Smart farming new way of agricultural management

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***Abstract*—The two biggest obstacles to global sustainable development are population expansion and the scarcity of food. The world's problems can be realistically solved by cutting-edge technology like mobile internet, the Internet of Things, and artificial intelligence (AI). In order to demonstrate data collection, transmission, storage, analysis, and appropriate solutions, this study focuses on the new ways related to smart farming (SF) from 2019 to 2021. Since it links sensor devices to carry out a variety of fundamental activities, the Internet of Things is one of the key pillars of smart systems. The sensors for water level, irrigation effectiveness, climate, etc. were part of the smart irrigation system. Smart controls, sensors, and a few mathematical formulas form the foundation of smart irrigation. Furthermore, using the Internet of Things (IoT), artificial intelligence (AI), deep learning (DL), machine learning (ML), and wireless communications, this work demonstrated the use of unmanned aerial vehicles (UAV) and robots to accomplish a variety of tasks in real-time, including harvesting, seedling, weed detection, irrigation, agricultural pest spraying, livestock applications, etc. Furthermore, because 5G mobile networks can link a huge number of devices per square kilometer and provide high-speed data transfer of up to 20 Gbps, this work highlights the significance of using them in the development of smart systems. This study outlined several strategies for smart farming, despite the fact that its implementation in developing nations faces numerous obstacles. Additionally, the implementation of Smart Decision Support Systems (SDSS) in emerging nations facilitates the mapping and real-time analysis of soil properties as well as appropriate decision management. Lastly, governments in developing nations must provide small-scale farms and the business sector with greater support for smart agriculture.**

***Index Terms*—Smart farming, IOT, AI, management**

I. INTRODUCTION

The use of new technologies in agricultural operations is the core of smart farming. Drones, artificial intelligence, big data, the Internet of Things, satellites, and other technologies make farming and agriculture "smart," enabling farmers to maximize their efforts and achieve better outcomes. All of this makes agribusiness more cost-effective by decreasing the proportion of human labor, lowering financial expenses, and increasing output volumes. Using cutting-edge technologies in farming is more important than ever right now. By 2050, the world's population is expected to increase by 34%. Higher crop yields and more efficient use of natural resources are necessary. The situation is getting worse due to climate change. Because of all of this, including efficient techniques into the work is essential. How many local farming benefit from smart farming? From monitoring fields and utilizing drones to distribute pesticides to harvesting and establishing the ideal greenhouse environment, today's service and technology companies give growers access to tools and strategies that may optimize almost every aspect of their operations. A distinct strategy that focuses on how weather affects agricultural decision-making is called "climate smart agriculture."

Farming Challenges

Significant obstacles affect the agricultural sector's sustainability and productivity. Typical ones that have an impact on agriculture include:

1. Lack of Workers

Labor shortages are a major problem for the farming sector, mostly because there are less and fewer agricultural laborers available. Finding and keeping a trained crew to satisfy the demands of farm operations is made more difficult by this.

2. Changes in Climate

One of the biggest challenges facing farming is the changing weather patterns and catastrophic events like heat waves, floods, and droughts. Unpredictable weather affects crop output, throws off planting and harvesting dates, and raises the danger of pests and diseases.

3. Increasing Prices

Farmers have to deal with rising input costs for things like fuel, machinery, fertilizer, and seeds. Farmers find it difficult to maintain their operations and make investments in cutting-edge technologies due to fluctuating commodity prices and growing restrictions, which further strain profitability.

4. Land and Resource Access

New farmers find it challenging to break into the market due to a lack of available farmland, high land costs, and competition from non-agricultural industries. Access to water supplies for irrigation is also become harder to come by, especially in dry areas.

5. Adoption of Technology

Adoption of new technology in farming can be difficult, even when they present prospects for greater productivity and efficiency. Many farmers face obstacles due to the expense of installing and maintaining sophisticated equipment, as well as the requirement for technical assistance and training.

With the introduction of IoT technology, the farming sector is gradually gaining prominence. The way farmers plow, harvest, and care for crops is being recreated by smart farm management systems. Furthermore, the notion of using smart IoT technologies to transform farms through smart farm management is thriving. Farmers are able to monitor crop progress in real time and record it for later analysis. This preserves the quality of the crop and indicates the conditions necessary for robust plant development.

