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Precision Agriculture: The Future of Agronomy

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ABSTRACT
The progressive growth of scientific knowledge and the evolution of technology is imminent. The advent of Wireless Sensor Networks (WSNs) has spurred into various multi-disciplinary fields, which include healthcare, military, industrial, agricultural, environmental, household, and other commercial applications. With the amelioration of WSNs, agricultural and farming industries have recently diverted their attention towards it, pursuing cost-effective technology for improving crop production and enhancing their agricultural yield standards. In this paper, we review the dormant applications of WSNs and the determined affairs and research challenges associated with the disposing of WSNs for improved farming.

INDEX-TERMS: Wireless Sensor Networks, multi-disciplinary fields, industrial and agricultural applications, applications of WSNs, research challenges.

I. INTRODUCTION

Wireless technologies aim at achieving ambient intelligence. Mobile devices embedded in offices, homes, banks, and public places enable ubiquitous sensing, computing, and communication. Mobility also implies that the size limitation and restriction on power consumption, impeccable connectivity with fixed networks and other devices, and increased data rates are the modicum requisites for an intelligent system. [1.] Wireless sensor networks(WSNs) have emerged as a powerful technology and play a vital role in metamorphosing automation around the globe with their sensing technology.

A wireless sensor network (WSN) is a network that comprises independently distributed sensor devices that are possibly low-size and low-complexity termed as nodes capable of sensing the surrounding environment and communicating the gathered information from the monitored area. WSNs have witnessed a formidable improvement in recent times because of their location-independent sensing capabilities even in inaccessible, remote, and hazardous regions, low cost of sensors, and long life of power supply because of low power consumption. [2.]

In this paper, wireless sensor technology is studied mainly in the agricultural domain and applications. The various types of sensors and their uses in the department of crop-yield development and how they will benefit the social cause of farmers are highly significant.

WSN in Agriculture

Agriculture is one of the last, largest systems in the world that is not yet entirely digitalized. It is a biological production system consisting of many parameters affecting its intricacy, for instance, human behavior, machines, nature, weather, and climate.

This aggregation consists of many factors that affect data gathering in agriculture monitoring, such as explicit characteristics of the geographic location of the field, weather, climate, proximity of markets, infrastructure for transportation, storage warehouses, agricultural methods, and activities individualized by the people performing them. For critical problems and challenges like these, sensor networks have always twigged branches in the agricultural domain and its applications.

The advancement of Wireless Sensor Network technology has accelerated the implementation of monitoring and controlling the agricultural parameters in rural areas. Considering the uneven natural distribution of rainwater, farmers must supervise its equivalent distribution to all the crops in their farm or as per the necessity of the crop. It is also possible to use them for automatic environmental administration of agricultural parameters. [2.]

Data gathered in this way show immediate change, enabling the system to monitor those parameters in real-time. Access to a large amount of

data generated from different sources in a short time creates complications in making the prime decision. Therefore, the accumulation of plentiful data is adept with the help of advanced analytical abilities.

Sensor Networks are widely pervasive distributed systems consisting of multiple sensor nodes deployed in a field that can mutually communicate via wireless networks. Sensor nodes are low-powered, small-sized, and cheap devices capable of sensing, commuting, and computing the surrounding conditions. The sensors are ingrained into the network to configure and connect themselves for data collection and forwarding the data to the Base Station. These nodes obtain information on the environment such as temperature, pressure, humidity, or pollutants and send this information to a base station. The Station then sends the data information through a wired network or activates an alarm or an action, depending on the type and magnitude of data monitored.

The main components of the sensor node consist of a sensing unit, a processing unit, a transceiver, and a power unit. Every sensor node has a single Omni-directional antenna. The sensing unit senses the physical quantity that will transform into a digital one through Analog to Digital converter(ADC). Subsequently, the processing unit will be utilized for further computations and a transceiver to transmit and receive data from the other nodes or the Base Station. The power unit is the most prominent one in any sensor node. Once the battery is exhausted, we cannot restore it for unattended applications. [1.] [6.]

Precision Agriculture

Precision Agriculture is a metonym with innovative agricultural techniques to enhance crop yield and lower environmental pollution. The inputs are put in precise amounts to get an increased average yield of crops. It is a better-observed method or technique compared to others.

Precision Agriculture is the most recent innovative technology based on sustainable agriculture and lively food production consisting of profitability and increasing production, economic efficiency, and the reduction of side effects on the environment. [3.]

Unfortunately, farmers use traditional methods that reduce the yield of growth which disastrously impacts the development of the farmers. The automatic system is enforced in agriculture to collect data from agricultural land with the help of sensors and send it to the server using wireless protocols to increase the yield of crops.

