IOT BASED POLYHOUSE AUTOMATION WITH CONTROLLING AND MONITORING SYSTEM

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***Abstract*: This paper discusses management of IOT Based Polyhouse Automation with Controlling and Monitoring System automatically without presence of human being in the field. The controlling and monitoring of polyhouse parameters play vital role in overall development of plant. Polyhouse automation system is the technical approach in which the farmers in the rural areas are benefitted by automatic monitoring and control of polyhouse environment. It replaces the direct supervision of the human. The development and growth of crop depends on internal environment of polyhouse such as temperature and humidity. The manual process for polyhouse is that the sunrays fall on it will pre-heat the air inside it. The major parameters to be considered for the polyhouse are temperature, humidity and the intensity of the light. The many polyhouses will be failed to show the result due to the manual error such as not maintain it properly. Scientist proves that the polyhouse techniques can held 4 to 10 times more yielding than the normal method of farming techniques. Mostly the polyhouse is constructed in east to west direction in order to allow proper entry of sun light in polyhouse farming; we can protect our crops from any adverse environment such as high humidity or high temperature. There is a facility in polyhouse to control temperature or humidity.**

***Keywords*: Node MCU, Temperature and Humidity Sensor, Soil Moisture Sensor, LDR Sensor, Polyhouse, IOT, Solar Panel, Battery, Relay, Voltage Regulators.**

INTRODUCTION

The parameters that need optimization are the water content of the soil, the light intensity coming from the natural or artificial sources, the temperature and humidity of the field area. The design proposes monitoring by soil moisture sensor and DHT11(temperature and humidity) sensor; all these sensors collected the data and given to the Node MCU module, and then after processing the data all the parameters are controlled via water pump, motors, exhaust system, and light system as per the data calculations. Focusing on making a smart greenhouse-controlled environment area to grow plants. By using a low cost more efficient programmable module to detect the climatic behavior inside the greenhouse and controlling the parameters according to their crop production need, through various techniques with the use of board ESP8266 Node MCU module. An accurate system would surely bring the change in this world of Android/IDS smartphone applications. The collected environmental parameters data sent to smartphones via online mode to the farmers to make the proper overlook on their fields, no matter how far they are just by using the IOT platform. In the field of agriculture and food production, the technology has paced up very quickly and is still furnishing its way, to optimize and achieve maximum plant growth in the field of agriculture. A polyhouse is a closed environment where the plants are grown on a controlled platform irrespective of climate and location. Generally, polyhouse is a structure built using bamboos or iron pipes which are covered with ultra violet sheet of certain thickness. The thickness of ultra violet sheets depend on the crop variety. Polyhouse provides a reliable and crucial way to generate higher revenues Basically, it is an automation system which alters the physical parameters in favor of the plantation and growth. Focusing on IOT based polyhouse Automation with Controlling and Monitoring System. By using a low cost more efficient programmable module to detect the climatic behavior inside the greenhouse and controlling the parameters according to their crop production need, through various techniques with the use of board ESP8266 Node MCU module. The parameters that need optimization are the water content of the soil, the light intensity coming from the natural or artificial sources, the temperature and humidity of the field area. The design proposes monitoring by soil moisture sensor and DHT11(temperature and humidity) sensor; all these sensors collected the data and given to the Node MCU module, and then after processing the data all the parameters are controlled via water pump, motors, exhaust system, and light system as per the data calculations. With the help of HTTP protocol, the Node MCU module is connected to the wireless internet connection or through IOT platforms like telegram bot. The collected environmental parameters data sent to smartphones via online mode to the farmers to make the proper overlook on their fields, no matter how far they are just by using the IOT platform. In the field of agriculture and food production, the technology has paced up very quickly and is still furnishing its way, to optimize and achieve maximum plant growth in the field of agriculture. An accurate system would surely bring the change in this world of Android/IDS smartphone applications.

PROBLEM STATEMENT:

There are a lot of Technology based products designed for agriculture. Taking few of them as an example: turning on motor through mobile phone, knowing the power status, checking the PH value of the soil, checking the properness of fertilizers etc.