1. Precision Farming

IoT enables farmers to use smart solutions and advanced farming methods to increase the productivity of their daily tasks. Sensor devices, which are placed in the fields for close surveillance, are used in IoT systems. These clever, cutting-edge gadgets enable farmers to track their farms in real time and gather data about local resources and topography. Additionally, for improved analysis, the sensors record changeable data like soil temperature and acidity. In order to anticipate future weather patterns and evaluate farm needs to prevent any obstacles during farming operations, intelligent farm management encourages precision farming and smart agriculture. For example, farmers can link their cellphones and remotely monitor their field operations by installing an IoT-powered farming solution. It provides visual representation through statistics on animal feeding and produce, as well as real-time monitoring of the farming machinery, crops, and livestock.

2. Smart Pest Management

With the use of IoT technologies, manual field inspections using traditional methods are no longer used. If pests in fields are not recognized, they harm crops. Additionally, it becomes challenging for agricultural managers to routinely oversee vast fields. In order to detect the pest regions and take the appropriate action, a clever IoT-powered system provides actionable insights. Additionally, pesticides aid in preventing infestations, but even a minor flaw in their quality might harm crops. As a cutting-edge technology, IoT guarantees that you manage crops with high-quality products and offers comprehensive data to spot swarm tendencies. Additionally, a cutting-edge idea that offers notifications on crop health and growth quality is the Internet of Things. Utilizing the capabilities of sensor devices and smart dashboards, smart farm management makes farming easier for farmers and lets them monitor the fields at their own pace.

Data from the fields is collected by the deployed sensor devices and stored for easy access on a cloud platform. It creates space for advancements and permits intelligent operation in the agricultural industry.

3. Intelligent Livestock Management

Large cattle and other livestock are kept on farms, and their diet and general health need to be regularly monitored. Farms frequently utilize IoT-powered smart wearables to monitor the health of their animals. Smart neckbands that are connected to an Internet of Things dashboard and provide precise health measurements can be worn by cows, horses, and other farm animals. It enables the farmers to monitor their temperature, blood pressure, and/or any other health conditions they may be experiencing in real time. Farm management activities involving a

variety of animals necessitate real-time behavior monitoring in order to directly increase farm productivity.

4. IoT in smart agriculture

The Internet of Things (IoT) is a clever and exciting technology that provides novel and useful solutions in a variety of fields, including smart agriculture, smart cities, traffic management, and healthcare. IoT technology has significantly advanced agricultural management in the realm of agriculture. This technology makes it possible to connect all agricultural tools and systems to make the right decisions about fertilizer supply and irrigation (Kumar & Periasamy, 2021). The precision and efficiency of equipment that track plant development and even raise livestock are improved by the smart systems.Data from various sensing devices is gathered via wireless sensor networks, or WSNs. Furthermore, cloud services are necessary for IoT integration in order to collect and analyze remote data, which aids in decision-making and helps put the best choices into action (Farooq et al., 2020).

II. CHALLENGES OF SMART FARMING

Even while smart farming and the use of cutting-edge technologies have many advantages, the concept of smart farming has some challenges to use of advanced technologies are as follow,

Lack of the Internet**.** You need a reliable Internet connection in order to use smart agriculture technologies. Regretfully, not all parts of the world have access to it.

Low consciousness. It is necessary to fine-tune and understand the peculiarities of modern systems. Farmers are either unaware of how to use smart farming technologies efficiently or do not completely comprehend their advantages.

Not being united- Since their equipment might not be interoperable, many vendors and industrial manufacturers make it challenging to set up a single system. Standardization of the technologies utilized is necessary for the seamless integration of hardware and software.

Inadequate scalability- The same technologies ought to be accessible to both major enterprises and small farms, albeit on different scales. Expanding production would be simpler and quicker with readily scaled technologies.

III. CONCLUSION

The current study demonstrated the value of smart agriculture in enhancing and raising agricultural output to help close the gap in food demand. Since it links every part of smart systems, not just in the agricultural sector but also in other applications, the Internet of Things is regarded as the foundation of smart agricultural technology. IoT can be applied to a wide range of agricultural tasks, including harvesting, irrigation, pest management, and farm monitoring. The Internet of Things links a number of sensors to processing units, analyzes the data, and then takes the right decisions instantly. The use of IoT integration with AI-controlled robot systems and UAVs, as well as the constraints on their use in developing nations, were examined in this work. The speed of data transfer has recently been linked to the success of SF performance. Due to its extremely high speed when compared to fourth-generation networks, the 5G network thus created the smart agriculture industry and offered flexible and efficient solutions. Developing nations benefit from the use of smart agricultural technology. Lastly, governments must to support these smart technologies at the small-farm level in order to boost output and enhance the effective use of water and land resources.

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