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IoT Based Environmental Factor Sensing and Monitoring System over Wireless Sensor Networks

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Abstract— This paper proposes an approach to build a cost-effective standardized environmental monitoring device using the ARDUINO. In many places people requires real time temperature and humidity like in Hospitals, in Mills, etc. So technique is to overcome this problem in many areas. It is going to consider solution to this problem. It is going to give real time temperature and humidity of any place in real time.

Keywords—IoT; ARDUINO; Temperature and humidity Sensing; Temperature and humidity Monitoring; IoT analytics platform service; wireless sensor networks.

I. INTRODUCTION

The Internet of things (stylized Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data [1].In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society"[2] .When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities[11]. Today there are many places where constant monitoring of temperature and humidity is essential. Considering this, it aims to sense the room temperature and humidity. For this, it requires ARDUINO UNO 2 Board. The sensed temperature and humidity will be shown on IoT analytics platform service.

II. EASE OF USE

A. Purpose

It is mainly for maintaining the temperature and humidity in a room. With this we can monitor the room temperature and humidity to our comfort.

B. Scope

The proposed system senses the room temperature and humidity after some intervals and communicates it to the IoT analytics platform service.

This information can be accessed via android app. As a further part, one can control to switch the A.C. on/off. It takes information about the surrounding environment through sensors and uploads it directly to the internet, where it can be accessed anytime and anywhere through internet.

People who suffer from asthma need temperature and humidity on certain range. The new born or old age people also preferred to have temperature and humidity in particular range for those can always monitor whether their place is in the specific range of temperature and humidity or not. It is going to sense temperature and humidity of targeted area not city or village. By this way people going to get specific results regarding environmental factor like temperature and humidity.

Finally, and this is cost effective as well as Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

III. IOT PLATFORM

As the Internet of Things (IoT) begins transforming businesses, economies and society, IoT platforms are emerging as the central backbone in the overall IoT infrastructure. In this study we examine the current landscape of IoT platforms, how they work and the main aspects to consider when choosing a platform provider.

A. ThingSpeak IoT Platform

The Internet of Things (IoT) provides access to a broad range of embedded devices and web services. ThingSpeak is an IoT platform that enables you to collect, store, analyze, visualize, and act on data from sensors or actuators, such as Arduino, Raspberry Pi, BeagleBone Black, and other hardware. For example, with ThingSpeak you

can create sensor-logging applications, location-tracking applications, and a social network of things with status updates, so that you could have your home thermostat control itself based on your current location[9][10].

ThingSpeak acts as the IoT platform for data collection and analytics that serves as bridge connecting edge node devices such as temperature and humidity and pressure sensors to collect data and data exploratory analysis software to analyze data. ThingSpeak serves as the data collector which collects data from edge node devices and also enables the data to be pulled into a software environment for historical analysis of data.

The primary element of ThingSpeak activity is the *channel*, which contains data fields, location fields, and a status field. After you create a ThingSpeak channel, you can write data to the channel, process and view the data with MATLAB code, and react to the data with tweets and other alerts. The typical ThingSpeak workflow lets you:

1. Create a Channel and collect data
2. Analyze and Visualize the data
3. Act on the data using any of several Apps

The ThingSpeak API is available on GitHub and includes the complete ThingSpeak API for processing HTTP requests, storing numeric and alphanumeric data, numeric data processing, location tracking, and status updates [10].

IV. DESCRIPTION

For proposed technique requires following components.

A. Components

The hardware requirements are:

i. Arduino Uno Board.
ii. Data cable.
iii. Power source..
iv. DHT11 temperature and humidity Sensor.
v. LM35 temperature Sensor.
vi. ESP 8266 WiFi Module

The software requirements are:

i. Arduino IDE.

B. Product function

The above mentioned software is to connect the Arduino with a computer, to compose code so as to perform desired action. And the Arduino IDE is used to to compile and upload the code on the Arduino board.. Except this software, we also need to use a website named ‘www.Thingspeak.com’, which gets the data from the Arduino board.

