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# TECHNIQUES USED FOR AUTOMATION IN AGRICULTURE

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**Abstract**

For every nation, the primary issue and burgeoning topic is agriculture automation. The need for food is rising quickly along with the world's population, which is growing at an extremely rapid rate. Farmers are forced to damage the land by applying more toxic pesticides since their traditional methods aren't enough to meet the growing demand. This has a significant impact on agricultural practices and in the end, the land is still unproductive and bleak. This article discusses many automation techniques, including deep learning, machine learning, artificial intelligence, and wireless communications. Certain aspects of the agricultural field are problematic, such as crop diseases, improper storage management, improper use of pesticides, improper weed control, inadequate irrigation, etc. Deciphering concerns including the use of hazardous pesticides, regulated irrigation, pollution management, and environmental repercussions in agricultural operations is urgently needed today. It has been demonstrated that automating farming operations increases soil productivity and improves soil fertility. This study provides a quick review of the present state of farm automation by surveying the work of several researchers.

Keywords: Agriculture , Automation, farm, .irrigation

## I Introduction

Agriculture has long been the backbone of India's economy, providing livelihoods to millions and ensuring food security for its vast population. In recent years, the agricultural sector has witnessed a transformative shift driven by technological advancements and automation techniques. This review aims to provide a comprehensive overview of the automation techniques employed in Indian agriculture, highlighting their impact on productivity, sustainability, and rural development. The adoption of automation in agriculture has been spurred by various factors, including the need to address labor shortages, improve efficiency, and optimize resource utilization in the face of changing climatic conditions and growing demand for food. Automation technologies encompass a wide range of applications, from precision farming and mechanization to the use of robotics, drones, and artificial intelligence (AI) in crop monitoring, irrigation management, pest control, and harvesting operations. One of the key areas where automation has made significant strides is precision agriculture, which involves the use of advanced technologies to tailor farming practices to specific field conditions and crop requirements. By employing sensors, GPS technology, and data analytics, farmers can optimize inputs

such as water, fertilizers, and pesticides, thereby minimizing wastage and environmental impact while maximizing yield and quality.[1,2,3] Mechanization plays a crucial role in easing the burden of labor-intensive tasks such as plowing, sowing, and harvesting, particularly in regions facing labor scarcity and rising wage costs. Tractor-mounted implements, seed drills, and combine harvesters have become indispensable tools for Indian farmers, enabling them to increase productivity and efficiency while reducing reliance on manual labor. Furthermore, the integration of robotics and AI holds immense potential for revolutionizing agricultural practices in India. Robotic systems equipped with computer vision and machine learning algorithms can autonomously perform tasks such as weeding, fruit picking, and sorting, offering solutions to labor shortages and enhancing productivity.[4] Moreover, AI-powered decision support systems can analyze vast amounts of agricultural data to provide insights and recommendations for optimizing crop management practices, mitigating risks, and maximizing profitability. The automation techniques are reshaping the landscape of Indian agriculture, driving innovation, efficiency, and sustainability across the entire value chain. By embracing these technologies, Indian farmers can overcome traditional challenges and harness the full potential of modern agricultural practices to ensure food security, livelihood sustainability, and rural prosperity in the years to come.[5]

## II. Literature Review

Real-time data gathering and analysis are made possible by Bluetooth technology, which empowers farmers to maximize resource management techniques and make well-informed judgments. Agricultural applications in remote or geographically separated places can benefit from the ubiquitous connection and remote monitoring capabilities provided by Global System for Mobile Communications (GSM) technology. Farmers may remotely monitor and regulate crucial microgreens growing factors, such irrigation scheduling, pest control, and greenhouse climate control, by utilizing GSM-enabled sensors and actuators Automation techniques in agriculture have emerged as a critical component in India's quest for sustainable and efficient farming practices. In recent years, the adoption of automation technologies has gained momentum, driven by the need to address labor shortages, optimize resource utilization, and enhance productivity in the face of increasing demand for food. According to a study by Ravi et al. (2020), automation in agriculture encompasses a wide range of technologies, including precision farming, mechanization, robotics, and artificial intelligence (AI), each offering unique solutions to improve farming operations and mitigate challenges faced by Indian farmers. Precision agriculture, characterized by the precise application of inputs tailored to specific field conditions, has garnered considerable attention in Indian agriculture. Sharma and Srivastava (2018) highlight the role of precision agriculture in optimizing resource management and enhancing crop yields while minimizing environmental impact. By leveraging sensors, GPS technology, and data analytics, farmers can monitor soil moisture levels, nutrient content, and pest infestations, enabling targeted interventions and reducing input wastage. Mechanization plays a pivotal role in relieving the labor burden associated

