Review on Controlling and Monitoring of Irrigation System in IOT based smart Agriculture

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ABSTRACT

Internet of things is a unique worldwide network that can sense and interact with the environment by means of the internet for the communication and interaction between user and other system. Agriculture plays an important role in the growth of a country like India. As population increases day by day, there is a demand of more food. To get good production in fields, irrigation is necessary for healthy crop. Irrigation is also necessary for the soaking up of nutrients by plants from the soil and improves food security. In our country, India many farmers still use the traditional methods of farming. In India most of the irrigation systems are manually operated by farmers. Farmer suffers from irrigation problem due to improper water utilization, erosion and cutting of cannels. These outdated techniques can be replaced with automated techniques using IOT. In IOT based smart agriculture a system is built for controlling and monitoring the crop fields with the help of sensors and automating the irrigation system. Smart agriculture includes smart irrigation based on accurate real time field data like moisture in soil, environment temperature and water level. This system is used to avoid the direct human intervention while implementing the low cost sensors and Internet of things (IOT).

1. INTRODUCTION

In India about 60-70% of population depends upon farming and one third of the nation's capital comes from agriculture. But now people flew from rural to urban there is obstruction in agriculture. To overcome this problem we prefer smart agriculture techniques using Internet Of Things (IOT). Smart agriculture uses modern technology to increase the quality and quantity of agricultural product. IOT enables the objects to be sensed and controlled remotely. Smart agriculture uses modern technology to increase the quality and quantity of agricultural product. Recently skilled migrants all over India and also from outside India had returned to their natives during Pandemic Covid-19 had chosen farming as their profession. These skilled migrants adopt smart agriculture as it take lesser time than traditional farming. IOT in controlling and monitoring system helps to know about water level, moisture in soil, temperature etc....IOT based irrigation system help to the farmer that supply water to crop at right time and amount. This paper shows controlling and monitoring of irrigation system by measuring soil

moisture. Soil moisture can be measured by deploying soil moisture sensor with Arduino Uno. The moisture measuring System measures the moisture level and periodically stores the result. The contents of the memory are accessed when ever required. The sensed values are validated and sent to the WI-FI module and from WI-FI module the validated data are sent to the farmer's mobile. The farmers are also notified by SMS. When moister level is low, it would be altered by the system.

Key words: Arduino , ESP8266, Humidity & Temperature Sensor, Internet of Things, Smart Irrigation, Soil moisture sensor, Water pump.

2.LITERATURE REVIEW

This paper focuses on monitoring agriculture by accessing of temperature, soil moisture and relative humidity information by using DHT11 and transfers data to cloud server for remote access [1] .

This paper aims to collect fields data from relative sensors and that data/information sends to the server using Li-Fi technology and Raspberry pi [2].

This paper built a system that monitor crop-field using sensors (Temperature, Humidity and Soil moisture) and to automate the irrigation system. The data from sensors are sent to the Thing speak cloud[3].
This paper includes sensors such as temperature, humidity, soil moisture and rain detector for collecting the field data with Arduino uno, ESP8266 (Wi-Fi module)[4].

This paper includes in the construction of smart grid which is based on Internet of things and the design and implementation in some application links including wind power prediction, condition monitoring of overhead transmission lines, power monitoring, smart home and asset management are elaborated emphatically[5].

This paper includes the water flow controller, pH sensor, water level monitoring sensor in the pond and temperature and soil moisture sensors are used to get information through External Wi-Fi. Finally data has been sent as a notification through mobile . Based on the acquired value the proposed system calculates pH level , water level , temperature and Soil Moisture required for irrigation[6].

This paper highlighting features of wireless network sensors to connect multiple sensors data and display big-data through Thing speak channel software to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, temperature maintenance, humidity maintenance and weather reports. This development includes smart irrigation with smart control and smart decision based on accurate real time field data[7].

This paper highlights a system for measuring and monitoring soil moisture by linking low-cost soil moisture sensor with Node MCU. It also designed a cloud based platform , so that any users can be able to inspect soil moisture for their specific piece of land through their Smartphone[8].

This paper highlights the smart irrigation system that implements microcomputer, internet driver, water pipes and C++ programming language used with Virtuino for the design of the user interface [9].

This paper uses telegram app for communicating with the cultivators about various environmental factors continuously. This project is also consisting of solar power generation and rainwater harvesting as technology method is implemented along with crop safety [10].

This paper[11] highlights a technology in which a system can monitor the humidity, moisture level and can even detect motions. According to the data received from all the sensors the water pump, cutter and sprayer get automatically activated or deactivated. The methodology not only focuses on the farm but also takes care of the warehouse where all cultivated crops are being stored. The warehouse is embedded with various sensors which help also detect humidity and theft. Based on the humidity sensor reading heater or cooling fan is automatically turned on. Similarly if the motion sensor detects any theft then an alarm is turned on to notify the farmer.

