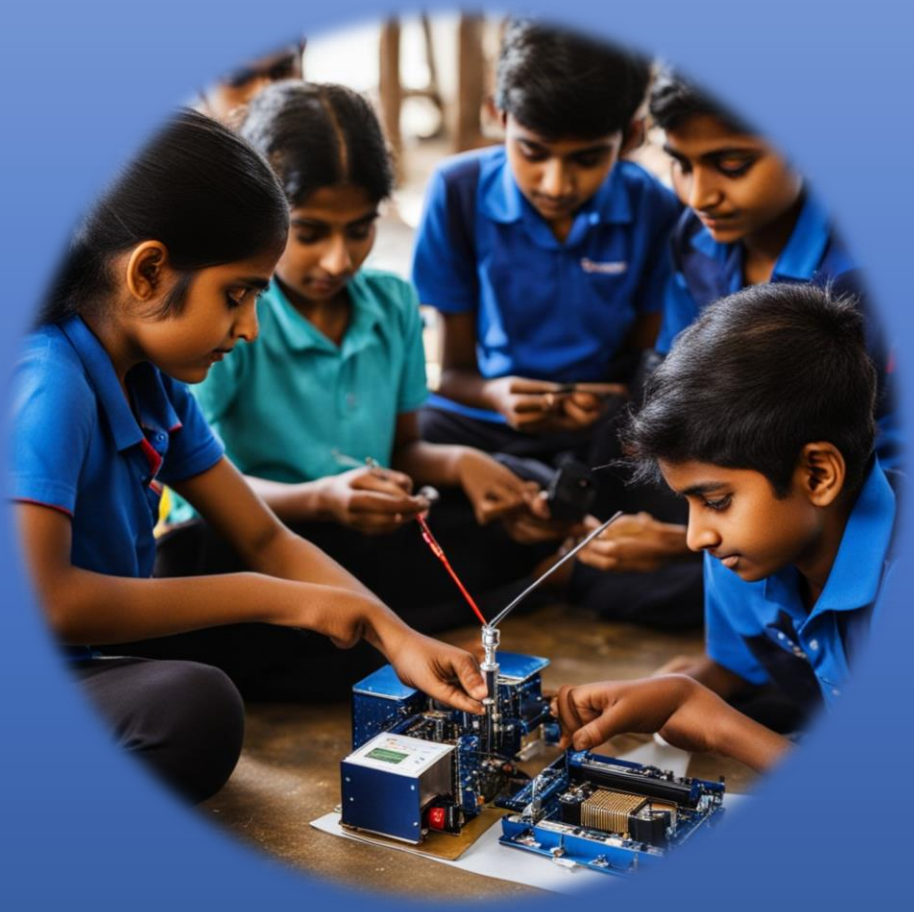
WeMoSat

Weather Monitoring Satellite by Vivruti



Vivruti

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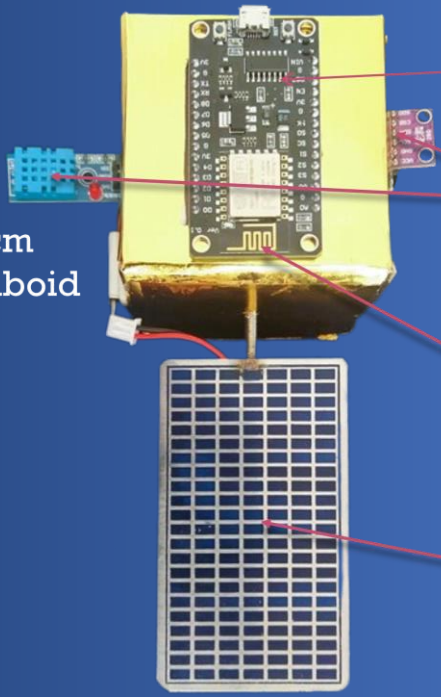
Weather Monitoring Satellite by Vivruti



