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EL-10. **Web Enabled Temperature and Humidity Monitoring System**

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Abstract:

The development in IoT based wireless sensor network system has proved to be a real time and reliable solution in monitoring environmental parameters. The work aims to built an IoT based system which can be a universal solution for monitoring environmental parameters. With the development of tiny smart sensor devices equipped with wireless technologies, it is possible to remotely monitor the environmental parameters viz. temperature and humidity. These components used in this work include DHT11 (humidity and Temperature) sensor and raspberry-pi as a computing platform to collect and share the real time environmental data. This data will be sent to the cloud-based service such as "ThingSpeak". This platform allows multiple users to access the shared data through the Internet. The uncontrolled industrial, medical developments are causing large damage to the environmental resources and becoming a foremost concern of the human/Animal/Plant life. The system developed in this work will enable remote monitoring of multiple locations in industrial, agricultural and medical sectors.

Keywords: Automation, LCD display, DHT11 Digital humidity, Temperature sensor.

1. Introduction:

Pollution and resulting environmental changes are major issues of concern. Uncontrolled industrial, medical and transport developments are causing large damage to the environmental resources[1], and becoming a foremost concern of the human/Animal/Plant life. Internet of things (IoT)[2], is a tremendous opportunity for a large-scale environmental parameter monitoring and store in cloud by connecting the sensor with Internet with help of IoT enabled embedded Systems[3]. The Internet of Things is the interconnectivity of physical device and electronic device i.e. embedded system, software, sensor and network connectivity which allow these substances to accumulate and exchange the data. ThingSpeak is an IoT analytics platform service that allows to accumulate, visualize, and study live data streams in the cloud server[2].

The aim of web-based temperatures and humidity monitoring system is achieved by using the latest technologies such as Internet of things (IoT) and Cloud [4,5]. In ThingSpeak

cloud server create the new channel for temperature and humidity, also input API key provide to Raspberry Pi.The raspberry pi GPIO port has been configured to sense temperature and humidity using DHT11 and transfer this data to ThingSpeak cloud server over internet link[6]. The purpose of this work is creating web-based monitoring system with temperature and humidity sensor so that data monitor web services.

2. IMPLEMENTATION SETUP

2.1. Components required:

2.1.1 Hardware

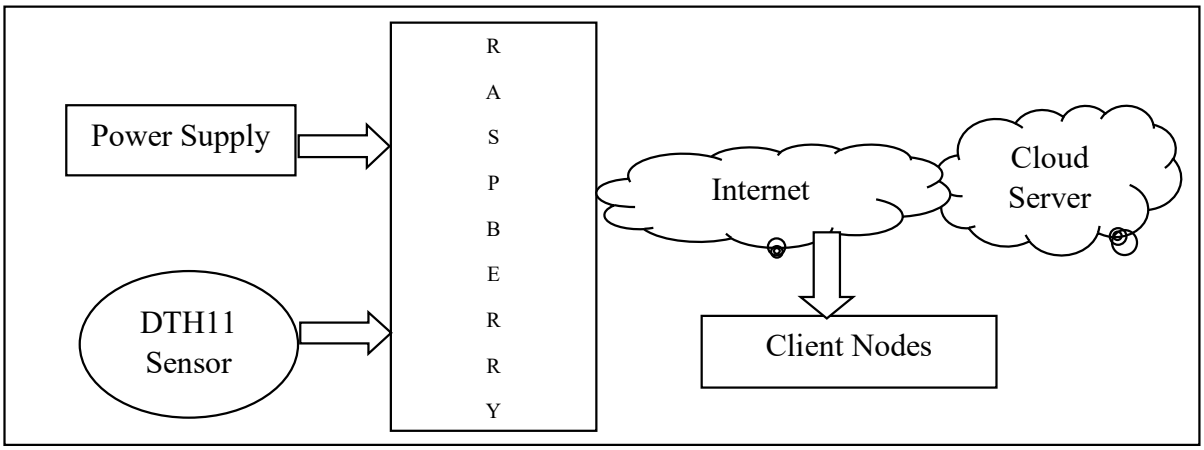
a) Raspberry PI3Model B
b) USB Cable
c) Computer
d) Temperature and Humidity Sensor (DHT11)
e) DC power Supply with 2 Ampere rating
f) 8 GB micro SDHC(CLASS10) CARD for Raspbian operating system.

