

# Ottawa PC Users Group Microcontrollers

## microcontroller

- A small computer on a single chip it contains:
  - program memory
  - programmable I/O peripherals
  - sometimes flash memory
- designed for embedded applications. E.G. installing into some other fixed device
  - light bulb
  - car
  - microwave
  - switch ...

Definition: <https://en.wikipedia.org/wiki/Microcontroller>

Common microcontrollers: [https://en.wikipedia.org/wiki/List\\_of\\_common\\_microcontrollers](https://en.wikipedia.org/wiki/List_of_common_microcontrollers)

## Some examples:

- arduino [Atmel](#) 8-bit [AVR](#) microcontroller
- pic micro [https://en.wikipedia.org/wiki/PIC\\_microcontrollers](https://en.wikipedia.org/wiki/PIC_microcontrollers)
- [STMicroelectronics](#). <https://en.wikipedia.org/wiki/STM32>
- [Espressif Systems](#) esp8266 and esp32
- [Raspberry Pi Pico](#) (Really New January 2021)

## I am going to discuss the esp8266 and esp32-Cam

- A disclaimer. We had questions about hacking of consumer switches, plugs, lamps etc. Can we make that another topic. No time today to discuss this.

Other than to note - if you do it yourself, you know what you have. This is my preference.

## Why I like the ESPs

- WiFi on board
- Programmed in C using the Arduino IDE - so it's easy.
- Lots of community support
- Price - borscht is more expensive

## What is it:



## ESP32 - Cam

Esp Chip and antenna, ESP8266 Development board, ESP32 - Cam board with camera

Thanks to <https://www.tdgulf.com> <https://www.joom.com> for the above images.

### More information

- <https://tttapa.github.io/ESP8266/Chap01%20-%20ESP8266.html>
- <https://en.wikipedia.org/wiki/ESP32>
- And **many** tutorials, blogs, ...

## Internet of things IOT Data

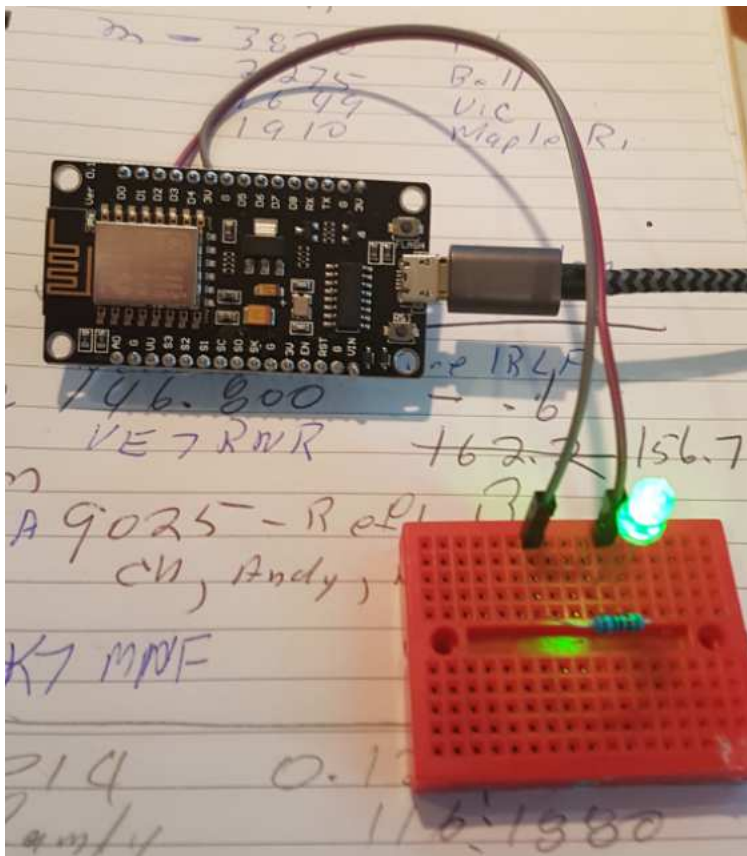
I like to measure things. Temperature, pressure, moisture, flow, ...

I really like the ESP8266 and ESP32 as I can stick them in zip lock bags all over the place and they measure and in some cases control.

What to do with the data they gather. I like to create my own but there are platforms already built. I either use node red or create a web server in the ESPs or both. More later.

## Hello World

Or, the micro controller equivalent - flash a LED



We actually have two leds. One on the ESP8266 Development Board and the external led on the red breadboard.

