Shaikh Sayeeda Gulab, et. al. International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 13, Issue 11, November 2023, pp 31-37

RESEARCH ARTICLE OPEN ACCESS

IOT BASED GREEN HOUSE MONITORING

Shaikh Sayeeda Gulab *, Dr. Suresh R. Halhalli **
**(Electronics & Communication, M. S. Bidve Engineering College, Latur)*
*** (Associate Professor, Electronics & Communication Engg. , M. S. Bidve Engg. College, Latur)*

ABSTRACT
Greenhouse environment, used to grow plants under controlled climatic conditions for efficient production, forms an important part of the agriculture and horticulture sectors. Appropriate environmental conditions are necessary for optimum plant growth, improved crop yields, and efficient use of water and other resources. Automating control the physical conditions and various climatic parameters that govern plant growth allows information to be collected with less labor requirements. So for this application we focus on making a green house monitoring system to grow plant. 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 atmega328 MCU module and sensors.
Keywords – Greenhouse, LCD display, Atmega328 microcontroller, sensors

---

Date of Submission: 03-11-2023 Date of acceptance: 16-11-2023

I. INTRODUCTION

In recent time and days, everything can be monitored and controlled automatically. Unfortunately, in an important sector like agriculture, the manual process is still very active, meaning the automatic monitoring and control of a greenhouse system hasn't completely scaled through just yet, especially when it comes to small scale farming. The reason whereby the automation of a greenhouse system hasn't been put to a full-fledged use may be in view of several reasons, such as the absence of technical know-how, high cost and the requirement of high maintenance. Agriculture has stood out amongst the most important occupations of individuals since the early advancement of humans and sadly, even to date, manual interventions in farming are inescapable. When it comes to a greenhouse monitor and control system, it is a very important part of agriculture as it can be used to grow plants under a controlled climatic condition for ideal plant produce, it is also to a great degree important in the sense that it shields plants from weather extremes by having a controlled climatic environment, it broadens the developing season and also empowers you to sow plants earlier and harvest plants later. In the case of this project, there will be the presence of an automatic greenhouse which will involve the system being closely controlled and monitored in a set climatic condition which is needed for optimum farm/plant produce.

(A)Temperature Control: Temperature influences most plant development process including photosynthesis, transpiration, absorption, respiration and flowering. In general, growth is promoted when the temperature rises and inhibited when temperature falls. Each species of plant has a different temperature range in which they can grow. Below this range, processes necessary for life stops, ice forms within the tissue, tying up water necessary for life processes. Above this range, enzymes become inactive and again process essential for life stops. [1]

(B) Humidity Control: Humidity is important to plants because it partly controls the moisture loss from the plant. The leaves of plants have tiny pores, CO2 enters the plants through these pores, and oxygen and water leave through them. Transpiration rates decrease proportionally to the amount of humidity in the air. This is because water diffuses from areas of higher concentration to areas of lower concentration. [1]

(C) Moisture Control: Plants take water from the root system and lose water through transpiring leaves. Large amount of water is lost through transpiration process. The rate of water lost depends on the condition of soil, air flow, relative humidity in air and the temperature of the

environment. Hence soil moisture level is needed to be considered.[1]

In IOT based smart greenhouse farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. By monitoring the greenhouse [2], the system will give a detailed value and then can be controlled by on-time controlling of the system [3]. The system can also be applied to scientific management methods, give maximum growth of the crops, and disaster prevention ability to the crops. This introduces a kind of agriculture greenhouse monitoring and controlling system which is made up of low cost, and the power consumption is low, based on short-distance wireless communication NodeMCU ESP32. it can connect with a Wi-Fi network and even work with the global internet system through the world wide web. The objective is to control the climatic conditions according to the data of the crop. So these sensors will collect information of the greenhouse parameters like- air pressure, atmosphere temperature, light value, soil water content, water content in air, and gases present in, water sprinklers and drip irrigation system and can view it on a human interface system[4].

