IOT based greenhouse monitoring and controlling System

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ABSTRACT

The main objective of this paper is to monitor temperature, humidity content and soil's moisture content with the help of temperature sensor, humidity sensor and soil moisture sensor respectively. The IOT system comprising of sensors, nodes, gateways and cloud systems gives the right analyzed information to the farmer or to the user about the irrigation. Internet of Things, Wireless Sensor Networks or Physical cyber systems with actuators and Cloud Computing systems, have been used in various fields in agriculture for efficient usage of resources.Here in this paper, we implement and experiment for different crops in various climatic or weather conditions that analyze plant growth and provide access to information that can be collected at regular intervals and with less human intervention.Agriculture is the source of employment for a large number of people in India and has a greater impact on the economy of this country. In this study the system senses the temperature, humidity around the crops and soil moisture content in that particular soil for that particular crop and automatically switches the pump to on/off with respect to data collected and analyzed. When soil moisture gets low or dry, the pump starts watering the crops up to the requirement of the crop. The aim of our work is to reduce water usage and power consumption which in turn will lead to effective use of other resources resulting maximum yield to the farmers.

Keywords: soil moisture, temperature, humidity, smart irrigation.

INTRODUCTION

Sensors in the fields can ensure the optimal use of available **water** resources. There are many resources available for the agriculture but for their optimal use IOT is necessary.

The following are some of them where IOT can be used,

- Weather forecast to get the weather conditions of the following days
- The level of water and time of flow of water from the dams to canals also needs sensors so that farmers get alerts on time
- **Fertilizer's sensors** can sense and alert farmers if the crop requires more fertilizer or they are less in the soil.
- Sensors can help in detecting crop diseases prior to damage
- The **water motors** can be connected with mobiles.
- The use of environmental sensors to predict weather forecasts can help the farmers in activities like sowing, irrigation, and harvesting.
- Environmental sensors can detect smoke and start the water sprinklers and avoid huge losses.

By these ways we can utilize IOT for betterment of the agriculture.
In our project we want to use the IOT mainly for irrigation purpose, that is usage of sensors to find the temperature,humidity,moisture of the environment of the field.

LITERATURE SURVEY

1. Abdelmadjid Saad at all proposed for "Water Management in Agriculture: Current Challenges and Technological Solutions"

Methodology:

Here they used cyber physical systems in agriculture, where sensors were deployed in agricultural fields with actuators to analyse the required water for crops. The sensors recorded the temperature, humidity around the crops and using these data the sprinklers let water to the crops, until it reached certain threshold values.

Accuracy:

The system they used here did not have anything related to Wifi, Bluetooth or cloud system which reduced the system to small fields and reduced efficiency as it did not involve much analysing.

2. Jinyu Chen at all proposed for "Intelligent Agriculture and Its Key Technologies Basedon Internet of Things Architecture"

Methodology:

Here four main technologies are designed: sensor technology, RFID technology, Quick Response Code and embedded system technology. RFID technology is a comprehensive technology which combines radio frequency with embedded technology. Quick response code (QR code) is a recognition technology, and the information is displayed in the form of Quick Response. Embedded system technology refers to an operating system applied to small devices, which is a collection of computers, sensors, integrated circuits and so on. Because the embedded system only aims at a specific technology, designers can optimize it to reduce its size and cost.

Accuracy:

The system used resources efficiently and produced better results but the system used varied technologies which was difficult for farmers or new beginners to understand make use of it.

3. Carlos Daniel López at all proposed for "Optimization of Energy and water Consumption on crop Irrigation using UAVs via Path Design"

Methodology:

Crop water stress index (CWSI)-based irrigation management. For this, attaining crop canopy at different periods and air temperature are needed for the calculation of CWSI. A wireless sensors based monitoring system where all the field sensors are connected to collect the mentioned measurements, further transmit to processing centre where corresponding intelligent software applications are used to analyse the farm data. Weather data and satellite imaging is applied to CWSI models for water need assessment, and finally specific irrigation. Appropriate example is VRI (Variable Rate Irrigation) optimization by Crop Metrics, which works according to topography or soil variability, ultimately improves the water use efficiency.

