PREDICTION OF SOIL PARAMETERS IN AGRICULTURE USING IOT

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***Abstract*—This paper delineates a Smart Agriculture System that can analyze an agricultural environment and intervene to maintain its adequacy. According to our proposal the system monitors temperature level, soil pH level, humidity, soil moisture and water level using sensors and provide the efficient solution by analyzing the parameter values given by the sensors. Using IOT board, the sensor values are uploaded to the server. Prediction algorithm is used to provide accurate data, further it will help the farmers to take necessary actions for optimizing the irrigation process. The information can be viewed via server or mobile app. This Prediction of soil parameters in agricultural system is cost effective; the predicted information will be displayed and necessary solutions are provided in such a way that farmers can easily understand the data.**

Keywords: Soil parameters; IOT; Prediction algorithm.

I. INTRODUCTION

Agricultural land is a small area which have some resources and produce food, fiber, feed and many other desired products by the cultivation and irrigation process**.** Improper irrigation affects the plant growth and causes soil erosion and salt imbalance and waste of water .Thus it is very important for the farmers to maintain the fertility of the soil. This can be enhanced only by using the suitable method of irrigation for the soil. However, in the existing methods of irrigation and plant growth monitoring; human influence is needed. Therefore, the delay occurs in appropriate action at the correct time which will lead to heavy loss. Automated irrigation system monitors and maintains the desired soil moisture content via automatic watering. Microcontroller ATMEGA328P (arduino uno platform) is used to implement the control unit. The setup uses sensors which measure the soil parameters. The values which are obtained from the sensors enables the system to provide appropriate solutions to prevent problems which will occur during cultivation. IOT(Internet of things) provides a solution for most of the problem facing in agriculture.

II. RELATED WORKS

A. Sub-1 GHz Based Solar Powered Soil Moisture Sensing Network(2018)

In this, a novel solar powered system which creates an information grid for soil moisture content in particular areas of interest. They have designed a module for determining the soil moisture of a land. According to their proposal, the sensor used will be powered through a hybrid MPPT (Maximum PowerPoint Tracking) approach for the PV cells. The proposed system includes a cloud based system which will gather the moisture content data from the modules installed at different field locations, selected according to the range of the system. The obtained data is collected at a central location and uploaded to cloud, further it is processed to find the appropriate amount of water that should be provided to the land for better irrigation process. The soil moisture sensing system can be used on small fields by the farmers or on a larger scale by government agencies. The system gives the ground level visibility of how water is being used by the farmers.

B. IOT Based Monitoring System In Smart Agriculture (2017)Internet of Things (IoT)

This system aims at making use of evolving technology i.e. IoT, and Monitoring environmental factors to improve the yield of the efficient crops. The system includes monitoring temperature and humidity in agricultural field through sensors using CC3200 single chip. Camera is interfaced with CC3200 single chip to capture images and pictures are sent through MMS to farmers mobile.

C. IOT Based Intelligent Agriculture Field Monitoring System(2018)

This system proposes a smart farming method based on Internet of Things (IoT) to deal with the adverse situations. The smart farming can be adopted which offer high precision crop control, collection of useful data and automated farming technique. This work presents an intelligent agriculture field monitoring system which monitors soil humidity and temperature. After processing the sensed data it takes necessary action based on these values without human intervention.

D. An IOT Based Automatic Agricultural Monitoring And Irrigation System(2018)

This system consists of sensor network for humidity, temperature, soil moisture, colour and water level sensors and these are placed in the root zone of the crops. The microcontroller of the controller unit is programmed with threshold values of the temperature and moisture content. The controller unit is used to control the irrigation motor thereby controlling the water flow to the field. Field measure data about paddy plants. Raspberry pi is used in the controller mode.This project is focused on improving the yield by providing a monitoring system with effective and efficient usage of water resource.

III. Proposed System

Our proposed work focuses on the use of effective IOT devices and efficient algorithms for refinement of sensed data and decision learning for prediction. In system design, we have included flow of communication between different system components such as input and output for different modules present in the system. Sensors are interfaced to the Arduino board, values are collected, processed and transmitted to the server. In server side, using prediction algorithm, analytics is done and the result of analysis is provided. Farmers can view the output via mobile app and the data are displayed in tamil so that farmers can easily understand.

A. Temperature Sensor:

The RTD-temperature sensing device whose resistance changes with temperature. The PT100 RTD evaluation board uses surfaces mount RTD to measure the temperature. An external 2,3 or 4-wire PT100 can also be associated to measure temperature in remote areas. The RTDs are biased using a constant current sources. In this system, the sensor is used to find the soil temperature.

