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A novel approach for temperature sensing and monitoring through wireless sensor using IoT

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***Abstract*— Advancement in Science and Technology have always helped us to live more happily. Through research and development, new innovations have made our life more peaceful and happier. Internet of Things (IoT) is one such technology which is developing at a very high pace. The proposed system is to make a system, using IoT, which senses the room temperature and sends this data to a cloud for further analysis and/or action. The proposed system has a wide area of application. Some of which are home automation, fire detection in labs, mines, etc.**

Keywords— IoT, temperature sensing, Arduino Uno, home automation.

I. INTRODUCTION AND MOTIVATION

Internet is the communication between human to human. Advancement in internet has let humans monitor few things and to some extend control them. In this entire system, humans play a very essential role. It is humans that read information, analyse the information and perform the necessary action. The action may be informing someone or controlling something. All of these actions are performed by humans. So we may call the internet as internet of people or internet of humans. But, what if a technology in which a thing or a device can communicate with other things or devices? What if one thing can control another thing!

Internet of things or IoT is a technology in which one connected thing can communicate with other connected things. The technology is not just to communicate one thing to another, but to get the data, analyse it and perform some actions based on the analysis. Here the intervention of humans is very less as the communication us between connected things. These things along with sensors are connected to the internet. Here, the sensors play very important role. The whole system actually relies on sensors and their data. The second most important part of the system is the cloud. Huge number of connected things means, huge number of sensors and their sensed data. These sensed data are to be stored for analysis and record purpose. This is where cloud is used. Unfortunately, the performance of this technology is highly affected by the environmental conditions, especially by the temperature.

In a recent research, it was found that the system consisting of wireless sensors are highly affected by the temperature on the board as well. Variations on the temperature also drastically affect the quality of wireless things between the capacity of the battery and it's time to discharge. This is the reason why the temperature should be monitored constantly. The proposed system is motivated by this idea.

II. LITERATURE SURVEY

Among all the environmental parameters, temperature is very essential and critical parameter. [4]There are many areas that needs real time temperature to be monitored. The areas like mines, labs, food and medical industries, etc. needs to be maintained at constant temperature. Hence, the proposed system will help to constantly monitor the temperature of any place.

III. METHODOLOGY

A. System architecture

This system is a connection of a temperature sensor, Arduino Uno board and a Wi-Fi shield along with a bread board and jumper wires. The system can be further expanded by using 'n' numbers of temperature of an area. The entire system uses a three tier architecture which consists of sensor module, communication module and cloud module. Fig. 1 is the diagrammatic overview of the system.

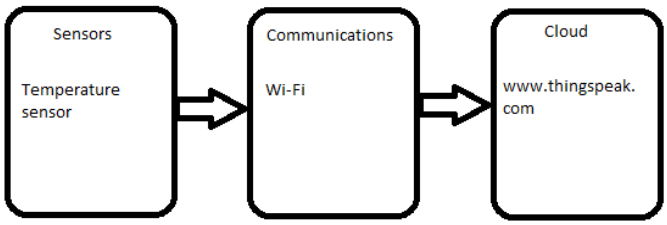

Fig. 1 System architecture

Sensor module consists of the temperature sensor, situated at some fixed location, senses the temperature. The sensed temperature is in analog signal format. This analogue signal is sent to Arduino which converts it to digital signal format. The communication module consists of a Wi-Fi shield. The digital signal is sent to the cloud using this Wi-Fi shield. The cloud module used in this system is the open source cloud www.thingspeak.com. The data received by the sensor is represented on the cloud in a graphical representation.

B. Hardware and software

Due to new innovation in the recent years, there are plenty of sensors and embedded systems available for various purposes. The hardware chosen for this project is based on their availability, sensing capability and the available platforms to develop it.

The processing board selected for the project is Arduino Uno. It is a microcontroller board based on ATmega328P. The board has 14 digital input-output pins and 6 analog inputs. The Arduino Uno board has a 16MHz quartz crystal, a USB connection for communication with computer and a power jack. To power the board, connect it to a computer using the USB cable or an AC-to-DC adapter or a battery.

The temperature sensor used in the system is LM35. The output voltage of LM35 is linearly proportional to the centigrade temperature. The sensing range of this sensor is -55 degree centigrade to 150 degree centigrade. The sensor requires only 60uA power. Due to this, it has low self-heating of less than 0.1 degree centigrade in still air. Accuracy of this sensor is +- 0.5 degree centigrade (at 25 degree centigrade). LM35 has three pins to make connections. First pin is connected to the Vcc (DC power supply). The middle pin is connected to the output. The output is analog voltage (10mV per degree centigrade). The last pin is connected to the ground (GND).

