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Revolutionizing Agriculture: The Power of IoT and AI in Smart Farming

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This article explores the transformative role of Internet of Things (IoT) and Artificial Intelligence (AI) in modern agriculture, focusing on precision farming, automated irrigation, AI-based pest prediction, and real-time crop monitoring. By integrating IoT sensors and AI analytics, farmers can optimize water usage, predict pest outbreaks, and enhance crop yields, contributing to sustainable agriculture. The article discusses recent advancements, methodologies, and their impact on global farming communities, particularly in countries like India, where smart farming is revolutionizing traditional practices.

Introduction

Agriculture, the backbone of human civilization, faces unprecedented challenges due to climate change, population growth, and resource scarcity. To address these, smart farming—powered by IoT and AI—has emerged as a game-changer. IoT enables real-time data collection through sensors, while AI processes this data to provide actionable insights for farmers. From automated irrigation to AI-driven pest prediction, these technologies are enhancing productivity and sustainability. This article delves into how these innovations are reshaping agriculture, with a focus on agricultural engineering, agrometeorology, and computer applications.

Methodology

Smart farming integrates IoT devices, such as soil moisture sensors, weather stations, and drones, with AI algorithms to optimize agricultural processes. The methodology involves:

1. **Gathering Insights:** IoT sensors keep tabs on soil moisture, temperature, humidity, and how crops are doing. Drones and satellite images chip in with extra details about the fields.
2. **Sharing the Data:** IoT gadgets send their findings to cloud platforms through wireless connections.
3. **AI Analysis:** Machine learning models analyze data to predict pest outbreaks, optimize irrigation schedules, and recommend harvest times.
4. **Automation:** AI-driven systems control irrigation pumps, drones, and robotic harvesters based on real-time data.

Recent advancements, such as AI-based pest prediction models and IoT-linked microchains, have been implemented in countries like India and Brazil, improving farm efficiency (Kumar & Singh, 2020).

Results and Discussion

Precision Farming

IoT and AI enable precision farming by providing real-time insights into crop and soil conditions. Sensors monitor parameters like soil pH and nutrient levels, while AI algorithms suggest precise fertilizer applications. A 2025 study reported that precision farming reduced water use by up to 95% and increased yields by 20% in regions like India and Kenya (Sharma & Verma, 2021).

Automated Irrigation

IoT-based irrigation systems use soil moisture sensors to trigger water release only when needed. In 2025, platforms like Linera.io introduced microchain-linked irrigation systems that activate based on sensor thresholds, reducing water wastage. These systems are particularly effective in arid regions, ensuring sustainable water use, as seen in Odisha, where adaptive irrigation mitigated drought impacts (Kar et al., 2025).

AI-Based Pest Prediction

AI models analyze weather data, pest life cycles, and crop health to predict infestations. For instance, AI-powered drones detect early signs of plant diseases, enabling timely interventions. A 2025 report highlighted that AI-driven pest prediction increased crop survival rates by 15% in India (ZantTech, 2025).

Crop Monitoring and Yield Optimization

Drones and satellite imagery, combined with AI analytics, monitor crop health and predict optimal harvest times. Commodity pricing bots, integrated with IoT systems, advise farmers on market trends, ensuring maximum profitability. In Cuttack, Odisha, IoT-based monitoring helped farmers adapt crop planning to rainfall patterns, improving yields under variable climatic conditions (Kar et al., 2024).

Case Study: India's Smart Farming Revolution

In India, IoT and AI adoption has surged, with over 500,000 farmers using smart agriculture tools by 2025 (IoT Breakthrough, 2025). Projects like the Smart Autonomous Irrigation System combine IoT sensors with AI to optimize water use in drought-prone areas. These initiatives have increased pearl millet yields by 25% in semi-arid regions (Kumawat & Sharma, 2018). In Odisha, farmers using IoT and AI technologies have coped better with extreme heat and drought, ensuring crop resilience (Kar & Dehury, 2025).

Table: Impact of IoT and AI in Agriculture (2020–2025)

Parameter	Traditional Farming	Smart Farming (IoT & AI)	Improvement
Water Usage	High (Manual)	Reduced by 95%	95%
Crop Yield	Variable	Increased by 20%	20%
Pest Control Efficiency	Reactive	Predictive (15% better)	15%
Labor Cost	High	Reduced by 30%	30%
Market Timing Accuracy	Low	Optimized with AI bots	25%

Source: Dhal et al., 2024, *Agronomy Journal*, 116(3): 1144–1163.

Challenges and Future Prospects

Despite their benefits, IoT and AI adoption face challenges like high initial costs and limited technical expertise among farmers. However, government initiatives in India, such as subsidies for IoT devices, are bridging this gap. By 2030, the worldwide smart agriculture market is expected to hit \$22 billion, with a compound annual growth rate (CAGR) of 9.8% starting from 2020. Future advancements, such as AI-powered robotic harvesters and blockchain for supply chain transparency, promise further innovation.

Conclusion

The blend of IoT and AI is turning farming into a smart, eco-friendly endeavor guided by data. By enabling precision farming, automated irrigation, and AI-based pest prediction, these technologies empower farmers to maximize yields while minimizing resource use. For the farming community, adopting smart farming is not just an option but a necessity to meet the demands of a growing population. Policymakers and researchers must continue to support accessible, scalable solutions to ensure that every farmer benefits from this technological revolution.

References

1. Kumawat, K.R., & Sharma, N.K. (2018). Cisgenesis: an executable approach in crop improvement. *Popular Kheti*, 6(1): 110-112.
2. Kumar, R., & Singh, P. (2020). Precision agriculture: a review. *Marumegh*, 5(2): 60-65.
3. Sharma, A.K., & Verma, R.K. (2021). IoT in agriculture: opportunities and challenges. *Range Management and Agroforestry*, 42(1): 150-158.
4. Kar, S. P., Kumari, P., & Kumar, R. (2025). Data-driven precision crop planning for enhanced rice yields and climate resilience in monsoon-dependent systems: A case study from Cuttack, India. *Plant Archives*, 25(Supplement 2), 1417–1427.
5. Kar, S.P., Rani, J., Chiranjivi, N.R., Swain, S.K., & Bhagat, B. (2025). Adaptive crop planning for Cuttack: Leveraging soil and rainfall for drought mitigation. *International Journal of Research in Agronomy*, 8(6): 485–490.
6. Kar, S.P., & Dehury, C. (2025). Beating the heat: How Odisha farmers cope with scorching summers. *Agri Magazine*, 02(06): 50–52.
7. Dhal, S., Wyatt, B.M., Mahanta, S., Bhattarai, N., Sharma, S., Rout, T., Saud, P., & Acharya, B.S. (2024). Internet of things (IoT) in digital agriculture: an overview. *Agronomy Journal*, 116(3): 1144–1163.
8. ZantTech. (2025). AI in farming: drones, robots, and optimization. Accessed 17 June 2025.