Smart Irrigation System

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Abstract- *India holds the record for the second-largest agricultural land within the world, drip irrigation may be a method of controlled irrigation during which water is slowly delivered to the basis system of multiple plants. The water system necessity for any harvest is that the measure of water that ought to be applied to satisfy the harvest's evapotranspiration. Penman Monteith equation is employed to compute the particular evapotranspiration. The longer the crop growth period the upper is that the water requirement. Input parameters of the evapotranspiration included temperature, heat radiation, atmosphere pressure and wind speed therefore month after sowing a crop is additionally a crucial parameter taken into consideration. The project uses microcontroller which controls the water system within the field to be irrigated. Sensors like Temperature, humidity, soil is employed to live all the parameters for irrigating the soil.*

Keywords- Humidity Sensor, Temperature Sensor, Penman monteith equation.

I. INTRODUCTION

This India holds the record for the second-largest agricultural land within the World, drip irrigation may be a method of controlled irrigation during which water is slowly delivered to the basis system of multiple plants. The water system necessity for any harvest is that the measure of water that ought to be applied to satisfy the harvest's evapotranspiration. Penman Monteith equation is employed to compute the particular evapotranspiration. The longer the crop growth period the upper is that the water requirement. Input parameters of the evapotranspiration included temperature, heat radiation, atmosphere pressure and wind speed therefore month after sowing a crop is additionally a crucial parameter taken into consideration, Microcontroller was used because the IoT end device connecting sensors.

Agriculture is the major source of income for the largest population in India. However, use of technologies and its usability have to be grown still and cultivate for agro culture sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agro vendor's information to farmers. Based on the survey it is observed that agriculture contributes 27% to GDP, and Provides employment to 70% of Indian population. IoT is changing the agriculture domain and empowering farmers to fight with the huge difficulties they face. The agriculture must overcome expanding water deficiencies, restricted availability of lands, while meeting the expanding consumption needs of a world population. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production.

Agriculture is the backbone of Indian Economy. In today's world, as we see rapid growth in global population, agriculture becomes more important to meet the needs of the human race. However, agriculture requires irrigation and with every year we have more water consumption than rainfall, it becomes critical for growers to find ways to conserve water while still achieving the highest yield. But in the present era, the farmers have been using irrigation technique through the manual control in which they irrigate the land at the regular interval.

According to statistics, agriculture uses 85% of available freshwater resources worldwide, and this percentage will continue to be dominant in water consumption because of population growth and increased food demand. There is an urgent need to create strategies based on science and technology for sustainable use of water, including technical, agronomic, managerial and institutional improvements. Agricultural irrigation based on Internet technology is based on crop water requirement rules. By using Internet technology and sensor network technology we can control water wastage and to maximize the scientific technologies in irrigation methods. Hence it can greatly improve the utilization of water and can increase water productivity.

The Internet of Things (IoT) is concerned with interconnecting communicating objects that are installed at different locations that are possibly distant from each other. Internet of Things (IoT) is a type of network technology, which senses the information from different sensors and makes anything to join the Internet to exchange information. It can also be used to modify the status of the device. The central processing unit will also include communication device to receive data from the sensors and to be relayed to the user's

device. This will be done using a higher communication device such as a Wi-Fi module. The data processed by the central module is converted to meaningful data and relayed to the user. Nowadays water scarcity is a big concern for farming. This project helps the farmers to irrigate the farmland in an efficient manner with automated irrigation system based on soil moisture.

The proposed system has been designed to overcome the unnecessary water flow into the agricultural lands. Temperature, moisture and humidity readings are continuously monitored by using temperature, moisture and humidity sensor and send these values to the assigned IP address. Once the soil moisture values are exceeded the particular limit then the relay, which is connected to the microcontroller controls the motor. All the data will be recorded in the online database Thingspeak from which the farmer can monitor the data.