Most of the thing's developed modules are not actually the solution for farmers. These technologies just help farmers in reducing the man power, but not in improving in yields. There has to be proper solution in helping farmers get the better yields or at the least not to spoil the crop they have in time.
A greenhouse is a structure that is built of walls and a transparent roof and is designed to maintain regulated climatic conditions. These structures are used for the cultivation of plants, fruits, and vegetables which require a particular level of sunlight, temperature, humidity and soil moisture. IOT based Polyhouse Automation with Controlling & monitoring System is designed to maintain these conditions in the greenhouse.

OBJECTIVE:
With world population growth, increasing agricultural production with a declining agricultural workforce has brought a new spotlight on agricultural ICT. As the cultivable land in South Korea is relatively small, farmers prefer the high productivity of greenhouse cultivation. In this case, labor efficiency can be achieved by developing an integrated smart platform to collect environmental information and control the greenhouse facility. This requires the construction of a network to transfer the sensed information to the control server and transfer commands from the control server to the control device. When installing a Wi-Fi communication network inside a greenhouse, verifying the communication stability is crucial. Therefore, this study measured the wireless communication transmission/reception ratio and confirmed that the communication distance varied according to the crop density.

SCOPE:
A greenhouse is a structure that is built of walls and a transparent roof and is designed to maintain regulated climatic conditions. These structures are used for the cultivation of plants, fruits, and vegetables which require a particular level of sunlight, temperature, humidity and soil moisture. IOT based Polyhouse Automation with Controlling & Monitoring system is designed to maintain these conditions in the greenhouse.

LITERATURE REVIEW:
Purnima, S.R.N. Reddy, "Design of Remote Monitoring and Control System with Automatic Irrigation System using GSM Bluetooth", International Journal of Computer Applications (0975 – 888) Volume 47– No.12, June 2012
In this paper, automatic irrigation system has seen a rapid growth in terms of technology. At present cost-saving technology, labor-saving are the addressing key issues in irrigation. This paper gives a review of these systems based on existing technologies and also proposes an economical and generic automatic irrigation system based on wireless sensors with GSM-Bluetooth for irrigation system controller and remote monitoring system. This system has simpler features designed with the objective of low cost and effective with less power consumption using sensors for remote monitoring and controlling devices which are controlled via SMS using a GSM module. A Bluetooth module is also interfaced with the main microcontroller chip. This Bluetooth module eliminates the usage charges by communicating with the appliances via Bluetooth when the application is in a limited range of few meters. This paper gives a review of these systems based on existing technologies and also proposes an economical and generic automatic irrigation system based on wireless sensors with GSM-Bluetooth for irrigation system controller and remote monitoring system.

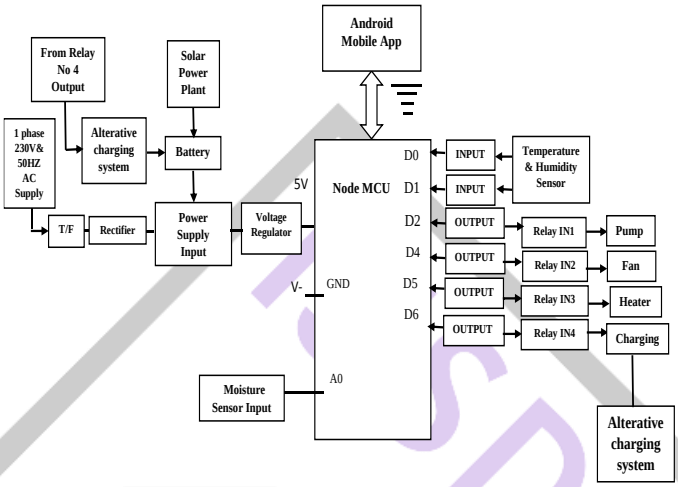
Prashant R. Gade, A. K. Lodhi, "Microcontroller Based Polyhouse Control System ", International Journal of Application or Innovation in Engineering & Management Volume 3, Issue 2, February 2014
In this paper, a ideal for proper plant growth and high yield of the crop, where the climatic ingredient scan be controlled automatically. Polyhouse cultivation is the modern, intensive and is considered highly productive and environment friendly agriculture practice. Polyhouses are constructed by assigning an ultraviolet plastic sheet of thickness 1501m which lasts for a minimum of 5 years. It is constructed using bamboos or iron pipes. In general, the length of polyhouses is 25-30 feet and width of 4-5 feet. The size of the polyhouse may vary according to the requirement. Mostly the polyhouses are always directed towards East to West which allows the polyhouse to utilize the maximum sunlight. Irrespective of the season the temperature and humidity levels can be automatically controlled in the polyhouse thus resulting improper plant growth and high yield of the crop. Agriculture also accounts for 8.56% of the country' s total exports. According to a survey made in 2007, agriculture accounts for 16.6% of India' s Gross Domestic Product. In India, the most influential field as compared to others is agriculture, which perhaps needs more emphasis on better agricultural practices. Crop growth is mainly influenced by the surrounding environmental climatic variables, the amount of water supplied and the fertilizers used for irrigation. By regular monitoring of the soil conditions and environmental conditions the quality of agriculture can be increased.