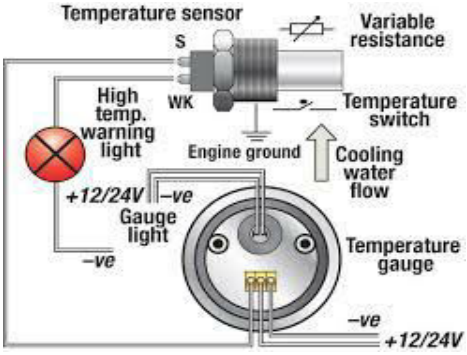

Fig.1 Temperature sensor

B. Humidity Sensor:

The ratio of moisture content in the air to the highest amount of moisture content at a particular air temperature is called relative humidity. Humidity sensors work by detecting changes that alter electrical current or temperature present in the air. There are three types of humidity sensors : capacitive, resistive and thermal. In this system,it is used to detect humidity value of the soil.

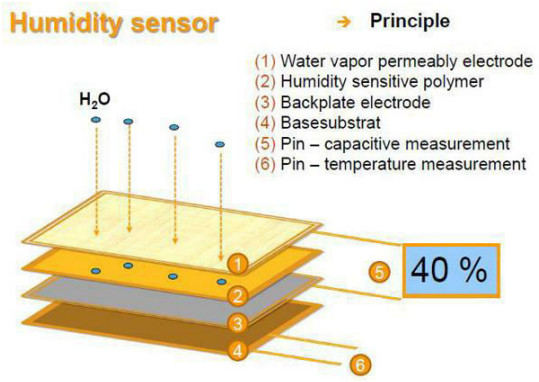

Fig. 2 Humidity sensor

C. pH Sensor:

A pH meter finds how acidic or alkaline a liquid is. The basic principle of the pH meter is to measure the concentration of hydrogen ions present in water. Acids that are present in water forms positively charged hydrogen ions. The greater the concentration of hydrogen ions, stronger the acid is. This sensor is used to find the acidic value of the soil in this system

Fig.3 ph sensor

D. Soil Moisture Sensor:

The Soil Moisture Sensors uses capacitance to measure the dielectric permittivity of the surrounding medium. It is used to measure the quantity of water present in the soil on volumetric basis.

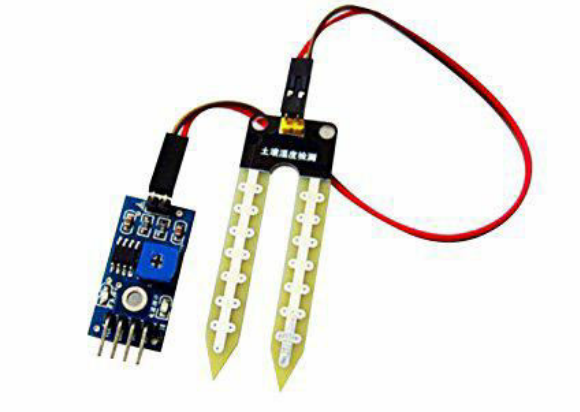

Fig.4 Soil moisture sensor

E. Water Level Sensor:

Water level sensor is used to check the level of water by assigning some specific value to the sensor.If the level of water is below or above that specific value, the sensor will indicate the problem to the user.

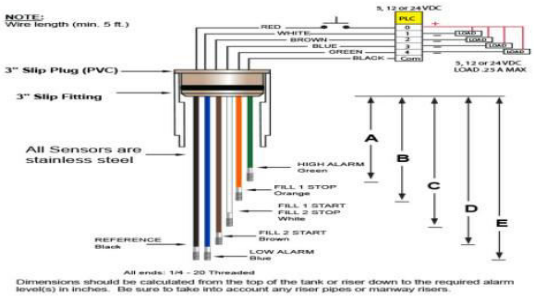

Fig . 5 Water level sensor

F. LCD:

Liquid crystal display is made up of active and passive display grid. In latest technology, active display grid is used . Generally LCD screen works on the principle of blocking light. LCD'S need backlight as they do not emit light by them. We always use devices which are made up of LCD display's which are replacing the use of cathode ray tube because cathode ray tube is heavier and bigger than LCD .

Fig.6 LCD

G. ARDUINO UNO:

Arduino Uno is an open source microcontroller board based on the ATmega328 which is used to upload(burn) a program to the microcontroller using a USB cable. It also has a 14 input and output pins and regulated power of 5V. Reset button which is present on the board can be used to

reset the Arduino microcontroller.