II. LITRATURE SURVEY

There are numbers of research papers that are related to Automated IoT based agriculture systems, there are different techniques which are reviewed to identify the various approaches to control the irrigation system

In the paper presented by Shikha Patel describes, Irrigation is the application of water to the land or soil. It is an essential in all agriculture cropping systems. Agriculture requires usage of plenty of water. But irrigation systems are available, but most of them requires a lot of power that makes it difficult for farmers to gain information. To overcome this issue, wireless sensor network and ZigBee technology is used. A WSN is a distributed network of tiny, lightweight wireless nodes that are implemented with sensors which provide real-time monitoring and controlling solutions. Proposed, the ARM based irrigation system for various soil sensors for N, K measurement, humidity, soil moisture, soil pH, temperature, soil. [1]

In the paper presented by Devika CM, Karthika Bose, Vijaylekshmy S the project team wants to deal with present gen. problem like food and water scarcity. They have observed that wastage of water is so much in irrigation due to traditional irrigation methods so the team tends to develop and automated irrigation system for adequate water supply in the land. The project senses the need of water in particular area and provide irrigation there. Their system uses AtMega328 microcontroller, it continuously senses the need of water/irrigation on fixed interval as programmed so when the soil is dry it starts pumping the water and when is moist its automatically turned off.[2]

In paper presented by KK Namala, Krishna Kanth Prabhu AV, Anushree Math, Ashwini Kumari, Supraja Kulkarni implements smart irrigation system for controlling irrigation and water supply. It provides water for crops and soil automatically where needed without human intervention. The project aims to reduce the human inference which leads cost effectiveness and manpower reduction. The prototype proposes Raspberry Pi as the Microprocessor as it is more compact, open source and more sustainable. The project can demonstrate as it measures the moisture in the soil and open the valve accordingly. [3]

In the paper proposed by G Nithin Reddy, Mohammad Danish, Yadala Syam Babu a project that is based on automatic irrigation and soil testing for crop laying. The team finds out present day mostly farmers are using traditional method for irrigation and testing of soil quality where while supplying water to the land cause water loss and testing soil takes most of their time so they proposed a system which fulfil the water requirement of the soil. And also, if soil testing is needed to be done for the crop it also shows the details of important nutrients required.[4]

In this a system is implemented by Ateeq Ur Rehman, Rao Muhammad Asif, Rizwan Tariq, Ahmed Javed with the help of GSM. The main aim of the system is to overcome the banes of the traditional time-consuming irrigation system which also led to water wastage and takes manpower. The work is done by assistance of soil moisture sensor, Temperature and Humidity Sensor are also used in this in order to make the model future proof. Their main key feature is that they are using GSM module which makes the system wireless.

The Electricity required is provided by solar cells so that project should face loadshedding. The moisture in soil is sensed by water sensor even it sensed the climate temperature for appropriate water supply to the crop.[5]

This proposed system by Vaishali Puranik, Sharmila, Ankit Ranjan, Anamika Kumari shows us the analyses of various parameters used in irrigation system through all these years. The system consists of various components such as soil, humidity and temperature and also Arduino UNO. The paper also discusses about Precision generation-tofarm agriculture providing high quality crops.[6]

The paper presented by Karlisa Priandana, Ramadina Al-Fatihah Wahyu states here the importance of water in irrigation. In this project the team had implemented an automatic plant irrigation system. The system consists of solenoid valves and moisture sensor and their amount set

according to number of plants. Here the irrigation is performed precisely for each plant on based of its water content. They tested the prototype on different variety of soil and outcome was a success of each type of soil. [7]

The paper presented by G Alex, Dr.M. Janakiranimathi is based on using solar energy for irrigation system. They made solar based automated irrigation system. Their main aim is to build a low-cost project with the help of microcontroller. The protype measure parameter like temperature and soil moisture. On paper they had implemented their project with new type of solar panels i.e., Spin cell which generates more current than the traditional flat panels. [8]

In this paper presented by Kriti Taneja, Sanmeet Bhatia analysed the current situation of irrigation. They observed that it cause wastage of water, manpower and sometimes harmful for crops health due to excessive water retention in the land so the proposed a system a Irrigation system with help of ARDUINO and moisture detector to track the water level of the soil and provide the water supply to the crops, The even demonstrated with an Experiment by taking two pots wheat grass one with dry soil and other with moist soil to test the result of the protype , They noticed with dry soil the prototype starts the water supply and the result were vice versa for moist pot. [9]

The presented by Zhang Feng 'Research on water-saving irrigation automatic control system based in Internet of Things' the project is based on irrigation system based on IOT. Their aim to improve water efficiency, reduce cost and manpower. This paper proposed implementing a wireless system and IoT for automated irrigation. The model consists of variety of sensors smart network thus enhancing the overall system and tracking. levels. The final analysis of the network in the Internet based on the agricultural plants of farmland watersaving irrigation system integrated approach. GSM technology is also used for wireless system which provides the moisture data of soil. [10]

III. PROPOSED SYSTEM

The objective is to make use of wireless sensor network and communication technologies, we are using ESP32 which has its own wireless module.