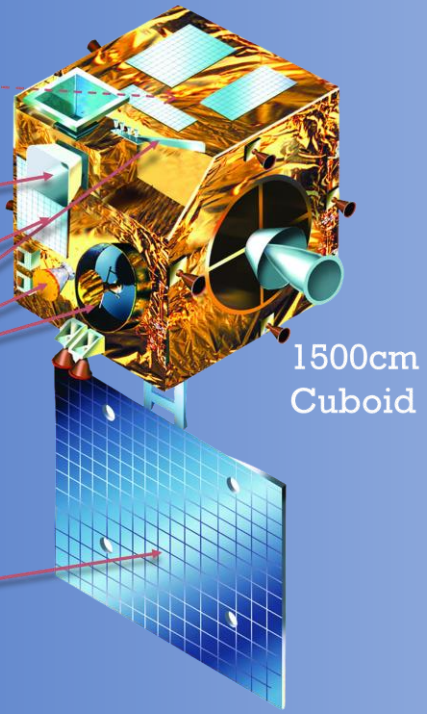
7 cm
Cuboid

Controller,
Processor etc

Sensors /
Payload

Communications
System - Antennas

Power System –
Solar Panel and
Battery

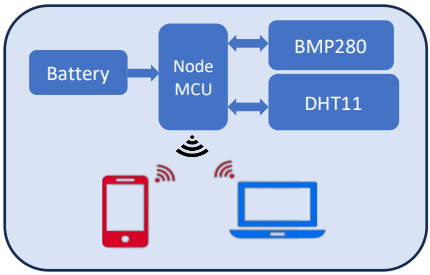


1500cm
Cuboid

WeMoSat **vs** **KalpanaSat**

- KalpanaSat is Indian weather satellite used for weather forecast.

The WeMoSat – A weather monitoring mini-satellite



The WeMoSat is a miniature satellite that can be used to monitor local weather conditions like temperature, pressure, humidity etc of your own local area. It also gives the altitude of the satellite. It is a low cost, easy to assemble satellite and uses open-source software.

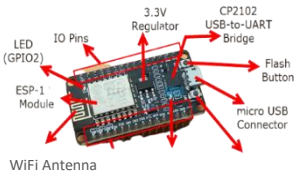
The WeMoSat uses **NodeMCU ESP8266** micro controller at its heart and two sensors **BMP 280** and **DHT11.** The programming is done in Arduino IDE. Open-source libraries and codes are used to program the WeMoSat.

Features of WeMoSat

1. WeMoSat is an extremely simplified version of a real satellite which can be used as a hands-on tool to learn about real satellites and to have a practical experience of a real space project.
2. The WeMoSat is similar to an actual weather satellite and contains many of the major subsystems found in an actual satellite like controller, sensors, communication system and power. Actual satellites have additional control mechanisms and advanced sensors.
3. Participants will learn all aspects of designing a satellite: selecting its mission, integrating the components, testing, deployment and then analyzing the data.
4. WeMoSat maps real-time atmospheric parameters like temperature, pressure, humidity and transmits it wirelessly to a ground station.
5. This data is then displayed in graphical format on a webpage so that students can easily comprehend it.

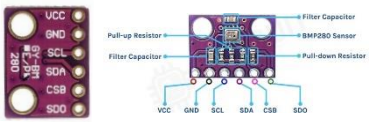
Major Components of WeMoSat

NodeMCU ESP 8266: 32-bit Microcontroller with Web Server



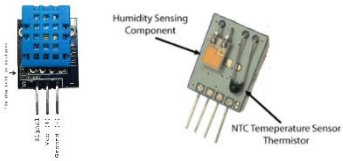
1. Input Voltage : 4.5V-10V
2. PC / Laptop connection: Micro USB
3. Digital I/O Pins : 11 Digital and 1 Analog
4. Programming: Arduino IDE

BMP 280: Temperature and Pressure Sensor



1. Operating Voltage: Typically, 3.3V
2. -40 to +85°C Temperature with ±1°C accuracy
3. 300 to 1100 hPa Pressure with ±0.12 hPa accuracy
4. +9000m to -500m Height with ±1m accuracy

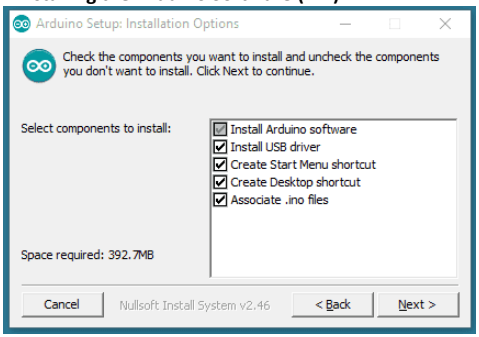
DHT11: Temperature and Humidity Sensor



1. 3 to 5V input power
2. 20-80% humidity readings with 5% accuracy
3. 0-50°C temperature readings ±2°C accuracy

