IoT Based Smart Humidity and Temperature Monitoring System
Additional by using WiFi Module

Akash Devade[1], Vaibhav Mare[2], Shubham Shinde[3], Abhishek Jori[4], Vishakha Dilpak[5]

[1,2,3,4,5] *Department of Computer Technology, Ekalavya Shikshan Sanstha's Polytechnic Pune, Maharashtra, India*

Abstract

In COVID-19 pandemic period, corona virus propagates rapidly in cold temperature and humidity. Many people are conscious about the environment they are living in. In order to help those people a smart environment monitoring system is needed. A smart Internet of Things (IoT) based temperature and humidity real time monitoring and reporting system is an effective system that is equipped with temperature sensor and relative humidity sensors for taking measurement. The proposed system is an advanced solution for monitoring and live reporting the temperature and humidity at different points in specific locations. The real time data from the sensors are stored in cloud server and email is sent to the predefined recipients to let them access the data remotely over internet. When the measurement of temperature and humidity reaches over safe level then the recipients can take immediate action to alert people to be careful about corona virus. The proposed system is designed based on Arduino UNO Board, humidity and temperature sensor DHT11, ESP8266 Wi-Fi module. The main characteristics of this proposed system is low cost, low power consumption because of self-powered device, high accuracy and user friendly. The system shows a high degree of accuracy and reliability

Indian industries majorly include biomedical, agricultural and pharmaceutical which are the pillars of country economy. The monitoring of temperature and humidity are major areas for all these industries. Any kind of unbalancing in the environmental conditions or unset parameters can create financial loss in the productivity of pharmaceutical and agriculture industries. Monitoring of temperature and humidity are also required for biomedical industry for drugs and cell culture methods. In healthcare sectors, environment-controlled conditions are also required for patients threatening. In this paper we are going to measure temperature and humidity by using Arduino tool and DHT11, which will be beneficial for balancing the environment to increase the productivity.

Key-Words: *Arduino uno, DHT11 Sensor, Proposed System Architecture*

1. INTRODUCTION

There are so many embedded devices to interact with environment by connecting internet. The increment of these types of objects is achieving the development of micro-controller-based systems which are replacing old complicated electronic circuits. By using IoT, we can control any electronic equipment in homes and industries. Moreover, we can read a data from any sensor and analyse it graphically from anywhere in the world. Arduino is a microcontroller board which works as a tiny computer. Arduino is a platform to develop an interaction with required programming software. Arduino UNO is micro controller unit to fetch a data of humidity and temperature from DHT11 sensor and process it and give it to a ESP8266 module (wi-fi module). In this paper we have different sections to trace the temperature and humidity. Section I defines the humidity and temperature by using humidity and temperature sensor DHT11, section II reads the DHT sensor module's output and extracts temperature and humidity values into a suitable number in percentage and Celsius scale, section III system

displays humidity and temperature on LCD, Section IV defines analyzing and designing the system architecture, section V shows the result and future scope.

2. ARDUINO UNO

Arduino is a new open-source hardware and software system. It has to take attention of a large technology design and community at affordable cost, which increases its use with advanced technology. Arduino hardware is a motherboard for making interaction between objects and suitable computer programming IDE (Integrated Development Environment).

Fig-1: Arduino Circuit

3. DHT11 SENSOR

This module features a humidity and temperature complex with a calibrated digital signal output means DHT11 sensor module is a combined module for sensing humidity and temperature which gives a calibrated digital output signal. DHT11 gives us very precise value of humidity and temperature and ensures high reliability and long-term stability. This sensor has a resistive type humidity measurement component and NTC type temperature measurement component with an 8-bit microcontroller inbuilt which has a fast response and cost effective and available in 4-pin single row package.

Fig-2: DHT11 Sensor

DHT11 module works on serial communication i.e., single wire communication. This module sends data in form of pulse train of specific time period. Before sending data to Arduino, it needs some initialize command with a time delay. And the whole process time is about 4ms. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and upto-20-meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.

