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Android Application for Temperature Monitoring Using IoT

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ABSTRACT: Since technology is advancing every physical device is getting connected. The goal of the Internet and IoT is to connect every possible device. This will surely enhance the quality of life. The proposed work is one of the solutions to monitor and control temperature and humidity by making the readings visible from anywhere in the world. The sensors connected with the microcontroller will sense the data and transmit it to the webserver. The data available in the web server can be visualized conveniently in the android application. The user can monitor the data and can take suitable actions sitting anywhere in the world through the android application connected to the internet. The stored data in the webserver can be used for further analysis or forecasting. The proposed system uses a sensor and microcontroller which is cost-effective and can be used in real-time.

KEYWORDS: Sensor, Temperature, Android application, web server.

I. INTRODUCTION

In many applications, some of the parameters like temperature, humidity, flow rate, pressure, and acceleration have to be monitored. Depending on the nature of the parameter there are many methods available to acquire these parameters as well as to monitor them. Many challenges are there to acquire and monitor the room temperature accurately. one such example is if we do not maintain the temperature between 15 to 20 degrees Celsius in the server room it may lead to a server crash which in turn causes a huge loss in terms of data and money. Humans monitoring the temperature of the room physically incurs a capital rather we can have a system in which it is possible to monitor and control the temperature remotely. Applications of IoT are also found in weather forecasting where temperature and humidity are sensed and presented to the world. So a similar system of monitoring the temperature remotely using the internet is one of the solutions. Such a system that can work efficiently is required to monitor the room temperature and humidity which cuts the expenses spent on humans to monitor the same. In some of the applications we need the recorded Temperature and relative humidity analysis and forecasting applications require the recorded data, so we need a monitoring system with a web server that is capable of recording the parameters and storing them for future use. The data in the web server can also be used to display in the android application running on mobile with an internet connection. Since the temperature and humidity of the room can be sensed continuously it is possible to monitor these parameters anywhere with an internet connection. Some of the applications in which temperature monitoring and analysis are required are air conditioning, automobiles, electric vehicles, power plants, etc.

The main aim of the proposed work is to design and develop a cost-effective, efficient, and robust system that is capable of remotely monitoring and controlling required parameters sensed using different sensors to store the parameters in a web server and displaying these values in the android application.

The network of physical devices like home appliances, vehicles, and other devices is called the Internet of things (IoT) in which they can connect and exchange the data. Human intervention to physical devices is reduced in IoT and also enables the remote controlling and direct integration of devices which improves efficiency, and accuracy. IoT benefits in creating a network infrastructure of devices and bringing more devices to the computer world. The use of sensors and actuators in technologies like smart cities, virtual grids, transportation systems, smart homes, and smart grids can be augmented with IoT. The application of

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IoT can be found almost anywhere in the network of embedded devices which has a memory unit, CPU, and power connection. Environmental sensing is one such field where the IoT systems find the application of collecting information ranging from factories, buildings, and natural ecosystems. Consumers started using IoT-enabled devices that significantly increased the demand. Some of the applications in the field of consumer appliances with IoT for remote control are home automation, car infotainment, entertainment, health and fitness, wearable technology, cameras, air purifiers, refrigerators, ovens, washers, and dryers. User interface and experience have opened new opportunities in the consumer IoT segment. Atmospheric conditions/ soil conditions, air quality/water quality, wildlife habitats, and their movement monitoring using different sensors are some of the IoT applications in the field of environmental monitoring. More effective usage of IoT can be made with some of the emergencies related to providing necessary aid lies in the applications like early warning systems during earthquakes and tsunamis. This type of application makes the IoT spread to a large geographic area and with increased mobility.

II. METHODOLOGY

Monitoring real-time systems like temperature control systems often lead to errors and wrong monitoring. Hence the only option is to digitalize these systems and enable them to be monitored remotely. There are two methods of monitoring the temperature of the room or environment:

1: Manual method

2: Automatic method.

Manual method: Organizations need to take human help to monitor the temperature of the server room or to monitor the relative humidity in the weather of a particular place. This could be monotonous work. The manual method often leads to errors and wrong monitoring of the parameters. This often leads to bad control of parameters due to human error. Drawbacks of the manual methods:

1) Error due to humans.

2) Error due to wrong monitoring or absence of the technician.

Automatic method: It's generally wise to automate certain monotonous work. By doing this the human capital will be reduced. The errors in the work will be reduced. Hence this leads to a proper monitoring system with a good amount of throughput. In automated methods, humans are replaced with controllers to increase accuracy. The temperature is sensed by a sensor and fed to a controller, which in turn is passed on to a cloud and finally will get displayed on an android application Advantages of the automatic methods:

1) Error is reduced by humans by a controller

2) The automatic method is more reliable compared to the manual method, it is costly but the stability and accuracy provided by this method cover the cost. The block diagram in Figure 1 depicts the design flow of the proposed work.