Bhagyashree K. Chate and J.G. Rana, "Smart Irrigation System Using Raspberry PI" in IRJET, May 2016.
In this paper, a IOT Based polyhouse Automation with Controlling and monitoring system using India is the largest freshwater user in the world, and the country's total water use is greater than any other continent. The agricultural sector is the biggest user of water, followed by the domestic sector and the industrial sector. Groundwater contributes to around □и% of the country's total water demand, and plays an important role in shaping the nation's economic and social development. The requirement of building an automation system for an office or home is increasing day-by-day. Automation makes an efficient use of the electricity and water and reduces much of the wastage. smart irrigation system makes the efficient use of water This paper presents a smart irrigation system for agriculture farm with the use of devices like raspberry pi. Python programming language is used for automation purpose. The aim of this paper is to develop a smart irrigation monitoring system using raspberry pi. Focus area will be parameters such as temperature and soil moisture. This system will be a substitute to traditional farming method. We will develop such a system that will help a farmer to know his field status in his home or he may be residing in any part of the world.

PROPOSED MATHODOLOGY

The appropriate values required to grow a particular crop will be embedded in the system. The system will measure the present conditions inside the polyhouse. The user will provide the input about the crop which he wishes to grow inside the polyhouse. The appropriate conditions for the crop will be set as threshold conditions inside the polyhouse. The control strategy for the system in this work is developed for the individual parameters to be controlled as follows. The temperature control requires the definition of two threshold limits: upper limit and lower limit. When the upper limit is exceeded, a fan is activated to cool the greenhouse environment. When the temperature drops below the lower limit, the fan is deactivated while a heater is activated and vice-versa. Humidity control is defined by a threshold set by the user. When the humidity of the greenhouse enclosure falls below this threshold, a fogging system is activated and then deactivated when optimum condition is restored. If the humidity is more, then fans are switched on to reduce the humidity.

BLOCK DIAGRAM



BLOCK DIAGRAM OF IOT BASED POLYHOUSE AUTOMATION WITH CONTROLLING AND MONITORING SYSTEM

WORKING PRINCIPLE

IoT is a nuclear relator. What we connect to sensors and software and exchange the data in it with the help of IoT device internet is called IOT.

IoT means IoT has 2 components (client) and (server), server is node MCU and client is Android App, we will control our project. That the server will remain the same. Which the Internet provider is the same but the users are different Client

The client does the job of sending the request just like (the client does the job of sending the request when a press the button).

Server

The server responds to the requested request.

And we port the request through internet. And the server enters the internet through the gate

Step 1:

(Input and output port)

Input

1) Our project is divided into 2 parts, input part and output part.

2) INPUT PART has Android Application has 4 buttons and 4 measurement indicators.

3) The first of the 4 buttons is ON / OFF. The second button is FAN ON / OF, the 3rd button is ON / OFF heater.

And the 4th button will help to change the battery (supply change over).

Also, in the measurement indicator have 3 sensors Soil moisture sensor, Temperature and Humidity sensor, LDR sensor.

