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RESEARCH ARTICLE OPEN ACCESS

MONITORING OF ENVIRONMENTAL ATTRIBUTES IN GREENHOUSE USING IOT

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Abstract

The main aim of this project is to design a simple, low cost, Arduino based system to monitor the values of environmental parameters and measured parameters are continuously updated and controlled to achieve optimum plant growth and yield. DHT11 sensor, LDR sensor, Soil moisture sensor, CO_2 sensor, UV sensor and fire sensor are the main sensors used in this project which gives the exact value of temperature, humidity, light intensity, water content, Co_2 level radiation intensity and fire respectively. All measured environmental parameters are sent to Android mobile phone via online. Blynk app is used to monitor the and control the parameters through online. When the sensor value exceeds a threshold or defined level then the notification is sent to the mobile user. The greenhouses can be controlled by all the farmers by knowing the status of measured parameters from any place and at any time and they can control actuators (cooling fan, exhaust fan, artificial light water pump and motor pump) to get desired level of environmental parameters by sending notification. This system reduces the power consumption, maintenance and complexity and maximizes the crop yields.

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I. INTRODUCTION

Agriculture is the spine of India's economic activity and it is still lagging behind in integrating modern technologies. If India wants to emerge as an economic power in the world, we need to develop new and effective technologies which can improve continuously the productivity, profitability, sustainability of our major farming system. One of the technology which provides the above mentioned advantages is Greenhouse technology. Greenhouse provides an environment to grow plants throughout the year irrespective of seasons by providing shelter from external environment. However, extreme environmental parameters inside the greenhouse such as high temperatures and a high humidity can negatively impact the plants. So 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 control the environmental parameters, by acting upon live sensor readings and is able to display the status of the system to the owner. Here we will use ARDUINO as a controller. It will receive input from a variety of a sensors and it control motor, light and other actuators. In order to monitor environmental parameters DHT11 sensor, Soil Moisture sensor, LDR sensor, Co_2 sensor, UV sensor and fire sensor are used which measures the value of temperature & humidity, water content, light intensity, Co_2 level radiation intensity and fire respectively. All measured parameters are sent to android mobile phone . A

GSM modem is used to send SMS when the sensor value exceeds a defined level which displays the present status of the environmental parameters.

II. RELATEDWORK

From the existing methodology we have taken the sensors like DHT11,Soil Moisture and LDR sensors to measure parameters like temperature&humidity, water content in the soil and light intensity levels in the soil respectively. In Addition to that,we have added $CO_2$and UV are used to measure carbon dioxide gas level, intensity of incident ultraviolet radiation. Along with that we have used a Fire sensor to protect the system when any sort of fire occurs within the system.

III.METHODOLOGY

The total progresses of method square measure tired this technique by mistreatment the materials that square measure used their process additionally explained clearly.

A. ARDUINO MEGA

The Arduino Mega 2560 could be a micro controller board supported the ATmega 2560. It offers 54 digital input/output pins (of that 15 are often used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports),a 16 Mhz quartz oscillator, a USB association, power jack, an ICSP header, and push button. It contains everything required to support the micro controller; merely connect it to a personal computer with a USB cable or battery to induce started.

Fig. 1Arduino mega

B. NODE MCU

NodeMCU comes with variety of GPIO (General Purpose Input Output) pins. Following figure shows the pin diagram of the board.There is a candid distinction between VIN and VU wherever former is that a regulated voltage which will stand somewhere between 7 to 12 V whereas later is that the power voltage for USB that has got to be unbroken around 5V.Node MCU V3 is principally employed in the Wi-Fi applications that most of the opposite embedded modules fail to method unless in corporate with some external Wi-Fi protocol. Following are some major applications used for NodeMCU V3.

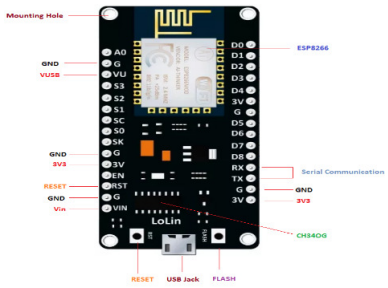

Fig 2:-NODE MCU

C. DHT11 SENSOR

This sensor is basically a low-cost digital humidity & temperature sensor. This sensor gives digital output and therefore, it can be directly connected to data 3 pins of the micro controller inspite of using ADC. It also consists of an eight bit micro controller to provide values of temperature & humidity in the form of serial data. It has 4 pins : VCC, GND, DATA and NC. It operates in between the range from 3.3-5 volts power supply. Humidity is determined by means of measuring the conductivity of liquid substrate that alters with exchange in humidity and the temperature is calculated by the usage of a thermistor.

