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IoT and Cloud Computing in A Smart Greenhouse

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Abstract - The Smart Green House Android app effectively monitors and controls the microclimatic conditions within a greenhouse. Easily obtain soil moisture, humidity, and temperature sensor values from the greenhouse and set predefined threshold values for each sensor. Based on sensor readings, we will control water sprayers, cooling fans, rooftop lights, and focus lights. Simply press a button in the Android app to turn on or off motors. It also contains datasheets of all horticultural plantations and season-specific precautionary materials for monitoring and controlling. The goal of this project is to create a straightforward, user-friendly, and easy-to-install system for monitoring and recording the natural environment's temperature, humidity, soil moisture, and sunlight levels, which are constantly adjusted and controlled to maximize plant growth and yield. The outcome demonstrates that the scenario described in the sensor's database and system is, in fact, correct. The successful test result indicates that the system is operating as intended.

INTRODUCTION

Cloud computing may be used to grow plants under controlled climatic circumstances for optimal production, greenhouses play a significant role in our nation's agriculture and gardening industries. An automated greenhouse aims to monitor and control the climate factors that either directly or indirectly control plant growth and, consequently, their yield. In India, where 60% of the population works in agriculture, it has long been the primary industry. India still needs to perform better when compared to other nations. The best way to improve performance is with a greenhouse. Some disadvantages of a still-hand-operated greenhouse include the need to visually examine plant growth, manually irrigate plants, manually turn on and off temperature controllers, and manually spray pesticides and fertilizers. It takes a lot of time, is prone to human mistake, and is therefore less precise and trustworthy. Therefore, a fully automated greenhouse is the best option. Reduce human involvement as much as feasible to eliminate the system's challenges. The Raspberry Pi reads the data at its input ports (GPIO) after the sensors detect a change. Because they may be used to grow plants under controlled climatic circumstances for optimal production, greenhouses play a significant role in our nation's agriculture and gardening industries. Monitoring and regulating the climate conditions that either directly or indirectly impact plant growth and, consequently, their output is the goal of automating a greenhouse.

Connected work

Sheetal Vatari, Aarti Bakshi, Tanvi Thakur says that Green House is the best solution to control and mange all this problem It is more important to search a method that gives perfect analyzation and controlling to develop proper environment. Large areas covered by sensor network this can establish greenhouse with precision environment required for different crops. This environment builds up by using two technologies it and cloud computing. By using IOT(Internet on things) we control devices or any environmental needs anytime, anywhere and the cloud which provides storage.

Ravi Kishore Kodali, Vishal Jain and Sumit Karagwal say that This work provides a model of a smart green house, which helps the farmers to carry out the work in a farm automatically without the use of much hand-operated inspection. The irrigation of agriculture field is carried out using automatic drip irrigation, which operates according to the soil moisture threshold set accordingly so as optimal amount of water is applied to the plants.

According to Uday A. Waykole, Prof. Dhiraj, and G. Agrawal, temperature and humidity are associated in that when the temperature rises, the humidity decreases, making it challenging to control both at once. A wireless sensor network can be utilized to collect data from point to point because the greenhouse's temperature and humidity must be continuously monitored to guarantee ideal conditions. The sensor will measure the data from the greenhouse, and the acquired data will be sent to the receiver. The LCD panel will show the data that has been read.

Bharat Institute of Technology issued a report on

The Project Green Bee‟ based on Monitor and Control of greenhouse environment. According to the report, the system is modeled for the automation of greenhouse using embedded system.Jia Song, He proposed a system on Greenhouse Monitoring and Control System using 8051 controllers.

SUGGESTED WORK

The advanced system is an implanted system which will closely observe and control the microclimatic variables of a greenhouse on a continues basis round the clock for farming of crops or specific plant species which could maximize their production over the whole crop growth season and to eliminate the difficulties involved in the system by reducing human intervention to the best possible extent.

