IOT - Based Smart Farming

Moiz Shabbir Kharodwala[1], Abhay Pratap Singh Sengar[2], Sarthak Mittal[3], Shant Rakshit[4]

[1,2,3,4] *School of Electrical Engineering, Vit University, Vellore, India*

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Abstract – *In India Agriculture is considered as the largest source of livelihood. Being a country with the second largest population of 1.3 billion, and nearly 70 percent of its rural resident rely on agriculture as their primary source income, in which 82 percent comprises of the farmers being small and marginal. Issues concerning agriculture have been always hindering the development of the country. The Internet of Things (IoT) has revolutionized every element of the average person's life by making things simpler and affordable. Machine advancements in the context of adaptable Smart Farming IoT are continually changing the substance of horticultural development by improving it, making it more inexpensive, and reducing waste. Environmental measurements and water management are considered to be the two of most important deciding factors for the growth of the any kind of crops. Modern horticulture can be influenced by a combination of traditional methods and advanced technologies such as the Internet of Things and the Wireless Network. Wireless Network collects data from a variety of sources and decides on its premises.*

Key Words: **—Internet of Things (IoT), Smart Farming, Wireless connection, Sensor Networks, Agricultural, NodeMCU**

1. INTRODUCTION

The increment demand of water daily has created the huge difference in the supply and demand of the water which has significantly resultant in the drought in semi-arid location.[1] Due to the scarcity of the low quality of the water is used for the purpose of irrigation which eventually affect the total production the crop. The water requirement for the for irrigating the one hectare of the rice field is equivalent to the fulling therequirement of the 100 families for the two years.[2]

An irrigation system takes care of watering the crop based on the readings taken from various sensors. This system helps in reducing the wastage of water used inirrigation on a day-to-day basis. The project monitors the farm or greenhouse and based upon the readings ofdifferent kinds of sensors like temperature, humidity, soil moisture, UV, IR, soil Nutrients and displays types of messages on the serial monitor about the present conditions so that the farmer can take quick action.

This will increase the quantity and quality of the crops by properly monitoring the various present conditions. Live data for different parameters can be seen on Laptops and Smartphones. Multiple sensors are interfaced with the microcontroller to keep an continues check on the real time data. Initially the sensors like temperature, moisture sensors, and light intensity. The temperature-humidity sensor will sense the temperature and humidity around the atmosphere and send it to the microcontroller. The moisture sensorsenses the moisture content in the soil and sends the moisture level of the soil to the microcontroller. In the control section, the received data is verified with the threshold values. If the data exceeds the threshold value the relay turns ON to start the motor and lights. This data is also stored graphically on a local host.

2. CHALLENGES AND IMPEDIMENTS OF IoT

2.1 Real time Monitoring

The IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at a very low cost so that live monitoringcan be done.

2.2 Reducing the water wastage

Human draw much more amount of water to irrigate theirfield which is even present on their geographical location. Hence, the smart irrigation machine can be installed in the field to address the problem of excessive water waste the smart farming machine

2.3 Approach to solve the problem

The project monitors the farm or greenhouse and is based upon the readings of different kinds of sensors like temperature, humidity, soil moisture, UV, IR, and soil nutrients conditions so that the farmer can take quick action. This will increase the quantity and quality of the crops by properly monitoring the various present conditions. Live data for different parameters can be seen on laptops and Smart-Phones. It makes use of sensor networks for noting the soil properties and environmental factors continuously.

Initially, the sensors like temperature, moisture sensor, and LDR sensor are connected to the microcontroller where it is placed in a field of agriculture.

The temperature-humidity sensor will sense the temperature and humidity around the atmosphere and send it to the microcontroller. The moisture sensor senses the moisture content in the soil and sends the moisture level of the soil to the microcontroller. In the control section, the received data is verified with the threshold values. If the data exceeds the threshold value the required output is received (e.g., turning onthe motor and lights).

3. METHODLOGY

3.1 Existing system

Agribusiness is the backbone of our country. Farmers had no notion of how to increase their harvests in thepast. They had little understanding of moisture, water quality, and, in especially, the farmers' ideal atmospheric conditions. They utilize pesticides that are based on specific suspicions that hurt a negative impacton yield if the speculation is incorrect. The penultimatestep of reaping, which is dependent on the farmer, is necessary for creation.

