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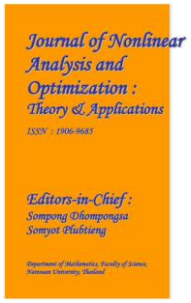

IOT-ENABLED GREENHOUSE MONITORING AND CONTROL SYSTEM

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ABSTRACT

Greenhouse is a controlled area environment to grow plants. In order to achieve maximum plant growth, the continuous monitoring and controlling of environmental parameters such as temperature, soil moisture, light intensity, humidity etc. are necessary for greenhouse system. A greenhouse provides an environment to grow plants all year round, even on cold and cloudy days. The main aim of this project is to design a simple, low cost system to monitor the value of environmental parameters and they are continuously updated and controlled in order to achieve optimum plant growth. There are various techniques available for precision agriculture to monitor and control environment for the growth of many crops. Due to the unequal distribution of rain water, it is very difficult to fulfil requirement needed by farmers to manage water equally. It requires some irrigation method that are suitable for any weather condition, soil types and variety of crops. It is more important to find method that give perfect analysing and controlling to develop proper environment.

Greenhouse is the best solution to control and manage this problem. DHT11, soil moisture sensor, LDR sensor are the main sensors used in this project which give the exact value of temperature, humidity, water content in soil and light intensity respectively. A cooling fan, artificial light and motor pump are connected to Raspberry pi. Here Raspberry pi processor and IOT (Internet of Things) are used. The use of IOT is to control devices or any environmental needs anytime, anywhere. Based on the characteristics of correct perception, efficient transmission and intelligent synthesis of Internet of Things. This project consists of, programming a raspberry pi using Python language to acts as the central hub that manages the various sensors such as DHT11, soil moisture, LDR and creating a app to allow the user to interact with the greenhouse controller.

I. INTRODUCTION:

Agriculture is the spine of India's economic activity and our experience during the last 50 years has demonstrated the strong correlation between agricultural growth and economic prosperity. Agriculture in India is still carried out in conventional way lags behind in integrating modern technologies. If India has to emerge as an economic power in the world, a new and effective technology which can improve continuously the productivity, profitability, sustainability of our major farming system is necessary. One such technology is the greenhouse technology. It is an old technique, but anyone can monitor it by using new technology to improve the system which can increase the yield and produce healthy organic food. Green house industry is the fastest growing sector. Greenhouses are controlled area environment to grow plants.

A greenhouse provides an environment to grow plants all year round, even on cold and cloudy days. However, extreme environmental factors inside the greenhouse such as high temperatures and a high humidity can negatively impact the plants. Consequently, controlling this environment is essential in order for the plants to grow strong and healthy. The main aim of this project is to design and build a greenhouse controller that can maintain the environmental parameters, by acting upon live sensor readings and be able to display the status of the system to the owner. Here the Raspberry Pi is used as a controller. It receives input from a variety of a sensors and it control light. The greenhouse separates the crop from the environment, thus providing some way of shelter from external environment. IOT is the network of physical thing embedded with electronic circuits, sensors, software and network connection which enables these. Thus, to exchange data from one another. The main advantage of greenhouse is to produce many crops at a time by manipulating environmental condition as per different crops. It leads to higher crop yield, prolonged production period, better quality, and less use of protective chemicals.

1.2 WORKING:

The Raspberry Pi is the heart of the system. The Raspberry Pi Model zero incorporates a number of enhancements and new features. This features of Raspberry Pi has increased connectivity and greater IO

