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Impact of IoT and AI on Smart Agriculture

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Abstract: *Objects acquired intelligence and the capacity to communicate as technology advanced. The Internet of Things (IoT) links common household items to the Internet, allowing them to make decisions like humans. Sensors collect real-time atmospheric data that AI algorithms use to make devices smarter. The Internet of Things has revolutionized agriculture. According to a study, 70% of India's population is dependent on agriculture, yet agriculture's importance is no longer concealed. Using technology, one can predict temperature, rainfall, humidity, fertilizer demands, and water needs. Modern agricultural approaches using IoT and AI are altering traditional farming practices and making farming profitable.*

Keywords: Internet of Things, Smart Agriculture, Artificial Intelligence, rainfall prediction, modern tools

I. INTRODUCTION

Technology's effect on our lives is not universal. Machines can converse and make decisions without human involvement. All of these applications have benefitted from AI and IoT [1]. This is a dense network of connected devices that interact and act on sensor data collected by different protocols. Where AI with IoT is considered as smart agriculture [2, 3]. We looked at the data produced by the many contemporary devices. IoT data analysis requires AI [4]. Agriculture is no longer a 21st century anomaly [5]. Besides AI, IoT has a big impact on agriculture. Agriculture contributes between 17% and 18% of India's GDP [6]. All of them are affected by external and internal variables that are difficult to anticipate [7] [8]. However, integrating AI and IoT enables farmers to breathe easily by automating practically the whole agricultural process [9]. From planting through harvesting, cyclical activities may be planned. Data analytics can now anticipate agricultural demand and supply, helping farmers financially [11].

Current techniques [12] [13] [14] fail to anticipate crop behavior and water requirements. Too much or too little lowers nutritional value and crop development. Irrigation consumes 60% of available water [15]. Assisting in agricultural production, AI and IoT collect sensor data and analyze it [16]. These are only a few of the factors examined in agriculture. Agriculture has benefitted from the IoT and AI in several ways, including crop disease prediction using image processing and pesticide application accuracy utilizing sensors. The Indian government has also made some beneficial attempts in this area, such as the eNAM, NMSA, and PMKSY [18]. Farm visits at night are no longer necessary to switch on water or electricity [18].

The remaining sections comprise the study: Section 2 conducts a thorough literature analysis of current agricultural methods using AI and IoT, Section 3 discusses the different methodologies of smart agriculture, Section 4 discusses the applications of smart farming and its security issues and Section 5 concludes with future work.

II. LITERATURE SURVEY

S.No	Authors & Year	Research Contribution
1	Kumar Nalinaksh et al. [25] 2018	Employing the IoT Simulator Virtual Module to oversee the monitoring of irrigation, crop output, soil health, and storage.The simulator is undergoing real-life testing. The user's text is a bullet point.A cold storage module minimises wastage and enhances environmental conditions. If properly constructed, the simulator has the capability to function with farms in the future.
2	Pankaj et al. [26] 2018	The IoT may be used for monitoring and managing water systems, controlling

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		pests, and enhancing safety measures. It enhances resource utilisation and increases yield magnitude. The LoRaWAN protocol facilitates communication. The user's text is a bullet point.The method identifies occurrences of pest infestations, heavy rainfall, and drought conditions. Unmanned aerial vehicles (UAVs), also known as drones, are used to oversee agricultural fields, capture images for the purpose of precision farming, and accurately administer pesticides in specific locations.
3	Sneha et al. [29] 2019	It's an IoT-based irrigation system. The solution relies on low-cost devices.
4	Durai et al. [4] 2019	Sensors assess the land before planting and MLP results guide choices. Changing soil properties improves agricultural production and therefore profit.
5	Vaishali et al. [11] 2019	Crop yield and timing predictions based on soil moisture, temperature, and PH
6	Shibin et al. [15] 2020	The GSM module will monitor soil factors including temperature, pH, and moisture. Sensing data can predict soil fertility, water, and nutrient needs. All values may be sent through SMS. Crop yields may improve.

III. DIFFERENT METHODOLOGIES FOR SMART AGRICULTURE

All three concepts are contemporary agricultural notions developed from new agricultural techniques, equipment, and processes.

3.1 Precision Farming

A field or crop is observed, measured, and analyzed as part of an optimization method. It uses big data, analytics, and robots. The four R's [20] describe it as "at the right time, place, amount, and technique."

3.2 Smart Farming

"Smart farming [22] [23] collects and uses field data to perform activities. In all aspects of farming, data, and information technology are used."

