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A Review on Smart Polyhouse Development and Control Using IoT

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Abstract: A revolutionary and cutting-edge technology called the Smart Polyhouse System with Raspberry Pi promises to automate conventional farming methods in a polyhouse setting with the help of IoT. The system uses the Raspberry Pi board and a number of sensors to build an environment that is favorable for plant development. This system has the ability to monitor and regulate a number of variables, including soil moisture, temperature, humidity, and light intensity. The Raspberry Pi analyses and processes the sensor data before using it to manage various appliances like fans, heaters, and irrigation systems. This technique offers an effective method of crop growth that requires less human involvement and increases output. This technique is the perfect solution for contemporary farming because it not only increases crop yield but also lowers production costs.

Keywords: Raspberry Pi , Sensors, Raspbian, IoT.

Introduction

Monitoring is employed in colorful operations including temperature, moisture, soil humidity. The Web- Grounded Climatic condition monitoring system that can be access anywhere and anytime through the internet is figure. With this system stoner can ever cover the poly house climatic conditions from anywhere which could save the mortal charges. Web-Grounded climatic condition monitoring is one type of archivist that monitors a temperature, Water Position, humidity in a poly house room and stores the data into a database and display the current temperature on the website through a webpage. The system will continuously cover the temperature, soil humidity and water flow of the terrain and the data can be covered at anytime and anywhere from the internet. Proposed design is, this system correspond of colorful detectors, soil humidity, temperature & water position.

These detectors smell colorful parameters and are also transferred to the Raspberry pi. After studying this, the program has been written on to the Raspberry pi for specific terrain exertion. The asked temperature and Moisture are maintained by turning on heater/ cooler. The humidity position within soil is also be controlled by turning the water valve on/ off. Hence the polyhouse terrain is controlled automatically. The purpose of this design was thus to make it easier to grow food at home. This can be achieved with the use of an automated polyhouse. A polyhouse makes it possible to replicate a different climate and accordingly

grow food that would not typically grow in the area also, making the polyhouse automated enables people to grow their own food or shops at home without having to constantly look after them. It can be Cheering to know that the shops are taken care of while one is on holiday or not around the house for a longer period of time. The exploration question of this study was to dissect if it's possible to maintain the poly house temperature in an asked range for optimal factory growth using a temperature control system. Another ideal was to probe if the watering system is dependable, that is whether or not is can gain a perfect soil humidity position for the chosen factory.

1. Methodology

The following steps make up the process for creating a Smart Polyhouse System with a Raspberry Pi:

1. Planning and Design: The system must first be planned and designed. This entails deciding which sensors, actuators, and additional parts are necessary. Also, the design must to include the particular needs of the crops to be cultivated, such as the ideal temperature, humidity, and lighting conditions.

2. Assembly of the Hardware: After the completion of the design is the assembly of the hardware. This entails attaching the Raspberry Pi board's sensors, actuators, and other parts. Care should be taken during hardware construction to make sure that each component is correctly attached.

3. Software Development: The creation of the system's software is the next step. Writing the code necessary for the Raspberry Pi to read data from sensors, process it, and operate various devices is a necessary step in this process. The programme ought to be created to offer a simple user interface for system monitoring and management.

4.Testing and debugging: The system should be rigorously tested to make sure it is operating as intended after the hardware and software have been developed. Any defects or problems must be located and remedied.

5.Deployment and Maintenance: The system can be installed in the polyhouse after it has been tested and found to be reliable. The system will require ongoing maintenance to maintain its optimal performance. including routine sensor calibration and the repair of defective parts.

In order to create a Smart Polyhouse System utilizing a Raspberry Pi, a thorough planning, hardware assembly, software development, testing, and continuing maintenance are all required.

3. Area Of Study

Agriculture and computer engineering are two disciplines that are studied in relation to the Smart Polyhouse System using Raspberry Pi. This technology automates conventional agricultural methods in a polyhouse environment by integrating hardware and software components. It makes use of a variety of sensors to gather information about environmental

variables like temperature, humidity, and light intensity. The Raspberry Pi board then processes this information to control appliances like fans, heaters, and irrigation systems.

Deep knowledge of agricultural and computer engineering topics, including plant physiology, soil science, programming, and electronics, are necessary for the development of this system. A degree in Agricultural Engineering, Computer Engineering, or a comparable topic is therefore an option for students interested in this field of study.

4. Tools Used

1. Raspberry – Pi
2. NODE MCU 8266
3. Humidity Sensor
4. Temperature Sensor
5. Soil Moisture Sensor
6. Rain Sensor
7. Waterflow Sensor
8. Relay Driver Circuit
9. Power Supply
10. Arduino IDE
11. Py-charm

5. Description Of Tools

Py – charm:

PyCharm is one of the most popular Python IDEs. This is due to the fact that it was created by JetBrains, the company behind the well-known IntelliJ Concept IDE, one of the larger 3 Java IDEs, and the "most smart JavaScript IDE," WebStorm. There are numerous explanations on why this is the case. Its use of Django for web development is a further plausible argument. PyCharm is the most comprehensive and full integrated development environment for working with the Python programming language due to a number of characteristics. PyCharm is the most comprehensive and full integrated development environment for working with the Python programming language due to a number of characteristics.