Accuracy:

This advanced system produced better results compared to other irrigation systems, but the whole system was considered a bit costly.

4. Norashikin M. Thamrin at all proposed "IoT implementation for indoor vertical farming watering system"

Methodology:

VF in the form of urban agriculture offers an opportunity to stack the plants in a more controlled environment resulting in, most importantly, significant reduction in resource consumption. By following this method, we can increase the production multiple times, as only a fraction of ground surface is required as compared to traditional agriculture practices. Human hands are not required to touch the crops at any stage when following the IoT-connected vertical farm.

Accuracy:

Not only for ground surface, this system is highly efficient in terms of other resources, as well. and most importantly, consuming 40% less energy and up to 99% reduced water consumption compared to outdoor fields. Under this farming method, many parameters are important, but CO2 measurements are most critical; hence, non-dispersive infrared (NDIR) CO2 sensors play a critical role to track and control the conditions in vertical farms.

5. Sheetal Vatari at all proposed "Green House by using IOT and cloud computing"

Methodology:

Greenhouse farming is considered the oldest method of smart farming. Crops grown indoors are very less affected by environment; most importantly, they are not limited to receiving light only during the daytime.As a result, the success and production of various crops under such controlled environment depend on many factors, like accuracy of monitoring parameters, structure of shed, covering material to control wind effects, ventilation system, decision support system, etc. Precise monitoring of environment parameters is the most critical task in modern greenhouses, where several measurement points of various parameters are required to control and ensure the local climate. In an IoT-based prototype is proposed to monitor the greenhouses where nodes are used to measure the inside parameters like humidity, temperature, light, and pressure.

Accuracy:

The crops that traditionally could only be grown under suitable conditions or in certain parts of the world are now being growing anytime and anywhere. And this has been possible because this method being widely accepted.

PROPOSED METHODOLOGY

Hardware used: Microprocessor- ESP32, LCD- 20*4, 2-channel 5V Relay module,channel 12V relay module, Voltage regulator- 7805, Heat sink, Temperature and Humidity sensor- DHT11, LDR module, Soil moisture sensor, Water-pump, Jumper wires.

Software used: Arduino IDE, Thinkspeak IoT Application

System Architecture:

The proposed system consists of the sensing part, controlling part, monitoring part and a message sending and receiving part. In the monitoring part the sensors included are temperature sensor, humidity sensor, soil moisture sensor and Light detection sensor. These sensors will sense the various parameters of the environment. And the values will be displayed on an LCD display. These sensors are

connected to the microcontroller ESP32 which is the controlling part. The actuators (Fan, Pump, Bulb) are switched ON based on the instruction passed to the microcontroller. An LCD is employed to show the condition inside the greenhouse. The system works in such a way

that when the environmental parameters cross a safety threshold, the sensors detect a change and the microcontroller reads the data from its input ports and performs the suitable action in order to bring the parameter back to its required level. The microprocessor will continuously display climatic conditions on LCD and will send this data over internet and the user using Blynk IoT application will get the climatic report.

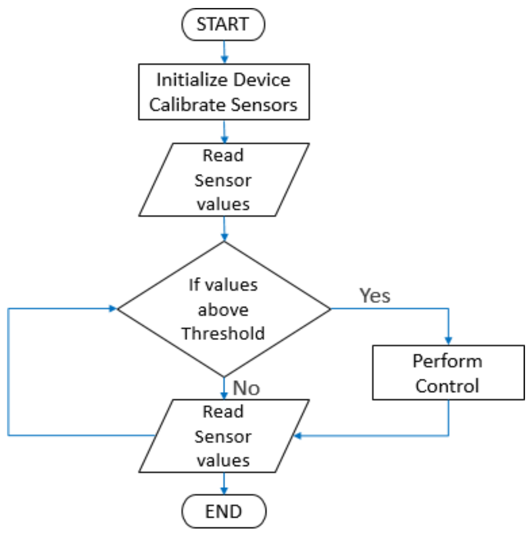

Fig. Flow Chart

Working:

Recently, the developments in the field of the IoT technology have led to renewed interest in developing the greenhouse technology. The pleasant was complaints from several things such as keep track the irrigation process and having to do it manually. Also, the plants may suffer from bad circumstances like temperature and light. The major objective of this paper is to develop practical smart greenhouse with three intelligent control systems in order to obtain suitable circumstances. The proposed system has the ability to monitor and control the greenhouse from any place in the world. Fig. 1 depicts the block diagram of the entire system.

