



TEMPERATURE MONITORING SYSTEM USING WIRELESS WEB SERVER

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ABSTRACT

Internet of Things (IoT) is expected to play a major role in our lives through potential systems of sensor networks surrounding our environment. These systems are designed to monitor vital physical phenomena, generating data which can be transmitted at cloud from where this information can be accessed through applications and further actions can be taken. This paper presents the implementation and results of an environmental monitoring system which employs sensors for monitoring temperature of the surrounding area. This data can be used to trigger short term actions such as remotely controlling cooling devices. The sensed data is uploaded to cloud storage and an Android application accesses the cloud and presents the results to the end users. This system employs Arduino board, sensors, Ethernet shield, ATmega 328 and Wi-Fi module. An Android application is used which accesses the cloud and displays results for end users.

Keywords—*ATmega328, Ethernet shield, Wi-fi module, Android application.*

INTRODUCTION

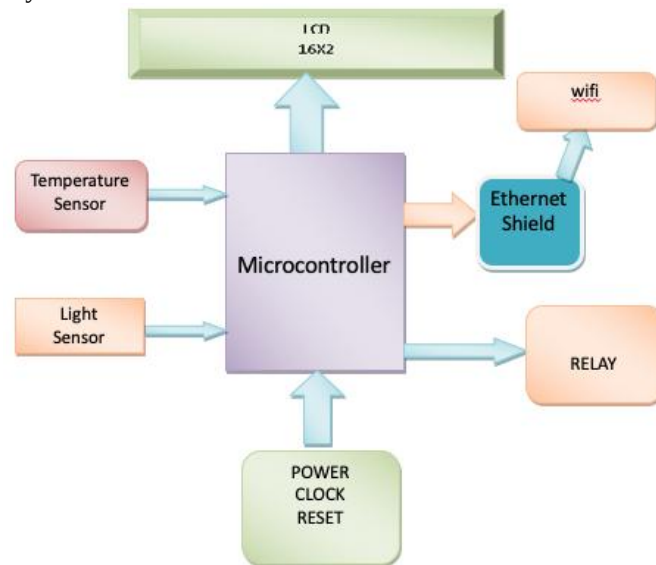
Wireless communication involves the transmission of information over a distance without the help of wires, cables or any other forms of electrical conductors whereas wired technology is not portable. Wired technology products, such as desktop computers, take up more space than equivalent wireless options.

As wireless frequency penetrates the walls, wireless networks are easy to install anywhere based on the users choice. This flexibility is one of the great benefits of wireless network where wired cable networks cannot be installed. Wireless networks are easy to install and easy to maintain as compared to messy wired networks. This will help when the network grows and will have hundreds to thousands of sensors. The great benefit of wireless communication is mobility of usage unlike wired communication. The wireless communication end devices are available at a very low cost due to the competition in handset manufacturing industry. Wireless network planning is very easy as compared to wired network due to wireless software configuration of frequency, power and other parameters. Wireless communication helps in connecting remote inaccessible areas behind the walls or buildings or hilly terrains.

Based on the above analysis, this paper adopts the wireless network architecture, and designs a system capable of enabling real-time monitoring and remote controlling options.

BLOCK DIAGRAM

The block diagram of this system is as shown.



In this system, we have to acquire the data and implement logic to it. For that purpose, in order to process the data we require a board, and that is “Arduino Board”. An external power supply is provided to the board. For monitoring the temperature and light we are going to use a temperature and light sensor respectively. The sensors can be directly interfaced with the arduino board, because the arduino board has an inbuilt ADC converter which will convert the analog input into digital form. We are using a 16*2 LCD display for displaying the temperature and light values. Now the data is sensed, converted in the required form and displayed. As this system is wireless we have to send the data further by using internet. Arduino gives the data as an output in the form of serial data, but in order to interface it with internet we use an “Ethernet shield”. Ethernet shield does the work of implementing TCP IP stack. Ethernet shield and Arduino will communicate serially with each other and Ethernet will convert the data in an internet protocol. Ethernet shield output is further given to “wifi modem”. The wifi modem will transmit the data wirelessly. As this data is transmitted on the internet continuously, there has to be some source which will handle the incoming data continuously, this will be done by using “cloud service”, it will be a free service. Now the data is being handled and the data is transmitted to the server, but to access the data from different source, we are going to use a mobile app named Blynk which will give us real time readings easily. The system requirements are :