which made this powerful, small and lightweight ARM based computer. The Raspberry Pi cannot directly drive the relay. It has only zero volts or 3.3 V. It needs 12V to drive electromechanical relay. In that case it uses a driver circuit which provides 12V amplitude to drive the relay. Various sensors are connected to the Raspberry Pi board give a resistance variation at the output. This output signal is applied to the comparator and signal conditioning circuit which has potentiometer to decide the moisture level above which the output of comparator goes high. This output signal is given to the Raspberry Pi board. If the soil moisture value is above the moisture level then the motor will be OFF, whereas if the moisture level is low motor will be ON through the relay. LDR (Light Dependent Resistor) is used to control the light automatically and by using this one can monitor the farm at night also. A cooling fan, artificial light and motor pump are connected to Raspberry-pi with the help of Raspberry pi processor and IOT (Internet of Things). By using IOT one can control devices or any environmental needs anytime, anywhere. Based on the characteristics of correct perception, efficient transmission and intelligent synthesis of Internet of Things. The project mainly focuses on developing a system that can automatically measure and monitor changes of temperature, light intensity, humidity and moisture level in the greenhouse. This project consists of, programming a Raspberry Pi using Python language to acts as the central hub that manages the various sensors such as DHT11, soil moisture, LDR and creating a app to allow the user to interact with the greenhouse.

1.3 BLOCK DIAGRAM OF PROJECT AND FUNCTIONING

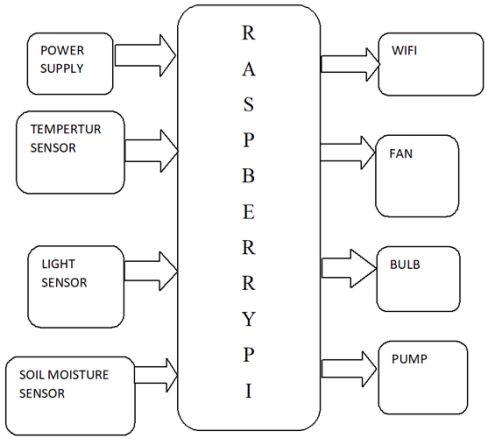

FIG 1. FUNCTIONAL BLOCK DIAGRAM

Temperature Sensor, soil moisture sensor, LDR, pump, fan and bulb are connected to the raspberry pi as above figure. The temperature sensor turns on the fan is the temperature is above 40 degree Celsius, the soil moisture sensor senses the moisture of the soil if the moisture content is low it starts the pump and the Light Dependent Sensor turns on the bulb if the intensity of the light in the surrounding environment is less.

1.4 COMPONENTS FUNCTIONALITY:

1.4.1 TEMPERATURE SENSOR:

Temperature Sensor which converts temperature value into electrical signals. The IC called LM35 is a temperature sensor. LM35 series sensors are precision integrated-circuit temperature sensors whose output voltage is linearly proportional to the Celsius temperature. The LM35 requires no external calibration since it is internally calibrated. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range.

1.4.2 FAN:

A vital way of maintaining good health is appropriate air circulation. Good ventilation keeps bad odors, impurities and other unsafe gases away, and stops the formation of harmful mold inside your home. A proper ventilation device keeps your home away from unfortunate damage. Exhaust fans are a means to make sure the appropriate ventilation in your home. The major areas where it should be installed are the restroom as well as the kitchen as they usually contain most of the moisture and odours.

1.4.3 SOIL MOISTURE SENSOR:

Soil moisture sensors measure the water content in soil. A soil moisture probe is made up of multiple soil moisture sensors. One common type of soil moisture sensors in commercial use is a frequency domain sensor such as a capacitance sensor. Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. Not only are farmers able to generally use less water to grow a crop, they are able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages.

1.4.4 LDR:

An LDR or a photoresistor is a device that is made up of high resistance semiconductor material. This article gives an overview of what is LDR or light-dependent resistor circuit and its working. An electronic component like LDR or light-dependent resistor is responsive to light. Once light rays drop on it, then immediately the resistance will be changed. The resistance values of an LDR may change over several orders of magnitude. The resistance value will be dropped when the light level increases.

1.4.5 BULB:

A light bulb, incandescent lamp or light globe is an electric light with a wire filament heated until it glows. The filament is enclosed in a glass bulb with a vacuum or inert gas to protect the filament from oxidation. Current is supplied to the filament by terminals or wires embedded in the glass. A bulb socket provides mechanical support and electrical connections.

