A STUDY ON ARTIFICIAL INTELLIGENCE IN FARMING

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Abstract— **Agriculture holds significant importance in the economy, and the rising interest in automation within this sector is notable. The integration of Artificial Intelligence (AI) in agriculture has sparked a revolution, addressing challenges such as climate variability, population expansion, labor shortages, and food security concerns. This study examines various research efforts to provide an overview of current automation practices in agriculture, including robotic and drone-assisted weeding systems, as well as the diverse methods employed by drones for tasks like spraying and crop monitoring.**

Index Terms— **Agriculture, Artificial Intelligence, Robotics, Disease detection, Smart Farming.** *(key words)*

I. Introduction

Agriculture holds significant importance in fostering economic prosperity, generating employment, and contributing to national income. Technological advancements have facilitated the evolution of agricultural practices, driving rural transformation. Artificial Intelligence (AI) represents the field of creating intelligent machines and programs, leveraging techniques like Machine Learning and Deep Learning to streamline problem- solving processes. Rooted in various disciplines such as Biology, Linguistics, Computer Science, Mathematics, Psychology, and Engineering, AI emerges as a promising technology in agriculture, bolstering crop production and enabling real-time monitoring, harvesting, processing, and marketing improvements. Implementation of automated irrigation, weeding, and spraying techniques aims to boost output while alleviating the burden on farmers.

Objective

- Smart farming encompasses the gathering and analysis of data related to weather conditions, soil moisture levels, crop growth stages, and other relevant variables utilizing sensors, data analytics, and advanced technology.
- Analyzing this data enables farmer to make informed decisions regarding the timing and methods for planting, irrigation, fertilization, and harvesting. Such informed decisions can lead to increased yields, reduced waste, and the conservation of resources such as water, fertilizer, and pesticides.
- The overarching objective of smart farming is to enhance the efficiency, sustainability, and profitability of agricultural practices.

Scope of this study

AI is increasingly employed in agriculture to interpret, acquire, and respond to diverse situations. Microsoft Corporation, for instance, is partnering with 175 farmers in India to offer services such as land preparation, sowing, fertilization, and other nutrient supplements. These efforts have resulted in an average 30% boost in crop yield per hectare compared to previous harvests

Identify the readiness of the crop

Images of various crops captured under white and UVA light are utilized to assess the maturity level of green fruits. This research enables farmers to categorize fruits or crops based on their readiness, organizing them into different stacks prior to market delivery.

II. Review of literature

- Zohreh Razaghi 2021 Applications of artificial intelligence in agriculture .This review paper AI application in agriculture include crop monitoring, yield prediction, and disease detection.AI in agriculture can increase efficiency and productivity, but there are challenges and opportunities for future research.
- David A. Landgrebe and Jiaoping Zhang 2018 The application of artificial intelligence in precision agriculture. This paper examines AI can be used to optimize crop production and reduce environmental impact. The authors discuss the use of AI technology must be widely adopted to be widely accepted by farmers.
- Tariq Saeed, Babar Hussain, and Imran Ali 2020 The Role of Artificial Intelligence in Agriculture: Opportunities and Challenges This paper examines AI has the potential to address climate change, population growth, and food security. The authors discuss the use of AI can be used for Crop monitoring, pest management, and decision support, but there are

challenges such as cost, data privacy, and interoperability.

- Jianming Liang, Jing Zhang, and Wei Wu 2019 The Role of Artificial Intelligence in Agriculture: A Comprehensive Review. This review paper provides a comprehensive overview of the use of AI in agriculture, including both theoretical and practical aspects.AI can be used to improve soil fertility, crop classification, and yield prediction, with potential for future research.

- Xiaowei Tang and Dan Zhang 2020AI in Agriculture: A Review This review paper provides a comprehensive overview of the use of AI in agriculture, including both crop production and livestock management. In this study AI has potential for agriculture, including crop yield prediction and animal behaviour monitoring.

III. The Internet of things (IOT) driven development

IoT solutions like proximity and remote sensing are employed to detect, recognize, and implement intelligent solutions aimed at improving crop yields. Remote sensing involves sensors that collect data from a distance, while proximity sensing involves sensors in direct contact with the soil. Hardware solutions like Rowbot are integrating software with robotics into optimize fertilizer application for corn cultivation.

Field management

Real-time estimations can be generated using high-definition photos obtained from drone and helicopter systems. These images enable the creation of field maps and identification of areas where crops require water, fertilizer, and pesticides. This process greatly aids in optimizing resource allocation.