The system in [12] proposed agriculture management system for receiving data about agricultural environment by using sensor network. The system collected sensors data about climate and soil. This system only monitor environment and soil parameters but did not observe irrigation process.

3.PROPOSED SYSTEM

In order to increase quality of crops, we must use technologies that analyze soil moisture, temperature and humidity content. The data is collected wirelessly through various sensors. Due to weather condition water level increases or decreases which is not good for crops. This system can be used in both small agricultural land and large farm also. The proposed system has been designed to watering the fields whenever necessary and also control unnecessary water flow into the field or crops.

Algorithm

Steps that system undergoes
Step-1 First code will be uploaded in Arduino board.

Step-2 The soil moisture sensors and DHT11 sensor are deployed in respective places which continuously send the activities or data to Arduino board.
Step-3 Submerge the motor in water container and motor outlet will be connected with it. Then power will be supplied to it. It also connected with Relay board . One should ensure that the water level should be higher than the motor.

Step-4 The soil moisture sensor detects the moisture content in the soil. DHT11 sensor senses the environment and calculates relative humidity.

Step-5 Water pump will receive the analyzed data from Arduino. When moisture of soil or humidity of environment reaches to its peak and all the requirements and data analyzed by Arduino are satisfied then buzzer will be turned on and Arduino micro controller switch on the water pump automatically.

Step-6 After watering en soil moisture sensor crossed the threshold value; motor will be turned off automatically.

BLOCK DIAGRAM
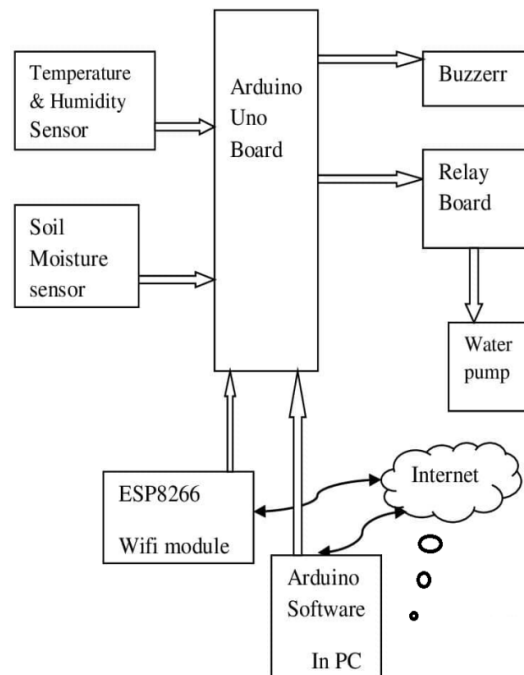
4.HARDWARE DESCRIPTION

A. Temperature Identifier:

This is a water-resistant temperature sensor .This sensor can dictate the temperature and humidity of environment discharge digital signal to data pin. As it is very small, it's not very effective in very large field. It can be used for small farm or for small area.
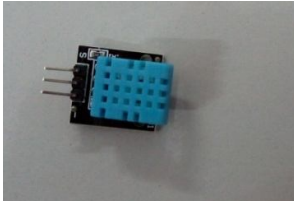
Fig –I   temperature & humidity sensor

B. Soil Moisture Measurement :

Water content of the soil can be measured by the soil moisture sensor. Capacitance is used by soil moisture sensor to measure the dielectric conductivity of the surrounding. If the soil is wet or moisture content is high motor will be turned OFF or it will not start for watering otherwise the motor will turn ON automatically.
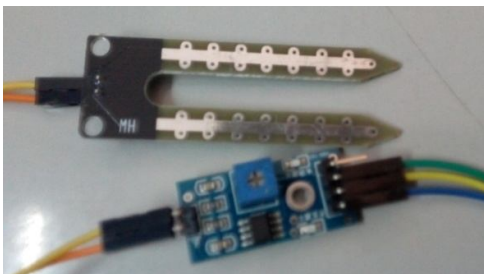
Fig-II   Soil Moisture sensor

C. Arduino Board:

Arduino Uno is a open source electronics component. Arduino contains microcontroller which is a physical programmable circuit board and IDE (Integrated Development Environment) that runs on a computer used to upload computer code to the Arduino board. We can send a set of instruction to the microcontroller on the Arduino board. Programming in C widely used for Arduino board. The main advantage is Programmer can write low number of codes.

Fig-III   Arduino Uno

D. Water Pump:

Micro dc 3v-6v submersible pump which can be operated from a 2.5 ~ 6V power supply. It can pick up 120 liters per hour with very low current consumption.

Fig-IV   Water pump

E. Relay Board:

This is also known as Relay module. The blue square component in the middle is known as Relay. The number of relays on the module indicates how many channels of a particular module support. The relay module is used to control the application by turn it ON or OFF.

