International e-Conference on New Horizons And Multidisciplinary Applications In Science And Technology
In Association withInternational Journal of Scientific Research in Science and Technology
Volume 9 | Issue 6 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)

Automation and Monitoring of Greenhouse with Arduino

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ABSTRACT

Automation and monitoring of greenhouse is very beneficial for farmers in India, especially in rural India. The main objective of this work is, to develop a simple and cost-effective system which monitor and control the environmental parameter in the greenhouse to maintain the best possible environment for crops and to get maximum yield. This system is also minimizing the labor cost of farmers.

Keywords: Greenhouse, Arduino

I. INTRODUCTION

In an agriculture field climate change is one of the major reason for low production & loss of crops. Which results in a shortage of food production. [1] To overcome this problem it needs to get crop production in control environment such as a greenhouse.

In this work greenhouse automation system is make using Arduino, with three necessary sensors namely LDR for light sensing, HTU21D sensor for temperature and humidity sensing, and soil moisture sensor to find the water content in the soil. Also, for controlling the various actuators & motors relays are used. LCD is used to display real-time values of temperature, humidity, light intensity & soil moisture level.

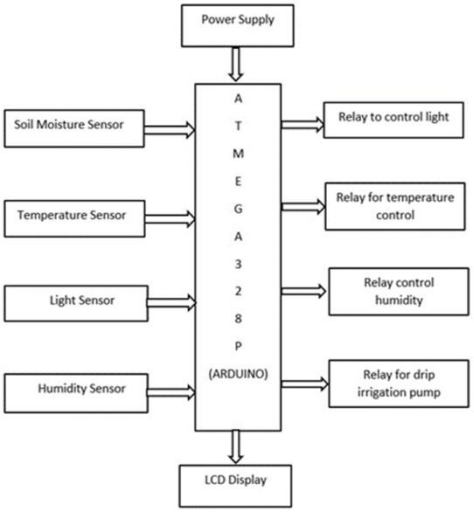

Fig 1: Block Diagram

II. METHODS AND MATERIAL

This system is developed by using three sensors (Temperature & moisture, Light sensor, Soil moisture sensor), Arduino UNO & relays.

1) System Hardware

A. Arduino Uno

Arduino UNO is the open-source development board. I consist Atmega 328P (DIP package) microcontroller. This board have total 6 analog input pin, 14 digital input/output pins, 1 UART port, 1 I2C port & 1 SPI port

Fig 2: Arduino Uno

Analog input pins are used to read the sense value of the light sensor and soil moisture sensor while digital pins are used to switch relay also a temperature and humidity sense through the I2C port.

B. Temperature and Humidity Sensor (HTU21D)

It is a high-resolution, high-speed temperature and humidity sensor. This sensor is connected with an Arduino using an I2C port. With this sensor, the temperature T(in^{0}C) is calculated by inserting temperature signal output S_{Temp} into the formula

$T = -46.85 + 175.72 \times \frac{S_{TEMP}}{2^{16}}$ while relative humidity % RH is calculated by inserting relative humidity signal output S_{RH} into formula $\%RH = -6 + 125 \times \frac{S_{RH}}{2^{16}}$

Fig 3: Temperature and Humidity Sensor (HTU21D)

The main work of this sensor is to monitor and maintain the greenhouse temperature and humidity within the desired range. If this parameter is below or above the desired range then the microcontroller sends signals to the respective device such as cooler or heater for temperature control and humidifier for humidity control.

C. Light Sensor (LDR)

The LDR stands for Light Dependent Resistor. This sensor is used to measure the light intensity level. When the light intensity is below desired value then the microcontroller turns on the light.

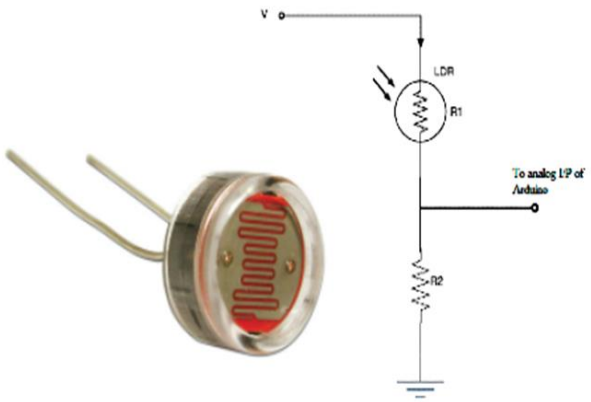

Fig 4: Light Sensor (LDR)