Disease detection

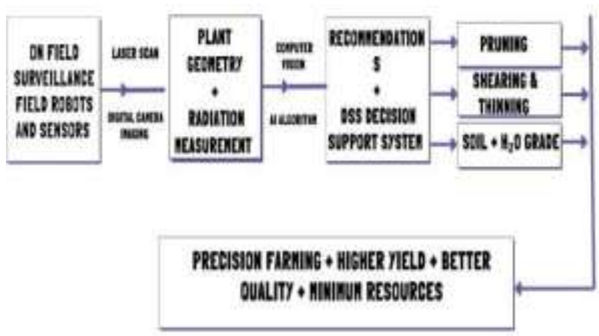
Plant leaf images are segmented into different regions such as the background, diseased area, and healthy area using image sensing and analysis techniques. Subsequently, the unhealthy or infected regions are cropped and sent to the lab for further diagnosis. Moreover, this method assists in identifying pests and detecting vitamin deficiencies. Figure 1.illustrates the comprehensive process.

Disease detection figure 1.

Development of Agricultural Robots

AI plays a pivotal role in robotics, enhancing efficiency, reliability, and precision in agriculture. As early as the 1980s, Japan pioneered the development of robots capable of spraying pesticides. Projects like AURORA have been specifically designed for autonomous navigation within greenhouses. While image recognition of species based on plant morphology is reliable, it necessitates learning crucial features autonomously through neural network approaches. Moreover, there's a focus on the selectivity of herbicides to mitigate herbicide pollution

Robotics in digital farming



Robotics in digital farming figure 2.

Challenges in AI adoption in agriculture

While AI holds immense promise in agriculture, there remains a gap in understanding advanced machine learning solutions. To fully leverage its potential, applications need to become more robust and cost-effective. Additionally, offering open-source platforms can make these solutions more accessible and affordable for broader adoption in the agricultural sector

IV. FINDING

1. The majority of respondents fall within the age range of 25 to 35, with 67 %, compared to 33 % for ages 18 to 25.
2. Rural areas have the highest frequency, with 66 %, while urban 22% and semi-urban areas have 12 % each.
3. Most respondents, with 55 %, believe that smart farming positively impacts agricultural productivity, while fewer respondents are uncertain 22% or skeptical 23 %.
4. Similarly, a significant number of respondents 55 % see potential in smart farming to reduce resource wastage, although some are uncertain 12 % or doubtful 33 %.
5. The majority 77 % agree on smart farming's ability to monitor crop health and growth, while fewer respondents express uncertainty 23 %.
6. Government incentives for promoting smart farming practices are supported by a considerable number of respondents 55 %, while some are unsure 22 % or against the idea 23 %.
7. Regarding the use of smart farming technologies on the farm, the majority of respondents 67% do not currently utilize such technologies, while a smaller number 33

V. SUGGESTION

1. Targeted Outreach: Given that the majority of respondents fall within the age range of 25 to 35 and are located in rural areas, targeting outreach and educational programs towards this demographic could be beneficial. Providing workshops or demonstrations specifically tailored to their needs and concerns could increase adoption rates of smart farming technologies.

2. Education and Awareness: Since there's a significant number of respondents who are uncertain or skeptical about the benefits of smart farming, focusing on education and awareness campaigns to address their concerns could be valuable. Providing case studies, testimonials, and tangible examples of how smart farming has improved productivity and reduced resource wastage could help sway opinions.

3. Monitoring and Crop Health: As most respondents agree on smart farming's ability to monitor crop health and growth, investing in technologies that facilitate this aspect of farming could be prioritized. Providing accessible and user-friendly tools for monitoring and managing crop health could further incentivize adoption among farmers.

4. Incentive Programs: Since a considerable number of respondents support government incentives for promoting smart farming practices, policymakers could consider implementing or expanding incentive programs to encourage adoption. These incentives could include subsidies for purchasing smart farming equipment, tax breaks, or grants for implementing smart farming practices.

5. Technology Accessibility: Recognizing that the majority of respondents currently do not utilize smart farming technologies, efforts should be made to improve accessibility and affordability of these technologies. Providing financing options, leasing programs, or cooperative purchasing arrangements could make it easier for farmers to adopt smart farming solutions without significant upfront costs.

6. Tailored Support Services: Offering tailored support services, such as training and technical assistance, to farmers who are interested in adopting smart farming technologies but may lack the necessary expertise could help bridge the knowledge gap and facilitate adoption.

VI. CONCLUSION

This review provides an overview of AI technology's relevance in agriculture, emphasizing its role in the Turing Test and two specific subfields. It also addresses three key practical challenges facing AI in agriculture: the unequal distribution of modern technology, the difficulty of translating AI-based machines and algorithms into real agricultural environments, and concerns regarding the security of devices used in open agricultural spaces. Additionally, it introduces advancements in agricultural robot development, including autonomous mobile robots for greenhouse pesticide spraying, GPS-guided tractors with machine vision capabilities, apple-picking robots employing Cartesian coordinate systems for object location, weed management robots exploring various innovations, and an apple harvesting machine featuring an innovative flexible gripper design.

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