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Wireless Arduino Based Weather Station

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Abstract: The monitoring of weather is really helpful in various applications like in critical scientific systems or for simulation purposes. In other fields like agriculture, disaster management and medical suited environments. Weather sensing is one of the major functions in aerospace applications to check suited weather environments of other planets too. For example, NASA Mars REMS(Rover Environmental Monitoring Station) for providing daily and seasonal reports. The need for this project came from the support of a fact of very low popular devices and instruments are available that can provide you live weather results. On top of that requirement of accessing it anywhere.

Keywords: Arduino, cc3000, weather station, thingspeak, wireless, portable, weather monitoring.

I. INTRODUCTION

Weather forecasting is done using predicting the weather and values obtained from sensors or instruments. We human use an approach of algorithms having certain or no input and valid output. Considering there is nothing random in nature and everything around us follows a particular pattern. On the basis of these weather forecasting patterns people can take precautions on even harsh weather conditions. The wireless arduino weather station has a capability of working on low power. Hence it is not much dependent on power source. The device is also made of low cost items and around ±1 unit error accuracy. As an application, a normal person can place this device at various places like in his backyard garden for soil moisture and rain water readings, indoor swimming pool for the maintenance of water temperature and humidity in air. This weather has an external feature of a website access all around the world. It attempts to show live feed of readings from that environment where the result is required.

Working Principle

The device works by taking readings from various sensors at different pins in arduino microcontroller. For this purpose we've used an arduino compatible WiFi shield stacked upon our arduino microcontroller which adds up extra functionality to our arduino board. It increases the scope of this project. The various sensors are attached to the microcontroller each of them taking 5V input from arduino except one pressure sensor requiring 3.3V using a 3.3V pin out from the board. All the sensors are connected using a breadboard. For temperature sensor to prevent any damage or unstable behavior a 10kΩ resistor is attached in parallel to the temperature sensor on the breadboard. We've used DHT11 temperature sensor to get the temperature and humidity readings connected to digital pin 7 on board for input signals. It gives us continuous reading of surrounding environment in the range of two to three seconds. A raindrop sensor module is also attached from analog pin on arduino to take input signals from the sensor. The sensor detects either there is any rain or not in terms of values. The raindrop sensor module comes with a potentiometer attached to it. For simulation purpose we can check it by putting some water droplets on the board and we can see the readings fluctuating.

BMP185 pressure sensor module is also attached to get the pressure readings in an environment. Because of its low cost it doesn't affect the overall system. We know that pressure varies with the altitude. Hence it could be used to measure the altitude too. One more sensor attached which is soil moisture sensor module, which when dipped within a humid wet or dry soil fluctuates accordingly. It detects how much moisture is present in the soil. For quick representation purpose it could be checked with moistening the board by dropping some water. It consists of two tongs like rod for sensing the moisture so that it could be added within the soil and take readings.

The other part of the system is wireless connectivity. We've attached a cc3000 wifi shield over the arduino to connect it to the local internet connection providers and connect. Its job is to transmit the data to a website linked to it and visualize the data over there for every minute or thirty seconds.

Since it is a shield and not a breakout board we don't have to make particular connections for each of IRQ, VBAT and CS. It makes our circuit less wired and neat. It has its own mac address and transmit to the web server. There are many benefits of using this shield over other wifi circuit modules present there in market as it can accept DNS where others require IP address as well as good circuit components and inbuilt antenna. It also has great libraries and support all around the world.

The website for this project is an open source IOT(Internet of Things) website named Thingspeak by a community of Mathworks. So it provides further facility to add code in Matlab and various function to get knowledge from the

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information obtained from the readings on the server. The website provides its DNS. On the Thing speak website, the first step is to register for the account.

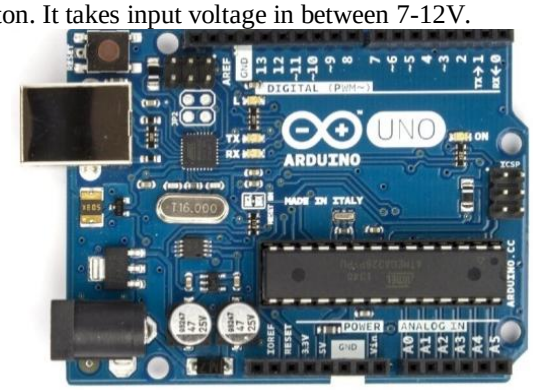
After registration, create a channel which will be for your device. A channel is made for taking all the information you want to display update send or receive. It is used for interaction between arduino and your channel. While creating the channel, specify or check the number of fields for data you want to visualize or post on the server.

Thingspeak website provide API write key and API read key for each of its own purpose. In order to send or update information regarding our device in live feed we will use API write key and specify in our code while making requests to the website.

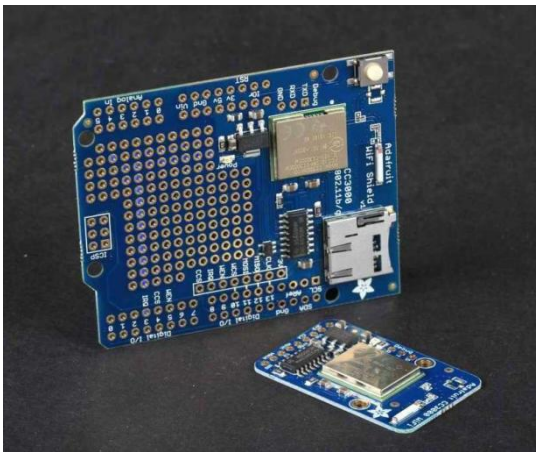
II. COMPONENTS

Arduinois an open source device, a prototyping board consisting of ATmega328Pmicrocontroller providing a 5V and 3.3V output volatage options. It takes input voltage from either connecting USB to your computer or either using a coaxial cable using a portable power supply. The arduino board is also capable of reading Twitter messages and respond in order to that. On the arduino you can upload sketches using Arduino IDE. Arduino comes in various flavours and according to needs like Uno, Mega, Yun etc.