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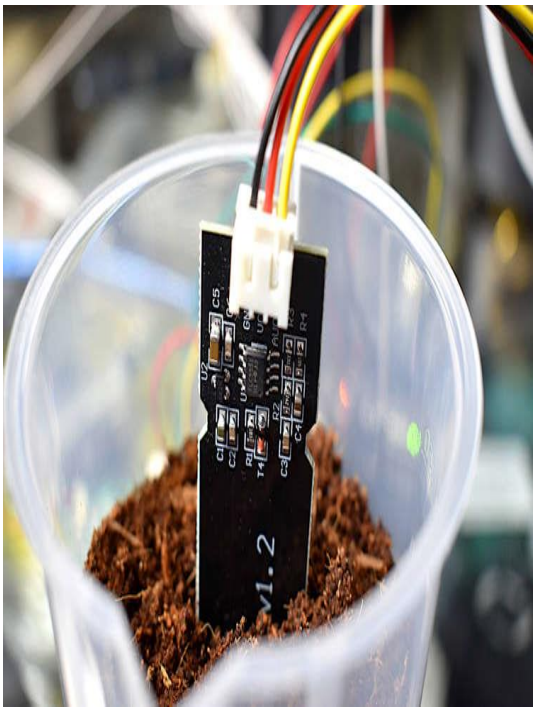
The raspberry-pi then executes the needed works by occupying relays pending the strayed-out variable has been conducted back to its optimum level. Since a raspberry-pi is used as the heart of the system, it makes the set-up low-cost and effective nevertheless. The system also provides continuously alert messages the user about the condition inside the greenhouse by using cloud services. The system contains of sensors, Analog to Digital Converter, microcontroller and actuators. When any of the above declared climatic variables cross a protected threshold which has to be maintained to safety the crops, the sensors sense the change and the microcontroller reads this from the data at its input ports after being transformed to a digital form by the ADC. The microcontroller then executes the needed actions by occupying relays pending the strayed-out variables has been conduct back to its optimum level. Since a microcontroller is used as the heart of the system, it makes the set-up low-cost and effective nevertheless.

METHODOLOGIES

SENSORS

SOIL MOISTURE:

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other stuff of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture variable. Soil moisture sensors typically refer to sensors that estimate volumetric water content.



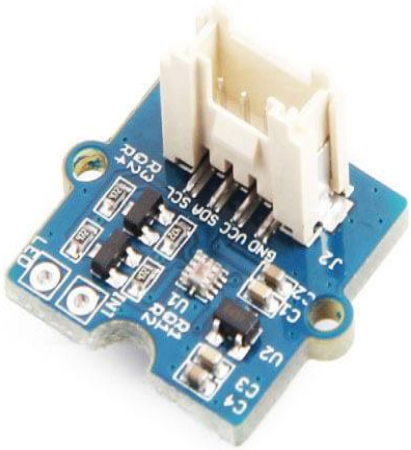
TEMPERATURE

The sensor panel itself has both analog and digital outputs. The analog output gives a parameters voltage rating that allows guessing the moisture satisfied of the soil. The digital output gives a simple ―on/off‖ when the soil moisture content is above a certain value

In general a temperature sensor is a device which is outline specifically to measure the warmess or cold of an object.DHT11 is a precision IC temperature sensor with its output proportional to the temperature (in °C).With DHT11,the temperature can be measured more accurately than with a thermistor.

SUNLIGHT

The light dependent resistor or also known as LDR sensor is the most important slice of apparatus in circuit. Without it, it is impossible to detect whether it is dark or light. In the light this sensor will have a resistance of a few hundred ohms while in the dark it can have a several mega ohms.



RASPBERRY-PI:

The is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and developing countries. A Raspberry Pi is a general-purpose computer, usually with a Noobs operating system, and the capacity to run multiple programs. Raspberry Pi is best used when you need a fully- developed computer: driving a more complicated robot, performing multiple tasks, doing intense calculations. Raspberry Pi board is a fully functional computer or fully- developed credit card sized. It has all the trappings of a computer, with a dedicated memory, processor, and a graphics card for output through HDMI. It even runs a specially outline version of the Noobs operating system and it is easy to install in most Noobs software, and used the Raspberry Pi as a functioning video game emulator or media streamer with a bit of effort.

