International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-9 Issue-1, May 2020

Automatic wireless Monitoring and Controlling of Greenhouse using multiple sensors

T.Jyothirmai, P.Sireesha, P.Anusha, M.Venkata Padma, N.Vasavi, R.Lavanya

Abstract*: Many parameters like temperature, soil moisture, light intensity, Humidity, Carbon dioxide (CO2) leads to the healthy growth of plants in greenhouse environment. Observing only few of those leads to improper growth of plants and minimize the yields. Every grower cannot visit the field and observe the parameters continuously. In order to monitor the parameters and give the approximate control to the greenhouse, we proposed this system. This system continuously monitors the plants and communicate the information to the grower through wireless Sensor Network (WSN), thus reducing the risk of staying at the field. The proposed system has three stations - Transmitter Station (TS), Control Station (CS), and Communication Station (CMS). The ZigBee plays a major role by enabling communication between the three stations. This implementation supports the farmers to simplify the management and to increase the crop production. The overall system has shown the benefits in price, volume, and strength.

Keywords: Greenhouse Environment, Wireless Sensor Network, ZigBee

I. INTRODUCTION

A greenhouse is structure with different types of transparent materials such as a glass or plastic materials. These structures range in small size from low cost industrialized sized buildings. The plants are created in adequate condition, particularly in some nations where the atmosphere is in troublesome conditions.

Manuscript received on April 02, 2020.
Revised Manuscript received on April 15, 2020.
Manuscript published on May 30, 2020.
* Correspondence Author
T.Jyothirmai, ECE department, Bapatla Women's Engineering College, Acharya Nagarjuna University, Andhra Pradesh, India. Email: tenepallijyothi12@gmail.com
P.Sireesha, ECE department, Bapatla Women's Engineering College, Acharya Nagarjuna University, Andhra Pradesh, India. Email: polurisireesha69@gmail.com
P.Anusha, ECE department, Bapatla Women's Engineering College, Acharya Nagarjuna University, Andhra Pradesh, India. Email: anushapodapati99@gmail.com
M.Venkata Padma, ECE department, Bapatla Women's Engineering College, Acharya Nagarjuna University, Andhra Pradesh, India. Email: mupparajupadma7@gmail.com
N.Vasavi, ECE department, Bapatla Women's Engineering College, Acharya Nagarjuna University, Andhra Pradesh, India. Email: vasavineelam2660@gmail.com
R.Lavanya, ECE department, Asst. professor of Bapatla Women's Engineering College, Acharya Nagarjuna University, Andhra Pradesh, India. Email: rlavanya601@gmail.com

The framework can screen up these parameters namely light, soil moisture, carbon dioxide (CO2), humidity, and soil temperature. In this framework we design the system with multiple sensors for wireless monitoring and controlling of field.

The framework has four sensors and exchange information with the control station using ZigBee module. The transmission of data between the control station and the communication station uses a ZigBee module.

Wireless sensor network has the advantage of low cost, small size, flexibility the network application sensors. The framework has three sections they are transmitter station, control station and communication station.

II. BLOCK DIAGRAM

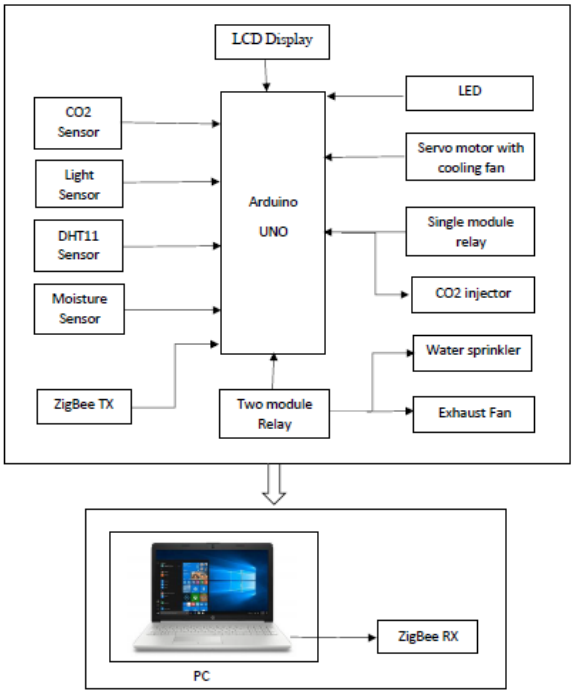

Fig: Block diagram for greenhouse monitoring and controlling

III. HARDWARE DESCRIPTION

The system is having mainly three categories: Transmitter Station (TS), Control Station (CS), and Communication Station (CMS). The complete system is shown above. The transmitter Station and control station are Arduino UNO based (Atmega328p micro controller) while the communication station is based on personal Computer (PC). All the stations described in the section.