In our project we are trying to implement multi-node mesh network in order to monitor multiple soil parameters.

3.1 System Requirements

This section will provide the user the required specification of the hardware and software components on which the proposed system is to be implemented.

3.1.1 Hardware Requirements

This subsection will provide the minimum requirements that must be fulfilled by the hardware components. The hardware requirements are as follows: -

- ESP82
- ESP8266ex
- Soil Moisture Sensor
- pH Probe
- Temperature Humidity Sensor.

3.1.2 Software Requirements

For software as we are connecting all the devices together to work, we and to store the data in the database.

- ThingSpeak Database
- C programming

IV. WORKING

Monitoring soil parameters becomes important in order to get maximum efficiency in crops. Soil erodes over the time which makes soil not-fertile. In order to maintain good soil fertility, the monitoring soil parameters must be done. In our project we are trying to implement the multi-node mesh network in order to monitor multiple soil parameters. Although measuring soil parameters at particular place of land is not sufficient hence, we are using a wireless sensor network technology in order to monitor the parameters from various parts of field. A mesh networking using a Wi-Fi connectivity is created with the help of ESP8266 and ES32 based Wi-Fi chipsets. Each node measures some different parameters and send back the collected information to the station node. Then station node processes the data and send that data to the cloud for further monitoring/ processing. Also master node can also sends some information regarding turning on/off the pump sets in order to maintain the soil parameters.

Each ESP8266 Node MCU will collect the particular data of soil and process it, processed data is then converted and sent to master node (ESP32) in json format. In our project for demonstration purpose, we are using only two nodes in Ad-HOC network configuration. We are using a painless mesh configuration library written in C++ to manage the Ad-HOC network parameters.

The collected data from all the sensors node is being processed by the esp32 Wi-Fi chip and then sent to the cloud dashboard of ThingSpeaks using the TCP/IP protocol and different API keys for security.

In smart Irrigation there is one main node which is responsible for taking decisions based on the Input it receives and what it is told to do in the code. Another part of this is the measurement nodes. These nodes are basically inter-connected modules which individually carry-out measurement in field, in this case, these individual nodes gather soil moisture content data and upload it to a local cloud. The main node then acquires this data and then compares it to the set condition. This set condition is regularly compared with measured value and then decides what to perform. In this case, if the soil moisture content falls below certain level, the controller has to turn on the water pump to supply water in the farm.

This pump will be ON for a short period of time and will turn OFF. When the pump is turned OFF, the controller request soil moisture level measurement again and if its low again, the pump will again turn ON for small time until the set moisture level is reached.

This type of control system is called ON – OFF control scheme and usually runs on Trial-and-Error situation. Its main decision making is based on If-Else statement and is easier to alter. The data of nodes can be monitored manually instead of a microcontroller. Here, the job of the microcontroller is to acquire the data from the measurement nodes and display them on an interface. The interface can be either an LCD/OLED Display, a Seven-Segment Display or it can be an IoT website which can interface directly with the individual nodes.

The Project that this system works on is a Level 4 IoT System with multiple end nodes performing local analysis [meaning performing soil measurement] and uploading the data on the cloud. Here in this project, we have utilized an ESP32 Microcontroller which has integrated WiFi capabilities.

This ESP32 Module will acquire the Soil Moisture Level, Ambient Temperature and Humidity Values and will turn ON or OFF its respective Pump. The information regarding this whole process will be uploaded on the cloud. Like this, there will be multiple units in the field managing their own little segment and in turn managing a bigger farm. All the data acquired from the nodes will then be displayed and also be controlled from the cloud itself. It will also be able to set threshold without going into the field and entering the threshold for the Pump Turn ON and Turn OFF.