The rest of the paper is organized as follows. Section II presents a review of related literature. Section III System Architecture this Section describes the main components used in the system, and explains their operation. Section IV which also explains the operation of the system in general and the outlines results of the project. V concludes the paper

II RELATED WORKS

In [5] Zigbee module the module a CC2430 sensor node with upper control pc is used which combines to work on the star network topology. The user interface used here is visual C++ 6.0 windows in which C programmed language is used in module
Software for controlling the characteristics of the greenhouse system.

In [6] the monitoring and controlling system is Arduino Uno. Arduino UNO with ATMEGA328P microcontroller, the whole board contains digital input/output pins and analog input/output pins with a USB jack through which
we can upload the controlling program which is written in C programming language which is compiled through Arduino IDE and upload to the board. For connecting this system to the IoT interface another Ethernet module is used which builds a bridge for making a connection between the home Gateway and the Local Proxy. This whole connection is used to control the greenhouse system.

Raspberry pi is chip module used to make hardware projects it mainly connects with the monitoring sensors and directly control with internet server for transferring data from user to module. In this system the language used is python which is easily work with raspberry pi and data processing and web

Development processes, the cost of this module is high as compare to the above modules. But it can work as same as for greenhouse monitoring and controlling like other systems.[7]

In[8] this system it worked with many-valued logic in which the truth value is varied between 0 and 1 inclusively both which is also known as completely false and completely true, the whole system is controlled with the help of fuzzy controllers which are work on programmable language to instruct the system for the further working process. These fuzzy controllers connect with iot to provide the interface to read and define the threshold values for growing particular plants.

In [9] A wireless sensors network for monitoring environmental variable in a greenhouse They proposed a research work in a tomato greenhouse in the South of Italy. They are using sensor devices for the air temperature, pH of water and CO2 level measurements with wireless sensor network. They have also developed a Web-based plant monitoring application. Greenhouse grower can read the measurements over the internet.

In [10] Micro Controller Based Automatic Plant Irrigation System They proposed an automatic irrigation system which helps in saving money and water. The entire system is controlled using 8051 microcontroller which is programmed as giving the interrupt signal to the sprinkler. Temperature sensor and humidity sensor are connected to internal ports of micro controller via

comparator. Whenever there is a change in temperature and humidity of the surroundings these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller and thus the sprinkler is activated.

III SYSTEM ARCHITECTURE

3.1 System Model

The basic block diagram greenhouse monitoring system is shown in figure 1. In this system we have used ATmega series microcontroller Wi-FI module, DHT 11 sensor, Light Sensor, Soil moisture sensor and LCD.

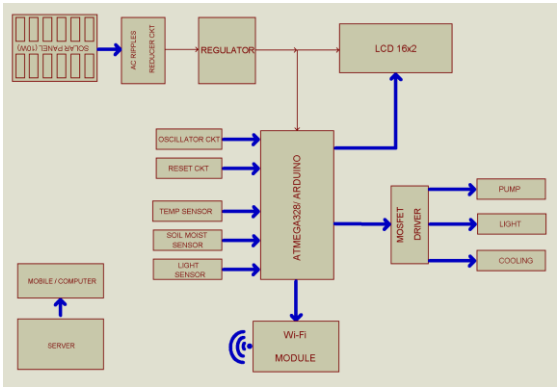


Fig.1: Block diagram of system

These sensors act as input to the microcontroller. The input feed provided to the micro controller is in the form of analog data. This data is converted by the controller into digital format. The data is shown on the LCD display and also on the android phone or computer by using thingspeak uses. Thus the monitoring of light, temperature, moisture, humidity and devices like bulb, fan and pump parameters is controlled automatically.

3.2 Hardware Component

3.2.1 Power Supply

In this system motor driver, FAN, light required 12V power supply and soil moisture sensor, moisture sensor module required, LED indicators, sensors and microcontroller operates with DC 5V. Solar panel with battery backup circuit provides DC output and 5V regulator to obtain regulated DC supply.

3.2.2 Microcontroller

In this (atmega328 28 pin microcontroller) works with 16MHz frequency used for (timer configuration), the unwanted frequency produced is bypassed by the capacitor of 27pf capacitor. Reset pin is connected to resistor of 10K whenever reset requires the reset switch (2 lead push to ON switch/ micro push to switch).The device operates between 1.8 and 5.5 volts. The device achieves throughput approaching 1 MIPS/MHz. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read- write capabilities. 1 KB EEPROM, 2 KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers. 3 flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/Converters (8channelsin TQFP and QFN/ML F package). Programmable watchdog timer with internal oscillator, and 5 software-selectable power saving modes.