1. Transmitter station:

The Transmitter station includes light sensor, DHT11 sensor, CO_2 sensor, moisture sensor.

Transmitter station is the important part for this system. The TS is of five sections.

- The light sensor is a specification of a LM393. It is a passive device that can convert light energy to electrical energy and is otherwise known as photo-electric devices or photo sensors.

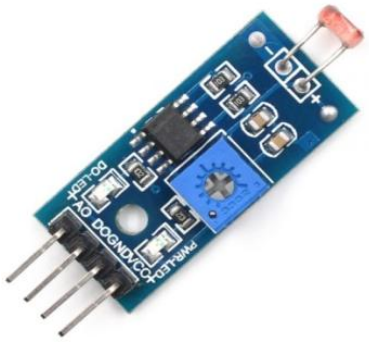

Fig: Light sensor

- DHT11 temperature &humidity sensors consists of four pins they are VCC, GND, NC and data pin. It includes two types of components:

1. resistive type humidity measurement component
2. Negative thermal coefficient temperature measurement component

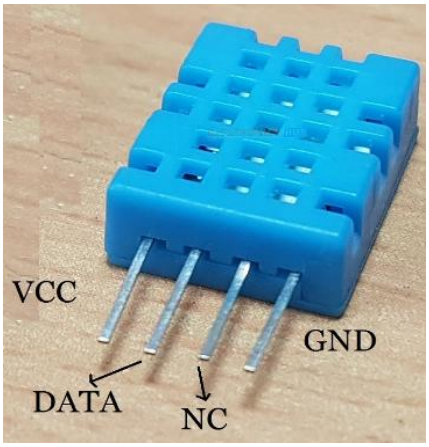

Fig: DHT11 sensor

- Carbon dioxide (CO2) is a specification of an MQ135.There are many applications in which control co2 concentration is important in ppm range. The sensitivity with co and humidity is also analyzed.

Fig: CO_2 sensor

- Moisture sensor is a specification of an LM393. The name moisture itself point outs the moisture that present in soil. The soil moisture depends upon various elements like sandy and clay.
- It has four pins: VCC, GND, analog and digital.

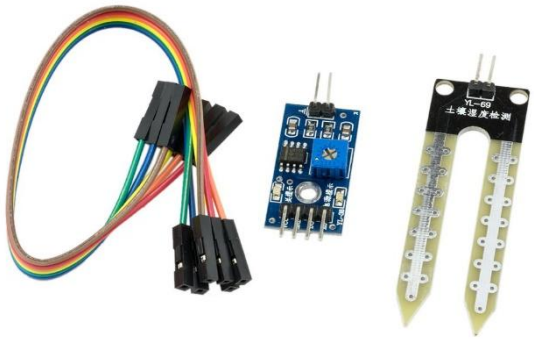

Fig: Moisture sensor

2. Control station:

The Control station (CS) includes humidifier, LED, exhaust fan, water pump, air pump. These stations are explained in below section.

- Exhaust fan is a device that is used to control the internal environment by no longer smoke and moisture. Here we used this fan as a humidifier to remove the excess humidity present in the soil. It acts as a control for the DHT11 sensor that can detect humidity and gets on when there is excess humidity in the air.
- A LED is a semi-conductor light sources that emit light when current flows in to it. It can be used when there is no sufficient light for the plant. It acts as a control for the light sensor.
- Air pump has a voluminous industrial application and they are peremptory to dart a bulk kind of system. It acts as a CO_2 injector as it can plucks the air back which contains the carbon dioxide required for plants.
- Cooling fan is used in this framework to reduce the temperature in the air. It is the control for temperature. It becomes active when there is high temperature in the air. It is connected to a servo motor which controls it.
- Water pump is nothing but an air pump to which a pipe is connected which is inserted into a water tank that sucks the water from the tank and gives to the plant if required.

3. Communication Station:

The communication station (CMS) is major station in the system. The actions of the system are:

- Arduino board adaptable from the Atmega328P technology is used in the transmitter station and coordinator station.
- The board has all the performance of an Arduino positioned system that consist of wireless communication and an economical move to start frisk with wireless Arduino designs.
- Directs the data to personal computer
- Development of coming in data and provides proper action that grant the customers to ingress.

- Arrange instructions to accustom the greenhouse environmental circumstances.

