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IOT based plant monitoring system and smart irrigation using new features

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Abstract

Agriculture is important for the survival of humans and also helps in balancing the ecological cycle. Most of the farmers still use the traditional technique for agricultural purposes as they are quite unaware of the development in the modern technology that can benefit them. In this paper we have come up with an IOT based approach for smart agricultural device using Arduino microcontroller. With the help of this system, farmers can treat their crop fields in a cost-effective way, they can monitor the growth of the plant and automatically irrigate it by sensing various parameters such as, soil nutrient sensor, PH sensor, Smoke sensor, Moisture sensor, Temperature and humidity sensor. And another important feature of this project is that, in sloppy areas, the agricultural lands will be inclined and when the crops are irrigated the water will go stand in the bottom of the land and there will be unequal proportion of water supply to the crops in the entire field. Due to this crops might be affected

Keywords: -IOT, GSM module, Cloud, Sensors, Soil nutrient analysis, Sloppy areas

Introduction

Internet of things has become one of the booming technologies which has been recently used all over the world for different purposes. It is mainly being used in agricultural field for smart irrigation. As agriculture is the main source of income, around 50% of the country's population relies on agriculture and its activities. Around 16% of the country's GDP is contributed by Agricultural sectors. The wastage of agricultural needs (such as water and nutrients) will affect the future needs, therefore agricultural needs should be thoroughly analysed and managed. Agriculture requires a lot of water for irrigation, Water plays a vital role, it can either help grow your crops or even destroy them according to the amount of water supplied. By applying new farming methods helps the farmers increase their yield. To reduce the wastage of water during irrigation, several methods have been invented among which drip irrigation seems better than any other methods. In drip irrigation method, the water is supplied directly to the roots of the plant drop wise. One of the advantage of drip irrigation is that water wastage by evaporation and runoff can be minimized. With the help of this system, farmers can treat their crop fields in a cost-effective way, they can monitor the growth of the plant and

automatically irrigate it by sensing various parameters such as, Soil nutrient sensor that defines Soil requires proper nutrients which is most important for the growth of plants. This sensor NPK Sensor) detects the contents of nitrogen, phosphorous & potassium in the soil as they heavily affect the fertility of the soil and yield of the crop. PH sensor determines the soil alkalinity and acidity. Smoke sensor senses for the smoke or fire indication around the field. Soil moisture sensor measures or estimates the amount of water in the soil and it accordingly irrigates the land automatically. Temperature and humidity sensor are the electronic devices that measures and reports the moisture and temperature of the environment.

In sloppy areas, the agricultural lands will be inclined and when the crops are irrigated the water will go stand in the bottom of the land and there will be unequal proportion of water supply to the crops in the entire field. We have proposed a system where equal proportion of water can be supplied to the crops in inclined field by dividing the entire field and placing valves which controls the water flow in the division. Initially the bottom valve (which has the most inclination) is open so that the water is supplied to the lower part of the field. Once a message is received, the flow of water is stopped by closing the valve. Later the second valve leading to a less inclined land will be opened using commands and water will be regulated according to the requirement. Similarly, this will be done to all the divisions in the field till the water requirement is satisfied. Shwetha B. Saraf and Dhanush H. Gawali in [1] proposed “smart irrigation monitoring and controlling system using IOT” and says that, to meet the requirements of human demands improving farm yield is essential and suggested that advances tools and technologies can be utilised to improve the crop yield. The automated system for irrigation is presented in this paper which favors in reducing the usage of water for irrigation purpose. Soil moisture sensor is used for implementing this system. They have also used Wireless sensors which monitors the environmental conditions like temperature, water level, moisture of the soil and humidity. The data sensed are stored in the cloud server for managing the actions. IOT is the objects connected with each other to exchange and store data without human intervention. The plants water needs are monitored and controlled with the help of cloud-based monitoring system. To increase the productivity, sensors are helpful.

Background

Gaurav Patil in [2] proposed a “plant monitoring system based on IOT using Node MCU”, plant monitoring system provides a feedback to the farmer through a mobile phone. The farmer can monitor plant parameters based on IOT using different sensors. Node MCU is a open source platform. It offers complete and self-contained WIFI networking. Soil moisture sensor is used to measure the content of moisture in the soil. The electronic board and the probe are the two pieces of the sensor which detects the moisture content. Depending on the moisture level, the sensor's voltage changes. The voltage decreases as the moisture level increases and vice versa. To measure the temperature and humidity DHT 11 is used in this system. The electrodes in DHT 11 measure the humidity. The resistance between these two electrodes changes as and when the humidity around it changes. Thermistor is used to measure the changes in the temperature. The sensor's resistance changes as the atmospheric temperature changes. In [3] Smart ways of irrigation has been applied due to the scarcity of water in today's world. The project gives a description of smart irrigation using IOT. The aim of this paper is to reduce the wastage of water and human interference in carrying out the irrigation. In this paper, mesh topology is being used wherein the farm area has the sensor nodes and a stationary base station which collects and processes data from the sensor nodes. The hardware components such as the photocell sensor, temperature sensor, soil moisture sensor, etc and the software components like the Android based application are together combined to form this system. The Soil

moisture sensor measures the amount of water contained in the soil. This information helps in maintaining the water level in the soil and allows water to be irrigated based on the soil's need for proper nourishment of plants. The acidity and the alkalinity of the soil is checked by using pH sensor. This information will be constantly updated to the Android application in the mobile. This is a simple process to use as the sensors will direct the user as to when the moisture content in the soil is low and the sprinkler needs to be turned on. We can overcome the cost barrier by using this system and therefore it is considered to be much useful in the irrigation process.