The accumulated information provides precise data equipped to increase crop cultivation. The data collected in the device server is not enough to increase the growth of crops. Other factors like insects and the use of pesticides result in poor yield affecting agriculture. People are usually involved in theft during the harvest season. The storage and maintenance of harvested crops are very difficult for farmers. The maintenance of the field requires constant care and engagement, which is where precision agriculture comes into the picture. [7.]

The soil moisture content is measured and the plants infected are inspected using a bio-sensor. The farmer's mobile phone gets notified with the analysis report. The GPS shares the location of the agricultural land with the farmer.

Soil Sensors

Soil sensors play a crucial role in precision agriculture via real-time monitoring. Physical and chemical signals in the soil, such as moisture content, temperature, pH value, pollutants, provide valid information to optimize the growth of crop circumstances, fight against biotic and abiotic stresses, and enhance crop yields. [4.]

Soil Moisture Sensor

A Soil Moisture Sensor is a device used to measure the water content from the soil. It consists of a fork-shaped probe with two exposed metal conductor plates for measuring the water content. The water level in the soil is directly proportional to the conductivity between the plates and inversely proportional to the resistance. The two exposed plates that work as probes act as a variable resistor. In addition, it has a potentiometer used for threshold adjustment of soil moisture.

Temperature Sensor

The temperature sensor measures the degree of coldness or hotness temperature in the agricultural land using a negative temperature coefficient thermistor (NTC) and a capacitive sensor, ensuring high reliability and stability. The two types of temperature sensors are contact temperature sensor, and non-contact temperature sensors. They can be used in greenhouses to monitor temperature and ensure that the plants aren't getting too hot. Failure to monitor and protect the plants from temperature extremes can result in frost-bitten and stunted plants. They can tell when the ground is thawed in the spring so that cultivators and farmers can lay foundations, dig and put in fence posts.

Humidity Sensor

The humidity sensor measures the humidity percentage in the air and is also called a dew sensor. Two electrical conductors conduct the electric field between them. Humidity sensors work by detecting minute changes that alter electrical currents or temperature in the air to calculate the humidity in the air.

Bio Sensor

A biosensor is an analytical device that converts biological reactions into electrical signals. It contains a combination of biological detecting components like sensor systems and transducers. Nanobiosensors are installed for sensing a wide variety of fertilizers, pesticides, moisture, and soil pH to increase the shelf life of plants, reduce the loss of nutrients, and enhance crop yields through better nutrition management. It measures the infection of plants and determines the level of infection. This information with the GPS location is transmitted to the mobile phone of the farmer. [8.]

Future Work

Farming is becoming more scientific under the aegis of remote sensing, GPS, and data analytics implemented in farming and irrigation equipment. Farmers all over the world are adopting new types of equipment to make farming more precise.

As future work, the number of sensors will be increased and implementing a machine learning algorithm capable of providing the right time and duration for crop irrigation. The predefined prediction of weather conditions helps the farmer to cultivate the crop based on the report.

Farming technology includes remote sensing with data collection on various parameters like moisture content and nutrient levels in the soil.

Thus, precision farming can make a difference to agricultural yield facing the challenge of a rising world population and can help farmers achieve crop sustainability and environmental protection, higher productivity, and economic benefits. [9.]

II. CONCLUSION

Wireless Sensor Networks(WSNs) have proven to be just more than mere technology. Its applications can be seen in many areas and significantly in the agricultural domain. The silver lining of WSN is that it gives more yield with less cost. As articulated in the paper, WSN plays a crucial role in precision agriculture by lessening human labor. The applications used are sensor networks that collect the required information for a farmer through scientific analysis of different elements of the soil in agricultural fields.

The gap between technology and farmers is shrinking. With relevance to agriculture for food and health, the yield produced meets its demands with technology.

REFERENCES

[1]. https://www.electronicsforu.com/market-verticals/communication/part-1-of-2-an-introduction-to-wireless-sensor-networks#:~:text=Part%201%20of%202%3A%20An%20Introduction%20to%20Wireless,...%204%20Location%20information%20only%20More%20items...%20
[2]. https://www.electronicshub.org/wireless-sensor-networks-wsn/
[3]. https://www.farmmanagement.pro/the-use-of-wireless-sensor-networks-in-precision-agriculture/
[4]. https://www.researchgate.net/publication/262989347_Wireless_Sensor_Networks_in_Agriculture_Sector-_Implementation_and_Security_Measures
[5]. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7728362/
[6]. https://iopscience.iop.org/article/10.1088/1755-1315/207/1/012059/pdf
[7]. https://www.sciencedirect.com/science/article/pii/S1877705811026324
[8]. Fundamentals of Wireless Sensor Networks. By Waltenegus Dargie, Christian Poellabauer
[9]. Intelligent System for Precision Agriculture DOI:10.1109/COMM48946.2020.91419