IV. METHODOLOGY

All the sensors come under transmitter station (TS).The transmitter station receives the data measurements and transmit to the control station (CS). The detailed sensors is present in the paper. The transmitter station is having four sensors those are CO2 sensor, DHT11 sensor, Light sensor, Moisture sensor. All the sensors values are sensed and those are displayed in the LCD through Communication station (CMS) will act like a router and it supervises the data flow and instruction between transmitter station and communication station in a preplanned way. It directs the functions like making on/off sprinkler, humidifier and all other control actions. It communicates with the transmitter station with the help of wireless ZigBee protocol. Control station communicates with communication station by using the same wireless ZigBee. They are effective to transmit data up to 5 km using antennas that can operate effectively at 2.4 Giga Hertz. Communication station is the heart of the system. The activities done by the communication station are

- It gives command to inner computer the incoming data is processed and provide an easy way to allow the users for easy access and to visualize data.
- It provides control commands for adjusting the greenhouse climate according to the grower's requirement.

The CMS is based on PC visual Arduino 1.8.9 is used for running the application. Program is friendly to the user GUI and to records the transmitter station data. Several specifications regarding the climate shown in real time. We can see the sensor values in the LCD or either we can see them in the serial monitor. Here we use ZigBee for wireless transmission. The ZigBee transmitter is connected to the kit and the receiver is connected to TTL and connect the TTL to PC without going near to the greenhouse. The control measures are automatically taken by the Arduino. They are controlled with the help of relay. All the parameters are monitored and controlled easily by the Arduino.

V. FLOW CHART

The flowchart describes the procedure of the experiment. First we should initialize the sensors and keep some threshold values in the software code. The sensors will then start sensing the parameters and display them on LCD as well as serial monitor in PC through ZigBee. As described in the flowchart, we have some threshold values to the sensors as

Parameter	Threshold value	Control
Temperature	<40	Cooling fan
Humidity	<70	Humidifier
Moisture	<500	Water pump
Light	<750	LED
CO2	>300	CO2 Injector

Table: Threshold values for sensors with control

As shown in the above table, the parameters should be in the ranges as mentioned. If they exceed the threshold values, the corresponding control will turn on until and unless the required range is obtained. For example, if the value of the moisture is displayed as 800 which means the plant has no sufficient moisture and automatically the water pump will turn on until the moisture will become less than 500. All the remaining controls will work as the same. The sensors will sense the parameters continuously for every second and the process will go on.

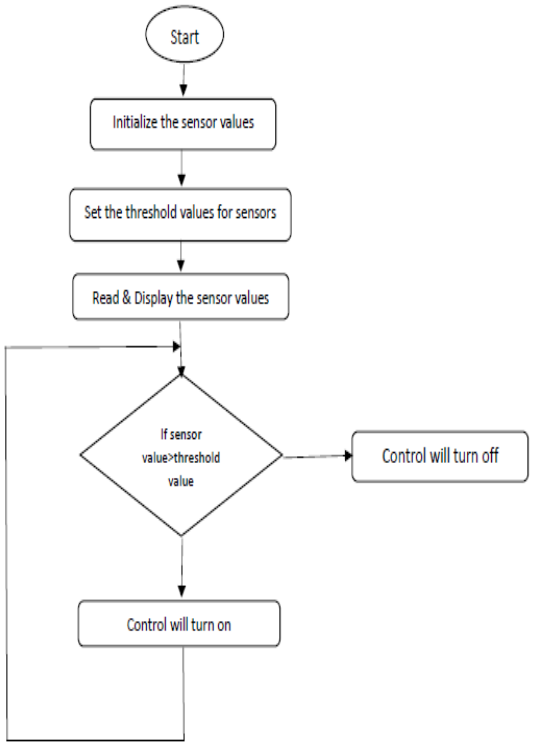

Fig: Flowchart showing experimental procedure

VI. RESULT

Finally, the test is being held on the kit which is emerged as shown in the above fig. The result of the experiment is automatic as said in the title.

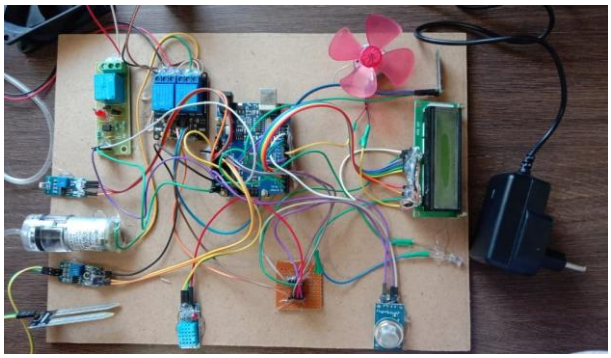

Fig: Experimental setup

We had kept some threshold values to each sensor as required for the plant growth. If the sensor exceeds the threshold value, automatically the corresponding control will turn on. We can monitor it on the personal computer which acts as communication station that is used for the communication between the plant and grower. The communication station uses ZigBee receiver for wireless reception from the transmitter which is connected to the Arduino. The parameters will be displayed on the screen as

Fig 8: LCD displaying sensor value

Thus, the controls are getting turn on as per the values and save the plant growth thus improving the plant yield.