To connect the system with internet, Wi-Fi module used is ESP8266. ESP8266 is a low cost Wi-Fi module with full TCP/IP stack. The Wi-Fi module has five pins for the connections. It has 64K memory for instructions and 96K memory for data. It requires 3.3V DC current to function.

The IDE used for the project is Arduino IDE. It is a cross-platform application for software development. It supports C and C++ languages. It is a code editor that features syntax highlighting, brace matching, etc. It has one click mechanism to compile and load programs to an Arduino board.

The cloud used for the project is www.thingspeak.com. This is an open source cloud platform for Internet of Things. It has eight channels in it for uploading data. To secure the data, an API key is given to each and every thing connected to the cloud. The sensed data is shown in a graphical presentation on the cloud. It has features of displaying it as public or private. The data uploaded on this cloud is after every 15 seconds.

C. Experimental Setup

The experimental setup is made by connecting the devices to the computer via USB cables, jumper wires and a bread board. First all the connections are made and then the Arduino Uno board is connected to the computer.

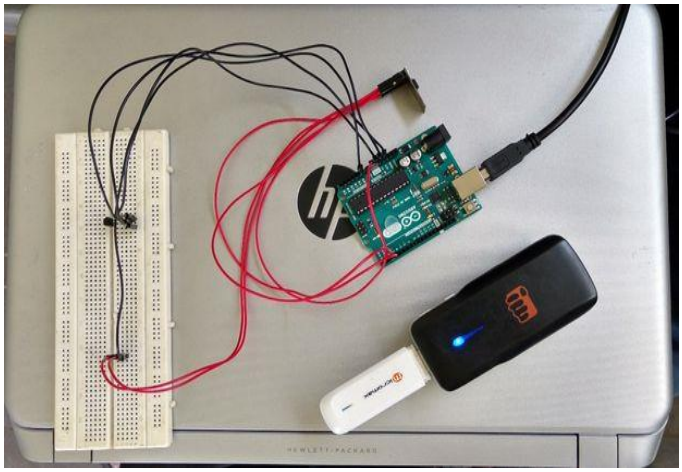

Fig 2. Hardware and sensor connections.

The Wi-Fi module has five pins for the connection. To connect the module to Arduino Uno, first connect the Tx pin of Wi-Fi module to the Tx3 pin on Arduino Uno. For these connections female-to-male connecting jumper wires. The Rx pin of Wi-Fi module is connected to the Rx2 pin of Arduino Uno. The GND of Wi-Fi module is connected to the GND of Arduino. Now using two female-to-male jumper wires, one connected to the Vcc and other to the CHPD pin of Wi-Fi module, are connected to a bread board. These connections on bread board are in a vertical line. Now a male-to-male jumper wire is used for the connection. This wire is connected in the same vertical line as previous connections. The other end of the wire is connected to +3V pin of the Arduino Uno.

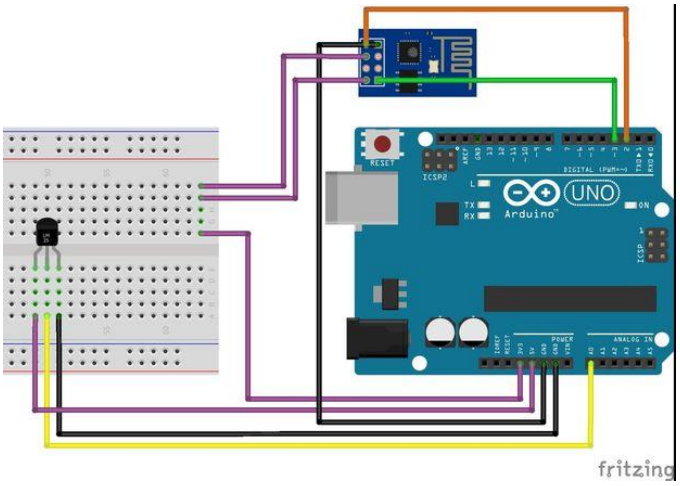

Fig 3. Circuit diagram for connections.

The temperature Sensor LM35 is now connected to the Arduino Uno via bread board. LM35 has three pins. They are supply, ground (GND) and output pin. The supply pin of LM35 is connected to +5V of Arduino Uno. The output pin of LM35 is connected to the A0 pin of Arduino. The GND pin of LM35 is connected to the GND of Arduino.

