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IOT AND SMART FARMING

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Abstract

The agriculture sector is more data-driven, precise, and smart than ever today. In virtually every industry, including "smart agriculture," the rapid development of Internet-of-Things (IoT)-based technologies has led to a redesign that has moved away from statistical to quantitative methodologies. Such profound changes are upsetting long-established agricultural methods and creating new opportunities alongside a variety of challenges. A thorough investigation into IoT devices and communication channels related to wireless sensors used in agriculture applications was conducted. Robots, drones, remote sensors, computer imagery, and ever-evolving Machine Learning and analytical tools are used in IoT in agriculture to monitor crops, survey and map fields, and give farmers information they may use to make time-and money-saving farm management decisions.

KEYWORDS: Smart agriculture, IOT in agriculture, Smart farming, IOT devices in agriculture.

1. Introduction

A large industry is agriculture. It is a manufacturing process that requires a lot of capital. It is essential to the economy of every country [1]. The agricultural industry now faces challenges such as population expansion, the influence of pandemics on the workforce, financial instability, unpredictable weather patterns, growing water shortages, dwindling arable land, limited access to natural resources, and changing prices. The agriculture sector needs to adopt new technologies to meet the demands of the expanding population. IoT can successfully meet the requirement [2]. IoT applications are aimed at assisting farmers in bridging the gap between the supply and demand of food by ensuring high yields, profitability, and environmental protection. The Internet of Things (IoT) is described as being "based on traditional information carriers, such as the Internet, communications networks, and so on."

2. IoT in Agriculture

The Internet of Things makes it possible for smart farming techniques to boost agricultural output. IoT technologies provide historical and real-time data for predicting soil quality, weather conditions, and crop health, which is a service that benefits farmers [3]. Robots, drones, remote sensors, computer imagery, and ever-evolving machine learning and analytical tools are used in IoT in agriculture to monitor crops, survey and map fields, and give farmers information they may use to make time-and money-saving farm management decisions.

Need for IoT Devices

IoT can be used in several ways for agricultural production and processing in Ethiopia, including smart farming and precision agriculture, as well as irrigation monitoring, environmental monitoring, cattle animal monitoring, and other agricultural fields,etc.,

- ❖ Monitoring of climate conditions
- ❖ Greenhouse automation
- ❖ Cattle monitoring

a) Monitoring Climatic Conditions

The weather stations that incorporate numerous smart farming sensors are arguably the most well-liked smart agricultural technology. They are spread out around the area and gather various environmental data before sending it to the cloud. The measurements offered can be used to map the climate conditions, select the suitable crops, and implement the necessary improvements (i.e,precision farming).AllMETEO, Smart Elements, and Pycno are a few instances of these agricultural IoT devices.This enables you to gain more knowledge from the data analytics offers. For example, the app can help you more effectively track the danger of agricultural illnesses, such as common diseases that affect wheat and apple crops.

b) Green House Automation

The multi-span greenhouse is a common greenhouse upgrade that combines the original independent greenhouse to create a multi-span greenhouse. It has the advantage of occupying less space and supporting fewer species of plants, but it is not suitable for large-

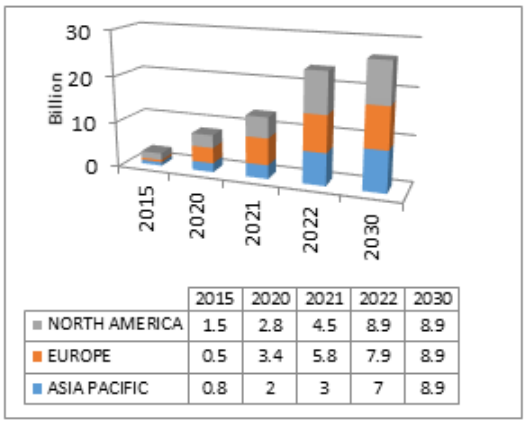
scale cultivation, has significant limitations compared to current requirements, and has a less-than-optimistic insulation and moisturizing effect [5]. The development of multiple-span greenhouses as a solution improved planting conditions, increased internal space structure, and improved moisture and heat retention. This technical document aims to demonstrate the advantages of a "sustainable intensification" of greenhouse crop production and an "integrated production and protection" (IPP) approach that links production technologies with plant protection methods to reduce the usage of pesticides.

c) Cattle Monitoring

The primary function of a health monitoring system is to continuously assess each individual animal's health and to quickly diagnose and treat sick animals. We employ sensor technology in that system to record the unique features of animal behavior, such as temperature, heart rate, etc. Cattle health is very important in food production because of owner concerns about the quality and safety of the food.Disease resistance and pathology are undoubtedly impacted by better-raised cattle.