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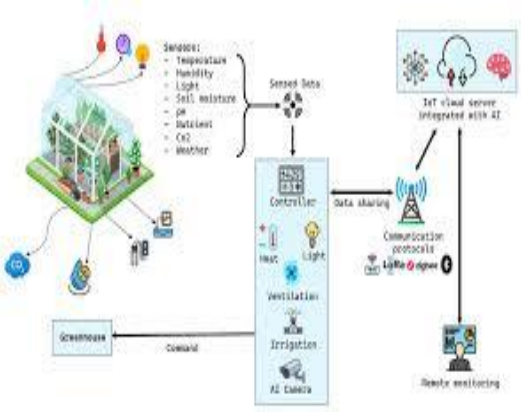
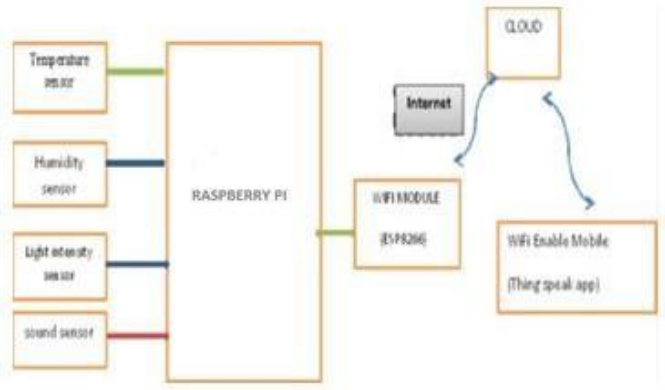
SYSTEM DESIGN

SYSTEM ARCHITECTURE

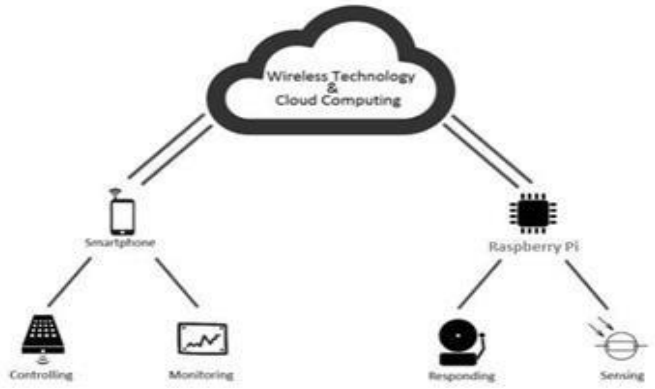


LOCK DIAGRAM

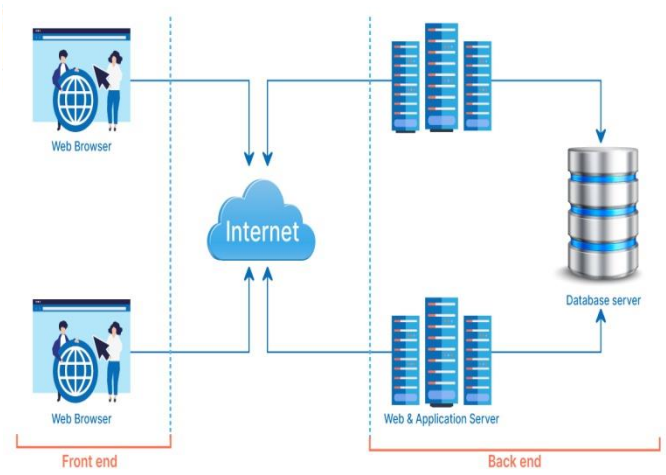


CLOUD COMPUTING

Cloud computing Services provide information technology (IT) as a service over the Internet or dedicated network, with delivery on demand, and payment based on usage. Cloud computing services range from full applications and development platforms, to servers, storage, and virtual desktops. Cloud computing is a general term for the delivery of hosted services over the internet. Cloud computing enables companies to consume a compute resource, such as a virtual machine (VM), storage or an application, as a utility -- just like electricity -- rather than having to build and maintain computing infrastructures in house. Cloud computing is a type of computing that relies on sharing computing resources rather than having local servers or personal devices to handle applications. In cloud computing, the word cloud is used as a metaphor for "the Internet," so the phrase cloud computing means "a type of Internet-based computing," where different services — such as servers, storage and applications — are delivered to an organization's computers and devices through the Internet. Cloud computing is a method for delivering information technology (IT) services in which resources are retrieved from the Internet through web-based tools and applications, as opposed to a direct connection to a server. Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. As long as an electronic device has access to the web, it has access to the data and the software programs to run it. It's called cloud computing because the information being accessed is found in "the cloud" and does not require a user to be in a specific place to gain access to it.