#### Code Hello World

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```
// micro controller hello world with 2 leds

// Global variables here
int boardLed = 2;
int externalLed = 5;

// Executed once
void setup() {
    pinMode(boardLed, OUTPUT);
    pinMode(externalLed, OUTPUT);
    Serial.begin(9600);
}

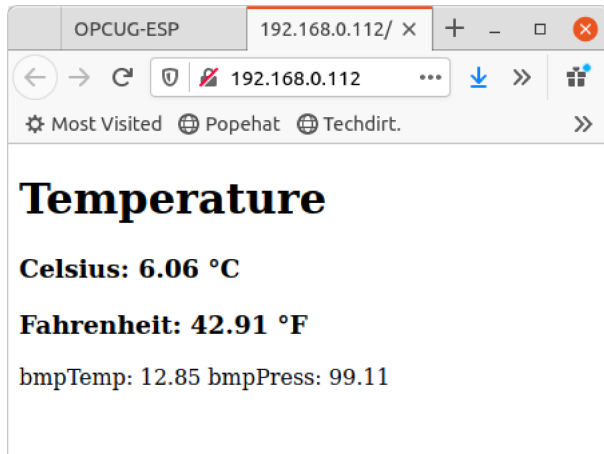
// Executed Continuously
void loop() {
    digitalWrite(boardLed, HIGH);
    digitalWrite(externalLed, HIGH);
    Serial.println("board led off");
    delay(2000);

    digitalWrite(boardLed, LOW);
    digitalWrite(externalLed, LOW);
    Serial.println("board led on");
}
```