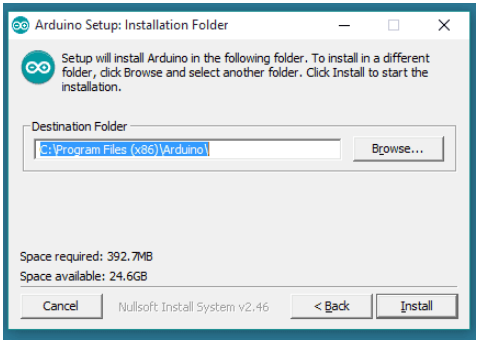
Appendix: Installation of software and libraries

Installing the Arduino Software (IDE)



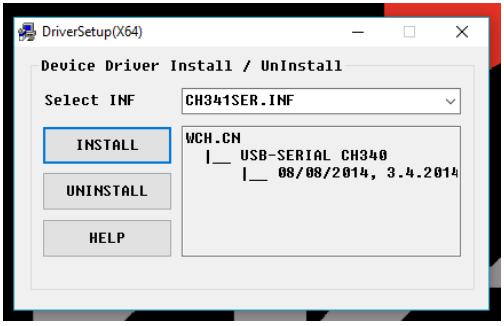
Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip packages. Select the Installer version as that installs directly everything you need to use the Arduino Software (IDE), including the drivers.
When the download finishes, proceed with the installation and please allow the driver installation process when you get a warning from the operating system.

Choose all the components to install.



Choose the installation directory. The process will extract and install all the required files to execute properly the Arduino Software (IDE)

Installing CH340 USB driver (if not available):



Download CH341SER.exe from Google search and run the executable.

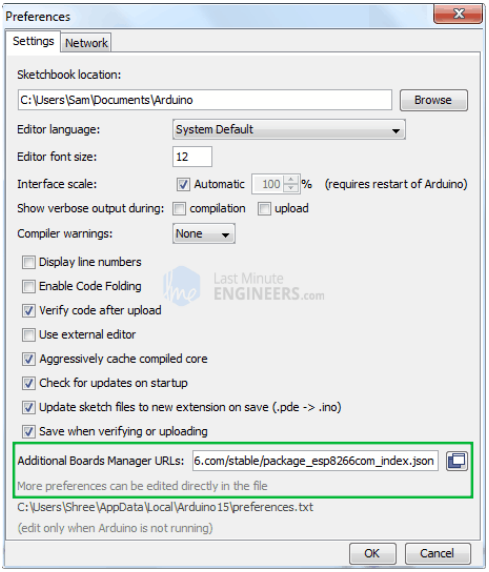
CH341SER (EXE)

Click the "Uninstall" button first. Then click on the "Install" button.

Windows CH340 Driver Installation

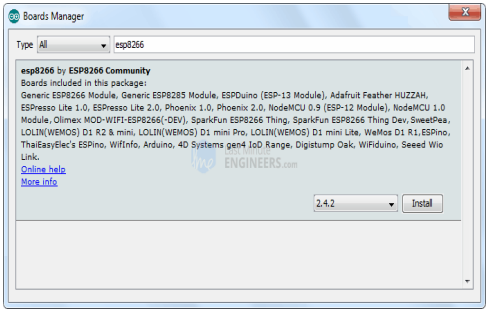
I

Installing the ESP8266 Core on Windows OS



Let's proceed with installing ESP8266 Arduino core. To begin, we'll need to update the board manager with a custom URL. Open up Arduino IDE and go to File > Preferences. Then, copy below URL into the Additional Board Manager URLs text box situated on the bottom of the window and Hit OK.

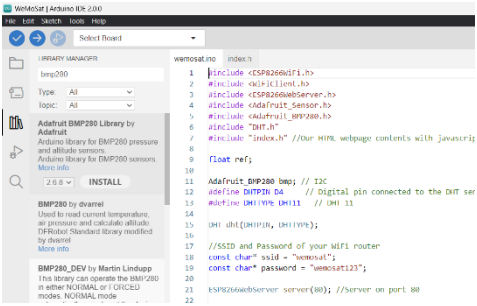
http://arduino.esp8266.com/stable/package_esp8266com_index.json



Then navigate to the Board Manager by going to Tools > Boards > Boards Manager. There should be a couple new entries in addition to the standard Arduino boards. Filter your search by typing esp8266. Click on that entry and select Install.