3. Smart Farming

Smart farming powered by the Internet of Things enables farmers and producers to maximize productivity while reducing waste, from the quantity of fertiliser used to the number of trips made by farm equipment [6].It also makes it Possible to use resources like water,



	2015	2020	2021	2022	2030
NORTH AMERICA	1.5	2.8	4.5	8.9	8.9
EUROPE	0.5	3.4	5.8	7.9	8.9
ASIA PACIFIC	0.8	2	3	7	8.9

Fig.1.IoT Devices Usage

Power, etc. efficiently. Smart farming techniques offer solutions to problems including as climate change, changing weather patterns, soil conditions, waste reduction, and green housing. Different sensors, autonomous cars, control systems, and robotics are all part of the Internet of Things. Fig.1 shows the usage of IoT devices in various countries.

There are the types of categories in smart farming, some of the type are;

- Machines for routine operations
- Crop monitoring
- Soil monitoring
- Drones for field monitoring
- Water management

3.1 Machines for Routine Operations

The agriculture industry has improved greatly thanks to new farm equipment. Combine or Combine Harvester, Rotavator or Rotary Tiller, Plough or Plow, Tractor Trailer, Power Harrow, Leveler, Water Bowser, Ripper Machine, and Disc Harrow are some of the most important and widely used pieces of equipment. To increase productivity and efficiency, agricultural activities use equipment like the sickle, plough, hoe, drills, and others. Farmers employ a wide variety of agricultural instruments for agriculture.

3.2 Crop Monitoring

Because farmers continue to practice conventional agricultural techniques that produce low yields of crops and fruits, crop yields can be increased by using automatic machinery. But by employing IOT, we may anticipate a low-cost boost in production by keeping an eye on the effectiveness of the soil and monitoring temperature and humidity. For the crop yield, they exclusively employed the conventional procedures in the current system. However, the proposed approach can practices agriculture by fusing established practices with IOT and wireless sensor networks. The new system is more effective and advantageous for farmers. The use of such a device in the field can undoubtedly aid in accelerating crop harvest and production worldwide.

3.3 Soil Monitoring Sensor

Another name for soil moisture sensors is soil moisture metres. It is primarily used for forestry protection, agricultural irrigation, tracking soil moisture, and measuring the volumetric water content of soil. The frequency domain and time domain types of the now widely used soil moisture sensor are referred to as FDR and TDR, respectively [7]. The tensiometer, capacitance, dielectric technique, gypsum blocks, volumetric, and neutron probes are the most popular kinds of soil moisture sensors. When buried in the ground, these sensors can monitor the volumetric water content of the soil or the soil tension. The soil moisture sensor is a tool that gauges the current moisture level of the soil. In order to efficiently organize water delivery, sensors are incorporated into irrigation systems in agriculture. To obtain the bestplant growth, these metres assist in reducing or increasing irrigation**.**

3.4 Drones for Field Monitoring

The use of drone monitoring systems by farmers allows them to observe aerial views of the harvest. This provides details about the water system, different types of soil, pests, and fungus infestations [8]. Drone use has already become a crucial component of extensive precision farming operations in many locations. Crop photos captured by drones provide information in the infrared and visual spectral ranges. Farmers can better plan their planting and treatments by using the information gathered by drones that record fields. According to some statistics, adopting precision farming equipment can boost yields by as much as 5%, which is a significant improvement in a sector where profit marginsare normally low.

3.4 Water Management

An autonomous irrigation system is one that is operated with little to no manual intervention other than surveillance. With the aid of timers, sensors, computers, or mechanical appliances, nearly every system (drip, sprinkler, or surface) can be automated.

4. Conclusion

The adoption of the Internet of Things by a variety of businesses has made its ubiquity a reality. It wouldn't make sense to ignore IoT because of how many enterprises, organizations, and government agencies find it to be a desirable alternative. IoT enables monitoring and manipulation of microclimate conditions, which in turn boosts production in indoor gardening. In order to monitor and regulate microclimate conditions for indoor planting, IoT has made this a reality, which in turn boosts output. In order to better manage smart irrigation and fertilizer systems for outdoor planting, IoT-enabled devices can sense soil moisture and nutrients in addition to weather information. One way to avoid wastage of a valuable resource is to have sprinkler systems only spray water when it is actually needed. For outdoor planting, IoT-enabled devices can detect soil moisture and nutrients and combine that information with meteorological information to better manage irrigation and fertilizer systems. Water waste can be avoided, for instance, if sprinkler systems only turn on when necessary.

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