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An IOT Appliance for Controlling the Fan Speed and Accessing the Temperature through Cloud Technology using DHT11 Sensor

Jahnavi.Y
Computer Science & Engineering
Geethanjali Institute of Science and Technology
Nellore, Andhra Pradesh, India
e-mail: csehod@gist.edu.in

Siva Priya. A
Computer Science & Engineering
Geethanjali Institute of Science and Technology
Nellore, Andhra Pradesh, India
e-mail: adala.sivapriya@gmail.com

***Abstract*—** In day to day, there are various necessities of common man. Internet of Things is going to play a vital role in applications such as smart home, smart cities, Industrial internet, healthcare systems etc. In this paper, we are presenting the module developed for controlling fan speed based on room temperature and also accessing temperature remotely through cloud. Temperature of the room can be sensed by using DHT11 temperature sensor. If the temperature is low then fan rotates slowly and vice-versa. Temperature of a particular room can be found from anywhere using DHT11 sensor and hosting on cloud. The proposed approach is accurate in terms of processing time, less circuit size, no external clock required and programming an arduino is easy when compared to 8051 micro processor. The developed approach is benefited in terms of preventing the waste of energy when it is not hot enough to use a fan and assist the disabled to switch on or off fan automatically. Experimental evaluation shows that the proposed approach is accurate and also takes less time.

Keywords*-IoT, cloud, DHT11 sensor, control, temperature*

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I. INTRODUCTION

In these days everything is being automated and smarter. A microcontroller is used to make a thing smart. A microcontroller called arduino is used to control and automate processes. It is a single chip that executes code. This paper displays the one of the output which is the speed of fan using Pulse Width Modulation (PWM) on 16x2 LCD. A sensor called DHT11 is used to sense the temperature so as to vary the fan speed. To sense temperature from a particular place connect the ESP8266 Wi-Fi module to the Arduino board. So the sensed temperature will be stored in cloud and we can be viewed from some other place.

II. LITERATURE SURVEY

Mustafa Saad, HossamAbdoalgader, and Muammer Mohamed, have proposed controlling fan speed using 8051 micro controller which is a controller with basic functionalities like gpio programming, timer operation, interrupt handling, etc. causes a complex design. To overcome this we have used arduino which is a development tool by ATmega328P. It contains inbuilt library support, inbuilt analog to digital convertor, Eeprom memory, Communication protocol like SPI and TWI. The block diagram based on 8051 microcontroller is complex because it contains additional sections like ADC (Analog to Digital Convertor) and amplifier. All the additional mentioned sections are built in the arduino itself.

III. METHODOLOGY

This paper represents a module in the home automation system. This is used for reducing the power consumption. A micro controller called arduino Uno board is used to control all the functions. In this paper, we are going to sense the room temperature using DHT11 sensor. This sensed temperature is used for controlling the fan speed. If the temperature is low then fan rotates slowly and if temperature is high then fan rotates speedily. If the temperature is less than 25 degrees centigrade then fan automatically off. If the temperature is less than or equal to 30 degrees centigrade then fan rotates with 20% speed and if temperature is less than or equal to 35 degrees centigrade then fan rotates with 40% speed. If the temperature is less than or equal to 40 degrees centigrade then fan rotates with 60% speed. If the temperature is less than or equal to 45 degrees centigrade then fan rotates with 80% speed and if the temperature is more than 45 degrees centigrade then fan rotates with 100% speed. We display the temperature of a particular place from another place using cloud. For this, we are used DHT11 sensor and a ESP8266 Wi-Fi module.

Arduino Uno Board:

Arduino is an open source computer hardware and software company. It is a single microcontroller that is used by the user communities to build digital devices so that it can sense and control the real time objects present in physical and digital world. An arduino board is designed based on different microprocessors and controllers. These boards contain a set of digital and analog input/output (I/O) pins that may be interfaced with different boards or Breadboards and other circuits. The board features the serial communication interfaces. To load programs a Universal Serial Bus(USB) is

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used. The microcontrollers are programmed using either Embedded C or C++. To program arduino provides an Integrated Development Environment (IDE). It is available at low cost and it can be used by both a technical person or a person who is new to the environment. The Arduino Uno Board used for the work is shown in Fig. 1

Fig.1:Arduino Uno Board

ESP8266 Wi-Fi module:

ESP8266 module is a device which is interfaced with the arduino board gives the Wi-Fi ability which works similar to Wi-Fi shield. It works with AT command set. This module has a powerful on-board processing and storage capability that allows it to be integrated with the sensors and other application through its GPIOs.

Fig. 2 represent ESP8266 Wi-Fi module used for storing data in cloud.