2.2 Software

a) Raspbian operating system
b) Network tools
   I) Advance IP Scanner
   II) Putty- SSH and Telnet application.
c) Adafruit_DHT library

3. DESIGN AND IMPLEMENTION OF THE SYSYTEM

The first phase include planning which start withselectingthe embedded system, sensor and IOT service satiable for this application.After implantation of the system the collected data will be then sent and store in the cloud server.The thing speak platform facilitated graphicaldisplay of the collected data and this feature can be accessed anywhere over the Internet.



4. SYSTEM HARDWARE AND SOFTWARE DESIGN:

A.Raspberry PI 3 Model B: Raspberry PI is the most significant unit and the core element of

the system Fig.2(a) and (b). It handles all the processes, controlling, and sending data required for the system to function. It collects the temperature and humidity data from DHT11, processes it and upload it ThinkSpeak. It is an ARM-based small SBC (Single Board Computer) generated by Raspberry Pi Foundation[7]. The features include Quad Core 1.2 GHz Broadcom 64bit CPU, 1GB RAM, Wireless LAN and Bluetooth Low Energy (BLE) on board, 100 Base Ethernet, 40-pin extended GPIO, 4 USB 2.0 ports[7], The DTH11 sensor has been interface with Raspberry pi according to the pin connection give in Table.1.

Table.1. Raspberry pi and DHT11 pin connection

Raspberry PI GPIO port and pin	DHT11 pin	Description
pin 2	pin 1	+5 VDC power supply in DHT11 from PI
pin 6	pin 4	Ground
pin 7 (GPIO 4)	Pin2	DHT11 data out pin 2

The Raspberry pi kit is booted with the Raspbian operating image installed on the micro-SD card.After login in the GPIO library and Adafruit library where installed using following command [7]

```
a) Sudo apt-get update
b) Sudo apt-get install rpi-gpio
c) Sudo pip3 install Adafruit_DHT
```

A python has been used for created a DHT11_WWEB.py for reading the sensor (DHT11)[8] and uploading sensor data to ThingSpeak cloud. The file was created following command and scripting 1.0 python code.

```
import sys
import urllib2
from time import sleep
import Adafruit_DHT as dht
# ThingSpeak Channel API key
myAPI = '************SCOE'
# ThingSpeak URL
baseURL = 'https://api.thingspeak.com/update?api_key=%s' % myAPI
def DHT11_data():
        # Reading from DHT11 and storing the temperature and
humidity
humi, temp = dht.read_retry(dht.DHT11, 4)
        return humi, temp
while True:
        try:
```

The data plotted on thing speak cloud server has been shown in figure 3 (a) Temperature (b) Humidity and (c)Sensor location

B. Temperature and Humidity Sensor (DHT 11): DHT11 is a humidity and temperature sensor[9]. The DHT11 sensor measure temperature reading from 0°C to 50°C with accuracy of ±2°C and Humidity from 20 % to 80 % reading with accuracy ±5%. The data transmission is 100 metre distances. This sensor is suitable for the systemimplementation.

C.Advance IP Scanner: It is fast and free software for network scanning. Itdetect the all-network computers and display their detailsallowed to fast detect all network computer and find access them.

D. PuTTY: The software (PuTTY) is used to communicate with raspberry pi using SSH protocolwithout the need for hardware peripherals like a screen, keyboard or mouse. The reason behind running the raspberry pi without keyboard and mouse is the power that saved by the raspberry PI kit running alone. Hence, by using this method, the raspberry pi power utilization is reduced to have a more effective and reliable system.

E. ThingSpeak:ThingSpeak is an open-source Internet of Things (IoT) application and API to store and recover data from things using the HTTP protocol over the Internet or via a Local Area Network(LAN).ThingSpeakallows for the creation of sensor data storeand display application and public network of things with status updates[10].