D. Soil Moisture Sensor

The soil moisture sensor has two metal plates. These metal plates are immersed in soil whose water content is to be measured. Now the resistance between two plates depends upon the water content of the soil

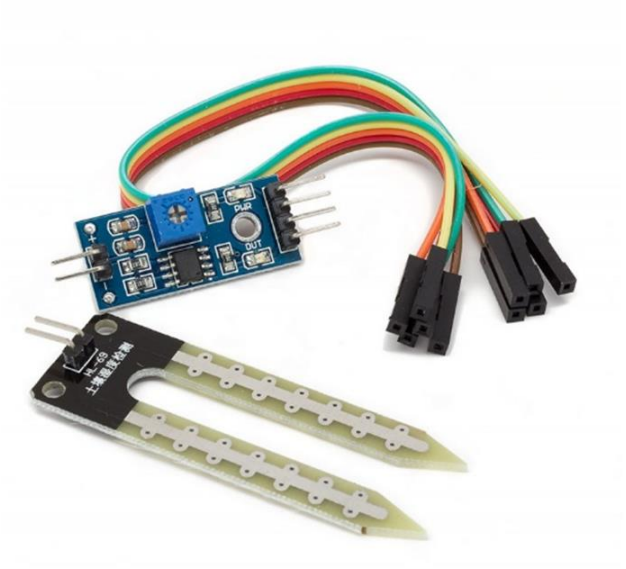

Fig 5: Soil Moisture Sensor

If the Water content is low, the resistance between plates is high and vice versa. This change in resistance changes the analog output value of the sensor. If the soil water content is below or above the range then the microcontroller turns on or off the drip irrigation system.

2) System Software

The system software is developed in C language using Arduino IDE.