C. External interfaces

The input is the sensing of the temperature and humidity by the Launch pad. This sensed temperature and humidity will be uploaded to the www.thingspeak.com website. From this site, the temperature and humidity near the Board will be given to www.thingspeak.com.

The output, i.e., the temperature and humidity will be shown on www.thingspeak.com. To get the live temperature and humidity, one must always be connected to the internet.

D. Functional Requirements

The system shall sense the temperature and humidity near the board using the inbuilt temperature and humidity sensor on the Board. This sensed temperature and humidity will be sent to www.thingspeak.com where the temperature and humidity will be stored and will be passed to this website. The website will show the temperature and humidity in both digital and graphical manner.

E. Design constraints

This technique is developed using Arduino Uno 2 Board. The limitations of this board will impact on the technique. For sensing the temperature and humidity, a continuous power supply is needed to the board. For updating the sensed temperature and humidity to the android application, we need a continuous internet connection.

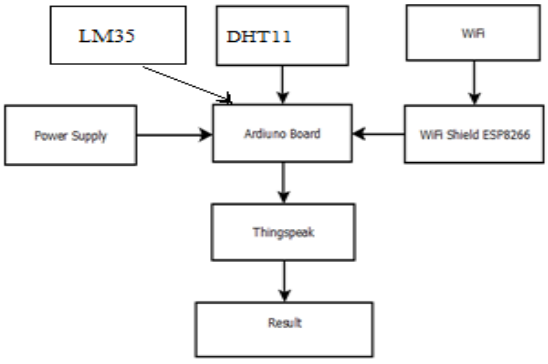

Figure 1: Block diagram of system

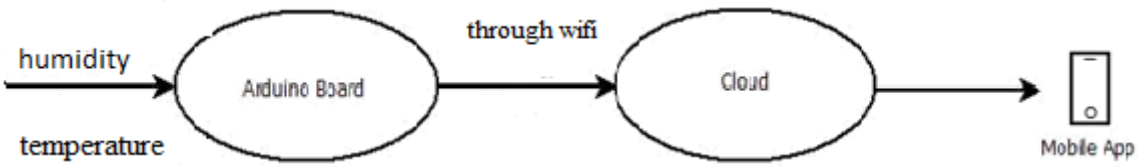

Figure 2: Data Flow Diagram of system

F. DHT11 temperature and humidity Sensor.

The DHT11 is a basic, ultra low-cost digital temperature and temperature and humidity sensor. It uses a capacitive temperature and humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old. [12]

G. LM35 temperature Sensor.

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output and precise inherent calibration of the LM35device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy). The LM35-series devices are available packaged in hermetic TO transis The LM35D device is available in an 8-lead surface-mount small-outline package and a plastic TO-220 package.[14]

H. Arduino/genuino uno

Arduino/genuino uno is a microcontroller board based on the atmega328p. it has 14 digital input/output pins (of which 6 can be used as pwm outputs), 6 analog inputs, a 16 mhz quartz crystal, a usb connection, a power jack, an icsp header and a reset button. it contains everything needed to support the microcontroller; simply connect it to a computer with a usb cable or power it with a ac-to-dc adapter or battery to get started[13].

1. The arduino integrated development environment

Arduino software (Ide) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. it connects to the arduino and genuino hardware to upload programs and communicate with them[13].

In order to send data to ThingSpeak using an Arduino, you need an Arduino with network connectivity either onboard or with a shield. We have an official library for ThingSpeak and we require Arduino 1.6.x or above running on Windows, MAC OS X, and Linux. This library needs to be installed and used by the Arduino device in order to send data to ThingSpeak. ThingSpeak requires a user account and a channel. A channel is where you send data and where ThingSpeak stores data. Each channel has up to 8 data fields, location fields, and a status field. You can send data every 15 seconds to ThingSpeak, but most applications work well every minute[13].