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with manual farming operations, particularly in regions facing labor shortages. According to a report by the Food and Agriculture Organization (FAO) (2019), the widespread adoption of mechanized equipment such as tractors, seed drills, and combine harvesters has significantly improved efficiency and productivity in Indian agriculture. This shift towards mechanization has not only increased farm output but also contributed to rural employment generation and livelihood enhancement. The integration of robotics and AI holds immense promise for revolutionizing agricultural practices in India. Drones equipped with multispectral cameras can provide real-time crop monitoring and yield estimation, enabling proactive decision-making and precision farming (Kumar et al., 2019). Furthermore, AI-powered algorithms can analyze agricultural data to offer insights and recommendations for optimizing crop management practices, minimizing risks, and maximizing profitability (Sinha et al., 2021). These advancements in robotics and AI have the potential to transform Indian agriculture by augmenting human labor, improving efficiency, and ensuring sustainable resource management. However, despite the significant advancements in automation technologies, several challenges remain in the widespread adoption of these techniques in Indian agriculture. Infrastructure constraints, including inadequate power supply and poor connectivity, pose hurdles to the deployment of automation solutions in remote rural areas (Kumar et al., 2020). Additionally, the high initial investment costs associated with automation technologies may deter smallholder farmers from adopting these innovations, highlighting the need for policy interventions and financial incentives to promote technology adoption and diffusion (Gupta et al., 2021). The automation techniques in agriculture hold immense potential for revolutionizing Indian farming practices, enhancing productivity, sustainability, and rural livelihoods. However, concerted efforts are needed to overcome existing challenges and ensure equitable access to these technologies, particularly among smallholder farmers. Policy support, investment in infrastructure, and capacity-building initiatives are essential to realize the full transformative impact of automation in Indian agriculture.

**Use of IoT in agriculture**

The integration of Internet of Things (IoT) technology in agriculture has emerged as a transformative force, offering novel solutions to enhance productivity, optimize resource utilization, and mitigate environmental impact. In recent years, IoT automation techniques have gained traction in Indian agriculture, driven by the need to address challenges such as climate variability, water scarcity, and labor shortages. This literature review aims to provide a comprehensive overview of IoT automation techniques used in agriculture in India, highlighting their applications, benefits, challenges, and future prospects. IoT-enabled precision agriculture has revolutionized farming practices by providing real-time monitoring and control of agricultural processes. According to a study by Kumar et al. (2020), IoT sensors embedded in soil, plants, and agricultural equipment can collect data on soil moisture, temperature, nutrient levels, and crop health, enabling farmers to make data-driven

decisions and optimize inputs. Additionally, IoT platforms facilitate remote monitoring and management of irrigation systems, enabling precise water delivery based on crop requirements and environmental conditions. [7] The adoption of IoT automation techniques in Indian agriculture has also led to advancements in smart farming practices. Rajput et al. (2019) highlight the use of IoT-enabled smart sensors and actuators to automate tasks such as seeding, fertilization, and pest control. By integrating sensors with actuators and control systems, farmers can automate routine agricultural operations, reduce manual labor, and improve efficiency. Moreover, IoT-enabled drones equipped with cameras and sensors can provide aerial imagery and data analytics for crop monitoring, yield estimation, and disease detection, as demonstrated by Singh et al. (2021). However, the widespread adoption of IoT automation techniques in Indian agriculture faces several challenges. Infrastructure constraints, including poor connectivity and unreliable power supply, pose hurdles to the deployment and operation of IoT devices in rural areas (Kumar et al., 2018). Additionally, concerns regarding data privacy, security, and ownership hinder farmers' trust and willingness to share agricultural data with IoT platforms and service providers (Kumar and Gupta, 2019). Addressing these challenges requires collaborative efforts from government, industry, and academia to invest in infrastructure development, cybersecurity measures, and farmer education and awareness programs. Looking ahead, the future prospects for IoT automation techniques in Indian agriculture are promising, with opportunities for innovation and collaboration across sectors. Advancements in IoT technology, including low-power sensors, edge computing, and artificial intelligence, hold the potential to further enhance the capabilities and scalability of IoT-enabled agricultural systems. Moreover, partnerships between stakeholders, including farmers, technology providers, and policymakers, can facilitate the co-creation of solutions tailored to the unique needs and challenges of Indian agriculture. IoT automation techniques offer significant potential to revolutionize Indian agriculture by enabling precision farming, smart agriculture, and data-driven decision-making. While challenges such as infrastructure limitations and data privacy concerns remain, concerted efforts to address these barriers can unlock the full transformative impact of IoT technology in Indian agriculture, leading to improved productivity, sustainability, and resilience in the face of evolving environmental and economic pressures.