1.4.6 RASBERRY PI:

A Raspberry Pi3 board contains BCM2837 controller which supports ARM11 processing unit. This is the Broadcom chip used in the Raspberry Pi 3, and in later models of the Raspberry Pi2. The underlying architecture of the BCM2837 is identical to the

BCM2836. The only significant difference is the replacement of the ARMv7 quad core cluster with a quad-core ARM Cortex A53 (ARMv8) cluster. The ARM cores run at 1.2GHz, making the device about 50% faster than the Raspberry Pi2. The Video core IV runs at 400Mhz.The Raspberry Pi 3 Model B builds upon the features of its predecessors with a new, faster processor on board to increase its speed. It also features WIFI and Bluetooth Low Energy capabilities to enhance the functionality and the ability to power more powerful devices over the USB ports.

II. POWER SUPPLY

The input to the circuit is applied from the regulated power supply. The AC input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating DC voltage. So, in order to get a pure DC voltage, the output voltage from the rectifier is fed to a filter to remove any AC components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant DC voltage.

2.2 BLOCK DIAGRAM:

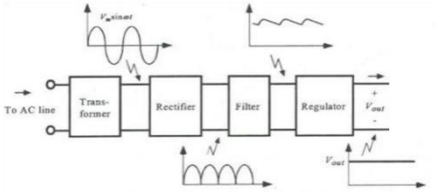

FIG 2.BLOCK DIAGRAM OF POWER SUPPLY

III. FLOWCHART:

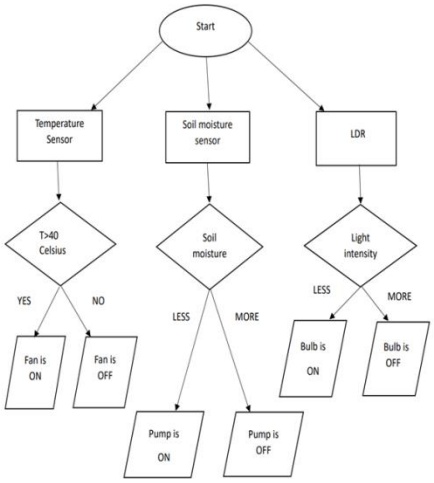

FIG.3: FLOWCHART FOR GREENHOUSE MONITORING AND CONTROLLING

The temperature sensor is used for sensing the temperature of the surroundings if the temperature in the surroundings is above 40 degree celsius then the fan is turned on to cool down the temperature of the surroundings, else if the temperature is less than 40 degree celsius the the fan is off. The soil moisture sensor is used for sensing the moisture content in the soil if the moisture content is less the pump is started else it is off. The Light Dependent Sensor works based on the intensity of the light in the surroundings if the intensity of the light in the surroundings is less then the bulb is turned on or else it is turned off.

IV. RESULT

4.1 RESULT WITHOUT POWER SUPPLY:

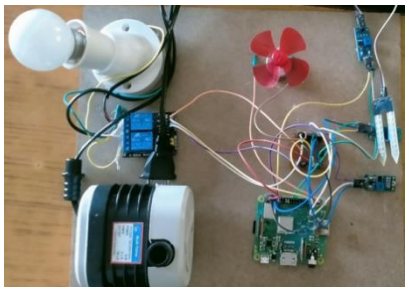

FIG 4: RESULT WITHOUT POWER SUPPLY

The temperature sensor is connected to the raspberry pi for sensing the temperature of the surroundings. The soil moisture sensor used for sensing the moisture of the soil and the LDR sensor works based on intensity of light and ON or OFF the bulb accordingly.