Fig.7 Arduino uno

H. Relay:

Fig.8 Relay

A relay is a switch used to turn on or off a motor used in agriculture land. The heart of a relay is an electromagnet (i.e) a coil of wire becomes a temporary magnet when electricity flows through it.

I. Motor:

An electrical motor is used to convert electrical energy into mechanical energy. In electrical motor, whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force".

Fig.9 Motor

IV. METHODOLOGY

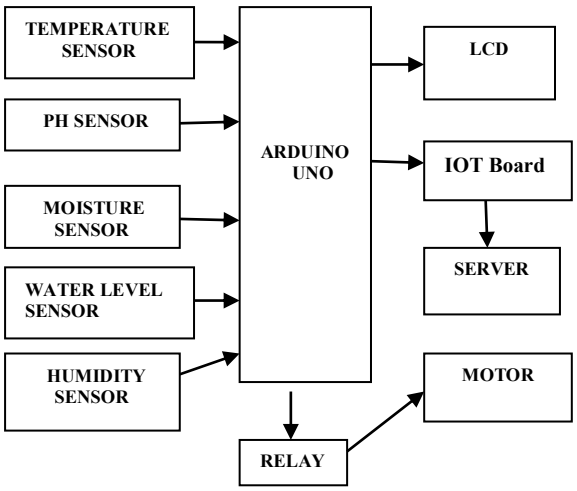

Fig.10 Block Diagram

The step involved in processing of the above described model is as following:

Step1: The device is switched ON, the values of the sensor are read, converts the analog value to digital output using ADC converter and displayed in the LCD board.

Step2: When the temperature value reaches 40, Motor is switched on automatically using Relay.

Step3: The value read from the sensors are transferred to the server via IOT board.

Step4: In Sever side, Prediction algorithm is used to process and analyse the value,then provide the predicted information such as what should be done, how to maintain the crops etc..

Step5: Farmers can login to the server with their username and password, and can view the information. They can also use mobile app to view the data.

V. RESULT

The values collected from the sensors is used to analyse the condition of the soil and to take necessary actions based on the prediction given by the algorithm used. This will help the farmers to prevent their land from any problem or loss. The values are collected periodically and stored in the server with respective date and time. Prediction algorithm used here provides accurate information on processing the values stored in the server. This system makes the farmers feel comfortable that their land is monitored and is free from any danger or loss.

In

sno	Moisture	Humidity	Water Level	Turbidity	PH	Temperature	Date
1	380	546	992	0	0	27	2020-03-06 06:55:03
2	377	430	991	0	0	27	2020-03-06 06:55:02
3	489	558	991	0	0	27	2020-03-06 06:55:01
4	415	407	974	0	0	31	2020-03-06 06:55:00
5	308	224	986	0	0	27	2020-03-06 06:54:59

Fig.11 Snapshot of data stored in server

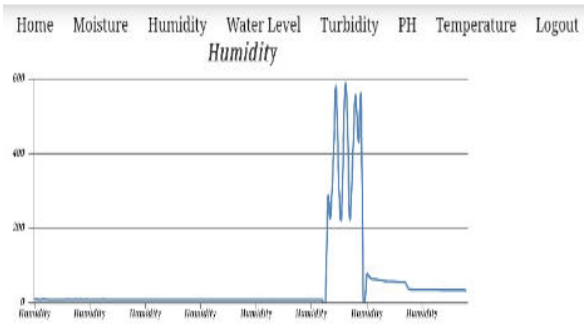

Fig.12 Graph obtained from Humidity sensor values

VI. CONCLUSION

The agricultural sector plays a vital role in our country. It is undergoing a process of transition to a market economy, with substantial changes in the social, legal, structural, productivity and supply set-ups, as in the case with all other sectors of the economy. Our plan is to help farmers in various means to protect their agricultural land from any problem and also to provide correct solutions incase if any problem occurs. This system is cost effective and user-friendly and will help the farmers greatly in an efficient manner.

VII. FUTURE SCOPE

In Future, we can detect other properties of soil, fertilizer content present etc..We can also check out the starch containing limits based on the advanced technology we prefer for plant growth monitoring. The IoT sensors are also capable of providing farmers with information about crop yields, rainfall, pest infestation, wind direction and soil nutrition which are invaluable to production and offer precise data which can be used to improve farming techniques over time.

VIII. REFERENCES

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