The board definitions and tools may take a few minutes to download and install). Once the installation has completed, a small *INSTALLED* text will appear next to the entry. You can now close the Board Manager.

Installing the BMP280 and DHT11 libraries



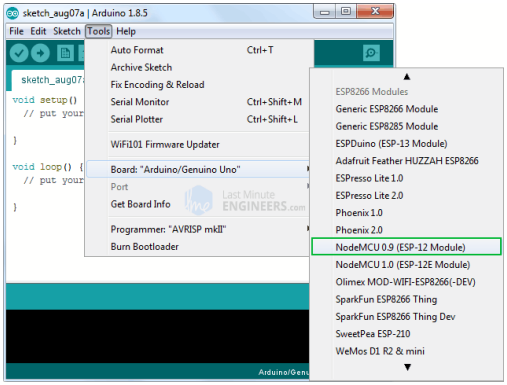
To run the programs for the pressure sensor (BMP280) and humidity sensor (DHT11), you need to download and install their respective libraries

From Arduino, open Library Manager. It will be in Tools Menu (or left pane menu, as shown in fig.) for 2.x version and under Sketch -> Include Library Menu for 1.x old versions.

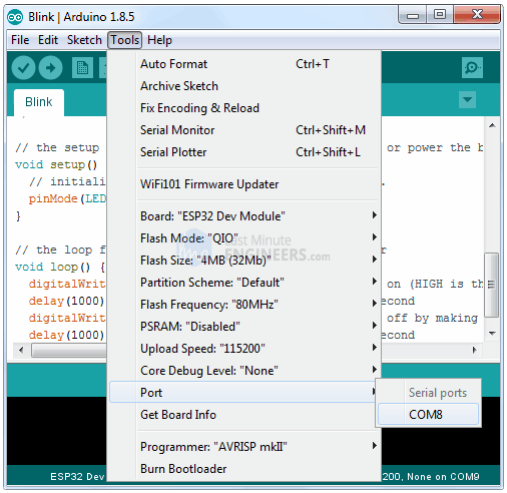
Search BMP280 and install Adafruit BMP280 library with all dependencies and then search DHT11 and Install DHT11 Sensor Library from Adafruit.

Arduino Example: Blink

To make sure ESP8266 Arduino core and the NodeMCU are properly set up, we'll upload the simplest sketch of all – The Blink! We will use the on-board LED for this test. As mentioned earlier in this tutorial, D0 pin of the board is connected to on-board Blue LED & is user programmable. Perfect!

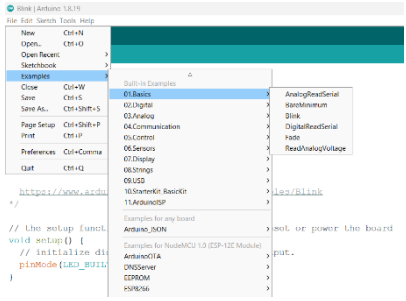


Before we get to uploading sketch & playing with LED, we need to make sure that the board is selected properly in Arduino IDE. Open Arduino IDE and select NodeMCU 0.9 (ESP-12 Module) option under your Arduino IDE > Tools > Board menu.



Now, plug your ESP8266 NodeMCU into your computer via micro-B USB cable. Once the board is plugged in, it should be assigned a unique COM port. On Windows machines, this will be something like COM#, and on Mac/Linux computers it will come in the form of /dev/tty.usbserial-XXXXXX. Select this serial port under the Arduino IDE > Tools > Port menu. Also select the Upload Speed : 115200

Now open the Blink example from Files Menu - Examples – Basic – Blink



Last Minute ENGINEERS.com

Notes

Notes

Notes

Instructions Sheet for opening webpage to display WeMoSat data on a mobile / laptop:

1. Create a Wi-Fi network or hotspot with following details:
   a. SSID: wemosat
   b. Password: wemosat123
   c. This may be done by starting hotspot on mobile and renaming hotspot – Fig 1
2. Install the App "Network Analyser" on your mobile phone.
   a. https://play.google.com/store/apps/details?id=net.techet.netanalyzerlite.an&hl=en_IN&gl=US
3. Turn ON the power switch on the WeMoSat
   a. When you do this an LED on the microcontroller (this is the biggest component on the WeMoSat) should blink and DHT11 LED will be glow. That indicates power is proper.
4. Open the Network Analyzer App on mobile where you created the WeMoSat hotspot
   a. Click the LAN Scan tab and Check for Espressif Inc in the list displayed – Fig 2
   b. Check and note or copy IP Address of the Expressif Inc
   c. Note: Sometimes the Espressif may not be displayed so you have to select an IP from the list using your own sense. There will be a W, P below the IP address of WeMoSat to indicate that the address is both ping ready and has a webpage attached to it. IP address will be like 192.168.xx.xxx
   d. For laptop / desktop, open command prompt and type > arp -a to get the IP address
5. Paste the IP address in any browser in the mobile phone– Fig 3
6. To check results on laptop, connect the Wi-Fi of the laptop to ssid: wemosat with password: wemosat123 and type the above IP address in browser.
   a. Any device on which you want to open the IP address must be connected to the same network to which WeMoSat is connected i.e ssid: wemosat and password wemosat123
   b. You can connect another mobile or laptop or desktop.
   c. Students if they have mobile with them can all likewise connect to same network and open the IP address in the browser
7. The browser will update every 5s with the temperature, pressure, humidity and altitude data
8. To change some data, you can blow air from your mouth on to the blue sensor which will increase the humidity and increase the temperature if it is cold.
   a. You can also blow on to the other brown sensor to increase temperature
   b. Lift the entire WeMoSat up to change altitude.
      i. You can use any convenient method to raise height of the WeMoSat
      ii. Get a student to go to higher floor or tie a thread and pull up the WeMoSat etc
9. Switch OFF the WeMoSat when the demo is over.

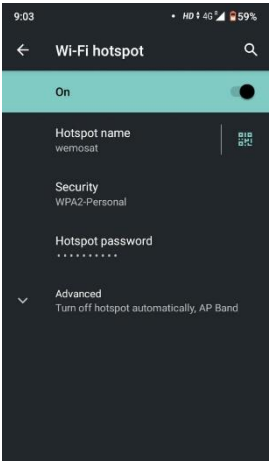


Fig 1: Hotspot

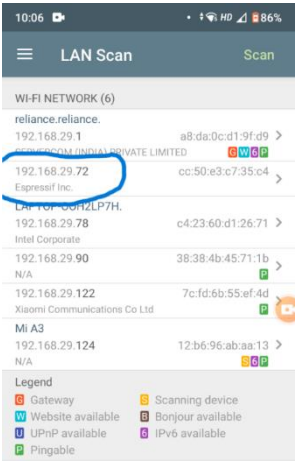


Fig 2: Net Analyzer

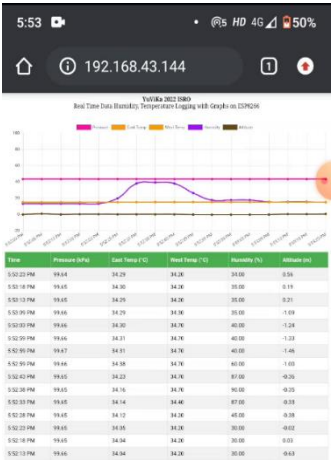


Fig 3: WeMoSat Data in browser

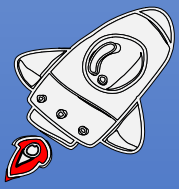
VIVRUTI

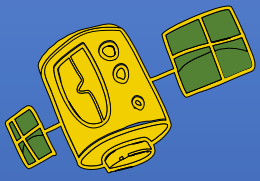
Simplifying Science

Let us embark on an extraordinary journey of discovery and inspiration! Let us explore the wonders of the Space!!

We introduce children at the school level to the wonders of both space science and space engineering. The participants will get hands-on experience by building their own home telescopes and observing the magnificent sky. Additionally, we will guide them through exciting projects like CANSAT to introduce them to the thrilling world of space engineering.

Space Talk Series
Satellites, Rockets and More





Build WeMoSat - a mini-satellite
The first step to a real satellite

Build a small Telescope
The Time Machine to see Universe

Vivruti team conducts these fun and learn programs on space science and engineering in schools which is willing to arrange the programs. Students from 4th standard to 9th standard are eligible to participate. As an exception, we will do programs for a groups of children if they are in Pune, Nasik or Ahmedabad provided there are more than 10 children interested and they are willing to host the program. Mail or message us for further details.

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