Python:

Python is an interpreted, object- acquainted, high- position programming language with dynamic semantics. Its high- position erected- in data structures, coupled with dynamic typing and dynamic list, make it particularly appealing for Rapid Application Development

as well as for operation as a scripting or cement language to bring being factors together. Python's straightforward syntax promotes readability, which lowers the cost of programme conservation. Python's support for modules and packages promotes programme modularity and law exercise. For all popular platforms, the Python practitioner and its comprehensive standard library are freely distributable in source or double form.

Raspberry pi:

The Raspberry Pi 3 is around 50% more powerful than the Pi 2 because to its quad-core 64-bit Broadcom BCM2837 ARM Cortex-A53 SoC CPU, which operates at 1.2 GHz. Consequently, the new Raspberry Pi 3 can run business software and browse the internet.

Technical Specification of raspberry pi: 1. Broadcom BCM2837 64bit ARMv7 Quad Center Processor powered single board machine running in 1. 2GHz. 2. 1GB RAM BCM43143. 3. Wi-Fi on board. 4. Bluetooth Low Energy (BLE) on board. 5. 40pin extended GPIO, 4 x USB 2 ports.

Fig. Raspberry pi

Humidity Sensor:

The relative humidity (RH) of the air is sensed, measured, and reported by a humidity sensor, which also establishes how much water vapor is present in a gas mixture (air) or a pure gas. The process of water adsorption and desorption is connected to humidity sensing. Sensors that measure humidity are used to keep an eye on both agricultural and industrial items. Equipment like incubators, sterilizers, and pharmaceutical manufacturing equipment all require humidity sensors.

Fig. Humidity Sensor

Temperature Sensor:

In order to record, monitor, or communicate temperature changes, a temperature sensor is an electronic device that monitors the temperature of its surroundings and turns the input data into electronic data. Temperature sensors come in a wide variety of forms. Some temperature sensors (contact temperature sensors) need to be in close proximity to the object they are monitoring, whereas other temperature sensors gauge an object's temperature indirectly (non-

contact temperature sensors). Infrared (IR) sensors are frequently used as non-contact temperature sensors.

Fig. Temperature Sensor

Soil Moisture Sensor:

Both the irrigation industry and plant gardens depend heavily on the soil's moisture. In the same way that soil nutrients provide plants the sustenance they need to develop, in order to adjust the plants' temperature, water must be provided to them. Utilizing a process similar to transpiration, water can be used to modify a plant's temperature Additionally, plant root systems grow more effectively in damp soil. Extreme soil wetness might result in anaerobic conditions that can promote the growth of the plant and soil pathogens.

Fig. Soil Moisture Sensor

Rain Sensor:

Rain Detectors are used in the discovery of water beyond what a moisture detector can descry. It can be used as a switch when droplet falls on the rain board and also for measuring downfall intensity. The module features, a rain board and the control board that's separate for further convenience, power index LED and a malleable perceptivity though a potentiometer

Fig. Rain Sensor

Waterflow Sensor:

A copper body, a water rotor, and a hall-effect sensor make up a water flow sensor. The rotor rolls as water passes through it at varying rates, changing speed as a result. And the appropriate pulse signal is output by the hall-effect sensor. A plastic valve that allows water to pass serves as the water flow sensor. The presence of a water rotor and a hall effect sensor

allows for the detection and measurement of water flow. The rotor is turned when water passes through the valve

Fig. Waterflow Sensor

Power Supply:

In order to make power accessible at its output in the form of a smooth and constant direct voltage, a mains power supply must convert the power supplied to it at its input by the sinusoidally alternating mains electrical supply. The transformer's function is to change the 230 V (or 115 V) mains voltage into a form that may be processed further to create a typically considerably lower voltage d.c. supply. Most electrical circuits require 5 to 15 V power supplies

Relay Driver Circuit:

Relay driver circuits can be created using a variety of integrated circuits, and they are used to drive relays. For these relays to activate or turn ON, a drive is required. Relays therefore need driver circuitry in order to turn ON or OFF (based on the requirement). Different integrated circuits, including as the ULN2003, CS1107, MAX4896, FAN3240, A2550, and others, can be used to implement the relay driver circuit. Let's talk about a relay driver circuit using the ULN2003 in this article. Let's first learn more about the IC ULN2003 before going into detail about a relay driver circuit

Fig. Relay Driver Circuit

Turn On/Off Devices:

While collecting the data and different readings by using sensors the relay driver circuit turn on or turn off the actuators as needed.

IOT Website/Laptop:

To display and monitor the different readings the information can be viewed on the particular webpage which is designed for specific monitoring the data and hence the user can remotely access the system from anywhere.