**Use of AI in agriculture**

The utilization of Artificial Intelligence (AI) in automation techniques has emerged as a transformative approach to addressing challenges and enhancing productivity in Indian agriculture. AI-powered automation techniques offer advanced solutions for optimizing resource management, improving crop yields, and enabling data-driven decision-making. This literature review aims to provide a comprehensive overview of the use of AI in automation techniques used in agriculture in India, highlighting itsapplications, benefits, challenges, and future prospects. AI-driven automation

techniques have revolutionized various aspects of agriculture in India, including precision farming, crop monitoring, pest detection, and yield prediction. According to a study by Singh et al. (2020), AI algorithms can analyze vast amounts of agricultural data collected from sensors, satellites, and drones to provide actionable insights for farmers. Machine learning models can predict crop yields, identify disease outbreaks, and recommend optimal planting and harvesting schedules based on historical data and environmental factors. This predictive capability enables farmers to optimize inputs, reduce risks, and maximize returns on their investments. Moreover, AI-powered automation techniques play a crucial role in enhancing the efficiency and effectiveness of agricultural operations. Ghosh et al. (2019) highlight the use of AI algorithms for automating tasks such as irrigation management, weed control, and harvesting. By integrating AI with IoT sensors and actuators, farmers can automate routine tasks and optimize resource utilization in real-time. For example, AI-powered irrigation systems can adjust water delivery based on soil moisture levels, weather forecasts, and crop water requirements, leading to water savings and improved crop health. Despite the significant advancements in AI-driven automation techniques, several challenges remain in their widespread adoption in Indian agriculture. Infrastructure limitations, including poor connectivity and limited access to technology in rural areas, pose barriers to deploying AI-powered solutions (Singh and Sharma, 2021). Additionally, concerns regarding data privacy, security, and ownership hinder farmers' willingness to share agricultural data with AI platforms and service providers (Rathore et al., 2020). Addressing these challenges requires investment in digital infrastructure, cybersecurity measures, and farmer education and training programs. Looking ahead, the future prospects for AI-driven automation techniques in Indian agriculture are promising, with opportunities for innovation and collaboration across sectors. Advancements in AI technology, including deep learning, reinforcement learning, and explainable AI, hold the potential to further enhance the capabilities and scalability of AI-enabled agricultural systems. Moreover, partnerships between stakeholders, including farmers, technology providers, and policymakers, can facilitate the development and adoption of AI-powered solutions tailored to the unique needs and challenges of Indian agriculture. AI-driven automation techniques offer significant potential to transform Indian agriculture by enabling precision farming, optimizing resource management, and enhancing productivity and sustainability. While challenges such as infrastructure limitations and data privacy concerns remain, concerted efforts to address these barriers can unlock the full transformative impact of AI technology in Indian agriculture, leading to improved livelihoods, food security, and environmental stewardship.

## Conclusion

Automation techniques in agriculture have become increasingly prevalent in India, marking a significant shift in farming practices towards efficiency, productivity, and sustainability. This review aims to provide an overview of the automation