4.2 RESULT WITH POWER SUPPLY:

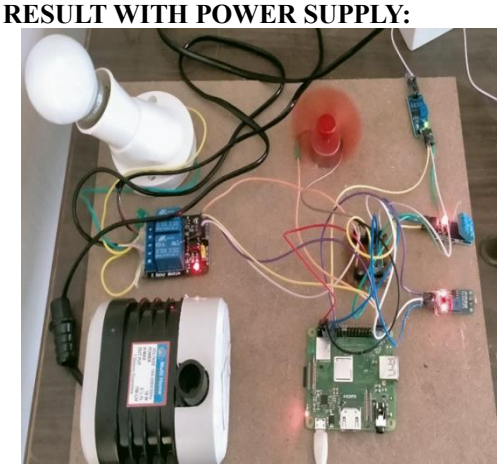

FIG 5. RESULT WITH POWER SUPPLY

Temperature Sensor, soil moisture sensor, LDR, pump, fan and bulb are connected to the raspberry pi as above figure. The temperature sensor turns on the fan is the temperature is above 40 degree Celsius, the soil moisture sensor senses the moisture of the soil if the moisture content is low it starts the pump and the Light Dependent Sensor turns on the bulb if the intensity of the light in the surrounding environment is less.

4.3 ADVANTAGES:

- Control and establish the optimal environment for cultivation. And can also adjust the temperature.
- Increases the production of the crops.
- The best conditions for plant growth while driving energy efficiency.
- It provides optimum environment for growing a specific crop.

- Helps in temperature sensing and controlling by turning ON the fan.
- Helps in soil moisture sensing and controlling by turning ON the pump to increase the water content of the soil.
- Helps to turn ON the light bulb if the intensity of light is low in the surroundings.

4.4 DISADVANTAGES:

- No protection against diseases, pests and other vermin.
- The maintenance and day to day care of greenhouse is difficult tasks and it is very costly. It requires heavy recurring expenses.
- Capital investment for the erection of greenhouse is very high hence it is beyond the reach of small and poor farmers.

4.5 APPLICATIONS:

- Helps the farmers with increased production which may not yield in normal conditions.
- Helps in measuring the humidity and temperature and maintain the appropriate condition for growing the crop.

V. FUTURE SCOPE:

In this project it only monitors and controls the temperature, soil moisture and the bulb. In future monitoring more parameters like PH of soil, pressure, and water level can be added and at the same time control them.

Climate Control and Automation: Advanced climate control systems can regulate temperature, humidity, ventilation, and CO2 levels within the greenhouse. Automation can help in adjusting these factors based on specific crop requirements, reducing the need for manual intervention and optimizing growing conditions.

Water Management: Efficient water usage and irrigation systems are crucial for sustainable greenhouse operations. Future developments may include the use of smart irrigation systems, moisture sensors, and water recycling techniques to minimize water consumption and ensure optimal moisture levels for plants.

REFERENCES:

[1] Wang Yi and Zhou Jie, "Design and Realization of Remote Monitoring System of Greenhouse Environment by Using GSM," Modern Electronics Technique, 2008, vol. 31, pp. 151-154.

[2] Remya Koshy, M D Yaseen, K Fayis, Shaji Nisil, N J Harish, M Ajay, "Greenhouse Monitoring and Control Based on IOT Using WSN,"ITSI Transactions on Electrical and Electronics Engineering, vol. 4, no. 3, 2016.

[3] Mittal, M., Tripathi, G., "Green House Monitor and Control Using Wireless System Network,"VSRDIJEECE, Vol. 2 (6), 2012, 337-345, 2012.

[4] Rahul Belsare, Komal Deshmukh, Mayuri Patil, A.M. Hattarge, "Smart Green House Automation,"International Journal of Computer Science & Engineering Technology (IJCSET), pp. 1127-1129.

[5] Ashwini Bhosure, Mayur Bhosure, Rakeshkumar Sharma, "Web Based Greenhouse Monitoring and Controlling System using Arduino Platform,"International Journal of Scientific Engineering and Applied Science (IJSEAS), vol. 2, no. 2, February 2016.

[6] Prerna Chaudhari, Aparna Kamble, Snehal More, Namrata Sawant, Archana Chaugule : "Crop Monitoring System using Raspberry-Pi," International Journal of advance Reasearch in science and engineering volume no.06, Issue no. 10, oct 2017.