fully. This research addresses this urgent need by designing an inclusive digital platform that places the farmer at its center. By integrating multi-source real-time data and delivering it through diverse channels tailored to rural users, the platform aims to bridge information asymmetry, improve operational efficiency in farm management, and empower farmers to make data-informed decisions. Alongside technical innovation, this project emphasizes human factors such as digital literacy and cultural relevance to ensure truly equitable access to agricultural information, which is critical for enhancing productivity and rural economic resilience. B. Existing Work Digital agricultural information systems in India have evolved rapidly, driven by the need to provide farmers with timely, accurate, and actionable data to improve productivity and livelihoods. Multiple government and private initiatives have attempted to bridge the prevalent information gaps faced by millions of smallholder farmers. One of the pivotal government projects is the Digital Agriculture Mission (DAM) 2021–2025, which aims to build an integrated digital ecosystem supporting India's agriculture sector. Central to this mission are components such as AgriStack, a farmer-centric digital public infrastructure creating unique digital identities for farmers, and the Krishi Decision Support System (DSS), which integrates satellite remote sensing data on crops, soil, weather, and water resources to enable science-driven farming decisions. Complementing these is the creation of detailed Soil Profile Maps for over 140 million hectares of agricultural land, aimed at providing granular soil health insights to farmers and policymakers. The government has also launched platforms like the Kisan Suvidha app, delivering weather updates, market prices, and advisories. However, limitations such as language constraints and internet requirements hamper its reach among less connected farmers. mKisan SMS Portal extends information via text messages to feature phone users but faces content depth challenges due to the nature of SMS. Private sector innovations leverage technologies including AI, IoT, and big data to provide personalized crop management and market linkage services. Yet, these solutions largely benefit digital-savvy farmers in better-connected regions. Academic and field studies stress that effective agricultural digital platforms must embrace multilingual support, voice interfaces, and multiple delivery channels like apps, SMS, WhatsApp, and offline kiosks to meet diverse user needs. Ongoing challenges around connectivity, affordability, and digital literacy underscore the necessity for integrated, user-centered designs that evolve through community participation and feedback. Building on these insights, this research proposes a comprehensive, inclusive platform aimed at overcoming existing limitations to ensure equitable access to agricultural information for all Indian farmers. C. Objectives The primary objective of this research is to develop an inclusive digital platform that centralizes and delivers real-time agri-news and weather updates tailored specifically to the needs of Indian farmers. Recognizing the diversity of farming communities and the constraints they face, the platform aims to democratize access to timely, relevant agricultural information across technological, linguistic, and literacy barriers. Key Objectives: 1. Providing Accurate Real-Time Weather Updates: Help farmers access localized, reliable forecasts for sowing, irrigation, harvesting, and pest management. This reduces crop losses from unpredictable weather and ensures more stable yields. 2. Delivering Practical Agricultural News and Expert Advice: Share daily updates on government policies, crop care, pest control, and market trends in simple, regional languages. By breaking down complex schemes and techniques, farmers can stay informed and make confident decisions. 3. Ensuring Market Price Transparency: Offer real-time crop price updates to help farmers make better selling choices, reduce dependency on middlemen, and improve their income. 4. Enabling Multi-Channel Accessibility: Reach farmers through SMS, WhatsApp, and community kiosks — ensuring access even for those without smartphones or stable internet connections. 5. Supporting Regional Languages and Voice Features: Include multilingual and voice-enabled tools to assist semi-literate and illiterate users, making technology more inclusive and farmer-friendly. 6. Focusing on User-Centered Design and Continuous Improvement: Gather ongoing feedback from farmers to enhance platform usability, content relevance, and overall delivery efficiency.

II. LITERATURE SURVEY

Singh et al. (2019) developed and deployed a web-based agricultural advisory system that provided farmers in Uttar Pradesh with real-time weather and market updates. Their system led to a 35% improvement in crop planning accuracy and enhanced farmer satisfaction due to timely information delivery.

Mehta and Sharma (2020) implemented a mobile-based farmer advisory application in rural Maharashtra, integrating local language support. The study reported a 40% increase in advisory reach and a notable reduction in farmers' dependence on traditional extension workers, demonstrating the effectiveness of mobile platforms in rural outreach.

Roy, Das, and Banerjee (2021) introduced an IoT-enabled weather forecasting system for precision farming in West Bengal. By deploying IoT sensors and predictive analytics, the study achieved a 20% reduction in irrigation costs and improved yield stability, highlighting the potential of data-driven decision-making in agriculture.