3.1.1 Drawbacks of the existing machine

The Productivity of the existing machine is not good and can be far better and it is unable to predict weather patterns due to the slow development of contamination and other factors

3.2 Proposed system

To encourage harvest creation, we should use innovation that monitors crop quality and makes recommendations on the farmers' behalf. A remote sensor network is a collection of sensors that collect data on plant conditions and environmental changes. This information is communicated from the organization to the farmer or assets, who then begin the maintenance work. Different obstacles to communication should be overcome by further improving low-power technology and making the userinterface more user-friendly

3.3 Flow of work

We initialize the parameters and variables and start taking values in said variables from the sensors, we then compare those values with preset thresholds and also send data through the web to be displayed and stored for later use. Once the data passes a set threshold we do certain actions, such as starting the water pump if water levels are too low.

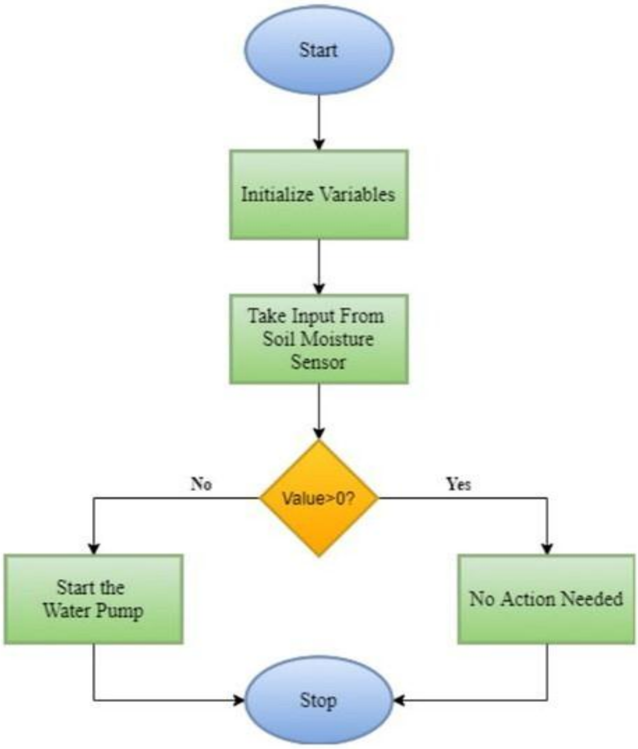

Fig -1: Flow of the machine

We carefully monitor the moisture in the soil to turn onand off the motor when required. The motor pump turns ON when the moisture level decreases way below efficient moisture levels, we considered for efficient growth the moisture should be around 40-70%.

We further monitor the temperature and humidity of the atmosphere and consider that we require an optimal environment to have temperatures in the range of 25-30°C, and humidity in the range of 60-70%.If the temperature rises too much or the humidity decreases then the motor will turn ON to maintain the range. Finally, we monitor the status of sunlight (Lightintensity in the environment), once the light intensitydecreases or if it turns night time then the artificial lights will turn ON so that the crops keep growing even without natural sunlight.

4. BLOCK DIAGRAM

The NodeMCU (ESP8266) is an open-source hardware development environment with all the essential features like RAM, CPU, and an inbuilt Wi-fi Module which is used to establish the wireless connection with the IoT platform to monitor the data.

Soil moisture, LDR, and DHT11 sensors are responsible for collecting the live data from the environment which is then sent to the microcontroller for further operations to perform.

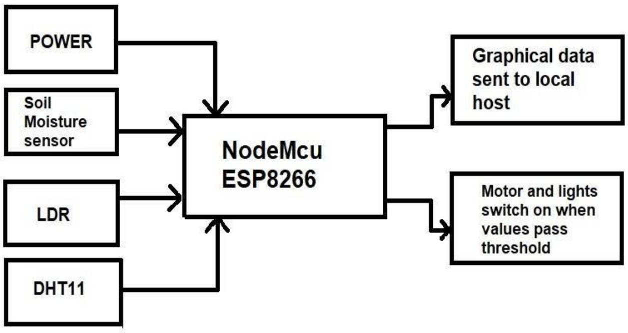

Fig -2: Block diagram of the system

Out of the three sensors; the LDR and Soil moisture are analog and the dht11 is a digital sensor. The LDR and dht11 sensor uses the D5 and D4 pin of the NodeMCU respectively while the soil moisture sensor is interfaced with A0 pin.

5. IMPLEMENTATION

Input data Pin

- A0- responsible to collecting the moisture content.
- D4- collects the temp and humidity value.
- D5- used for sensing the reading from LDR sensor.

Initialization

- Serial.begin() - initiate the data transfer rate with hardware
- pinMODE(Pin_variable, function) - used to configure pin depending on their function.
- Wifi.begin – initiate the wi-fi module.
- server.on ("/", HTTP_GET, (AsyncWebServerRequest * request) {request-> send (SPIFFS, "/file.html");}) – Route the webpage.

Function

- digitalRead – used to read the digital value from the sensor.
- AnalogRead – read the analog value
- SerialPrint – display the analog and value on COM screen.