3.3 Digital Agriculture

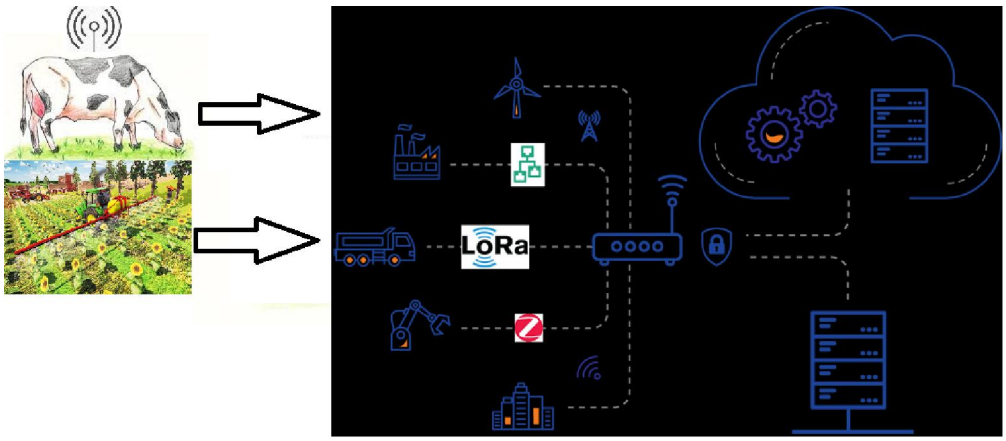

Fig 1: Interaction between the components of smart Agriculture

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"Digital farming [24] [25] blends precision and smart agriculture. As a result, actionable suggestions are generated for future usage. It also helps customers by offering knowledgebase information."

Despite the use of several contemporary methodologies, there are certain obstacles that must be surmounted in order to enhance agricultural practices. This study article aims to examine several well-established agricultural practices and assess their potential for future advancements.

A recent study predicts a 9.6 billion increase by 2050. Also, farming is restricted to obtaining the internet of Things. Fig. 2 shows how IoT is helping the US fulfill its food requirements while eliminating climate change and environmental effects. Late-20th-century technical advancements like farm tractors and gatherers were introduced globally. Also, the increasing interest in food requires agricultural innovation.

Fig 2: Farming with IoT

IV. APPLICATIONS OF SMART AGRICULTURAL SYSTEMS

With smart agriculture, the goal is to reduce human involvement and make the system self-sufficient. Many researchers use new technologies like the ones mentioned. A good harvest is suggested, as is alerting farmers to bad weather and food and gadget theft.

4.1 Agricultural AI and IoT:

A) Drones help monitor and improve agricultural development.

B) Agriculture is highly dependent on weather, therefore monitoring weather data and informing farmers may help agriculture grow.

C) Robots assist reduce human labor and help produce crops on time.

D) Image Analysis: Farming research is useful.

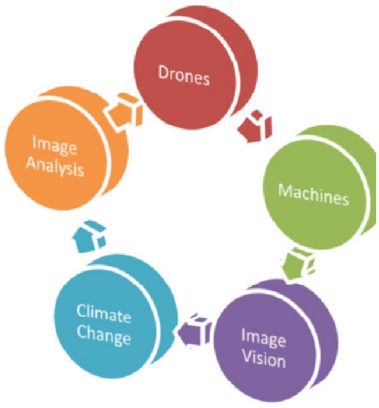

Fig 3: Smart Technology role

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V. CONCLUSION AND FUTURE WORKS

Crop demand and supply are important factors that farmers must consider while using new technologies. These issues need contemporary agricultural infrastructure and technology. With IoT and AI in agricultural operations, this research looked at many publications and found that it can be done productively. With AI and IoT, farmers will be less reliant on unpredictable weather patterns and the cost of human labor will be reduced as well. Agri-AI and IoT use cases are discussed in the paper.

The vast majority of Indian farmers continue to rely on seasonal rains and do not make use of any technology-based irrigation systems since they do not get any financial assistance. To add insult to injury, the small size of their landholdings is another factor that makes it difficult for them to use mechanised farming instruments. Furthermore, since these farmers have very tiny landholdings, the effects of climate change on them are considered to be negligible. The adoption of these technologies by the vast majority of farmers is required for them to be considered practicable. For the purpose of finding a solution to the issue, it is very necessary for young people to cultivate a strong interest in the technological developments that are being made in the field of contemporary agriculture.

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