6. Working

1. All sensors and actuators should be set up by using the python language.
2. As the sensors are set up, they start performing their functioning step by step.
3. The temperature sensor senses the temperature in air also the humidity sensors check the humidity side by side and collects data and send to the processor to check the conditions.
4. If the temperature is below the set level, then the Relay driver circuit gets the command the turn on the devices to rise the temperature in Polyhouse and vice versa.
5. Also, the soil moisture sensor checks the moisture in the soil and the soil is too dry then it sends the command to turn on the water flow and the amount of water supply to plant is managed by water flow sensor.
6. Only the needed amount of water supply is done by the waterflow sensor by which plants or crops may not get damage by excessive flow of water.
7. Periodically gather sensor data and transfer it to the controller
8. In accordance with criteria created by the controller using the sensor data, the CPU will process the data and activate or deactivate the appropriate actuators.
9. Wi-Fi is used to update the status of the sensors and actuators on the IOT homepage

7. System Block Diagram

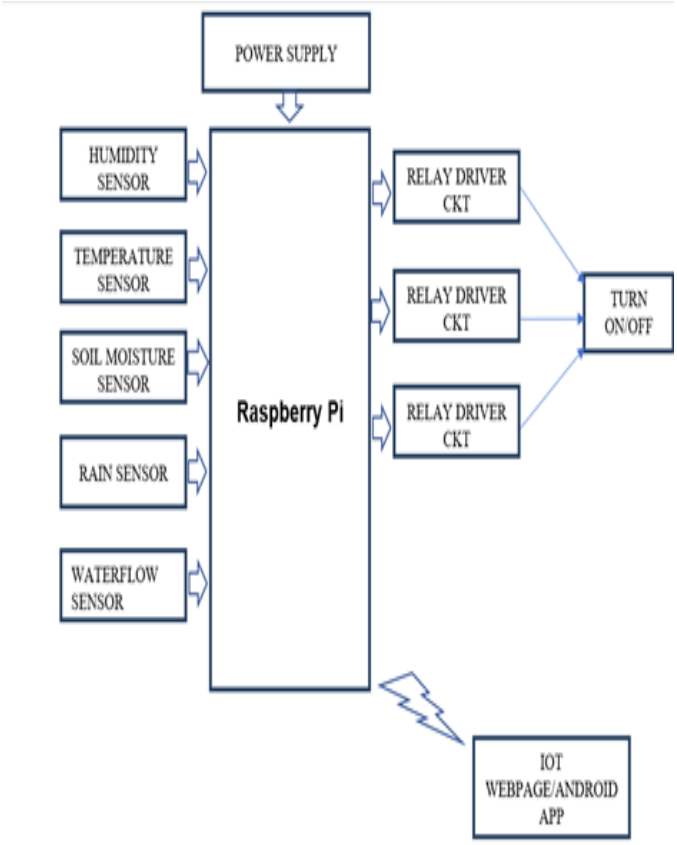

Fig. System Block Diagram

8. Flow Chart

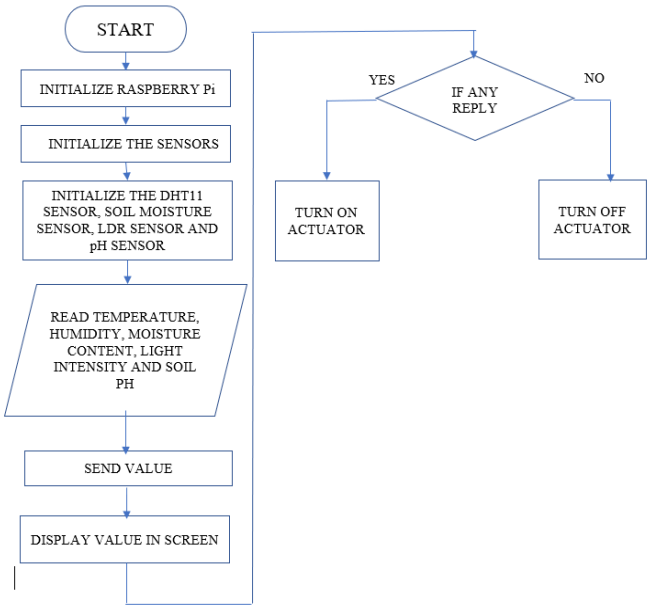

Fig. System Flow-Chart

9. Conclusion

The Smart Polyhouse System with Raspberry Pi, in conclusion, is a cutting-edge technology that has the potential to transform conventional farming techniques. It offers an effective method of crop growth that requires less human involvement and increases output. The system makes use of sensors to keep track of various environmental factors, and the Raspberry Pi board is used to manage equipment like irrigation systems, heaters, and fans.

This system's construction necessitates a thorough comprehension of both agricultural and computer engineering ideas, making it a great subject of study for individuals with an interest in both. This technique is useful for modern farming since it also has uses in precision agriculture, sustainable agriculture, and urban agriculture. The Smart Polyhouse System using Raspberry Pi has the potential to address many of the issues the agriculture sector is now dealing with, including the rising food demand, the scarcity of available land, and climate change. Thus, it is a fascinating field of study with great potential for advancement.

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