In this instrument I've used **Arduino uno**board. It is cheap and feasible. Also it is good to start as a beginner. It has 14 digital input/output pins, 6 analog inputs and a reset button. It takes input voltage in between 7-12V.

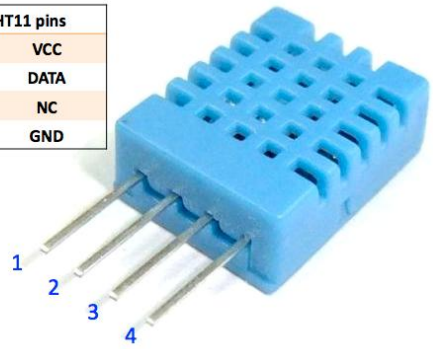


Adafruit CC3000 wifi shield
Adafruit CC3000 wifi module consists the wifi chip from Texas Instruments which uses really low power. It can do TCP and UDP and convert IP address from DNS. Provides capability of adding your own UFL antenna. SD card slot for data logging is also provided.It is easy to configure username and password for this device. It acts as a second brain for Internet of Things application for the instrument. It uses SPI for communication not UART so you can push data as fast as you want or as slow as you want. It has a proper interrupt system with IRQ pin so you can have asynchronous connections. It supports 802.11b/g, open/WEP/WPA/WPA2 security, TKIP and AES.



DHT11
DHT11 is a basic low cost temperature and humidity sensor. In this project we've connected DHT11 sensor to the digital pin 7 of arduino. It consists of 4 pins from left to right Vcc, Data, NC(not connected) and GND. There are mainly three pins which are used. Connecting the ground on ground of arduino and Vcc to 5v output of arduino.

DHT11 pins	
1	VCC
2	DATA
3	NC
4	GND



Raindrop sensor module
The rain drop sensor module is a sensor which is used to detect whether there is any rain or presence of rain weather near surrounding. It is a tool for rain detection. The module consists of a rain board on which droplets can be detected, a potentiometer attached to adjust the sensitivity for it and a LED to show the power indication. It gives only analog output. It is connected to analog pin A0.

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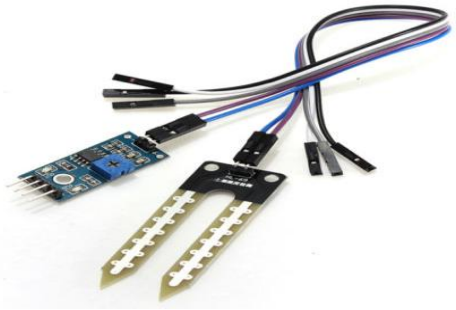
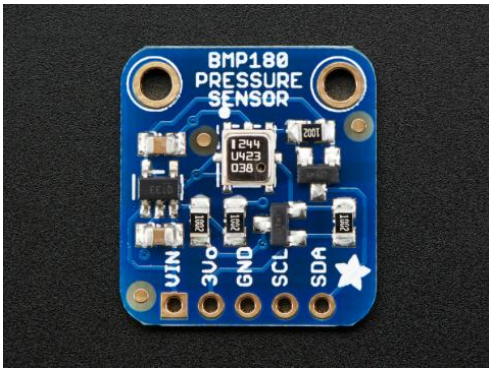
Soil moisture sensor module

Soil moisture sensor module consists of a sensor which detects the moisture within the soil or volumetric water content. If you want to know that when you need to give water to your plants or they're needy. It can inform you that your garden soil is wet, dry moisture or not. It also consists of a potentiometer to vary the sensitiveness of the sensor. It is connected to analog pin A1 to take the readings.



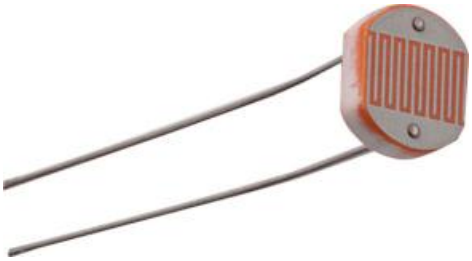
BMP180 sensor

It is a barometric pressure sensor which senses with an I2C interface As the pressure varies with altitude it can used to measure the altitude too. It has 4 pins SDA, SCL, GND and Vin.



LDR Sensor

Light Dependent Resistor also called as Photo resistor or Photocell. It works bygiving the value of varying resistance when it engages with light. If the light is reduced itgives lesser value of lower light intensity and vice versa.



III. RESULTS

Thingspeak is an open data platform for the Internet of Things. It sends data to the cloud. Using this we can analyze and visualize our data. Finally on the basis of those we can react or trigger an action. It provides real time data collection and other devices an technologies like Particle Photon, Raspberry Pi, Twitter, Electric Imp etc.

IV. CONCLUSION AND FUTURE SCOPE

In further improvements on small scale it is desired to be cased within a arduino case either own made or bought as desired. Adding one more sensor LDR(Light dependent sensor) one of the other available cheap sensors can be used to light cloudy weather or not. One of the future scope of it as desired is compatible with smartphone apps to give any critical feedback of data. Updating twitter status and performing actions on the basis of that which is one of the most efficient use of IOT. The special feature to be included as an idea in this device is that it can be used for any critical environments or local area rather than expensive weather stations capable of performing over a large scale. These work on small scale too on public wireless LANs.

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