Pernapati kiranmai in [4], has proposed a cost effective smart irrigation system using Node MCU microcontroller. This model uses the different sensors which are connected to the Node MCU to check the level of water in the soil. These sensors continuously send data to the ESP8266 Node MCU in which the controller processes the data first and will then send it to the web server in the phone through MQTT. These sensors are connected to the Microcontroller as inputs. The values measured from the sensors are sent to the end user that being the phone. Based on the requirements of the data received, respective operations are performed. This system reduces the amount of water wastage during irrigation by traditional methods as well as operates the system at less power due to Node MCU.

In [5] The food chain pyramid mainly depends on the plants as they are the primary producers. So it is very important to maintain the nutrients and the growth of plants. This paper aims in demonstrating the automatic irritation system using the IOT technology. In this paper, it uses respective sensors for checking the moisture content, the temperature as well as humidity in the soil. The proper evaluated data from these sensors will then decide the amount of water required for irrigation in order to reduce over irrigation. The hardware components like DHT11(which measures the temperature and humidity) , ESP8266 (which is a Wi-Fi model used to provide internet to the Microcontroller), Water pump, Arduino Uno etc and the software components like Android based application are together combined to form this system. Agriculture consumes a lot of water for proper growth of plants. This design's prototype is used for irrigating the plants depending on the values measured by the sensors. This system is one of the most time efficient activity because it automates the process of irrigation by just switching the motor on/off. Online monitoring by farmers through an android based application makes it more efficient. This paper concludes that the development in automation using IOT has expanded considerably in the agricultural domain.

In [6] The farmers usually tend to use a lot of water for irrigating and due to which the electricity increases. This could cause soil damage. Smart system and automated irrigation system is created, used to control and observe irrigation. This paper aims at implementing the above proposed system by using WSN and water pumps. Water level sensors are connected to canals and flow sensors are connected to pump. The data is periodically sent from these sensors through a wireless gateway to the web server. This paper gives a system that is used for automation by analysis of moisture of ground. It is used for regulation of water without any human interference.

In [7] soil management will also improve yield by various parameters of soil according to crops. Considering WSN to this system makes possible to measure various parameters of soil. This model can be considered to get great yield in smaller grounds. The overuse of fertilizers is the cause of declining productivity. Arduino Uno can also be found on Atmel Atmega328, has clock speed of 16MHZ. Microcontroller has 6 input with analog to digital converter and 14 I/O ports. Data analysis is done to get application rates of fertilizers. Excess use of fertilizers causes soil damage and even damage environment.

In [8] pH is main parameter for soil product, it should be addressed to improve system. pH is used to check hydronium ion, and which is used to check how much fertilizers need to be provided. Knowing pH has advantage for this system. Soil pH is taken as negative logarithm of h+ concentration of soil. The soil is "acidic" if the pH value measured is below 7, it is "alkaline" if pH value is above 7, the soil is "neutral" at pH 7. present while in alkaline soil P, Fe, Cu, Z and B are present.

Objectives: The main aim of this paper is to utilize internet of things to accomplish the succeeding goals and to properly manage the wastage of water during irrigation by measuring various parameters such as soil moisture value, temperature, PH value of the soil, Nutrient analysis. To reduce the time intensive of irrigation the alternative and effective automations are introduced. To analyze nutrients of the crop, PH level of the soil so that proper nutrients can be supplied to the crop for increasing the crop yield. To find the efficient method for irrigating crops in unequal lands so that equal proportion of water can be supplied to entire field by installing valves.

Methodology

First, Agriculture plays a vital role in human survival and it also helps in balancing the ecological cycle. Most of the farmers still use the traditional technique for agricultural purposes as they are quite unaware of the development in the modern technology that can benefit them. In this paper we have come up with an IOT based approach for smart agricultural system using the Arduino Microcontroller. With the help of this system, farmers can treat their crop fields in a cost effective way, they can monitor the growth of the plant and automatically irrigate it by sensing various parameters such as, In this project, first all the input parameters such as moisture , humidity , temperature, pH and all the other sensors are sensed which are later fed to the microcontroller. Once the microcontroller receives the information about these parameters it sends to the telegram application. The moisture content of the plants are sensed and the water pump is switched on automatically to irrigate the fields. And another important feature of this project is that, in sloppy areas, the agricultural lands will be inclined and when the crops are irrigated the water will go stand in the bottom of the land and there will be unequal proportion of water supply to the crops in the entire field. We have proposed a system where equal proportion of water can be supplied to