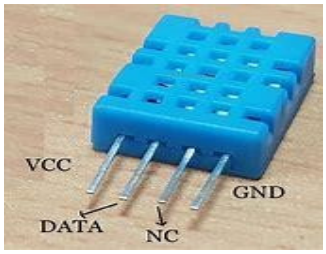

Fig. 3 DHT11 Sensor

D. SOIL MOISTURE SENSOR

Moisture sensor has 3 pins – one is for voltage input, second is for ground and third is for analog input. Water content of the soil (volume %) can be measured by using this sensor. The analog value needs to be mapped within the vary of 0-100 as wetness content is evaluated in percentage. Electrical resistance property is used by this sensor. There are pair of probes in this sensor that helps us to pass current through the soil. After that it gets the value of resistance to measure the water content level in soil. This implies that higher the water content higher is the electricity which implies lesser resistance. If the soil is not wet then there is poor conduction in the soil, this leads to increase in level of resistance. Therefore, it uses the property of resistance to measure the wetness in the soil.

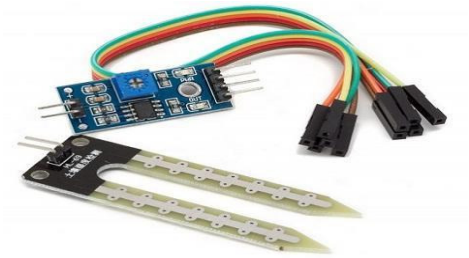

Fig. 4 Soil Moisture Sensor

E.LDR SENSOR

LDR (Light Dependent Resistor) sensor module is used to measure light intensity. It has both an analog output pin and digital output pin. If light intensity increases, resistance of LDR decreases and vice versa., The sensor has a potentiometer knob which is used to adjust the sensitivity of LDR towards light. LDR is also called as Photo conductor.

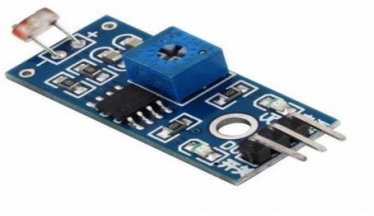

Fig. 5 Ldr Sensor Module

F.UV SENSOR

UV sensor measures the intensity of incident ultraviolet (UV) radiation. This type of electromagnetic radiation has shorter wavelengths than visible radiation, but is still longer than x-rays. UV sensors are used for determining exposure to ultraviolet radiation in laboratory or environment setting. Wavelength range in nanometers (nm), that can be detected by UV sensors. UVA radiation ranges the wavelengths from 315 nm to 400 nm. UVB radiation covers the wavelengths from 280 nm to 315 nm. UVC radiation is defined in between 100 nm and 280 nm. Because UVC radiation is more energetic and also the most harmful.

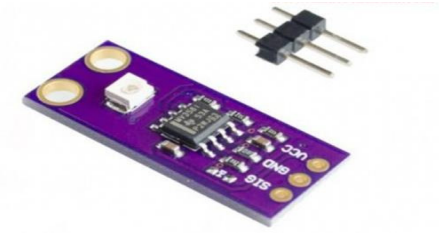

Fig.6 UV Sensor

G.Co_2 SENSOR

A carbon dioxide sensor or CO2 sensor is used for the measurement of carbon dioxide gas. Measuring carbon dioxide gas level is important in monitoring indoor air quality. The carbon dioxide gas sensor measures the carbon dioxide gas level by detecting the quantity of IR radiation absorbed by carbon dioxide molecules. The device employs a hot metal filament that acts as an IR supply to come up with IR radiation.

Fig. 7 Co_2 Sensor

H. FIRE SENSOR

A fire sensor/detector works by detecting smoke or heat. These devices responds if there is smoke or extremely high temperatures that are present with a fire. After the device has been activated, it sends a signal to the alarm system to perform the programmed response for that zone.

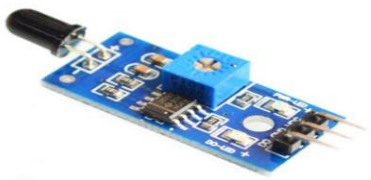

Fig. 8 Fire Sensor

I. LCD

The term LCD stands for liquid crystal display. It is one type of electronic display module used in an wide range of applications like various circuits &devices like calculators, mobile phones, TV sets,computers, etc. These displays are mainly used for multi-segment light emitting diode and seven segments. The main benefits of using this module are inexpensive, easily programmable, animations, and there are no limitations for displaying custom characters, special and animations, etc.

Fig. 9 Lcd

J.DC MOTOR

A machine that converts DC power into a mechanical power is known as dc motors. Its operation depends on the principle that when a current carrying conductor is placed throughout the field of force, the conductor experiences a mechanical force.