The overall designed system could be divided into three important parts; hardware, software, and IoTstructure.

*A. Hardware Design*The system compromises numerous tools that are utilized to obtain the desired system. The tools are explained in two sections (Sensing and Actuators):

a) Sensing:

In order to apply the automation process on a given system, sensors are required. The adopted intelligent control system is fed by sensor information. Several types of sensors are used including:

1) Temperature and Humidity sensor (Htd11):

is new advanced temperature moistness sensor that has many favorable circumstances, for example, small size, basic interface, quick reaction, and inexpensiveness.

2) The Soil humidity Sensor uses capacitance:

measure the water in a soil by computing the dielectric tolerance of the soil, which is a component of the water .

3) A Light Dependent Resistor (LDR) or a photograph resistor: is a gadget whose resistivity is a component of the occurrence electromagnetic radiation.

Subsequently, they are light sensitivity gadgets.

b) Actuators:

The actuators could be defined as system that receive control signal that categorized as low power signal usually generated by the microcontroller to operate the devices that require high Energy that may be voltage or currents

Parameters	Conditions	Minimum	Typical	Maximum
Humidity				
Resolution		1%RH	1%RH	1%RH
			8 Bit	
Repeatability			±1%RH	
Accuracy	25℃		±4%RH	
	0-50℃			±5%RH
Interchangeability	Fully Interchangeable			
Measurement Range	0℃	30%RH		90%RH
	25℃	20%RH		90%RH
	50℃	20%RH		80%RH
Response Time (Seconds)	1/e(63%)25℃, 1m/s Air	6 S	10 S	15 S
Hysteresis			±1%RH	
Long-Term Stability	Typical		±1%RH/year	
Temperature				
Resolution		1℃	1℃	1℃
		8 Bit	8 Bit	8 Bit
Repeatability			±1℃	
Accuracy		±1℃		±2℃
Measurement Range		0℃		50℃
Response Time (Seconds)	1/e(63%)	6 S		30 S

Item	Measurement Range	Humidity Accuracy	Temperature Accuracy	Resolution	Package
DHT11	20-90%RH 0-50 ℃	±5%RH	±2℃	1	4 Pin Single Row

CONCLUSION

This paper involves establishing a contemporary design technique of monitoring and controlling the moisture level of soil, temperature and humidity

using their respective sensors. Providing comprehensive tools that need to build any measurement or control application in dramatically less time. The system is feasible and cost effective for optimizing water resources and power consumption in any small scale agricultural sectors. By implementing Android interface apps in mobile, a user can control the irrigation system remotely.

Therefore, the intervention of human is much reduced using this smart irrigation system. With consideration of modern water management and monitoring techniques relying on advanced technologies such as the Internet of Things (IoT), Wireless Sensor Network (WSN) and cloud computing. Advanced energy harvesting technologies, and power-saving techniques should be leveraged for decreasing the sensors energy consumption. Finally, reliable wireless communication modules with low energy consumption must deserve attention. No longer only are farmers able to generally use much less water to grow a crop, they're able to increase growth yields and the satisfactory of the crops by using better management systems which plays vital part in plant growth.

REFERENCES

1. "Green House by using IOT and cloud computing" Sheetal Vatari , Aarti Bakshi , Tanvi Thakur
2. "IoT implementation for indoor vertical farming watering system, Muhammad Ikhwan Hanif bin Ismail , Norashikin M. Thamrin
3. "Optimization of Energy and water Consumption on crop Irrigation using UAVs via Path Design, Carlos Daniel López ,Luis Felipe Giraldo
4. "Intelligent Agriculture and Its Key Technologies Based on Internet of Things Architecture", Jinyu Chen, Ao Yang
5. "Water Management in Agriculture: Current Challenges and Technological Solutions" Abdelmadjid Saad, Abou El Hassan Benyamina, Abdoulaye Gamati