Step 2:

(Node MCU)

1) Node MCU is in hardware. It is IoT model and ESP-12E is Wi-Fi module in Node MCU. This means that it is made by mixing these two, this is called as Node MCU.

2) is generally how. An IoT device is an IoT when the Internet and microcontroller mix. I need a model to connect with IoT called ESP-12E Wi-Fi module. The ESP-12E is connected in the hand along with the microcontroller so this single Node MCU is made.

NODE MCU PINS

Features:

- Operating Voltage: 3.3V.
- Input Voltage: 7-12V.
- Digital I/O Pins (DIO): 16.
- Analog Input Pins (ADC): 1.

- UART: 1.

1) Analog pins
2) Total pins are 30
3) and its digital input and output pins are 16.
And its flash memory is 4 MB.
And Ram is 64 KB and its total operating voltage is 3.3V. But it manages from 5V to12V.

Step 3:
(Sensor)
1) Sprinkler water pump, heater, Cooling fan, Charging are all operating voltage. And controlling voltage is different so we have used Relay.
2) Relay operates on our 5V and its common supply depends on the application as we can give 12V and 14V but it depends on its application.
3) We are going to use 4 relays, its name is (sugar cube).

Relay type = Sugar cube
Step 4:
Solar Supply (Hybrid)
Right now, our Solar Supply is Hybrid.
Like there are 3 types of solar supply.
1) ON grid / MSCB supply ON grid
2) OFF grid
3) Hybrid
ON GRID =

In ON grid have MSCB supply which means home has a load of 1HP. Suppose install solar panel for 1HP load by estimation of it and some more increase the load and suppose it becomes RHP. For this we use ON grid Solar panel. We synchronize the supply of MSCB. This means that even if the load increases, and do not need to change the solar panel.
Hybrid is independent so we are use it. This means that Hybrid has storage, so we store energy through Solar and we use the battery as we store it in the battery.
OFF grid is direct in the grid so we don't use it.
How to do the project?
1) First let's do full input output wiring.
2) We have 1 Analog to which we will connect Soil moisture Sensor, Temperature & Humidity Sensor & LDR Sensor.
3) Configures Wi-Fi Pass and Node MCU. We configure this in programming. Then we do programming.
4) And the code is the Authentication code which belongs to our software. Software connects when it inputs into it.
A complete IoT system integrates four distinct components: sensors, connectivity, data processing, and a user interface.

HARDWARE IMPLANTATION
Temperature & humidity Sensor (DHT11):
The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%. So, if you are looking to measure in this range then this sensor might be the right choice for you. The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. You can get new data from it once every 2 seconds, so when using the library from Adafruit, sensor readings can be up to 2 seconds old. Comes with a 4.7K or 10K resistor, which you will want to use as a pullup from the data pin to VCC.

DHT11 Temperature & Humidity Sensor

Soil Moisture Sensor:
Although soil water status can be determined by direct (soil sampling) and indirect (soil moisture sensing) methods, direct methods of monitoring soil moisture are not commonly used for irrigation scheduling because they are intrusive and labor intensive and cannot provide immediate feedback. Soil moisture probes can be permanently installed at representative points in an agricultural field to provide repeated moisture readings over time that can be used for irrigation management. Special care is needed when using

soil moisture devices in coarse soils since most devices require close contact with the soil matrix that is sometimes difficult to achieve in these soils. The basic technique for measuring soil water content is the gravimetric method. Because this method is based on direct measurements, it is the standard with which all other methods are compared. Unfortunately, gravimetric sampling is destructive, rendering repeat measurements on the same soil sample impossible. Because of the difficulties of accurately measuring dry soil and water volumes, volumetric water contents are not usually determined directly. Measuring soil moisture is very important in agriculture to help farmer for managing the irrigation system.

Soil Moisture Sensor

NODE MCU (Node Microcontroller Unit):

The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USAN, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping.

Node MCU Development Board.

The NODE MCU is a low-power CMOS 8-bit microcontroller based on the AVR enhanced 28 RISC architecture. By executing powerful instructions in a single clock cycle, the NODE MCU achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed the NODE MCU provides the following features: 4K/8K bytes of In-System Programmable Flash with Read-While-Write capabilities, 256/512/512/1K bytes EEPROM, 512/1K/1K/2K bytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6- channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes.