2. Wi-Fi Module:

we used ESP8266 Wi-Fi module which is having TCP/IP protocol stack integrated on chip. So that it can provide any microcontroller to get connected with Wi-Fi network. ESP8266 is a preprogrammed SOC and any microcontroller have to communicate with it through UART interface. It works with a supply voltage of 3.3v. The module is configured with AT commands and the microcontroller should be programmed to send the AT commands in a required sequence to configure the module in client mode. The module can be used in both client and server modes. Once it gets connected in a Wi-Fi network, we‟ll get one IP address which is accessible in its local network. The module is additionally having 2 GPIO pins alongside UART pins. It is also having inbuilt SPI protocol by using the two pins of UART as data lines and by configuring the two GPIO pins as control lines and clock signal. It is also having 1MB on-chip flash memory. Internally it is having power management unit with all regulators and PLLs.'

V. ASSEMBLAGE

1. Start.
2. Do the connection of sensor and WiFi shield with the Arduino board with the help of jumper wires..
3. Start Wifi connection.
4. Connect board to the Laptop.
5. Sense the Temperature and humidity which is sensed by DHT11 Temperature and humidity sensor.
6. Send the sensed temperature and humidity to the Thingspeak.
7. Access sensed temperature and humidity through Thingspeak.

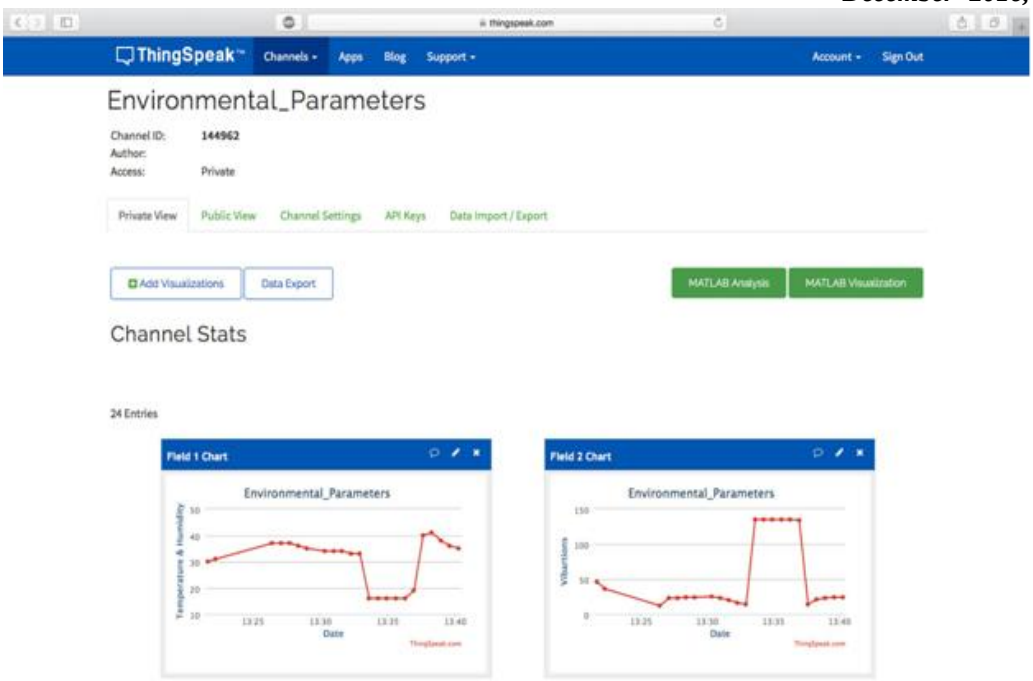

Figure 3:Temperature and humidity data on IoT platform

VI. CONCLUSION

Since IoT allows the objects to be sensed and controlled remotely, the parameters like temperature and humidity, temperature, vibration etc. It will be automatically monitored and intelligent decisions will be taken if the value of the parameters crosses certain threshold value.

Iot based environmental factor sensing and monitoring system is the solution for people who preferred to have temperature and humidity in particular range. These people can always monitor whether their place is in the specific range of temperature and humidity or not. It is going to be cost effective as well as with ease of use by using existing internet infrastructure like wifi etc. and people can access information over mobile app.

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