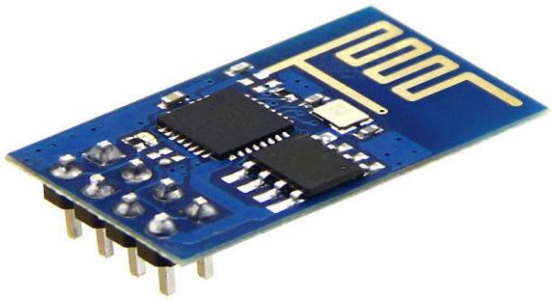

Fig. 2:ESP8266 module

DHT11 Sensor:

DHT11 Temperature and Humidity Sensor features a liberated digital signal output with the temperature and humidity sensor. It has excellent quality, fast response. It is available at ultra low cost. DHT11 Sensor containing Data, Voltage and Ground that are used for connecting Arduino Uno Board is shown Fig. 3.

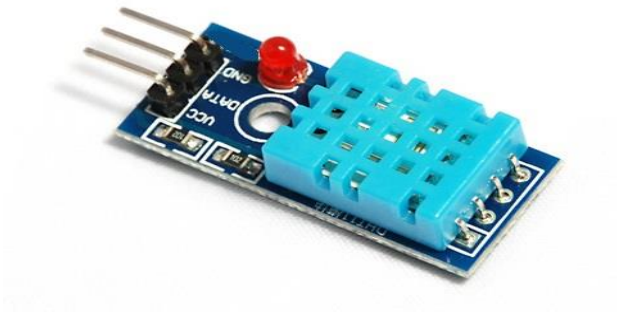

Fig.3:DHT11 Sensor

The overall work is a two-step process. In the first step, fan speed is being controlled based on the temperature at current location. In the second step, temperature is displayed through cloud. Cloud based accessing is used most frequently by the officials in the industries.

Initially the fan rotates with 100% speed. After sensing the temperature of the room the fan rotates accordingly. We use a software called Arduino IDE through which we can easily write code and upload this code on to the Arduino board. We connect the hardware materials as shown in Fig. 5, represents block diagram of the first half process:

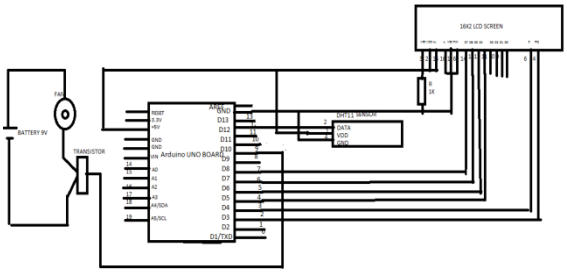

Fig. 4: Block Diagram for controlling fan speed

The output of this part is variation of the fan speed with respect to the change in temperature and display it on the LCD screen. The part of the project is displaying the temperature of a particular place from somewhere else. The block diagram of the other part can be represented as:

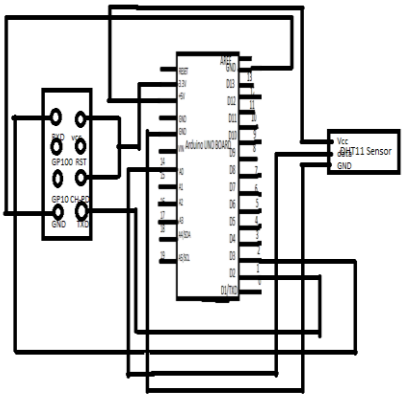

Fig. 5 Block diagram for displaying temperature using cloud

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In this module a sensor called DHT11 has been placed. Then we create a account in ThingSpeak.com. These details are given in the algorithm which displays the output in ThingSpeak website in the form of graphs.

Algorithm1:

Input:

i)power supply:- 9v battery

ii)temperature:- sensed value

Desired output:

LCD will display the temperature along with the speed of the fan.

Method:

```
Pwm<-  9
startSetup()
        analogWrite(0,255)
end Setup()
startloop()
        temp<-DHT.temperature
        if(temp<=20)
                analogWrite(9,0)
                speed=20%
        else if(temp<=25)
                analogWrite(pwm,51)
                speed=40%
        else if(temp<=30)
                analogWrite(pwm,102)
                speed=60%
        else if(temp<=35)
                analogWrite(pwm,153)
                speed=80%
        else
                analogWrite(pwm,255)
                speed=100%
end loop()
```

Algorithm2:

Input:

i) SSID, password.

ii)temperature:- sensed value

Desired output:

The sensed temperature is displayed on the website called ThingSpeak

Method:

```
loop()
        humidity <- DHT.humidity;
        temperature <- DHT.temperature;
        cmd = "AT+CIPSTART=\"TCP\",\"";
        cmd <- cmd + "184.106.153.149";
        cmd <- cmd+ "\",80";
end loop()
```

Description of algorithm1:

Read the room temperature by using a sensor called DHT11. If temperature is less than 20 then set pin to 9 and value to 0 in analogWrite, display fan off, else if temperature is less than or equal to 25 then set pin to PWM and value to 51 in analogWrite, display fan speed=25%, else if temperature is less than or equal to 30 then set pin to PWM and value to 102 in analogWrite, display fan speed=40%, else if temperature is less than or equal to 35 then set to pin to PWM and value to 153 analogWrite, display fan speed=60% else if temperature is less than or equal to 40 then set pin to PWM and value to 204 in analogWrite and display fan speed=80%, else if set pin to PWM and value to 255 in analogWrite and display fan speed=100%.

