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Smart Agriculture with IoT

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Abstract: Precision farming, often known as smart agriculture, is a management strategy that makes use of IoT technologies to raise the caliber and output of agricultural goods. Agricultural productivity has been hampered by the climate, for example, creating difficulties. Soil moisture, changes, and a lack of resources. It has been researched to use wireless sensors to incorporate proper crop management and soil moisture monitoring in order to overcome these difficulties. Precision farming enables real-time data collection and analysis on elements including weather patterns, soil moisture, and crop health. With better efficiency, less waste, and higher crop yields as a result, farmers are able to make educated decisions about pest control, irrigation, and fertilization. IoT technology's promise is illustrated through the application of precision farming in agriculture.
Keywords: Agriculture, Soil Moisture Monitoring, IoT Based agriculture

I. INTRODUCTION

Since the end of World War II, the world has faced a food scarcity, and thousands of people have died as a result. Every year, millions of people die from hunger. Many countries lack sufficient food production to support their citizens, and farming is frequently hampered by obstacles such as a shortage of water. Water, crops, soil, and climate change are all examples of sustain able resources. Precision farming, which uses wireless sensors to optimize crop management practices, can use IoT technology to solve these difficulties. Crop management is picking the appropriate crops for each season and ensuring their correct growth. Wheat, cotton, and rice are the most widely produced crops in India. There are three farming seasons in India: rabi, kharif, and Zaid, each with its Since the end of World War II, the world has faced a food scarcity, and India has three farming seasons: rabi,kharif,and Zaid, each with its own variety of crops. Agriculture's objectives and goals Agriculture is the main industry in India. India's agricultural sector takes up over 43% of the total land area. More than70% of rural residents rely upon agriculture. Given that it accounts for 17% of the country's GDP, agriculture is the foundation of the Indian economy. The Internet of Things (IOT) is a popular technology that we can employ in agriculture to boost crop output. IoT (Internet of Things) is nothing more than the network of electronic devices that can exchange and gather data without the need for human intervention. The IoT's contribution to agriculture has a significant effect on how productive and effective the crop is. The principal elements we are contemplating are the moisture in the soil temperature and humidity in the farm. As is common knowledge, too much moisture in the soil causes water to be wasted and also causes farm crops to fail. We can install sensors on the farm that can read these changeable numbers, which will lessen the load on farmers who currently have to check water content manually. Even the data storage and machine learning algorithms, such as the water in algorithm that uses node MCU and is transferred to the cloud for processing, are being run in our project using cloud computing. To predict, they have the KNN machine learning algorithm. This algorithm's inputs include the soil moisture, temperature, and humidity readings, as well as whether or not the farm needs to be watered. By putting its emphasis on things. Farming management idea called "smart farming" aims to improve both the quantity and quality of agricultural products.

Farmers today have access to technology for data management, soil scanning, GPS, and the Internet of Things. The purpose of smart agriculture research is to provide a solid foundation for a farm management decision-support system. Population growth, climate change, and labour are all challenges that smart farming believes must be addressed. This includes everything from crop planting and irrigation to health and harvesting.

2. APPLICATION

India is the second-largest producer of rice in the world. The rice crop is grown in several areas of India. The crop typically yields in three to four months. According to the water availability and the climate. Temperature, soil moisture, rainfall, and biotic conditions are all aspects of the climate. Typically, rice is planted right before the rainy season because of climate change and other factors. Sometimes the rainy season doesn't come as predicted because the farmer needs to use an outside source of water or the crop won't grow as anticipated and will either waste food or yield less harvest than anticipated.

In a different situation, the crop entirely rinses in water due to strong rainfall, and half of the crop is lost. Climate Smart agriculture has been developed as a solution to this problem been added to support the crop. Farmers that use IoT from the start face the fewest hassles and can track all changes from any location. The moisture is first measured and recorded for the future with the assistance of the soil moisture season. As a result, the sensors are linked via a network (Arduino and Raspberry Pi), and the data is stored in the cloud. The sensor is typically calibrated with some optimum values for the ideal harvests. Therefore, this provides the suitable crop, which advances to the following step of seed sowing. While often done by humans, an autonomous tractor is also capable of performing this task. This Water is the primary resource for crop yielding and it must be to the needed quantity.

2. HARDWARE COMPONENTS

A.TEMPERATURE SENSOR : The output voltage value of the LM35 sensor is directly proportional to the centigrade or Celsius. This sensor is used to measure the soil temperature and air temperature in the field. The LM35 sensor's operational temperature range is -55 degrees to 150 degrees, and it is an extremely expensive sensor.