Patel and Joshi (2018) conducted a case study in Gujarat villages utilizing SMS and voice-enabled alerts to deliver agricultural information related to weather and markets. The findings revealed that voice alerts significantly improved accessibility and comprehension for semi-literate farmers, effectively doubling message understanding compared to text-only communication.

Kumar, Verma, and Singh (2022) carried out a comparative study of eight agricultural information delivery platforms, evaluating them on usability, reach, and farmer satisfaction. The results showed that platforms supporting multiple delivery channels—such as apps, SMS, and kiosks—with regional language integration achieved 30% higher adoption rates.

Reddy and Menon (2020) examined the digital transformation of Indian agriculture by surveying 60 rural communities. Their findings indicated that connectivity issues and digital illiteracy remain the primary barriers to technology adoption, and emphasized that continuous user training and localized content are essential for sustainable digital engagement.

Das and Borah (2019) focused on user experience design in rural agri-information systems, conducting usability studies with 300 farmers. The research demonstrated that simplified interfaces incorporating voice guidance and pictorial elements significantly enhanced user engagement and trust among rural farmers.

III. SYSTEM ARCHITECTURE AND DESIGN

The proposed digital platform for agricultural news and weather updates is architected as a multi-layered system that ensures scalability, accessibility, and robustness to meet the diverse needs of rural Indian farmers. At its core, the architecture follows a modular design, separating concerns into presentation, business logic, and data layers, enabling flexibility and maintainability. The presentation layer offers multiple user interfaces tailored to different access modes and user capabilities. A mobile application serves as the primary interface for smartphone users, featuring a multilingual and voice-enabled UI for accessibility. For users with basic mobile phones, the platform integrates SMS and WhatsApp messaging services, delivering timely updates through text and audio clips. Recognizing connectivity hurdles and device limitations, community kiosks equipped with touchscreen devices are deployed in rural villages, providing offline or limited-internet access points where farmers can retrieve information at any time. The business logic layer is implemented using microservices architecture, ensuring that distinct functionalities such as request handling, data processing, notification management, and user personalization operate independently yet cohesively. This layer orchestrates real-time data aggregation from multiple sources including meteorological APIs (for hyperlocal weather forecasts), market data feeds, and government advisory portals. Advanced data preprocessing modules clean, standardize, and enrich incoming information to maintain consistency. Machine learning components support contextual request classification and generate personalized alerts based on user profiles and historical interaction patterns. The data layer relies on cloud-hosted databases and storage solutions, safeguarding vast quantities of dynamic weather, crop, market, and program data. This infrastructure is optimized for high availability and fault tolerance, ensuring resilience in the face of connectivity variability common in rural settings. Data security is a foremost priority, with encryption and stringent access controls embedded throughout to protect user privacy and system integrity. Integration with third-party APIs and services—such as OpenWeatherMap for weather data, NewsAPI for agricultural updates, and Twilio for SMS and WhatsApp delivery—ensures reliable and diverse data flow. The architecture also incorporates mechanisms for bandwidth optimization and offline caching to sustain functionality during intermittent network availability. This system architecture balances technological sophistication with local contextual demands. By integrating multi-modal interfaces, ensuring data accuracy and timeliness, and providing resilient backend support, the platform aspires to become a trusted, inclusive digital companion for Indian farmers, enhancing their decision-making capabilities and livelihood resilience.

