INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 05, Issue 07, July 2025, pp : 1351-1354
www.ijprems.com
editor@ijprems.com
e-ISSN : 2583-1062
Impact Factor : 7.001

SMART FARMING TECHNOLOGIES: A REVIEW OF IOT AND AWS INTEGRATION

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DOI: https://www.doi.org/10.58257/IJPREMS42960

ABSTRACT

Internet of Things (IoT) technology has brought a revolution in every field. It helps in making every device smart and intelligent. IoT refers to a network of things that makes a self-configuring network. Intelligent Smart Agriculture IoT-based devices is the need of the hour in agricultural domain. The objective of the proposed system is to develop an IoT-based Smart Agriculture System. Smart agriculture assists farmers in getting Live Data (Temperature, Humidity, and Soil Moisture) for efficient environment monitoring and better yield. The IoT-based Smart Agriculture System is integrated with NodeMCU. It has a Wi-Fi module which helps in obtaining live data feed. Live sensor data can be obtained online from efasal.herokaupp.com. This paper gives an insight to introduction to IoT, role of IoT in agricultural domain, emerging wireless technologies of IoT, architectures, and applications of IoT.

Keywords IoT· Smart Agriculture, Humidity· , Temperature·, Soil Moisture· , NodeMCU.

1. INTRODUCTION

Smart Agriculture model is a real-time monitoring system. It monitors the soil properties like temperature, humidity, and soil moisture etc. It is possible to control many operations of the field remotely from anywhere, anytime by IoT. It offers a futuristic way of life in which an individual gets to control his electronic devices using a smartphone. And it also offers efficient use of energy. It is applied in all areas of industry, including smart agriculture, smart parking, smart building environmental monitoring, healthcare transportation, and many more.

2. LITERATURE SURVEY

In the existing system of agriculture, the crops are being monitored with the help of Arduino boards and GSM technology [1]-[8] wherein Arduino boards act as a microcontroller but not as a server. Hence to overcome this, latest Arduino Nano boards are included in NodeMCU which acts as controller as well as server. It offers cheaper solution and multiple platforms like laptop, desktop and smart phones to control the agricultural system.

3. PROBLEM STATEMENT

To provide efficient decision support system using wireless sensor network which handles different activities of the farm and gives useful information related to the farm like soil moisture, Temperature, and Humidity.

In India weather conditions are not favorable for farming. Hence monitoring environmental conditions is very much required. Also, smart irrigation is very much essential to conserve water. Figure 1. Depicts the smart farming.

4. PROBLEM DEFINITION

The main objective of the proposed system is to monitor temperature, humidity and soil moisture content and automate the farming activities.

5. PROPOSED SYSTEM

The proposed system aims to automate the farming activities there by reducing the human intervention and assuring better yield and crop quality. NodeMCU is used to fetch the live environmental data and monitor the same.

Figure.1 Smart Farming

NodeMCU acts as a mini system to control the farming activities from anywhere with the help of smart phone and AWS cloud services. In figure 2. The various components of smart agriculture model are shown.

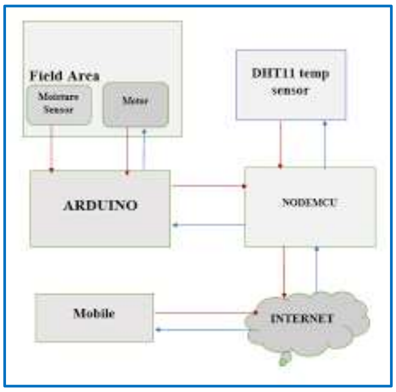

Figure:2 Block Diagram of Smart Agriculture Model

6. IMPLEMENTATION

NodeMCU: NodeMCU is an open-source IoT platform. it includes firmware that runs on the ESP8266 Wi-Fi SoC from Expressive Systems and hardware that is based on the ESP-12 module.

Figure 3. Various sensors and actuators used in smart farming

The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. The programming code is being written for the ESP8266 Wi-Fi chip using Arduino IDE, for which installation of the ESP8266 library is required. NodeMCU is as shown in figure 3.

DHT11: The DHT11 is a temperature and humidity sensor. DHT11 can be interfaced with any microcontroller like Arduino, Raspberry Pi, NodeMCU, etc. DHT11 is a low-cost humidity & temperature sensor which provides high reliability and long-term stability. Figure 3. Shows DHT 11 sensor.