4. LITERATURE REVIEW

Temperature and humidity are very important parameters of the environment in various industries like medicine, food, paper mills, textile, metrological, semiconductors, services etc. In recent years, optical fibre sensors have attracted more attentions in sensing and measurement areas due to their many advantages over their conventional electronic counterparts. Similar works in this particular area make use of the Short Message Service (SMS) facility so as to alert the user as seen in the paper [1]. The temperature-humidity sensor could be also used in tissue culture lab use this particular mechanism and use a GSM module to send a message which displays the present status of the temperature and humidity and displays the message "Tissue Culture lab parameters exceeded". But majority of times such an alerting message could easily go unnoticed, the user or the person in charge is sleeping in case if the intended person in sleeping.so it is better to log the data in a remote computer in case of such an event so that he can keep a track of the data.

Another work in use the alarming system for the Attending staff [2]. The temperature and humidity measurement sensor can fail if the user of the in charge is Away for the situation where the emergency is taking place [3]. A temperature and humidity rise and alarm following it would be unnoticed, so a robust device combines an alerting and data logging system is needed to avoid this kind of situation. To sending the values of temperature of the environment the sensor is exposed to, by SMS for the user or the person in charge [4]. Also, by creating microcontroller database, this design described in the paper can be used as a modification for alerting the user by giving an "ALERT SMS" when the temperature have deviation from a critical value pre-set by the user [5]. The system of server guard maintenance mechanism presented in this paper is totally different as it doesn't take any software which has to be run in personal or any computer [6]. The response of our designed system presents the temperature or humidity is out of range as defined by the user by using Arduino and DHT11.

5. REQUIREMENTS IDENTIFICATION

Technology that was used in past scenario was Evaluation Kit for digital Humidity Sensor EEH110 and EEH210. The problems were as follows:

- It took comparatively more time to process.
- It required additional devices for operation.
- It required external clock.
- Programming for micro controller 8051 was difficult.
- For programming it required development system. Circuit size became large.
- PCB making became complex

6. PROPOSED SYSTEM ARCHITECTURE AND IMPLEMENTATION

The system design consists three sections - one senses the humidity and temperature by using humidity and temperature sensor DHT11. The second section reads the DHT sensor module's output and extracts temperature and humidity values into a suitable number in percentage and Celsius scale. And the third part of the system displays humidity and temperature on LCD. The system connection is based on single wire serial communication. First Arduino send a start signal to DHT module and then DHT gives a response signal containing temperature and humidity data. Arduino collect and extract in two parts one is humidity and second is temperature and then long-term stability. This sensor has a resistive type humidity measurement component and NTC type temperature measurement component with an 8-bit microcontroller inbuilt which has a fast response and cost effective and available in 4-pin single row package. DHT11 module works on serial communication i.e., single wire communication.

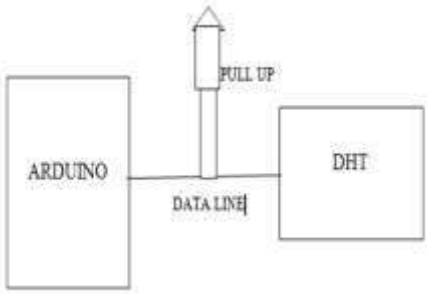

Fig-.3: System Architecture for measurement of temperature

This module sends data in form of pulse train of specific time period. Before sending data to Arduino, it needs some initialize command with a time delay. And the whole process time is about 4ms. First of all Arduino sends a high to low start signal to DHT11 with 18µs delay to ensure DHT's detection.

And then Arduino pull-up the data line and wait for 20-40µs for DHT's response. Once DHT detects starts signal, it will send a low voltage level response signal to Arduino of time delay about 80µs. And then DHT controller pull up the data line and keeps it for 80µs for DHT's arranging of sending data. When data bus is at low voltage level it means that DHT11 is sending response signal. Once it is done, DHT again makes data line pull-up for 80µs for preparing data transmission. Data format that is sending by DHT to Arduino for every bit begins with 50µs low voltage level and length of high voltage level signal determines whether data bit is "0" or "1". One important thing is to make sure pull up resistor value because if we are placing DHT sensor at <20-meter distance,5k pullup resistor is recommended. If placing DHT at longer the 20 meter then use appropriate value pull up resistor.