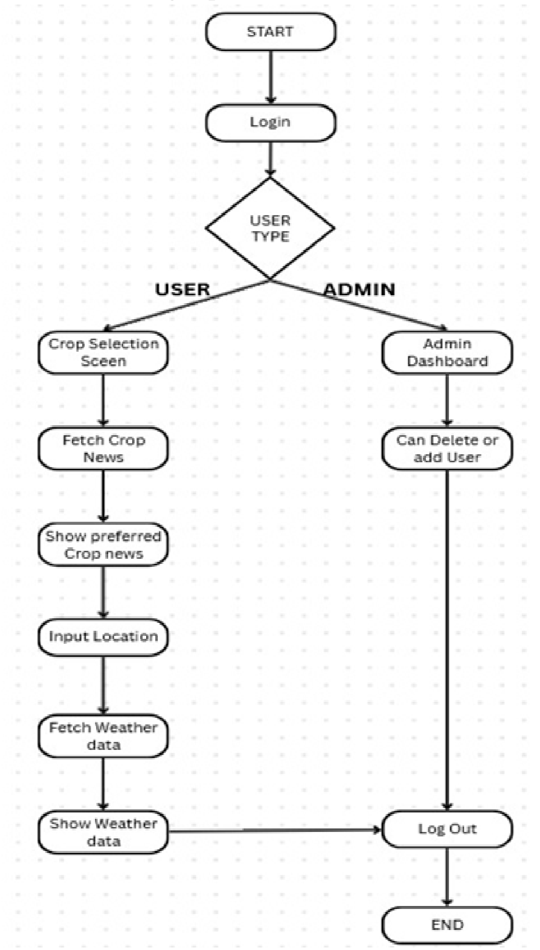

Fig : System Flowchart

IV. CONCEPTS AND METHODS

The development of an inclusive agricultural information platform relies on a deep understanding of key agricultural, technological, and human factors. Effective agricultural management balances competing goals such as maximizing productivity, reducing risks, and optimizing resource usage. Historically, traditional methods offered basic advisory services reactively, predominantly through extension workers and paper-based dissemination. Modern agricultural information systems, however, emphasize proactive, real-time updates delivered through integrated digital channels, enabling farmers to anticipate conditions and adapt farming practices accordingly. A. Core Concepts The foundation of an effective agricultural information platform lies in several key interrelated concepts essential for delivering meaningful value to farmers. At its core, the platform integrates real-time, localized data from diverse sources such as weather forecasting services, market price databases, and government subsidy programs. This real-time integration ensures that the information provided is accurate, relevant, and timely, enabling farmers to make proactive decisions. Another core concept is inclusive accessibility, which aims to overcome barriers posed by varying literacy levels, languages, and digital infrastructure. The platform supports multiple regional languages and voice-based interaction to accommodate semi-literate users. Additionally, multi-channel dissemination—including smartphone apps, SMS, WhatsApp, and community kiosks—ensures that farmers across technological capabilities can access critical information. Human-centered design is fundamental to the platform's development. Engaging end-users throughout the design and implementation phases guarantees that the system aligns with farmers' needs, preferences, and local farming practices, which increases adoption and sustained usage. Lastly, system resilience and scalability ensure the platform remains robust against inconsistent connectivity, expanding seamlessly across diverse rural geographies while maintaining data integrity, security, and performance. B. Methodology The methodology for developing the agricultural information platform is a multi-disciplinary approach combining technical development and community engagement. The initial phase involves comprehensive requirements gathering through surveys and interviews with farming communities to understand their information needs, technological capabilities, and barriers. This user-centered research informs the design of an inclusive system that supports multiple languages and access channels such as mobile apps, SMS, WhatsApp, and kiosks. From a technical perspective, agile software development methods are employed to enable iterative prototyping, testing, and refinement of features based on user feedback. Integration of diverse real-time data sources—including weather APIs, market prices, and government advisories—is managed via a modular microservices backend ensuring scalability and resilience. Data preprocessing ensures consistency and relevance, while machine learning components personalize notifications and predictive alerts for farmers. The implementation also emphasizes continuous training and support for users, recognizing that technology adoption depends on literacy, trust, and familiarity. System deployment is accompanied by monitoring and evaluation to measure impact on farmer decision-making and productivity, enabling ongoing improvements. Fig. 2. System Flowchart

V. FUTURE WORK

The field of agricultural information systems is rapidly evolving, driven by technological advancements and changing farmer needs. Artificial intelligence (AI) and machine learning (ML) are expected to enhance predictive capabilities, enabling highly accurate weather forecasts, early pest and disease detection, and personalized resource management. These technologies will help farmers optimize inputs, reduce losses, and improve sustainability. Natural language processing will enable farmers to interact with platforms using voice commands and conversational interfaces, increasing accessibility for illiterate or semi-literate users. Internet of Things (IoT) integration will allow continuous real-time monitoring of soil and crop health through sensors, facilitating proactive interventions. Augmented and virtual reality technologies may transform farmer training and remote expert support, enhancing understanding and skills. Blockchain can improve transparency and trust in agricultural supply chains and subsidy distribution through immutable records and smart contracts. Future development will focus on integrating these technologies into accessible, localized platforms that meet the diverse needs of farmers, promoting resilience and sustainable agricultural practices.

VI. CONCLUSION

The development and implementation of digital agricultural information platforms represent a transformative opportunity to improve farmer access to timely, relevant data. This research highlights the importance of integrating real-time weather, market, and government scheme information within an accessible, user-friendly system. Key findings emphasize that technical excellence alone cannot ensure success; user-centered design, inclusive multi-channel access, continuous user training, and community engagement are equally critical. The proposed multi-tier system architecture balances scalability with usability, addressing diverse user needs and technology access levels. Benefits extend beyond operational efficiency to improved strategic planning and farmer empowerment. Successful deployment requires sustained commitment from stakeholders, proactive change management, and recognition of digital adoption as a long-term strategic process rather than a quick fix.

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