B. GSM MODULE: It is wireless cellular communication. It is utilized to transmit output messages to the farmer's registered mobile. Voice calls can be transmitted, sent, and received using it. Low cost, extensive connection, and compact foot print. The frequencies 850/950/1800/1900MHz are supported.

C. SOIL MOISTURE SENSOR: soil moisture sensor measure the amount of water, PH level, and temperature in the soil. It consists of two probes made of thin copper wire that are 5cm long and are placed into the soil in order to measure the moisture. The soil between the copper wires behaves as variable resistance when the circuit gives the output voltage, which is equivalent to the conductivity of the soil. After detecting the soil moisture, the circuit can then detect from dry soil to completely moist soil.

D. ARDUINO MICROCONTROLLER: It is an open-source platform for both hardware and software that uses the microcontroller Arduino. It is based on the AT mega 328p architecture and has 6 analogue inputs, a 16 MHz ceramic resonator,14 digital input and output pins, and a reset button. It has all the necessary components to function as a microcontroller. The microcontroller's operating voltage is 5volts, and it has 32 kb of flash memory, static ram, and EEPROM (electrically erasable programmable read only memory).

E. PYRO ELECTRIC INFRARED SENSOR (PIR): PIR, commonly known as a motion detector, is an abbreviation for pyroelectric infra red sensor.It is made of crystalline materials that develop a surface charge when exposed to heat in the form of radiation. When a person comes into contact with a PIR sensor, which has a large field of view of 120degrees and is used to detect human presence, the sensor can detect the presence of the human body. It is also particularly sensitive to human motions. Because the highest radiation emitted by a human body is 9.4 micrometers in wave length, it can even detect a human's slightest movement. Once it detects a human, however, it will promptly transmit an alert message.

F. ULTRASONIC SENSOR: It is employed to determine the tank's water level. A device called an ultrasonic sensor uses ultrasonic waves to gauge a distance to an item. It transmits and receives ultrasonic pulses using a transducer. They are safe to use, simply interface with microcontrollers, and simple to utilize. It is more durable, accurate, and easier to operate. This sensor is analogue.

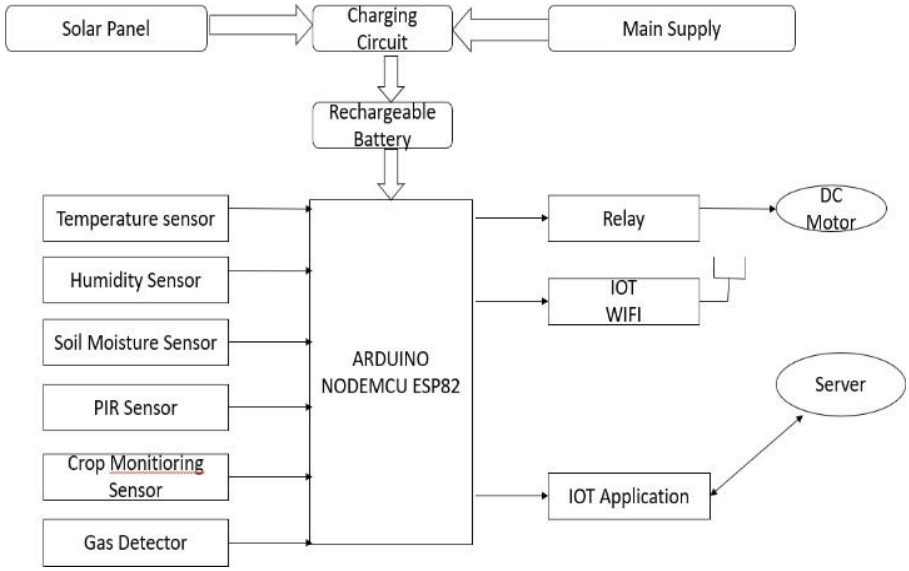
G. CROP MONITORING: Remote sensing technology enables the use of drones to monitor crops. Because it is the first stage when the crops can easily be affected by pests and infections, crop monitoring is the most crucial stage during which farmers must be attentive about crop growth. If that occurs, the entire crop could perishat the beginning stage. The farmer should monitor and assess the status of the crop for a decent yield in order to avoid such issues.