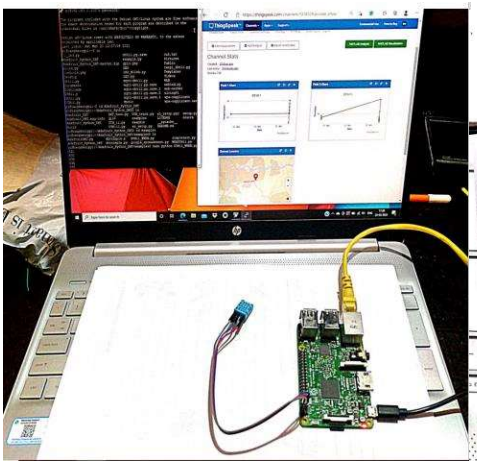


Figure 2a. System Hardware and web display

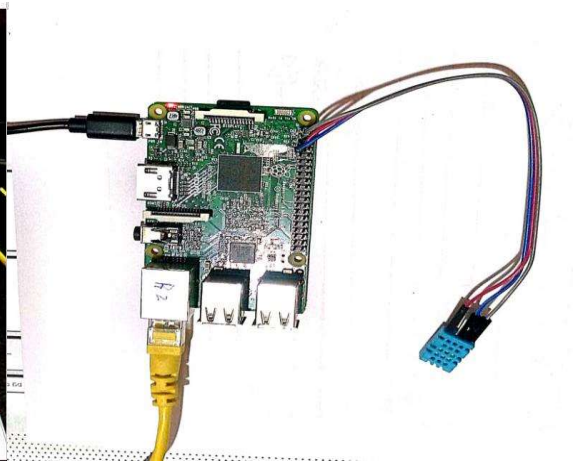


Figure2b. System Hardware connection

5. RESULTS AND DISCUSSIONS

The system implemented as part of this work is a web-enable real-time temperature and humidity monitoring system which polls sensor at static interval of time. The Sensor employed here is the DHT11 Temperature and Humidity sensor which is suitable for environmental parameter measure. The raspberry PItakes real-time Temperature and humidity data from the sensor and sends it to the ThingSpeak cloud server. The ThingSpeak cloud server shows

graphical representation of data in is data base. In addition, that it also allows data to be exported in CSV format. Raspberry PI processed data will be updated continuously on a cloud server in defined time intervals & stored data logs in the ThingSpeak on an hourly and daily basis.The onboard Wireless WIFI in Raspberry PI is attached to the wireless network so that it fetches data with the help of the internet and user can access location-wise temperature and humidity from any part of the world. The blow Figure 3(a) Temperature (b) Humidity and (c)Sensor locationshows implemented system result.

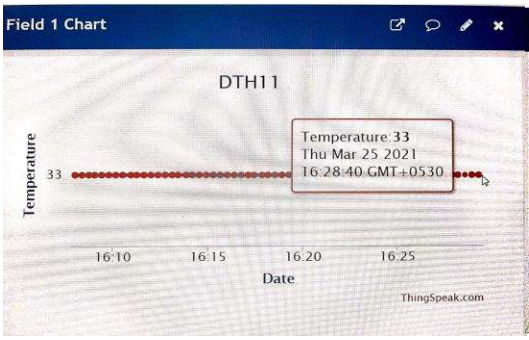


Figure 3a. Temperature

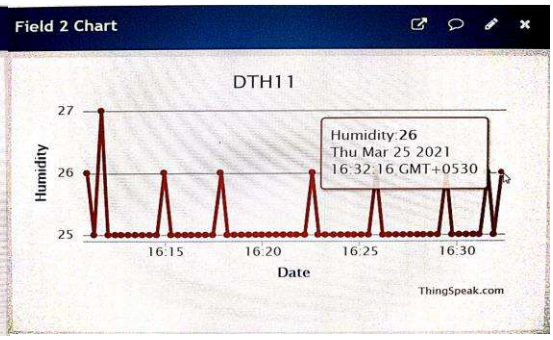


Figure 3b. Humidity

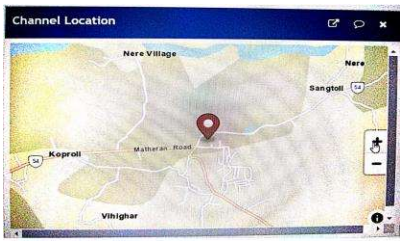


Figure 3.(c) Sensor location

6. CONCLUSION:

It is a low-cost, accurate, creative method of web-based monitoring Temperature and humidity using a IoT enabled embedded system via Internet. The environmental parameter temperature and humidity data stored in ThingSpeakcloud server to accessed anywhere over the Internet.

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