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RESEARCH ARTICLE OPEN ACCESS

IoT Based Smart Irrigation System for Precision Agriculture

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ABSTRACT
Mostly, India is a farming country. For the majority of Indian households, agriculture is the most significant employment. It plays a key part in agriculture's growth. Agriculture accounts for around 16% of total GDP and 10% of total exports in India.Water is Agriculture's major resource. Irrigation is widely utilised worldwide for fulfilling the requirement for agricultural irrigation, especially pivot centres. When compared to other irrigation methods, such as drip systems, this irrigation method is inefficient and frequently wastes water by not taking into account the plant's actual demands.Irrigation is one way of supplying water, however there will be plenty of waste of water in some instances. In this regard, we have introduced a project dubbed the IoT Automatic Irrigation System in order to save water and time.We use several temperature, humidity and ground moisture sensors in the system suggested, which are sensitive to various parameters of the soil and are automatically watered by the motor's ON / OFF based on soil moisture value. The user android app will display these detected metrics and the motor status.
Keywords-Internet of Things; Precision agriculture;

I. INTRODUCTION

In especially where the supplies for freshwater are limited, irrigation management is crucial. The irrigation process aims to provide plants with sufficient water to guarantee their water needs. The application of the Water Production Function (WPF) enables the estimation of output by dry matter or marketable yield, by evapotranspiration or water in irrigation (IW).The estimate of water requirements is a cornerstone from which the right irrigation dosages may be calculated. Indeed, the amount of water accessible for the crop is a function of soil texture, precipitation, prior irrigations, crop growth stage, and the amount of water already existing in the soil. Because of the expenses, center-pivot irrigation is generally reserved for irrigating vast areas ranging from 3.5 to 65 hectares.In today's environment, the Internet is essential in all sectors. The suggested approach is utilised in agricultural areas to monitor farm fields using IoT. Sensors based on wireless sensor network technology are used to analyse numerous characteristics in the agricultural area. In this case, the suggested system is utilised to gather soil characteristics, which are subsequently saved in a cloud database.The Internet of Things (IoT) is the application of electrical engineering and computer science to traditional agricultural concerns.This is accomplished through the use of specialised equipment, software, and IT services. This method obtains real-time data on the circumstances of soil water content, environmental temperature, and other pertinent information. The data is used by the programme to advise farmers on irrigation, harvesting periods, soil management, and crop market rates. Agriculture, on the other hand, is a large discipline that may be split into several domains of specialisation. The system investigates the function of IoT in the irrigation process.

1. Internet of things

In today's world, the Internet is vital in all industries. The proposed method is used in agricultural regions to monitor farm fields with IoT.Sensors based on wireless sensor network technology are used to analyse numerous characteristics in the agricultural area. In this case, the suggested system is utilised to gather soil characteristics, which are subsequently saved in a cloud database.The Internet of Things (IoT) is a global information-society infrastructure that connects (physical and virtual) "things" to allow better services based on existing and developing interoperable information and communication technologies.The Internet of Things (IoT) completely utilises "things" by using identification, data collection, processing, and communication capabilities to deliver services to all sorts of applications while ensuring security and privacy requirements are satisfied.

2.Precision Agriculture

Agriculture is undergoing a transformation. Precision agriculture has become more reliant on technology. In Pennsylvania, the rate of technology use is rising. Precision agriculture is making agriculture more precise and regulated. The utilisation of information technology is a critical component of agricultural management. Precision agriculture's primary goal is to ensure profitability, sustainability, and efficiency while conserving the environment.PA benefits include decreased usage of water, fertilisers, herbicides, and pesticides, improved produce quality and quantity, and lower production costs, in addition to farm equipment. Farmers no longer have to make rash judgments and then worry about unpredictability of environmental changes. With the Internet of Things, it is possible to obtain extremely precise, real-time information on agricultural activities such as irrigation, seed planting, harvesting, agricultural job management without investing in man hours, and so on. Farmers may also get real-time information about farming advancements, soil quality, weather conditions, crop market rates, and much more.