Solar Panels:

Solar Panels are devices that convert light into electricity. Use of 12V Solar Panels solar panel is a collection of solar cells. Solar cell is a photovoltaic cell is made up of silicon Semiconductor. Polycrystalline Solar panel is used.

Solar Panel

Ni-cd Battery:

Two or more Ni-Cd battery cells combine to form a battery pack. Because they are often sized like primary cells (non-rechargeable batteries), Ni-cd may have lower terminal voltage and less ampere-hour capacity. However, Ni-cd provide a nearly constant terminal voltage during discharge, unlike primary cells, which results in nearly undetectable low charges. During discharge, Ni-cd batteries transform chemical energy into electric energy. During recharge, Ni-cd =retransform electric energy into chemical energy.

NI-Cd Battery

Polyhouse Model:

Polyhouse farming is essentially an outsized greenhouse that uses glass & plastic poly film walls. In Addition, aluminum siding and sheeting, or netting instead of glass and plastic film. With more surface area for solar panels and more insulation. Between you and what nature might throw at you. It's clear why growing in a poly house can save you money on electricity bills. It also makes growing vegetables throughout the winter possible. Polyhouses are easy to build yourself. But many growers choose to have them professionally constructed. This option often includes a low-cost lease option with upgrades later on. When choosing a design for your new home. Keep in mind they come in two main varieties. Those with solid walls and those with mesh coverings. If you are an aspiring entrepreneur who wants to start your own business. You should consider the Polyhouse farming industry as it has many potentials. Making it one of the most profitable businesses today.

Polyhouse Model

Voltage Regulator (LM7805) IC:

Linear voltage regulators also called low-dropout linear regulators use a transistor controlled by a negative-feedback circuit to produce a specified output voltage that remains stable despite variations in load current and input voltage. Electronic systems usually receive a power-supply voltage that is higher than the voltage required by the system's circuitry. For example, a 9 V battery might be used to power an amplifier that needs an input range of 0 to 5 V, or two 1.5 V batteries in series might provide power for a circuit that includes 1.8 V digital logic. The transistor inside the regulator, which is connected between the input and output terminals, functions like a variable series resistance; thus, high input-to-output voltage differential combined with high load current results in large amounts of power dissipation. The current required for the functionality of the regulator's internal circuitry, labeled in the diagram, also contributes to total power dissipation.

Voltage Regulator

Relay (Sugar Cube):

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters:

they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Channel 5V Cube Relay Module

ADVANTAGES:

1. Polyhouse is very beneficial for the farmers specially those who prefer organic farming. here are few of the benefits of a polyhouse:
2. Your plants are grown under controlled temperature thus there is less chances of crop loss or damage.
3. You can grow crops throughout the year and will not have to wait for any particular season.
4. There are less pests and insects in a polyhouse.
5. External climate will not have any impact of the growth of crops.
6. Quality of produce is obviously higher in polyhouse.

APPLICATION:

1. Education.
2. Research.
3. Organizations**.**

CONCLUSION:

IOT Based Polyhouse Automation with controlling and Monitoring System is highly useful for farmers as they don't have to monitor the conditions inside the polyhouse physically and take the required steps. The system will monitor the conditions and take the respective steps required to maintain the threshold conditions inside the polyhouse. it can be more expensive to afford an effectual micro climate control system only for bigger greenhouses but results to it is always more effective. Based on size of the land the profit can be increased on each addition of sensor devices, automating it further helps in large productivity. Considering the small polyhouses or greenhouses, these can observe a control system by keeping the monitoring unit as centralized unit and distributing the sensors and actuators all over the area of sub greenhouses. The central programming unit controls temperature, light and soil moisture and rail by actuating exhaust fan, artificial light, water pump and ventilators based on different conditions of sensors. In this manner, the crop can give a better yield in very less time. Since, the crops are working for extra hours because of artificial environment. Also considering the survey, growing different crops in a single unit gives advantage for the farmer.

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