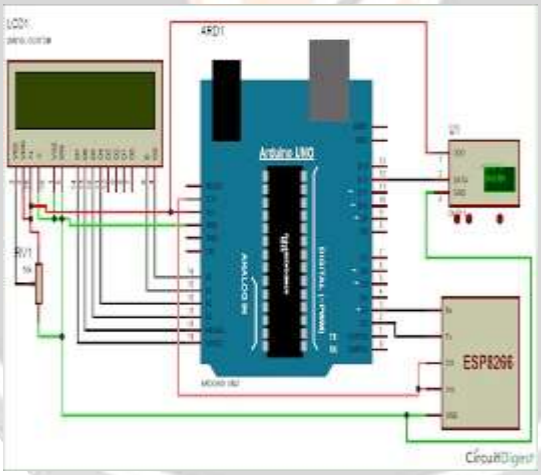

Fig-4: Circuit design of Arduino

A liquid crystal display is used in figure.5 for displaying temperature and humidity which is directly connected to Arduino in 4-bit mode. Pins of LCD namely RS, EN, D4, D5, D6 and D7 are connected to Arduino digital pin number 2, 3, 4, 5, 6 and 7. And a DHT11 sensor module is also connected to digital pin 12 of Arduino with a 5k pull-up resistor.

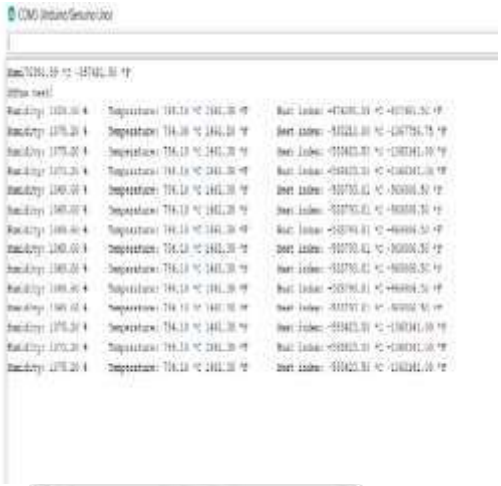

Fig-5: Result on Arduino Screen

7. CONCLUSION

This proposed system can provide a convenient method for effective monitoring of temperature and humidity in real time. This system is compact to an extent and cost effective when compared to prices of instruments used to measure the environmental factors. From the above all analysis, it is ensured that the nested wired systems can be replaced by the wireless sensor networks to get an accurate data as well as to avoid many hazardous issues.

8. REFERENCES

[1] N. H. A. Aziz, W. N. W. Muhamad, N. A. Wahab, A. J. Alias, A. T. Hashim, and R. Mustafa, "Real time monitoring critical parameters in tissue culture growth room with SMS alert system," in Intelligent Systems, Modelling and Simulation (ISMS), 2010 International Conference on, 2010, pp. 339343.

[2] E. Parrish and T. Hickey, "A Temperature Monitoring System for Use on Normal Newborn Infants," Instrumentation and Measurement, IEEE Transactions on, vol. 21, pp. 59-60, 1972.

[3] L. Ruiz-Garcia, P. Barreiro, and J. Robla, "Performance of ZigBee-based wireless sensor nodes for real-time monitoring of fruit logistics," Journal of Food Engineering, vol. 87, pp. 405-415, 2008.

[4] N. Zarka, I. Al-Houshi, and M. Akhkobek, "Temperature control via sms," in Information and Communication Technologies, 2006. ICTTA'06. 2nd, 2006, pp. 2678-2683.

[5] R. K. Megalingam, V. Radhakrishnan, D. K. M. Unnikrishnan, D. C. Jacob, and A. K. Sudhakaran, "Autonomous Smart Server Guard for advanced safety measure using wireless mobile technology," in Mechanical and Electrical Technology (ICMET), 2010 2nd International Conference on, 2010, pp. 654-658.

[6] S. J. Brown, "Remote health monitoring and maintenance system," ed: Google Patents, 2001.

[7] http://www.ardumotive.com/iot-wifi-temp-andhumidity.html