Fig-V   Relay module

F. Buzzer:

A buzzer is used to give audio warning signal that motor is turn ON/OFF. It works on physio electric concept of creating a sound. It is used for very secure application.
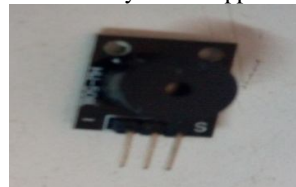
Fig-VI   **Buzzer**

G. ESP8266:

ESP8266 module is standalone wireless transceiver which can be used for IoT developments. It enables internet connectivity to embedded IOT applications. Arduino microcontroller needs to set off AT commands to communicate with the ESP8266 module. ESP8266 has a set of GPIO pins (General Purpose Input Output pins) that can be used to "control" external sensors.

Fig-VII ESP8266

Connections Of Sensors with Arduino Board

```
Esp8266 | Arduino    Buzzer         Relay
----------------    ----------     ---------
   RX   | RX        Datapin | 12    Signal  |13
   TX   | TX                        VCC    | 5V
  GND | GND                          GND   | GND
  RST | GND
  3V3  | 3V
  EN   | 3V
 GPIO 0 | None
 GPIO 2 | None


Humidity Sensor     Soil Moisture
--------------------  -------------------
signal | 2             G | 8
VCC   | 5V             Y | GND
-VE   | GND            B |3.3V
```

5.EXPERIMENTAL RESULT

In this paper a Smart Irrigation system is implemented using Arduino Uno to obtain high crops productivity which reduces human efforts. Many sensors combined with microcontroller of Arduino Board to collect the information. Actual values detected by the system are observed by the farmer and with his intervention irrigation ran automatically at his crop field. Board to collect the information. Actual values detected by the system are observed by the farmer and with his

intervention irrigation ran automatically at his crop field.

Before Watering

Table-I Soil Moisture, humidity& Temperature reading

Date	Soil Moisture value	Humidity value	Temperature value (°C)
16/6/2021	123	53.00	33.80
17/6/2021	141	66.00	31.30
18/6/2021	151	73.00	28.90
19/6/2021	170	61.00	32.00

After watering:-
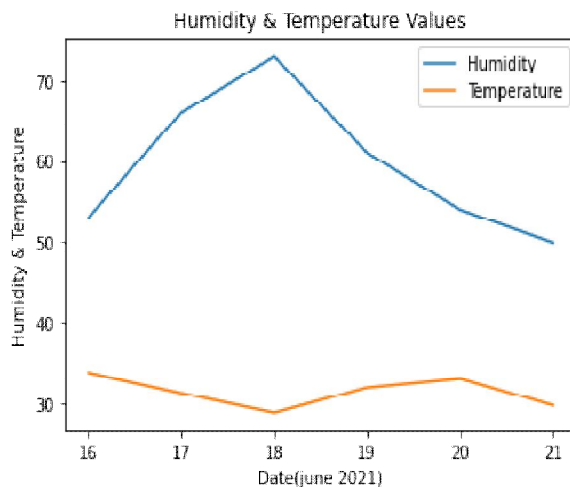
Table-II   Soil Moisture, humidity& Temperature reading

Date	Soil Moisture value	Humidity value	Temperature value (°C)
19/6/2021	107	61.00	32.00
20/6/2021	140	54.00	33.10
21/6/2021	154	50.00	29.80
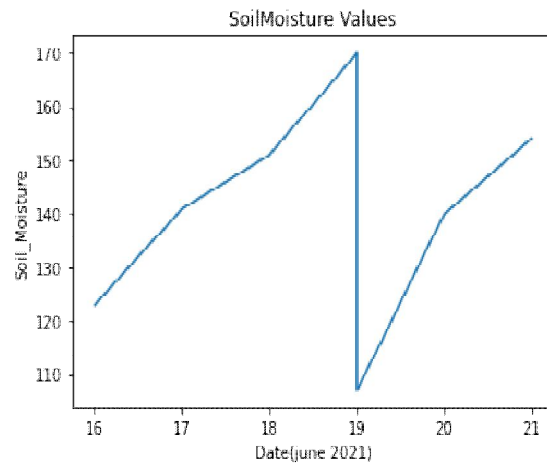
Fig-VIII Soil_Moisture data

Fig-IX   Humidity & Temperature data

Fig-X   Design prototype

6.CONCLUSION AND FUTURE WORK

This project is helpful for those farmers who do not have enough time for watering in time. The proposal of using IOT in agriculture is to perform in a smart and more efficient way.The collected data can be helpful when crops are planted in future. This system can improve the way of irrigation system in different region of our country. Sensors of different types are used to collect the information of environmental changes and this information is transmitted through network to the particular devices that initiates the corresponding actions. In future I would develop an android application through which the user can see the sensor data's and that application will also detect animal or human (thief) and turn siren ON and camera will capture it's video and send to user. So that user can aware about his farm's present condition at anytime from anywhere.

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