RESULTS



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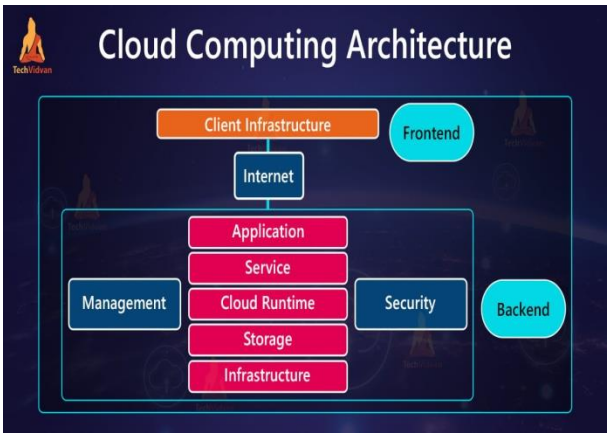

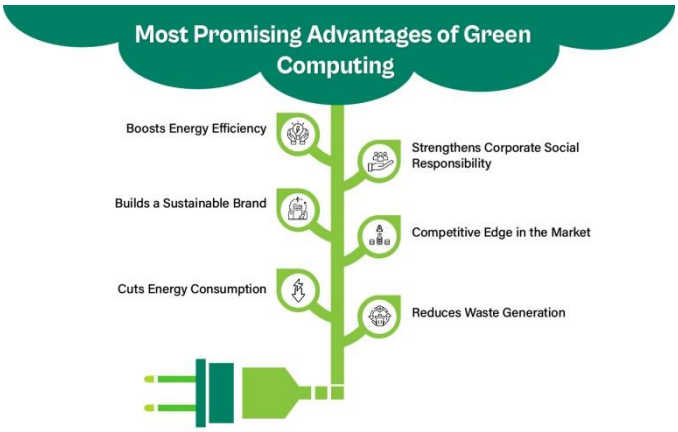

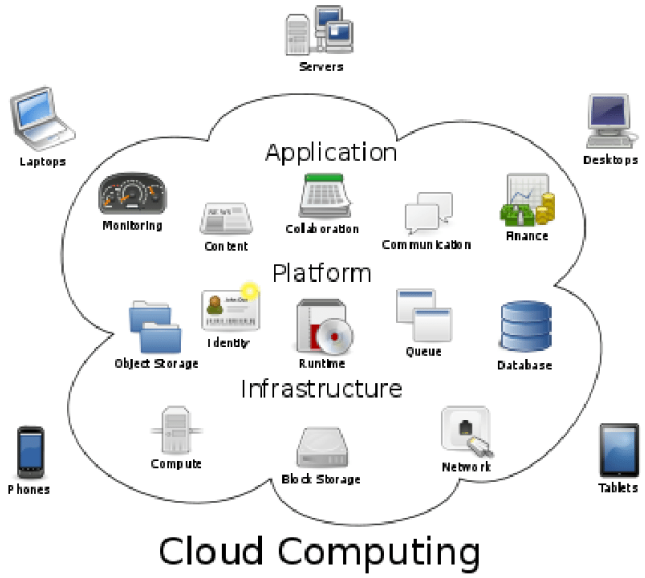

CONCLUSION

India is a nation focused on agriculture. A number of interrelated physical factors must be measured and controlled in order to increase the quality and productivity of crops grown in greenhouses and open fields. Only "control systems with built-in software" can complete these tasks. Building a greenhouse is costly. Automation equipment is costly because it is imported from India. The expensive expense of greenhouse technology prevents many farmers from adopting it. Our technology demonstrates how to regulate the environment in a greenhouse. Through input sensors and procedures, the greenhouse controller detects variations in soil moisture, humidity, dry and wet temperatures, and other factors in order to take control. When making decisions about improving agricultural output, real-time monitoring provides accurate and fast information about the state of the soil and crops. Because it requires visiting specific crop fields to measure and record specific physical, chemical, and biological characteristics of the cultivated areas as well as analyzing all input parameters, evaluating agricultural production systems is a time-consuming and challenging process.

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[6]. Jia Song, He proposed a system on Greenhouse Monitoring and Control System using 8051 controller.
[7]. In this project we have discussed about Greenhouse Monitoring and Control System Base on microcontroller Wireless Senor Network using ARM controller. The parameters in the green house are monitored on the PC. In this project we have proposed a low cost method microcontroller to accurately monitor and control the various parameters like humidity, soil moisture, light intensity carbon dioxide (gas sensor) and temperature.