Description for algorithm2:

The SSID and password of the Wi-Fi are given as input. The humidity and temperature are sensed using DHT11 sensor. The sensed data will be send to cloud by using the IP address of the ThingSpeak Website.

IV. Experimental Evaluation

The microcontroller used in this system has a PWM module which is used to control fan speed by the change of duty cycle. According to the values that are sensed by the sensor duty cycle will be changed automatically thus controlling fan speed. The Table 1 contains the duty cycles varying with the sensed temperature.

Table 1: Duty cycle and Temperature

S. No	Temperature in Celsius	Duty cycle%	Speed
1	<=20	0	0
2	<=25	20	20
3	<=30	40	40
4	<=35	60	60
5	<=40	80	80
6	<=45	100	100

The variation of the duty cycle with temperature is shown in Fig. 6. The fan rotates with full speed when duty cycle is 100% and varies accordingly due to temperature changes.

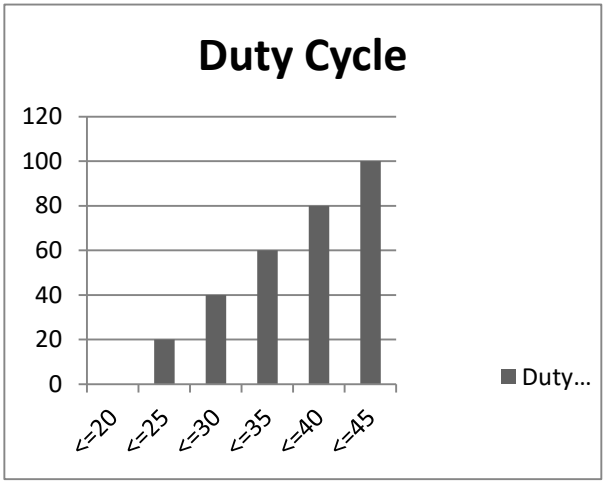

Fig. 6: Temperature vs. Duty Cycle

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This project requires two inputs such as power supply and temperature.

a) Power supply: Power supply is the basic need for any electric circuit. Here this work uses 5v dc battery to give power to arduino and sometimes we can give power directly from the system.

b) Temperature: As this project mainly focuses on temperature, the input is taken from a sensor called DHT11.
Output: According to this paper, after building the circuit we test it. The output of the project is the temperature that is sensed and the speed of the fan which will vary according to the room temperature.
In Table 2, the proposed work has been tested and the values are recorded accordingly. The sensed temperature represents the value that is sensed by the sensor and the fan speed represents the speed of the fan that changes with respect to the sensed temperature.

Table 2: Sensed temperature and fan speed

S. No	Sensed temperature	Fan Speed
1	23	10%
2	22	10%
3	26	20%
4	27	20%
5	21	10%
6	20	10%

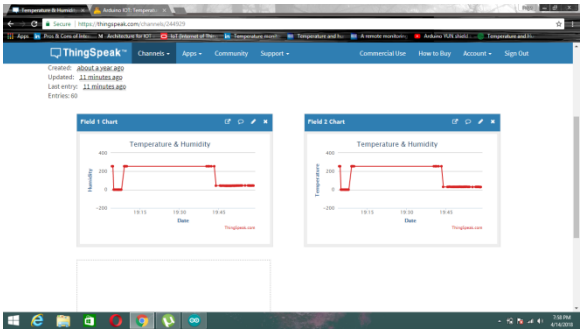

Fig.7:- Screenshot for displaying temperature

The figure shows the sensed temperature in the ThingSpeak website.
The developed model can be applicable for various purposes such as:

- Monitor the environments that are not possible for humans to monitor for extended period of time.
- Prevents waste of energy when it is not hot to use a fan.
- This work can also be used in home appliances
- To assist the disabled people to control the fan speed automatically based on given conditions.

V. CONCLUSION

An efficient fan controller based on room temperature by using arduino board has been developed. Output was checked by setting the temperature at different levels and it was found that the fan speed changes accordingly. It is very useful to the people who are disabled. There is much future scope for this work. The designed circuit can be used in many practical applications, where the circuit can be connected to a device whose temperature has to be controlled at a particular value. For example, a water tank with heater whose temperature can set to a desired value. In future the designed circuit can be connected to a GSM module so that it can be used in industrial areas when a machine crosses its desired temperature. We can send a message to the control room so that the damage of the machine can be avoided.

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