DHT11 sensor can measure a humidity value in the range of 20-90% of relative humidity (RH) and Temperature in the range of 0-500^{0}C.

MOISTURE SENSOR:

Soil moisture sensor shown in figure 3 measures the water content in the soil. It uses the property of the electrical resistance of the soil. The relationship between the measured property and soil moisture is calibrated and it may vary depending on environmental factors such as temperature, soil type, or electric conductivity. Here, It is used to sense the moisture in the field and transfer it to the microcontroller to take the controlling action of switching the water pump ON/OFF.

RELAY MODULE: A relay shown in figure 3 is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

MOTOR: It is a micro submersible pump that works on dc 3-6v with cost-efficient and portable. It can take around 120 liters for every hour with extremely low current consumption. The water level should be high, if the motor is used without water it may harm the parts of this device due to overheating. There are many applications such as controlled fountain water flow, hydroponic systems, and controlled garden watering systems. Motor is shown in figure 3.

7. CLOUD SERVER

7.1 AWS CLOUD: A reliable, scalable, and secure place for our data. AWS offers a complete range of services to store, access, govern, and analyze data to reduce cost, increase agility, and accelerate innovation.

AWS cloud is connected to NodeMCU as shown in figure 4 and collects the sensor data from NodeMCU and stores them in AWS DynamoDB. Then the data is sent to the website or Mobile for end users.

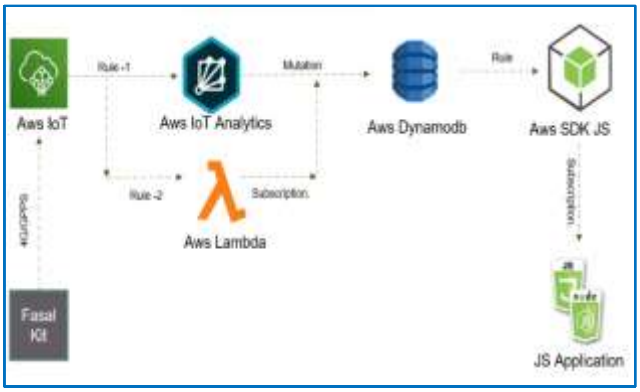

Figure 4: AWS Cloud Server

8. EXPERIMENTAL RESULT

The experimental setup of smart agriculture monitoring system is as shown in figure 5. The setup contains Microcontroller that is NodeMCU and sensors like soil moisture and DHT11. The Motor is connected through a relay. NodeMCU fetches live temperature, humidity, soil moisture and sends the sensor information to the server using ESP8266 Wi-Fi module.

Then the sensor data is read by the NodeMCU. Later it is sent to the cloud. When the soil moisture reaches the value below threshold value, then it turns on the motor with the help of relay.

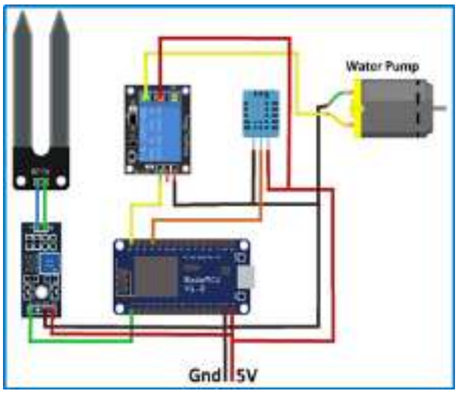

Figure 5: Hardware Setup

9. CONCLUSION AND FUTURE SCOPE

CONCLUSION

The proposed system makes use of IoT in agricultural domain. It helps to automate the farming activities with less or no human intervention. Also the crop quality can be improved by monitoring the live temperature, humidity and soil moisture levels. AWS Cloud helps in the real-time sampling of the soil and hence the data acquired can be further used for analyzing the crop.

Soil moisture, temperature, and humidity of the environment are monitored for various days at different times of the day. Data on the cloud also helps the agriculturists in improving the yield, evaluating the amount of manures, illness in the fields. This system is cost-effective and feasible. It also focuses on optimizing the use of water resources which combats issues like water scarcity and ensures sustainability. This model focuses on the utilization of IoT in agriculture and the solutions are proposed to improve farming methods, increased productivity and lead to effective use of limited resources.

FUTURE SCOPE

The future scope of this work is to include rain sensor and pH level sensor to improve the crop quality and better yield.

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