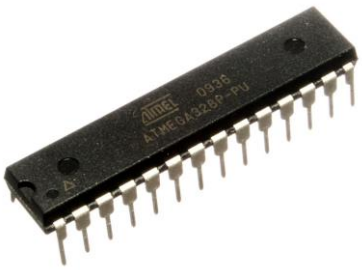


Fig.2: ATmega 328 microcontroller

Various packages for ATmega328 microcontroller

- TQFP (Quad-flat Package)
- MLF/VQFN (Micro Leadframe or Quad-flat no-leads)
- DIP (Dual in-line Package)

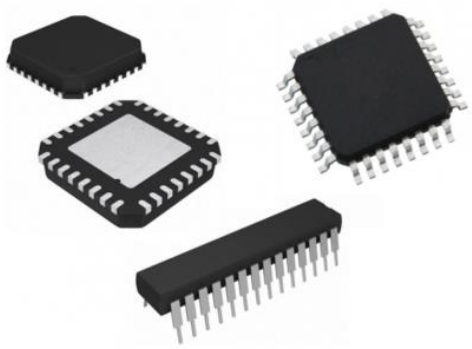


Fig.3: Various packages

3.2.3 DHT 11

Humidity is the measure of water vapour present in the air. The level of humidity in air affects various physical, chemical and biological processes. In industrial applications, humidity can affect the business cost of the products, health and safety of the employ so,in semiconductor industries and control system industries measurement of humidity is very important. Humidity measurement determines the amount of moisture present in the gas that can be a mixture of water vapor, nitrogen, argon or pure gas etc Humidity sensors are of two types based on their measurement units. They are a relative humidity sensor and Absolute humidity sensor. DHT11 is a digital temperature and humidity sensor.

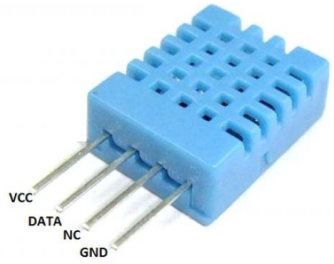


Fig.4: DHT11 Sensor

DHT11 sensor consists of a capacitive humidity sensing element and a thermistor for sensing temperature. The humidity sensing capacitor has two electrodes with a moisture holding substrate as a dielectric between them. Change in the capacitance value occurs with the change in humidity levels. The IC measure, process this changed resistance values and change them into digital form.

For measuring temperature this sensor uses a Negative Temperature coefficient thermistor, which causes a decrease in its resistance value with increase in temperature. To get larger resistance value even for the smallest change in temperature, this sensor is usually made up of semiconductor ceramics or polymers. DHT11 sensor has four pins- VCC, GND, Data Pin and a not connected pin shown in fig 4. A pull-up resistor of 5k to 10k ohms is provided for communication between sensor and micro-controller.

3.2.4 Soil moisture sensor

This sensor works on the principle of capacitor, consisting of a pair of electrodes to measure the capacitance and dielectric strength of different materials as shown in the Fig 3. In this model the

material being the soil with varying amount of water content in it. The sensor builds and dielectric strength of the material together counts for the capacitance of the soil sample, depending on temperature and vapour pressure of the location. A dielectric strength of 80 will be observed at normal room temperature which is much higher compared to our soil sample, thus, more the water content less will the capacitance detected by sensor

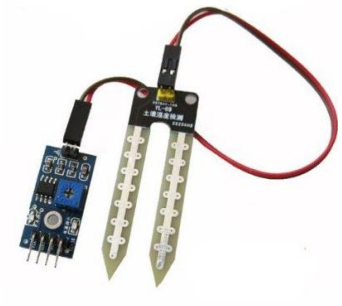


Fig.5: soil moisture sensor

It is used to sense the moisture in soil, its output is available in both format analog and digital. It has 3 pins Vcc, Gnd, Output. It has probes to sense soil moisture. It is used to measure soil moisture in land slide possibility area.