techniques employed in Indian agriculture, highlighting their applications, benefits, challenges, and future prospects. The adoption of automation in Indian agriculture has been primarily driven by the need to address labor shortages, optimize resource utilization, and enhance productivity in the face of growing food demand and changing environmental conditions. Mechanization, precision farming, robotics, and artificial intelligence (AI) are among the key automation techniques deployed in various stages of agricultural operations. Mechanization has played a pivotal role in easing the burden of labor-intensive tasks such as plowing, sowing, and harvesting. Tractor-mounted implements, seed drills, and combine harvesters have become ubiquitous in Indian agriculture, enabling farmers to increase efficiency and reduce dependency on manual labor. Moreover, the advent of precision farming has enabled farmers to optimize inputs such as water, fertilizers, and pesticides, leading to improved crop yields and resource conservation. Robotics and AI have emerged as game-changers in Indian agriculture, offering solutions to complex challenges such as pest management, crop monitoring, and yield prediction. Autonomous drones equipped with cameras and sensors can provide real-time aerial imagery and data analytics for crop monitoring and disease detection. AI-powered algorithms can analyze agricultural data to provide insights and recommendations for optimizing crop management practices, mitigating risks, and maximizing profitability. However, despite the numerous benefits of automation techniques, several challenges remain in their widespread adoption in Indian agriculture. Infrastructure constraints, including poor connectivity and inadequate power supply in rural areas, hinder the deployment and operation of automation solutions. Moreover, the high initial investment costs associated with automation technologies may pose barriers to adoption, particularly among smallholder farmers. Looking ahead, the future prospects for automation techniques in Indian agriculture are promising, with opportunities for innovation and collaboration across sectors. Advancements in technology, including the integration of IoT, big data analytics, and machine learning, hold the potential to further enhance the capabilities and scalability of automation solutions. Moreover, policy support, investment in infrastructure, and capacity-building initiatives are essential to realizing the full transformative impact of automation in Indian agriculture. In conclusion, automation techniques offer immense potential to revolutionize Indian agriculture by improving efficiency, productivity, and sustainability. Addressing existing challenges and leveraging emerging technologies will be crucial in unlocking the full benefits of automation, ensuring food security, livelihood sustainability, and rural development in India.

## References

1]. Ravi, S., Reddy, B. P., & Kumar, P. M. (2020). Emerging Trends in Agricultural Automation and Precision Farming. In IoT and AI in Intelligent Environments (pp. 195-213). Springer, Singapore.

2]. Sharma, A., & Srivastava, R. K. (2018). Role of Precision Agriculture in Agriculture Value Chain: An Overview. Indian Research Journal of Extension Education, 18(3), 29-38.

3]. Food and Agriculture Organization (FAO). (2019). Mechanization in Indian Agriculture: Status, Challenges and Opportunities. Retrieved from http://www.fao.org/3/ca6597en/CA6597EN.pdf

4]. Kumar, S., Sheoran, R., & Nain, A. S. (2019). Application of Drones in Agriculture: A Review. Journal of Pharmacognosy and Phytochemistry, 8(1), 16-19.

5]. Sinha, P., Kumari, M., & Mandal, S. K. (2021). Applications of Artificial Intelligence in Agriculture: A Review. Journal of Pharmacognosy and Phytochemistry, 10(2), 1106-1112.

6]. Gupta, R., Kumar, A., & Sarker, P. K. (2021). Role of Agri-tech Start-ups in the Adoption of Precision Agriculture in India: A Review. Journal of Agribusiness in Developing and Emerging Economies. Advance online publication. https://doi.org/10.1108/JADEE-11-2020-0219).

7]. Kumar, A., Kumar, A., & Kumar, A. (2020). Internet of Things (IoT) Applications in Precision Agriculture: A Review. International Journal of Current Microbiology and Applied Sciences, 9(2), 3207-3215.

8]. Rajput, V. S., Rawal, M., & Jain, R. K. (2019). IoT-Based Smart Agriculture: A Review. 3rd International Conference on Inventive Research in Computing Applications (pp. 66-70). IEEE.

9]. Singh, A., Sharma, S., & Sinha, A. (2021). IoT in Agriculture: Applications and Challenges. International Journal of Engineering Research & Technology, 10(3), 102-108.

10]. Kumar, S., & Gupta, R. (2019). Challenges in Adoption of IoT in Indian Agriculture: A Review. International Journal of Agriculture Sciences, 11(1), 2340-2346.

11]. Kumar, S., Singh, R., & Singh, M. (2018). Opportunities and Challenges of Internet of Things (IoT) in Indian Agriculture: A Review. Journal of Pharmacognosy

ISSN2454-9940

www.ijasem.org

Vol 18, Issue.2, 2024

and Phytochemistry, 7(6), 1839-1842.

12]. Singh, A., Saini, G. S., & Dhillon, G. S. (2020). Application of Artificial Intelligence in Agriculture: A Review. Journal of Pharmacognosy and Phytochemistry, 9(6), 1667-1673.

13]. Ghosh, S., Singh, S., & Choudhary, S. K. (2019). Artificial Intelligence in Agriculture: A Review. International Journal of Computer Applications, 182(47), 1-5.

14]. Singh, S., & Sharma, V. (2021). Challenges and Opportunities of Artificial Intelligence in Agriculture. International Journal of Management, Technology, and Engineering, 11(1), 4696-4701.

15]. Rathore, R. S., Roy, P., & Nandy, B. (2020). Artificial Intelligence in Indian Agriculture: A Review. International Journal of Current Microbiology and Applied Sciences, 9(9), 1322-1327.