VII. CONCLUSION

In this project, we have structured and executed a system that can comprehend the field conditions and that system is progressively sorted as three stations: transmitter station, control station and communication station. The tests we have conducted in the fields shows us the working of the system. The transmitter station sense the conditions of the plants in the field and transmit the data to the control station through the communication station. The transmitter station has four sensors each one for one parameter as CO_2 sensor for CO_2, light sensor for light, moisture sensor for moisture and DHT11 sensor for temperature and humidity. The control station then decides the appropriate control to function and executes the control thus improving the conditions of the plant growth. The computer acts as a communication station as it transmits the data from sensors to actuators such as humidifier, fan, led, co_2 injector etc. Thus, the system was solid and performed sufficiently..

ACKNOWLEDGMENT

We sincerely thank Bapatla Women's Engineering College Management and principal for providing necessary facilities towards carrying out this work. Our sincere thanks to our guide who supported us to achieve this work.

REFERENCES

1. Zhou Jianjun, Wang Xiaofang, Wang Xiu1, Zou Wei1 and Cai Jichen "Greenhouse Monitoring and Control System Based on ZigBee", Proceedings of the 2nd International Conference on Computer Science and Electronics Engineering (ICCSEE 2013)
2. Ibrahim Al-Adwan and Munaf S. N. Al-D " The Use of ZigBee Wireless Network for Monitoring and Controlling Greenhouse Climate "International Journal of Engineering and Advanced Technology (IJEAT) ',2012 , Volume-2.
3. Robert Faludi, "Building Wireless sensor networks ", United States of America, O'Reilly, First Edition, December 2010.
4. Yu Chengbo Cui Yanzhe Zhang Lian Yang Shuqiang," ZigBee Wireless Sensor Network in Environmental Monitoring Applications ".IEEE, October, 2009
5. DIGI. XBee ® / XBee – PRO ® ZB OEM RF MODULES. 2008 http://www.digi.com.
6. Digi. X-CTU Configuration & Test Utility Software. [Cited 2008 20-8]
7. Jin-Shyan Lee, Yu-Wei Su, and Chung-Chou Shen, "A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and Wi-Fi ",' Proceedings of the 33rd Annual Conference of the IEEE Industrial Electronics Society (IECON), 2007, Taipei, Taiwan
8. Ning Wang, Naiqian Zhang and, Maohua Wang, "Wireless sensors in agriculture and food industry—Recent development and future perspective",' Elsevier Journal of Computers and Electronics in Agriculture, 2006, Vol 50.
9. LM35 Precision Centigrade Temperature Sensors datasheet, November 2000.
10. Light dependent resistors datasheet, March 1997232-3816.

AUTHORS PROFILE

Jyothirmai Tenepalli is pursuing B Tech in the stream of Electronics and Communication Engineering in Bapatla Women's Engineering College, Andhra Pradesh. Her research areas include Automatic wireless monitoring and controlling of Greenhouse using multiple sensors.

Poluri Sireesha is pursuing B Tech in the stream of Electronics and Communication Engineering in Bapatla Women's Engineering College, Andhra Pradesh. Her research areas include Automatic wireless monitoring and controlling of Greenhouse using multiple sensors.

Podapati Anusha is pursuing B Tech in the stream of Electronics and Communication Engineering in Bapatla Women's Engineering College, Andhra Pradesh. Her research areas include Automatic wireless monitoring and controlling of Greenhouse using multiple sensors.

Mupparaju Venkat Padma is pursuing B Tech in the stream of Electronics and Communication Engineering in Bapatla Women's Engineering College, Andhra Pradesh. Her research areas include Automatic wireless monitoring and controlling of Greenhouse using multiple sensors.

Neelam Vasavi is pursuing B Tech in the stream of Electronics and Communication Engineering in Bapatla Women's Engineering College, Andhra Pradesh. Her research areas include Automatic wireless monitoring and controlling of Greenhouse using multiple sensors.

Lavanya Ravi, working as an Assistant Professor in the Department of Electronics and Communication Engineering, Bapatla Women's Engineering College ,Bapatla, since 2011. Received M.Tech degree in the area of Communication & Signal Processing from Acharya Nagarjuna University, Guntur. Presently working research in the area of IOT Applications.