3.2.5 Light Sensor

The Light detecting sensor is nothing but a resistor without any polarity as shown in Fig. 6, meaning they can be connected in any direction. Light sensor is used to sense the darkness and it has 3 pins Vcc, Gnd, output. Output is connected with microcontroller and if dark detects microcontroller controls light.

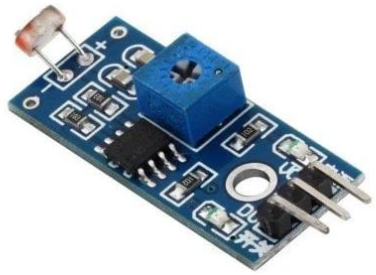


Fig.6: Light Sensor

The sensor(LDR) is made up of Cadmium Sulfide (CdS) because of that the resistance becomes inversely proportional to the amount of sunlight or any other artificial light falling on it, the change in resistance gives the change in voltage which can be measured in the form of analog data and converted into digital signals for processing in the module.

3.2.6 Lcd Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

Fig.7: LCD display

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

IV Result

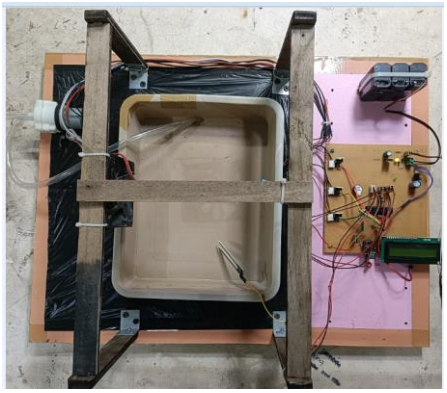


Fig.8: Proposed Greenhouse Monitoring System

We have planned this System to track and monitor environmental parameters. Physical parameter like light, temperature and humidity is measured and controlled by our project instantly displays on LCD display.

Fig.9: Dry detected Pump is ON

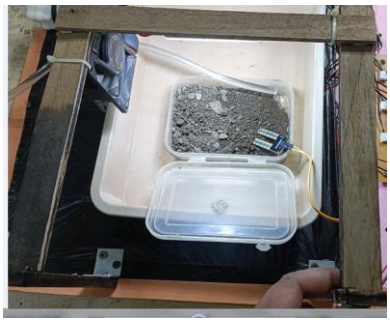
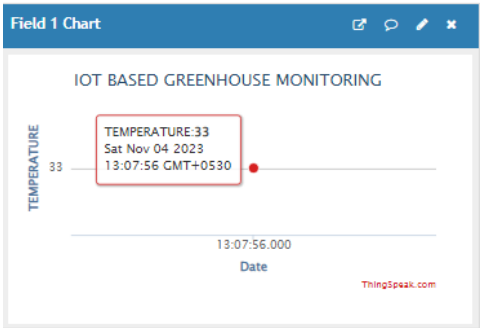


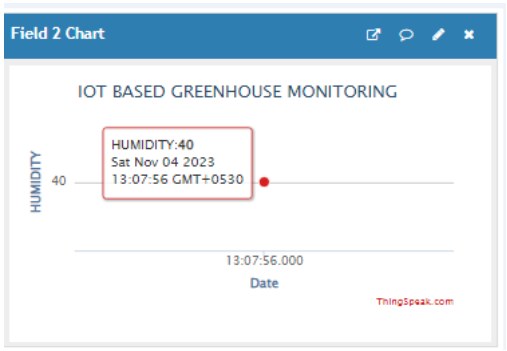
Fig.10: Dark detected Light is ON

Fig.11: Humidity/ temperature high Fan is ON

Also system sends data through thing speak server to monitor data on internet successfully.

If parameter is exceeds limit then system can automatically control through device ON and OFF.