We have implemented the software of our smart farming machine in Arduino IDE which contains all the function and the command which are for the operating the machine.

We have built a local server to represent the environmental data graphically using HTML+JS.

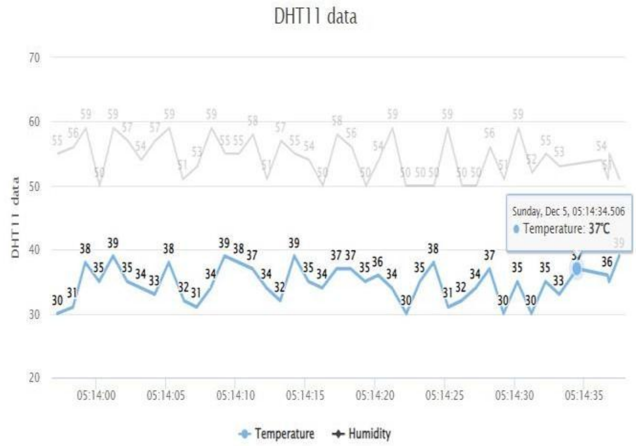

Fig -3: DHT11 data received form the sensor

The entire data is sent through NodeMCU using Asynchronous servers which request and handle multiple connections at the same time at high speeds, which makes it extremely reliable for the farm's environmental data.

Fig -4 : Moisture value of the soil

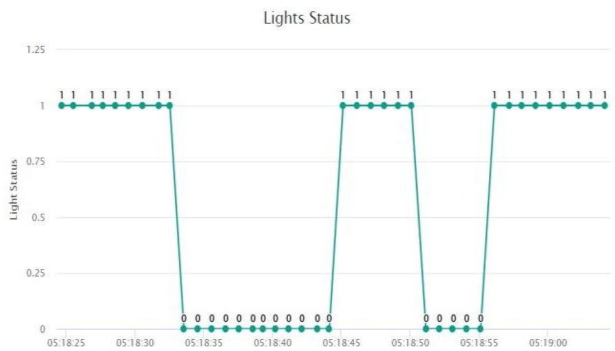

Fig -5 : LDR sensor output

6. CONCLUSIONS

The objective of the paper is to modernize the methods of farming with easy and economical cropping. With the help of IoT, users can analyze the data and understand the variations in ambient temperature, humidity, sunlight of surrounding, and moisturecontent in the soil from any part of the planet. In metropolitan and rural regions, landscapes and private yards are utilizing soil moisture sensors to interface with a water system regulator. Interfacing a soil moisture sensor with a straightforward water system clock will change over it into a "smart" water system regulator that forestalls water system cycles when the soil is wet, for example following a recent rainfall event. This machine will minimize the wastage of water by predicting the moisture level and notifying the user of the exact amount of water to be sprinkled to maintain the optimum level of moisture in the soil.

REFERENCES

[1] Balaji Bhanu, Raghava Rao, J.V.N. Ramesh, and Mohammed Ali Hussain, "Agriculture Field Monitoring and Analysis using Wireless Sensor Networks for Improving Crop Production", 2014 Eleventh International Conference on Wireless and Optical Communications Networks (WOCN).

[2] LIU Dan, Cao Xin, Huang Chongwei, JI Liang Liang, "Intelligent agent greenhouse environment monitoring system based on IOT technology",2015 International Conference on Intelligent Transportation, Big Data & Smart City

[3] Joseph Haule, Kisangiri Michael, "Deployment of wireless sensor networks (WSN) in automated irrigation management and scheduling systems: a review",Science, Computing and Telecommunications (PACT), 2014, Pan African Conference.

[4] S. Vijayakumar, J. Nelson Rosario, "Preliminary Design for Crop Monitoring Involving Water and Fertilizer Conservation Using Wireless Sensor Networks", Communication Software and Networks (ICCSN),2011 IEEE 3rd International Conference.

[5] G. Nisha, J.Megala, "Wireless Sensor Network Based Automated Irrigation and Crop Field Monitoring System '', 2014 Sixth International Conference on Advanced Computing (IcoAC).

[6] Eniscuola. 2022. Water waste in agriculture –Eniscuola. [online] Available at:\https://www.eniscuola.net/en/argomento/wat er-knowledge/uses/water-waste-in-agriculture/

[7] Fao.org. 2022. India at a glance | FAO inIndia | Food and Agriculture Organization of the United Nations. [online]Available at: https://www.fao.org/india/fao-in-india/india-at-a-glance/en/#:~:text=India%20is%20the%20world's%20largest,poultry%2C%20livestock%20and%20plantation%20crops.