II. LITERATURE SURVEY

Understanding the current techniques, the needs, and creating an abstract for the system are all steps of primary inquiry. In this article, soil moisture and temperature sensors are put in the root zone of a plant and send data to an Android application. To manage the amount of water, a soil moisture sensor's threshold value is programmed into a microcontroller. Temperature, humidity, and soil moisture data are displayed via the Android app.The two most difficult challenges in designing an automated irrigation system for an irrigation pivot-center are, on the one hand, selecting an acceptable water-requirement assessment approach and, on the other, identifying a suitable cloud IoT platform for data storage and treatment.System models are critical in the development of agro-ecological and socioeconomic conditions in agriculture. The amount of resources available for field and farm trials to provide information and identify acceptable and successful management approaches.As long as the required soil, management, climatic, and socioeconomic information is available, it can aid land managers in identifying management over space and time.

Sanjay D.Sawaitul et al. proposed a novel method for categorising and forecasting future weather using the Back Propagation Algorithm, which records weather parameters such as wind speed, wind direction, rainfall, temperature, and projected climatic conditions.The artificial neural network back propagation approach is used to anticipate meteorological conditions. The Author tested three weather prediction models. The first model is employed in the collection of weather forecasting systems.The second model is meant to showcase the WSN data gathering tool kit, and the third model is used to show how the Back Propagation Algorithm may be used to various elements of weather forecasting [6].

Duncan Waga and colleagues share their findings on cloud computing-based environmental factors. Cloud computing analytics is critical in agriculture. Access to the information is also highly beneficial for the framers. They use the private cloud to store and retrieve dataThe HDFS is used to collect and aggregate data in a distributed, flexible, and efficient manner. They address the issues associated with using the cloud and big data in terms of performance, capacity, and scaling. Wind, temperature, and rainfall are among the variables used in this investigation. The new IT platform will include Hadoop packages. [7].

The author [8] projected her research effort in the agricultural field using a decision tree method. This approach is used to increase the production of soybean crops. During the kharif and rabi seasons, they gathered data on meteorological factors in Madhya Pradesh's Bhopal District.They use the Navie Bayesian classification approach to estimate rice crop yields based on temperature and rainfall data. The wheat crop's production is determined by the meteorological conditions.

II.USE CASES

II.1 Soil preparation and sowing

Soil preparation and planting are essential farming activities because they can have a positive or negative impact on crop quantity and quality. Plants will be deprived of water, nutrients, and sunlight if the density of seeds in a farm is too high. However, if seed density is low, i.e. there is a lot of space between plants, land will be wasted.When seeds are planted too deeply, plants have poor growth, emergence, vigour, and crop stand. There is a possibility that weeds will outnumber crops.If seeds are too near to the surface, they may be eaten by birds or dry out. The moisture content of the soil is particularly important here.

The following methods are used by the cloud-based DA subsystem:

1. Previously used dataset for modelling with the ML method.
2. Sensor data is collected in real time.
3. Crop variety (width of plant)
4. Feeds from weather channels

DA assists in determining exact sowing rates (Distance and depth).

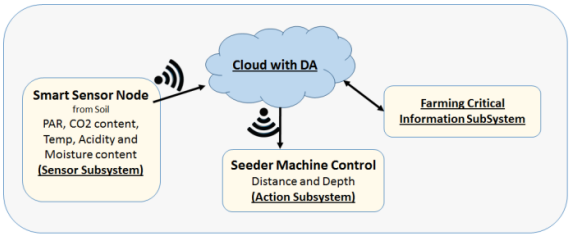

Fig.1. IoT based precision Sowing.

Through DA and cloud weather management, this technology will not only give precise depth and distance information to the Seeding machine, but will also aid in the development of an appropriate seedbed.

II.2 Water Supply Management

Farming need regular irrigation, which uses the greatest proportion of water resources in any location. A substantial amount of this irrigation water is squandered due to a lack of control and real-time monitoring.Smart irrigation systems powered by cutting-edge IoT technology can increase water resource conservation by monitoring irrigation using remote sensing technologies [3].Smart connected sensors work with smart sprinklers to achieve the goal, and a smart motor switch assists in the attainment of the goal.