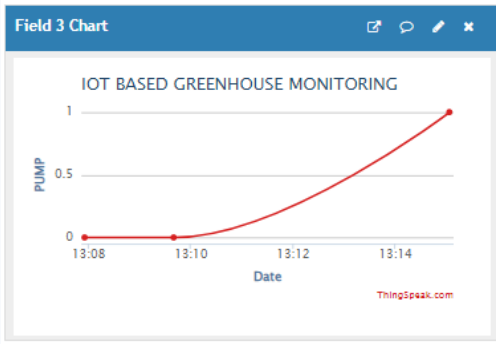


Fig.12: Sensors result on things speak

Conclusion and Future Scope

A smart greenhouse monitoring system has been implemented successfully using the concept of IoT which can prove to be a boon for agriculture sector. The traditional system for greenhouse monitoring is labor-intensive and time consuming. The proposed system saves time, money and human effort. It provides a controlled environment for the plants and thus increases the overall yield. The smart greenhouse automatically optimizes the various parameters for the plant growth. It sends the real time data of parameters to the mobile/ internet for continuous and effective monitoring.

The smart greenhouse can be further upgraded in many ways and can be used in wide agricultural applications we will implement a common server for recording the parameters and controlling the system. The other necessary updating is the implementation of chemical sensor. Chemical sensors can be used to measure the PH and chemical components in soil. Advantages of the proposed system: GUI, wireless, vast controlling and monitoring. Easily implementable, Record parameters on Cloud servers, User defined and automatic modes and Reduce the use of water and pesticides.

Acknowledgements

We convey our sincere thanks to the Principal Prof. B.V. Dharne, Dean of P. G. Department Dr. Suresh R Halhalli and staff M.S. Bidve College of Engineering, Latur for help in carrying out this research work at the institute.

REFERENCES

[1]. Jenish. D, Dr. Ferlin Deva Shahila**,** Mrs. D. Lill Evangelin Iot based greenhouse monitoring and control system, 2022 JETIR August 2022, Volume 9, Issue 8.

[2]. L.Dan, C. Xin, H. Chongwei, and J. Liangliang, "Intelligent agriculture greenhouse environment monitoring system based on IOT technology," in 2015 International Conference on Intelligent Transportation, Big Data and Smart City, 2015, pp. 487-490

[3]. R. R. Shamshiri, F. Kalantari, K. C. Ting, K. R. Thorp, I. A. Hameed, C.Weltzien, D. Ahmad, and Z.M. Shad, ''Advances in greenhouse automation and controlled environment agriculture: A transition to plant factories and urban agriculture, Int. J. Agricultures. Biol. Eng., vol. 11, no. 1, pp. 1–22, 2018.

[4]. "Telegram Bot", [online] Available: https://telegram.org/blog/bot-revoluti

[5]. Jian Song, "Greenhouse Monitoring and Control System Based on Zigbee Wireless Senor Network", International Conference Electrical and Control Engineering IEEE Computer Society, pp.2785-2788,2010.

[6]. Rajeev Piyare "Internet of Things: Ubiquitous Home Control and Monitoring System using Android based Smart Phone" International Journal of Internet of Things 2013, 2(1): 5-11.

[7]. NeelP. Shah, and Priyang P. Bhatt, "Greenhouse Automation and Monitoring System Design and Implementation", International Journal of Advanced Research in Computer Science (IJARCS), Vol 8, Issue 9,2017.

[8]. Zaidon Faisal Shenan, Ali Fadhil Marhoon, and Abbas A. Jasim, "IoT based intelligent greenhouse monitoring and control system", Basrah Journal for Engineering Science (2017), Vol. 17(1), pp. 61-69.

[9]. Dae-Heon Park, B.-J.K., Kyung-Ryong Cho, Chang-Sun Shin, Sung-Eon Cho, Jang-Woo Park, Won-Mo Yang, A Study on Greenhouse Automatic Control System Based on Wireless Sensor Network. Proceedings of an International Conference on Security Technology, pp. 41-44, 2008.

[10]. Gonda, L. Cugnasca, C.E., A Proposal of Greenhouse Control Using Wireless Sensor Networks. Proceedings of a Computers in Agriculture and Natural Resources, 4th World Congress Conference, 2006: pp. 229-233.

[11]. R.Mythili, Meenakshi Kumari, Apoorv Tripathi, and Neha Pal, "IoT Based Smart Farm Monitoring System", International Journal of Recent Technology and Engineering (IJRTE), Volume-8 Issue-4, November2019.