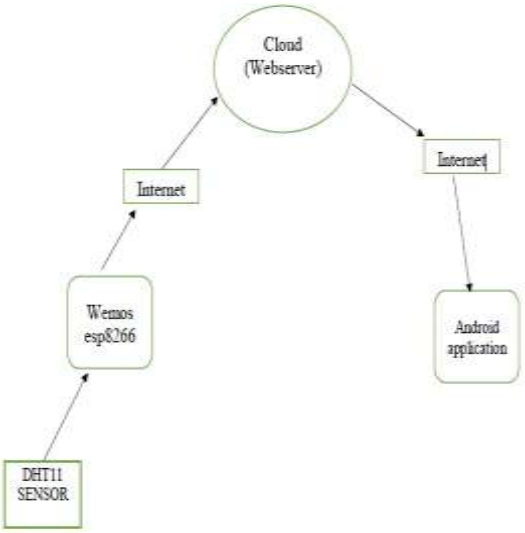

Fig 1. Block diagram of the proposed work

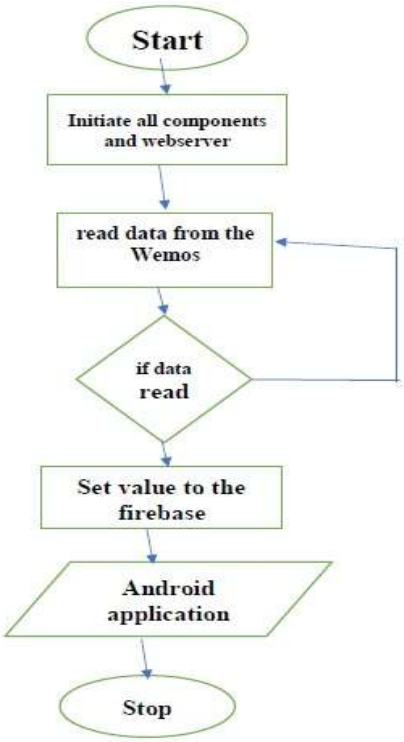

Fig 2. Flow chart of the proposed work

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The data of the proposed work is shown in figure 2. The temperature in Fahrenheit and the humidity in terms of percentage are read from the dht11 sensor by the Wemos esp8266 microcontroller. The values are transmitted to the webserver through the internet by the Wemos. Webserver stores the values.
Stored values in the webserver can be retrieved by the android application through the internet. Hence the values will be displayed on the mobile screen for further monitoring of the particular system.

III. SOURCE CODE FOR CONTROLLER

```
#include "DHT.h"
#include <ESP8266WiFi.h>
#include <FirebaseArduino.h>
#define FIREBASE_HOST "URL"
#define FIREBASE_AUTH "FIREBASE AUTH"
#define WIFI_SSID "WIFI-SSID"
#define WIFI_PASSWORD "*********" #define DHTPIN D7
#define DHTTYPE DHT11 DHT dht(DHTPIN, DHTTYPE);
void setup() {
Serial.begin(115200); Serial.println("DHTxx test!");
dht.begin();
WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
Serial.print("connecting");
while (WiFi.status() != WL_CONNECTED) {
Serial.print(".");
delay(500); }
Serial.println();
Serial.print("connected:");
Serial.println(WiFi.localIP());
Firebase.begin(FIREBASE_HOST,
FIREBASE_AUTH); Firebase.set("slot_1",1);
Firebase.set("slot_2",1);
}
void firebasereconnect(){ Serial.println("Trying to reconnect"); Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH); }
void loop() {
if (Firebase.failed()) {
Serial.print("setting number failed:");
Serial.println(Firebase.error());
firebasereconnect();
return; }
Serial.print("Temperature = ");
float k= dht.readTemperature(true);
float o=dht.readHumidity(); Serial.println(k);
Serial.print("Humidity=");
Serial.print(o);
Serial.println("%");
Firebase.set("slot_1",k);
Firebase.set("slot_2",o);
delay(1000); }
```

IV. HARDWARE IMPLEMENTATION

1. Compiling and uploading the code to WEMOS
The screenshot of code compiling and uploading it to WEMOS is shown in figure 3.