After all the connections, plug the USB cable to Arduino and computer. Now, open the Arduino IDE, select port and set the baud rate accordingly. After this, open the serial monitor and enter the following commands. First is 'AT', which responds to 'OK'. Second command is 'AT+CWMODE'. This command is to select the Wi-Fi mode. Third command is 'AT+CWLAP'. This command lists all the available access points in the range of the Wi-Fi module. The last command is 'AT+CWJAP="SSID", "Password" '. This command is used to join a particular access point.

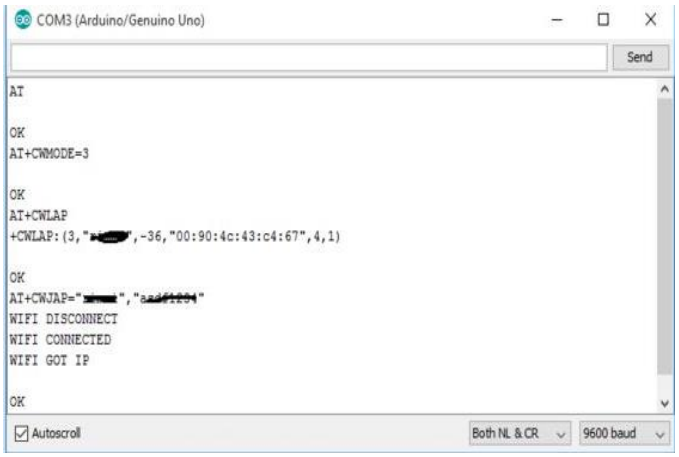

Fig 4. Commands and their response.

Now the two pins connected to Wi-Fi module and Arduino are to be changed. Now compile and execute the code.

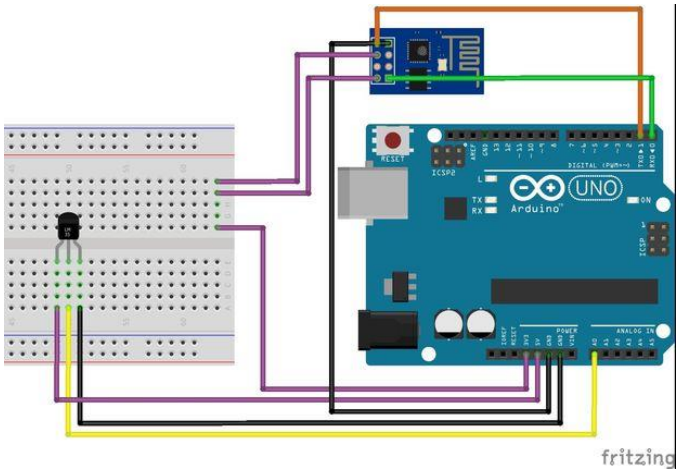

Fig 5. Connections after executing the commands

IV. Result

The result of the system is shown in the figure below.

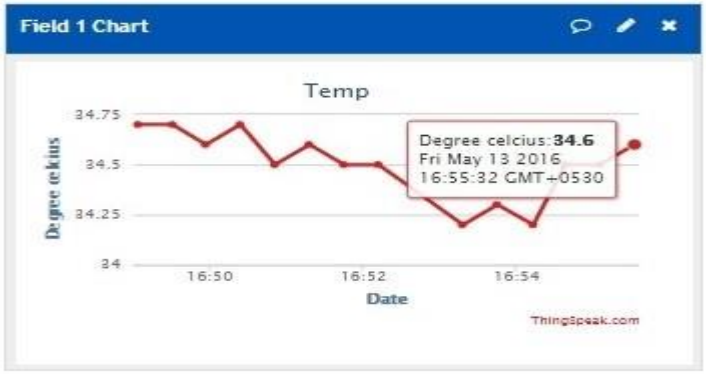

Fig 6. Graphical presentation on cloud.

The figure shows the live temperature that is sensed by the sensor in a graphical presentation. Out of the eight channels present on cloud, the said system uses only one channel for monitoring.

V. Conclusion and Future Scope

The paper presented here is based on the project work carried by us. This project is an implementation of Internet of Things. The said project is able to sense the temperature and monitor it remotely. The proposed use of Internet of Things will help the researchers in the field to come up with solutions that are inexpensive and more reliable. The project can be further expanded to control things. The sensed temperature can be useful for various projects such as home automation, lab monitoring, etc.

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