H. GAS DETECTOR: This type of sensor is used to monitor the quality of the air around a field an disbased on a microcontroller. When poisonous gases, such as smoke, Benzene,NOx,orCO2,enter the designated area of the field,this sensor detects the gases and automatically activates the buzzer and notifies the user. It can also function without a microcontroller.

I. POWERSUPPLY ADAPTOR: It is an external power supply is used to power small electronic or electrical devices. Output of power supply adaptor is 12VDC.

3. METHODOLOGY

The voltage regulator and power supply adaptor used to power the Arduino Uno.The analogue output of the temperature sensor, which measures the surrounding agricultural field's temperature, is sent to the LCD via the Arduino. On the LCD, the relevant temperature is shown. When a PIR sensor detects an intruder in a farm field, it outputs a digital signal that is sent to an LCD and sent as a text message (i.e.,"Intruder Detected") to a registered cell phone number. No SMS will be sent to the registered mobile phone if the sensor in the agricultural field does not detect any motion. The moisture content of the soil is detected by a soil moisture sensor. No signal will be delivered to relay 2 through Arduino if the measured moisture content of the soil is higher than the pre determined value. Pump for drip irrigation will be turned off. The output signal from Arduino will be delivered torelay2 if the measured moisture content of the soil is lower than the predetermined value. Relay 2 is turned on, the electromagnet turns on the switch, the drip irrigation pump turns on (ON State), and so on. To the registered mobile number will be sent an SMS (i.e. DRIP IRRIGARTION PUMP ON).The water level in the tank is measured using an ultrasonic sensor. No signal will be transmitted to realy1through Arduino if the water level is higher than the pre determined value, and relay1 will be in the off state. The tank pump will also be turned off. The output signal will be transmitted torealy1 through Arduino if the water level is lower than the specified value of (9 inches), and relay1 will be in the ON state. The state of ON will also have a tank pump. A registered mobile number will receive an SMS (for example, TANK PUMP ON).



4. RESULTS

PIR Sensor: The farm's PIR (Passive Infrared) sensor looks for movement. It starts an event when it notices any movement LCD Display: The LCD display is a system output device that is attached to the system. The LCD display will read "Intruder detected" when the PIR sensor senses motion. This notifies the farm's owner or staff of the intruder's presence. Temperature Sensor: This device gauges the surrounding temperature in Celsius. Continuous temperature monitoring and display, together with other data, on the LCD screen. If the soil moisture sensor detects low moisture, the LCD display will read "Moisture low and tank pump on."This alerts the farmer that irrigation or watering of the soil is necessary. The water level in the tank is measured by an ultrasonic sensor. It measures the separation between the sensor and the water's surface using sound waves. Water Level Display on LCD: The LCD panel shows the ultrasonic sensor readings as "Water level in tank in inches." This gives information about the water level in the tank in real time. SMS Alerts: In addition to sending notifications to a registered cell phone number via the LCD display, the system is also able to send SMS alerts. Moisture SMS Alert: A text message with the subject "DRIP IRRIGATION PUMP ON" is delivered to the registered mobile number when the soil moisture sensor detects low moisture. The owner of the farm receives notice of the low moisture level and is prompted to activate the irrigation system. SMS Water Level Alert: An SMS with the subject "TANK PUMP ON" is sent to the registered mobile number if the ultrasonic sensor detects that there is in sufficient water in the tank. The farm owner is informed by this notice that they must either refill the tank or take other suitable action.

Figure1Temperaturevalue

Figure 2Moisture low and motor

Figure3PIR Detect monitor

5. CONCLUSION

A important part to play in the modern period is smart farming, a fast developing technology in the agricultural sector. With a predicted 9.5 billion people on the planet by 2040, the agriculture sector will need to adopt IoT technology to meet the growing demand for food and address issues like extreme weather, rising temperatures, and environmental effects of intensive farming practices. Numerous advantages, including increased crop yields, decreased waste, and better resource management, have already been demonstrated when IoT devices are used in agriculture. Farmers may gather and analyze real-time data using IoT technology like sensors, drones, and machine learning algorithms to make educateddecisionsandimprovetheirfarmingtechniques.Theagricultural sector will have more employment opportunities thanks to IoT, which will also aid in addressing significant economic and environmental problems. Smart agricultural practices can boost sustainability, lessen the impact on the environment, and increase food security for the expanding population. In conclusion, IoT technology has the ability to revolutionize the agricultural sector and assist farmers globally in growing more productive, healthier crops while protecting the environment for coming generations.

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