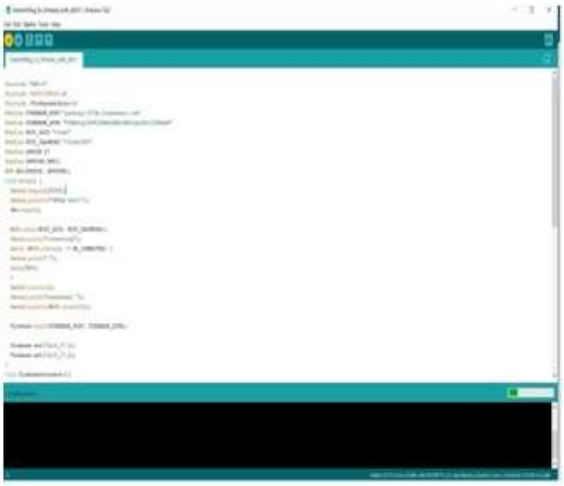

Fig 3. Screenshot of code compilation

2. Setting up Firebase
i) Create a new project
ii) Set up the access attributes as true
iii) Copy paste the url and the secret key in the code.

In the proposed work firebase is used which is a platform for mobile and web applications developed by firebase. The contents are pushed to the world wide web through a web server which is web software, or dedicated hardware with software running in it. Incoming network requests are processed using the HTTP protocol or several other protocols by the webserver. Store, process and deliver web pages to clients is the primary function of web servers. With HTTP protocol web server delivers web pages very frequently.
In addition to text content, HTML documents may also contain style sheets and images. A web browser is used by the user agent to put a request to a specific resource which initiates the communication to the server using HTTP and the server responds by fetching the requested resource or replies with an error message if the resource is not found/unable to fulfill. Typically Server's secondary storage contains resources in the form of the real file but not necessarily. In some cases, it depends on how the server has been implemented. The screenshot of the firebase project page is shown in Figure 4.

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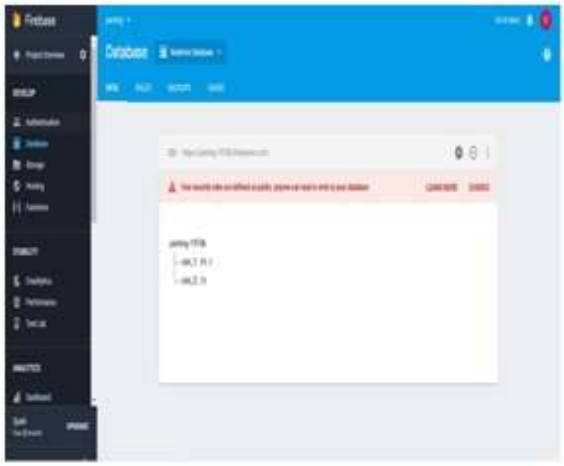

Fig 4. Firebase project page.

3. Creating a mobile application

Using MIT app inventor this mobile app is constructed. The MIT application workspace is shown in figure 5.

Fig 5. Screenshot of MIT app inventor

V. INTERFACING OF SENSORS

DHT 11 temperature and humidity sensor is interfaced with wemos. Wemos is loaded with complied code which is ready to accept input from the sensors. Temperature and humidity are read in real-time and fed to the controller, which in turn sends these readings to the webserver.

The interfacing of sensors to wemos is shown in figure 6.

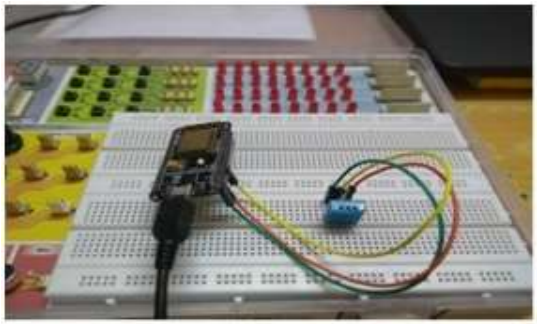

Fig 6. Image of interfaced device and components.

VI. RESULTS AND DISCUSSION

After all the initial setup is done sensors are ready to read the data. When the sensor is off and wemos is not connected to wifi, the android application output is shown in figure 7.

Fig 7. Screenshot of Android app when Sensor is off and Wemos is not connected to wifi.

When the sensor is on and wemos is connected to wifi, the android application output is shown in figure 8.

Fig 8. Screenshot of Android app when Sensor is on and Wemos is connected to wifi.

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The output of the sensor can be visualized on the computer monitor. The screenshot of the monitor which displays the temperature is shown in figure 9.

Fig 9. Output on the monitor

VII. CONCLUSION

The proposed method is an efficient and cost-effective system that uses sensors for reading the temperature and humidity, which was successfully transferred to a web server. The web server data is then transferred to the android application. The user can watch the readings live and take necessary action if required. The proposed method can be installed in server rooms, temperature, and humidity-controlled greenhouses for crops, etc.

SOME OF THE ADVANAGES FROM THE ABOVE RESULTS

a) Reduces the physical efforts
b) Helps in constant monitoring
c) Reduces the human capital
d) Reduces errors
e) We can monitor 24/7

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