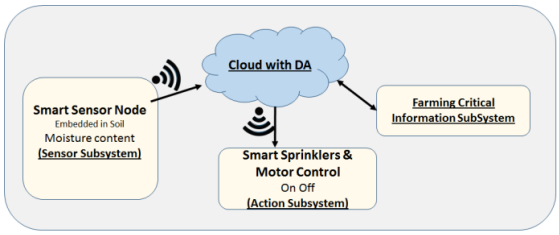

Fig. 2. IoT based Water Supply Management

PROPOSED WORK

This is a clever system that will benefit farmers. It captures real-time data from sensors installed around the farm. Sensors measure the moisture in the soil and the temperature of the surrounding environment, and this information is sent to Farmer's phone. This technology keeps the farmer informed by sending out notifications on a regular basis. The mobile application includes functionality for controlling and monitoring the farm's motor and street lights. This saves human labour while also ensuring that the necessary amount of water is applied to the crops, reducing water waste and helping to enhance crop quality and farm economic production.Raspberry Pi is the system's processing unit (controller). The Pi is powered by a 5V power supply that is connected outside. It supervises and regulates all system input and output. Sensors offer input data; in this case, the soil moisture sensor and temperature sensor transmit data to the Raspberry Pi in a predetermined time frame. When the moisture data threshold is met, the pump is activated. The farmer can observe the sensor's value and, with the aid of a mobile app, will take necessary actionFig. 3.

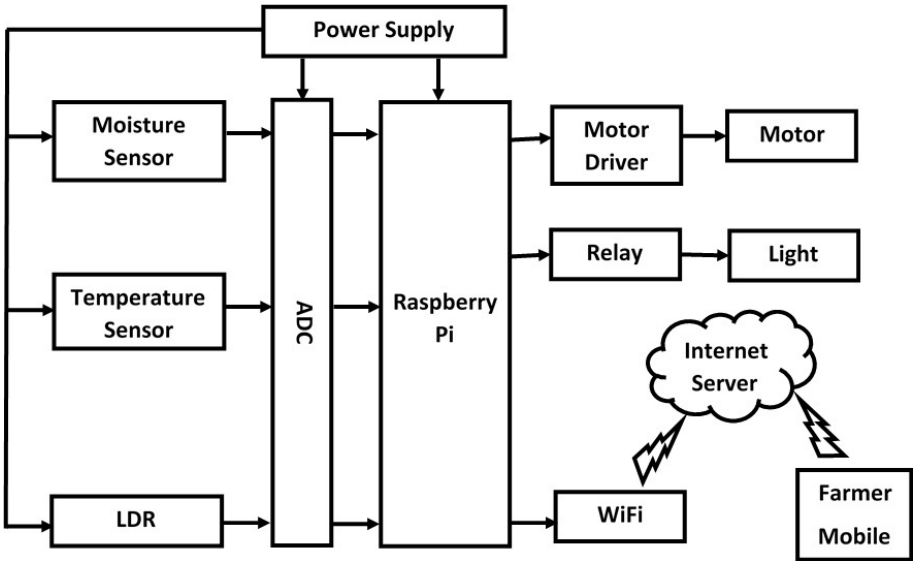

Fig.3. System Architecture

III. CONCLUSION

Developing nations have been looking forward to technology that would help them grow and improve the quantity and quality of their crops. IoT, Cloud, and Data Analytics can have a positive impact on current agricultural methods by providing traditional farmers with cutting-edge technologies to aid them in taking sensible actions. These are critical because they will help him make the best use of his resources, such as water, fertilizers, and so on, when he would otherwise have wasted a lot of his labor and resources, compromising the volume and quality of output.The Internet of Things and data analytics have been a boon to agriculture, but they are still in their infancy.A basic electrical system is used to construct a PA agricultural irrigation system. Two sensors, the soil temperature and moisture, are efficiently used in the circuit to give calibrated data to the system.Two sensors and Raspberry Pi microcontrollers have been successfully interfaced by all three Nodes.All observations and practical testing show that the suggested system is a full solution to field activities and irrigation difficulties. Implementing such a system in the field may undoubtedly assist to enhance crop yield and overall productivity.

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