1. Arduino
2. Microcontroller (ATMEGA328)
3. Sensors – Thermistor and Light Sensor
4. Power Supply
5. LCD Display
6. Relay
7. Ethernet Shield
8. WiFi Modem
9. Cloud Services
10. Mobile App - Blynk

Arduino : An Arduino is an open-source microcontroller development board. We can use the Arduino to read sensors and control things like motors and lights. This allows us to upload programs to this board which can then interact with things in the real world.



1. Thermistor : The Thermistor is a solid state temperature sensing device that acts a bit like an electrical resistor but is temperature sensitive. Thermistors can be used to produce an analog output voltage with variations in ambient temperature and as such can be referred to as a transducer.

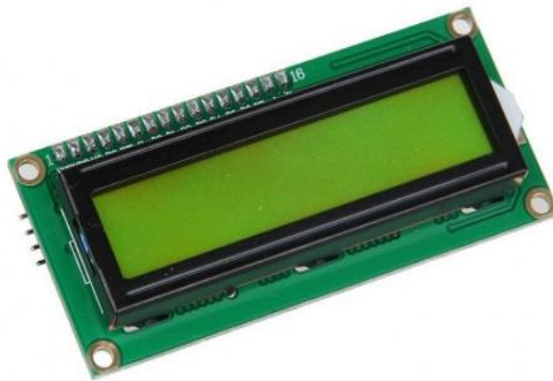


2. Light Sensor : The light sensor is a passive device that converts light energy whether visible or in the infra-red parts of the spectrum into an electrical signal output. Light sensors are more commonly known as “Photoelectric Devices” or “Photo Sensors” because they convert light energy (photons) into electricity (electrons).



3. Microcontroller ATmega328 : A microcontroller is used to run the code. The code is burned onto the microcontroller and is executed in it.
4. Relay : A relay is an electrically operated switch. It consists of a set of input terminals for single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal.

LCD Display : An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module commonly used in circuits.