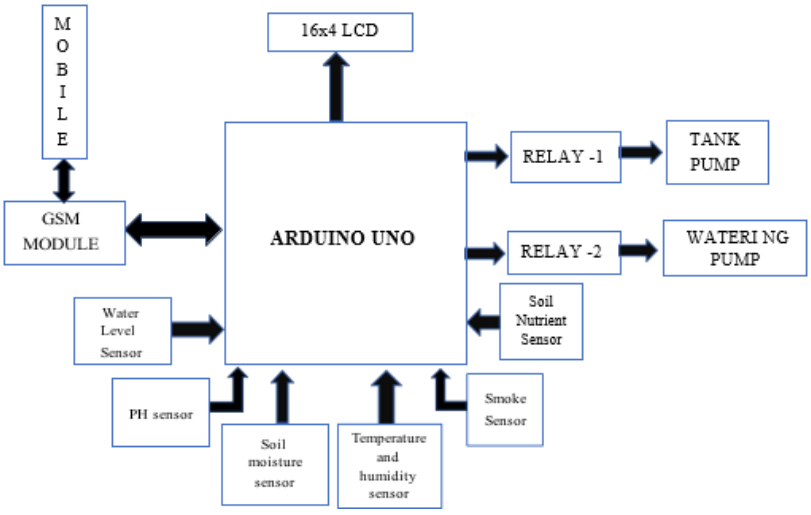


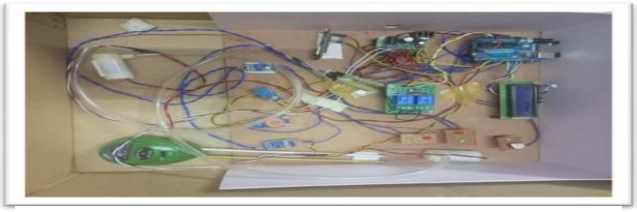
Figure 1: *Block diagram*

the crops in inclined field by dividing the entire field and placing valves which controls

the water flow in the division. Initially the bottom valve (which has the most inclination) is open so that the water is supplied to the lower part of the field. Once a message is received, the flow of water is stopped by closing the valve. Later the second valve leading to a less inclined land will be opened using commands and water will be regulated according to the requirement. Similarly, this will be done to all the divisions in the field till the water requirement is satisfied. All the data sensed by the sensors are sent to the microcontroller and the data is exchanged with the users with the help of telegram app. The data collected is stored in this app for further use.

Results

In smart irrigation technique, we can grow different types of plants or vegetables throughout the year by maintaining the respective parameters like temperature, humidity, pH. Due to indoor structure and monitored environment, there is less chances of becoming diseased plants and need very less of pesticides and insecticides. It requires about 70-90 percent less water due to circular chain supply of water during over all the process. At the end, we can get fresh, clean and healthy plant production.



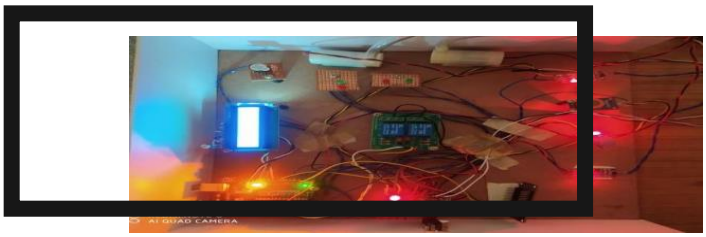


Figure 3: *Working Model*

The Fig 2 and Fig 3 shows the hardware implemented or this project. The results will be displayed on the LCD once the power is supplied to the system. We have installed LED's and buzzer for the purpose of indication/ alerting the farmer.

Figure 4: Display of project title Figure 6: Display of Moisture content Figure5showsthetitleofPhosphorous Figure 7:Display ofHumidity& Temp

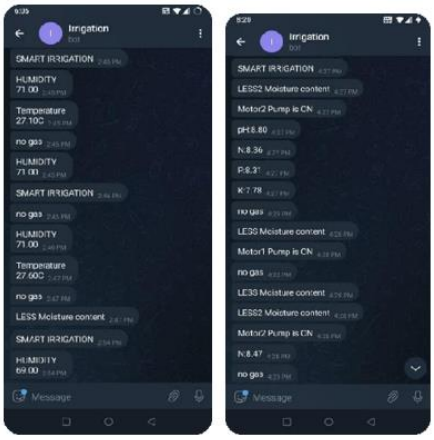


Figure 8: *Results in Telegram application*

Conclusion

We have proposed a system where equal proportion of water can be supplied to the crops in inclined field by dividing the entire field and placing valves which controls the water flow in the division. All the data sensed by the sensors are sent to the microcontroller and the data is exchanged with the users with the help of GSM module. The data collected is stored in cloud for future references and is the one responsible for irrigating the field.

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