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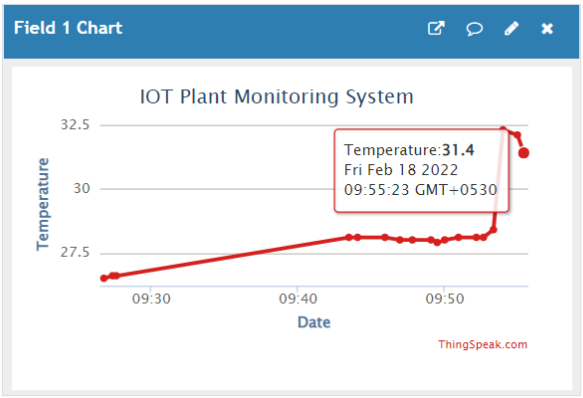
V. RESULTS

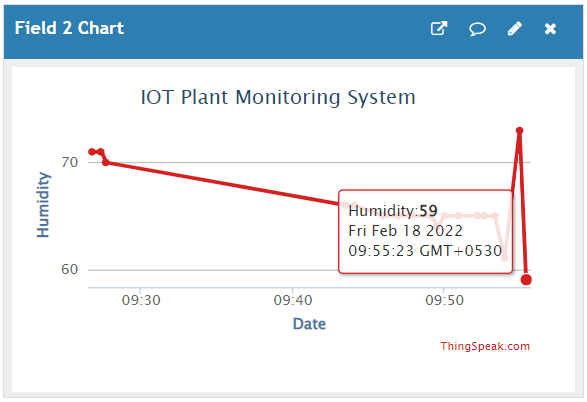
In proposed system we have two nodes ESP1 and ESP2, ESP1 is connected with the soil mositure sensor and water pump and ESP2 is connected with the temperature sensor and pH sensor. This all sensor are installed in the soil to measure all the parameters.

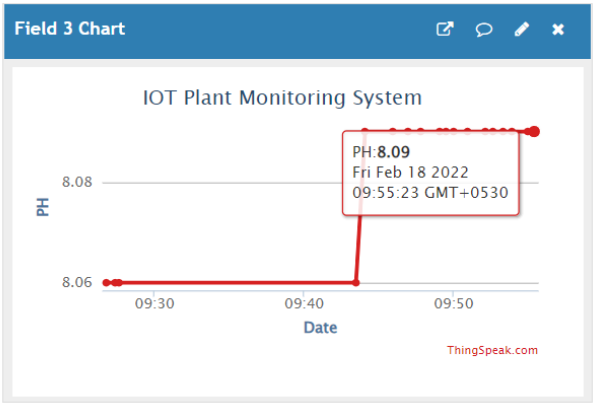
These nodes are connected with ESP32 which collects all the data using WIFI from all the nodes. We have set conditions for all the sensors and the main node compares all the values which we are getting with the set conditions and, if the soil moisture content falls below certain level, the controller has to turn on the water pump to supply water in the farm.

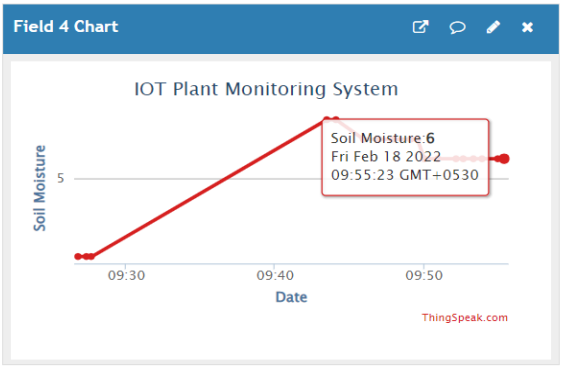
This pump will be ON for a short period of time and will turn OFF. When the pump is turned OFF, the controller request soil moisture level measurement again and if its low again, the pump will again turn ON for small time until the set moisture level is reached.

All this data that we get from all the node is sent to the cloud server that we have on Thingspeak which records every sensor data and saves it, it also shows us the state of the pump. We can see it below charts









VI. CONCLUSION

The application of agriculture networking technology is need of the modern agricultural development, but also an important symbol of the future level of agricultural development; it will be the future direction of agricultural development. After building the agricultural water irrigation system hardware and analysing and researching the network hierarchy features, functionality and the corresponding software architecture of precision agriculture water irrigation systems, actually applying the internet of things to the highly effective and safe agricultural production has a significant impact on ensuring the efficient use of water resources as well as ensuring the efficiency and stability of the agricultural production. With more advancement in the field of IoT expected in the coming years, these systems can be more efficient, much faster and less costly. In the Future, this system can be made as an intelligent system, where in the system predicts user actions, rainfall pattern, time to harvest, animal intruder in the field and communicating the information through advanced technology like IoT can be implemented so that agricultural system can be made independent of human operation and in turn quality and huge quantity yield can be obtained.

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