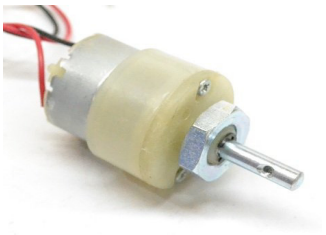

Fig. 10 DC motor

K. BLYNK

Blynk is a platform that allows you to rapidly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device.After downloading the Blynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen.

Fig.11 Blynk

IV.OVERVIEWOFPROPOSEDWORK

A greenhouse is a structure that is built of walls and is transparent roof and is designed to maintain regulated climatic conditions. These structures are preffered for the cultivation of plants, fruits, and vegetables which require a particular level of environmental parameters like sunlight, temperature, humidity and soil moisture. IoT and Arduino based Greenhouse Environment Monitoring and Controlling Project is designed to maintain and control the environment conditions in the greenhouse. It uses four sensors to detect the Temperature, Light, Humidity and Soil moisture in the Greenhouse. Temperature inside the greenhouse can be detected or measured by temperature sensor. Reading from the sensor is sent to the micro controller. The micro controller is connected to different relays. One of those relays is connected to a blower. If the temperature is above or below the threshold value, then the

micro controller would send signals to turn ON the Fan.

In today's greenhouses, monitoring and controlling of many environment attributes are important for the good quality and productivity of plants. But to get the desired result some parameters like temperature, humidity, soil moisture, light intensity, carbon dioxide, UV radiation are important for better plant growth. So an Arduino based project is designed. Arduino microcontroller is used. Arduino can receive input from a variety of sensors and it can control actuators like motors, lights and other.

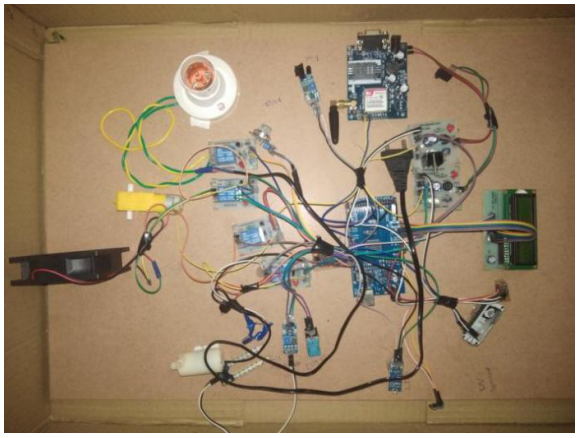

Fig.12 Monitoring Of Environmental Attributes in Greenhouse Using IoT

Six sensors, DHT11 sensor, LDR sensor, Soil moisture sensor UV sensor, CO2 sensor and Fire sensor are used. Temperature and humidity are measured by the DHT11 Sensor. Soil moisture sensor can measure the water content in soil. UV sensor for the protection of plants from harmful radiation (UV-B). CO2 sensor for providing sufficient amount of CO2 for respiration. Fire sensor for farm safety and fire protection. A cooling fan, exhaust fan, water pump, artificial light and motor pump are also connected to the Arduino. All environmental parameters are sent to android mobile Phone via offline and online.

V. BLOCK DIAGRAM

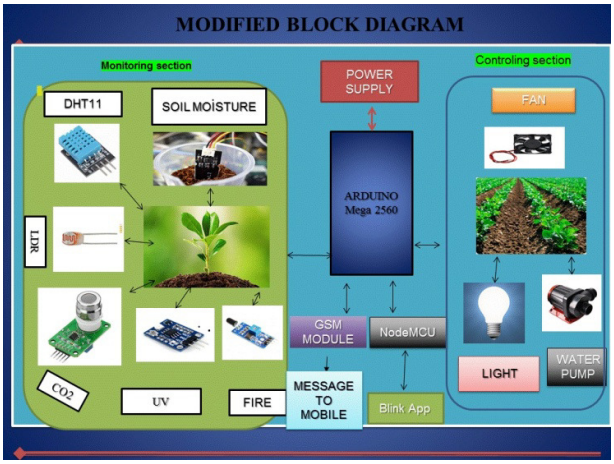

Fig.13 Block Diagram

VI.CONCLUSIONS

An Arduino based greenhouse monitoring and controlling system is designed. DHT11 sensor, Soil Moisture sensor, CO2 sensor, LDR sensor, UV sensor and Fire sensor are the main sensors used in this project which give the exact value of temperature, humidity, moisture content, CO2 level, light intensity, UV radiation and Smoke range respectively. This system is designed for controlling and monitoring environmental parameters in Greenhouse by a simple IoT connected blynk Application. This system reduces the power consumption, maintenance and complexity. This project can be used in agricultural field, in nursery and in botanical gardens.

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