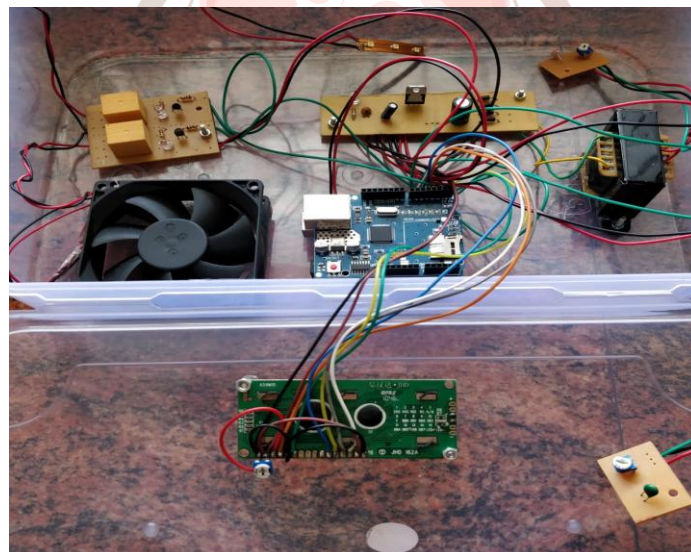


5. Power Supply : A power supply is designed to run the system.

WORKING OF THE SYSTEM

In this system, we are going to sense, monitor and control the temperature and light using wireless web server. We will be programming the microcontroller using Arduino and embedded C language. To sense the temperature and light, we have used a temperature and a light sensor respectively. The temperature sensor is commonly called as a thermistor. Thermistors are said to have NTC which means that the value of their resistance decreases as temperature increases. The value of the thermistor will be 10K at normal room temperature (27 degrees C). We provide +5V to the thermistors. These thermistors sense the temperature and provide analog input to the analog pins of Arduino (pin no. 0,1). But, as temperature varies, the resistance of thermistor changes and we need changing voltage at the analog input of Arduino. Hence, we connect another 10K resistor in parallel with the thermistor to form a potential divider circuit which will give changing voltage at the analog input pins of the Arduino. Hence, at normal room temperature (27 degrees C), 2.5 V will appear across the analog input pins of the Arduino. Also, this changing input voltage cannot exceed 5V as we are providing only 5V to the thermistors. The Arduino board has an inbuilt ADC (Analog To Digital Converter) which will convert the analog input into digital form. This digital input will further go into the programmed microprocessor, get processed there and appear as final output on digital pins of Arduino (pin no. 3 to 12). We will interface a 16x2 LCD display at these digital output pins(pin no 3 to 8) for displaying the resultant temperature sensed. We will be using data bits D4 to D7 of LCD display for interfacing. Next step is sending the data onto the internet, but Arduino provides only serial data at its output. Hence, we use a hardware module

called ethernet module which we will be interfacing with the Arduino (pin no. 9,10,11,12). This ethernet module can also be directly mounted onto the Arduino board. This ethernet module has an RJ45 jack provided for LAN cable. The data will enter this ethernet module, get converted into TCP/IP protocol stack. This output will be provided to a WiFi modem instead of a LAN cable as our aim is to have wireless communication. Therefore, the output will be thus sent wirelessly to the Internet. The data will be stored on cloud and can be accessed when required. To access the data, we will be making use of Blynk App. We will configure this app as per the project requirements and will be able to see real time data (temperature values) anytime. Whenever the temperature value will exceed the temperature limit, we will also be getting a notification from the app. Apart from this, we need to take control action as well. For this, we will be using 2 transistors which will act as switches and connect to Arduino board at pin no. 2 & 13 (interrupt pins). When the temperature is in the normal operating range, the input to the transistors will be 0 and they will act as closed switches. As soon as the temperature exceeds normal values of operation, logic 1 will appear across the transistors and they will act as open switches. As voltage will flow, the coil will get magnetized & the relay operation will take place (NO contact will become NC and vice versa). This will result in turning on of a fan which will in turn cool the device or furnace that has exceeded the temperature. On dropping to normal values, the transistors will get switched off again and the fans will turn off automatically. Hence, in this way we will be sensing, monitoring and controlling the temperature remotely.



WORKING OF BLYNK APP

The Blynk app is an Android app developed especially for IoT systems. We first install the app and Create A New Project. We sign in with our email id because of which a authentication token is sent onto our email. This token is included in our code.

We name the project in the app and based on our system we select gauges, sliders etc to display the real-time readings. We can also take control actions from this app by turning on or off the devices.

There are two modes in the app namely auto and manual for controlling the readings. In manual mode we control the fan and led by the buttons on the app. While, in auto mode the fan and led operates automatically.

SYSTEM RESULTS

The temperature of the surrounding is monitored and when it exceeds decided threshold value the fan gets started as a control measure while for the light led gets turned on when the intensity level of light goes below the decided threshold level.

CONCLUSION

This paper designs a wireless temperature and light remote monitoring system based on arduino, microcontroller, Ethernet shield ,wifi modem, cloud services and mobile app. The system not only removes the limitation of wired monitoring system ,but also reduces the energy and installation cost, real-time readings are available and system becomes mobile. The time required to take manual readings is eliminated. This system has a wide range of applications in many industries of various fields. For further development we can draw graphs of variations in these parameters using computer and also it can be implemented in home automation.

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