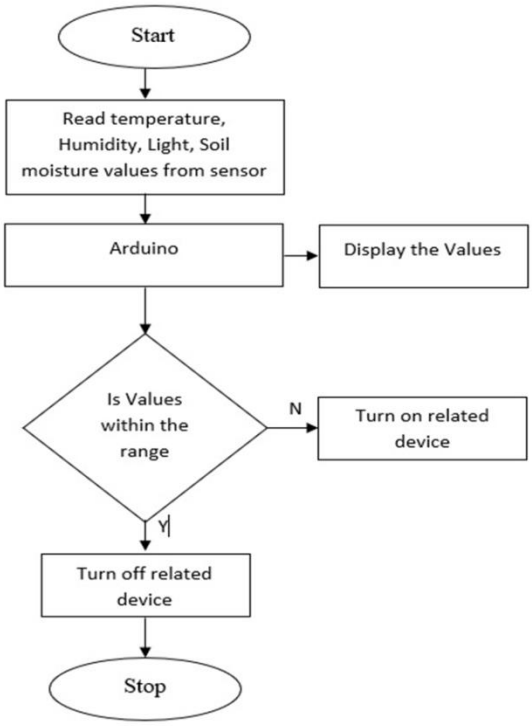

Fig 6: Flow chart

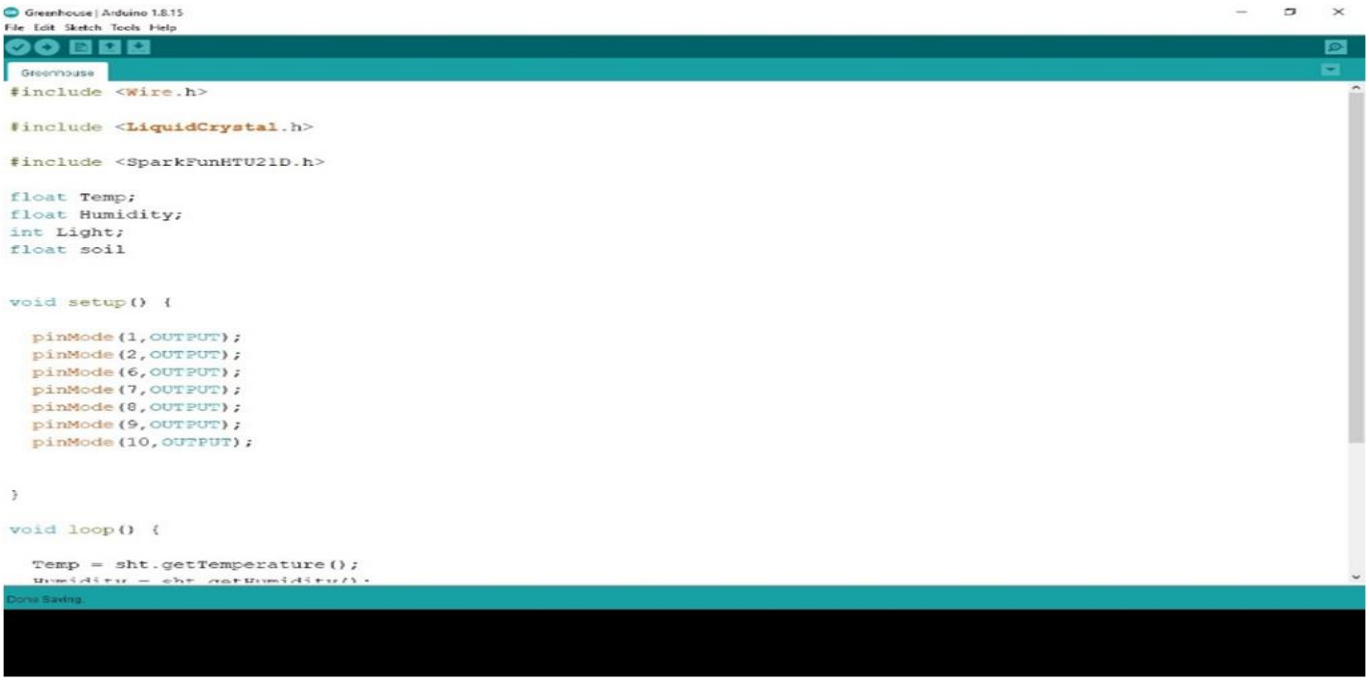

Fig 7: IDE software

III. RESULT

It is observed that if climate parameter such as temperature, humidity, light, soil water content is out of range then the corresponding device is controlled by relays. If the temperature goes below or above desired range

then the system turns on the heater/cooler. If the light intensity is low system turn on artificial light. It is also observed that if soil water content is below range then the system automatically turns on drip irrigation pump and turn off the pump when the desire water content level is achieved. Similarly, humidity is maintained within the range by turning on or off the humidifier

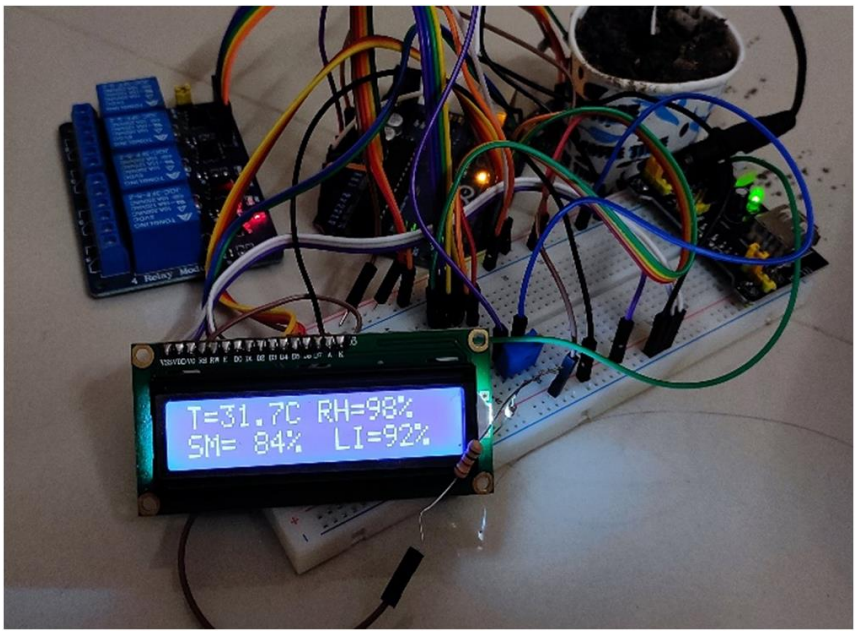

Fig. 8: Working model

IV. CONCLUSION

This system is used to implement in the greenhouse. The accuracy of this system is far more than a manual system and hence eliminates human error. Using this system farmers can get healthy crops all over the year hence maximize their income. This system is also useful for the nursery & garden.

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