```
    delay(500);  
  }  
  ^
```

[And by request](#) - A comparison to the new Raspberry Pi Pico.

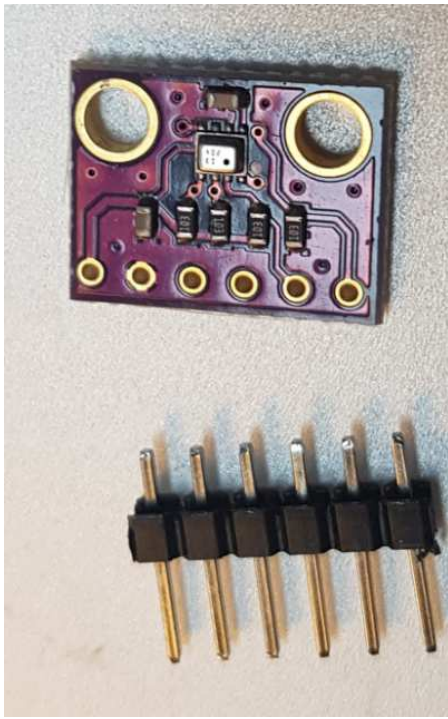
## Temperature pressure example



Note the temperature measured by the temperature sensor on the BMP280 is much higher than the temp. measured by the DS18B20. The BMP280 is in the ziplock bag and is heated by the ESP8266.



ESP8266 Lolin development board under back deck in its ziplock bag. The barometric pressure sensor is under the 8266. The DS18B20 temperature sensor is the black wire on the left. Its sensor part is about a meter away where rain and sun don't affect it but there is good air flow.



BMP280 and DS18B20

Code Temperature and Barometric Pressure

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## Power Control

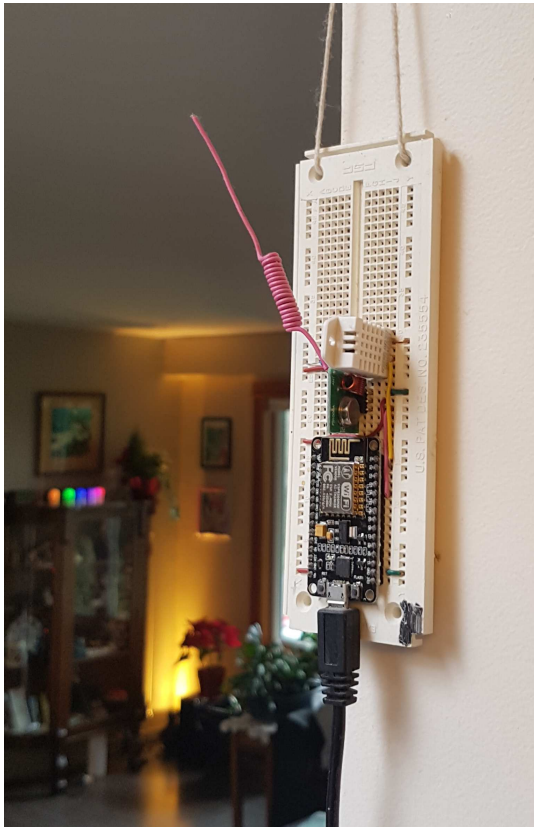


### Switches v8.2

**Temperature: 21.90°C**

**Humidity: 5.30%**

1 - Guest Room	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
2 - Living Room	<input checked="" type="button" value="ON"/>	<input type="button" value="OFF"/>
3 - Family Room	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
4 - WorkBench	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
5 - SB Bedroom	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
6 - Tool Box	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
7 - Patio	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
8 - Pond Pump	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
9 - Radio	<input type="button" value="ON"/>	<input type="button" value="OFF"/>
10- Driveway	<input type="button" value="ON"/>	<input type="button" value="OFF"/>



Detailed Presentation on RF Switches: <http://drsol.com/~deid/pi/esp1/index.html>

## Fun Examples - or Silly

### Hat

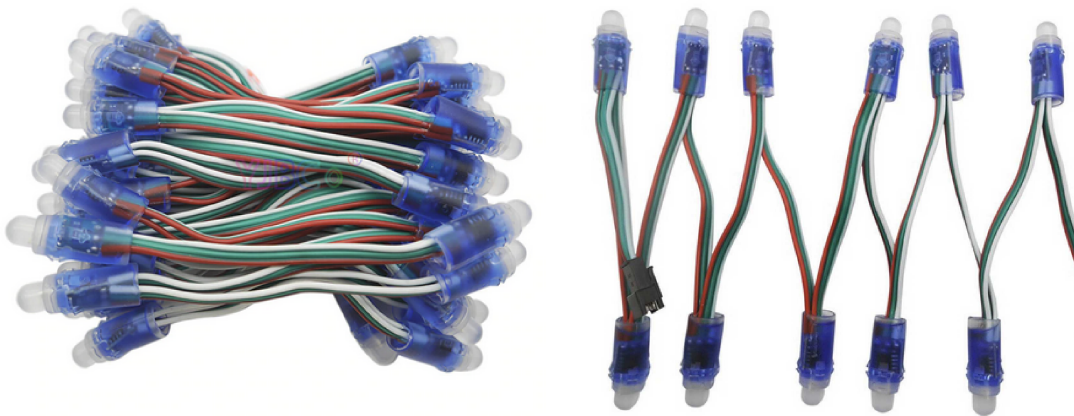
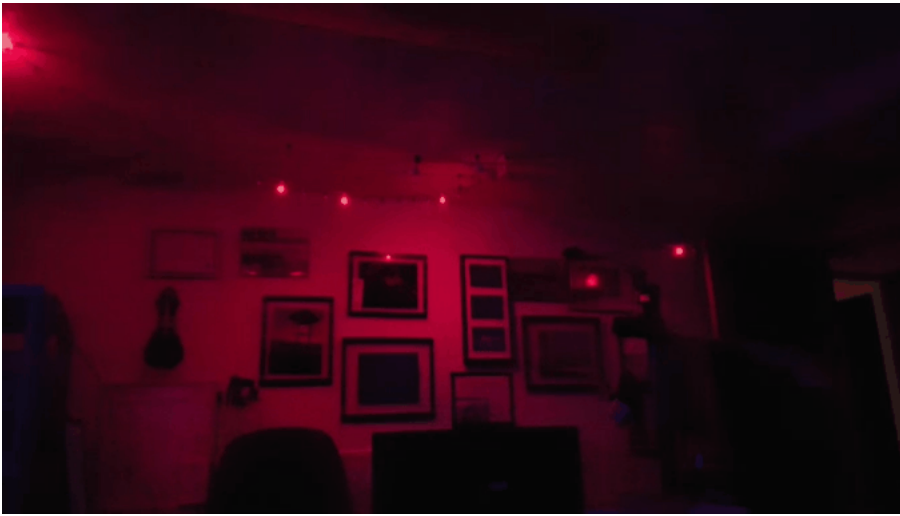


<http://drsol.com/~deid/pi/summer2020/index.html>

<https://youtu.be/kskl0ykmiJM>

Code Social Distancing Hat  
^ ^

## Leds



## Addressable Leds Christmas V0.1

Colour (#hhhhh):

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1 - Primary	<input type="button" value="ON"/>
2 - Random	<input type="button" value="ON"/>
3 - Web Safe	<input type="button" value="ON"/>
4 - Follow	<input type="button" value="ON"/>
5 - Lead	<input type="button" value="ON"/>
6 - Random On	<input type="button" value="ON"/> **
7 - All On	<input type="button" value="ON"/>
8 - All Off	<input type="button" value="ON"/>
9 - Rainbow	<input type="button" value="ON"/>
10- Moving	<input type="button" value="ON"/> **
11- Colour	<input type="button" value="ON"/> **
12- Christmas	<input type="button" value="ON"/>
13- Rainbow Group	<input type="button" value="ON"/>

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Size:

14- Dual Colour

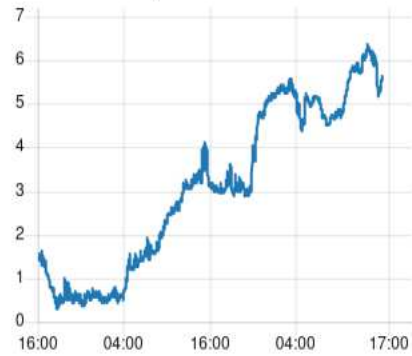
```
Code Addressable Leds
^  ^
```

## Node Red and collection.

- back deck

## Temperature

### Temperature Plot

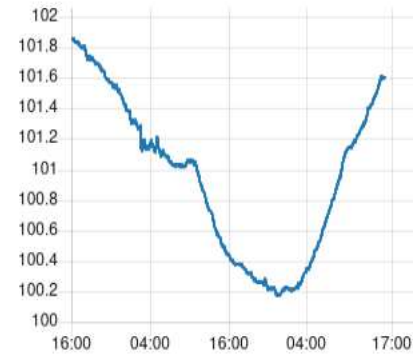


### Temperature Celsius

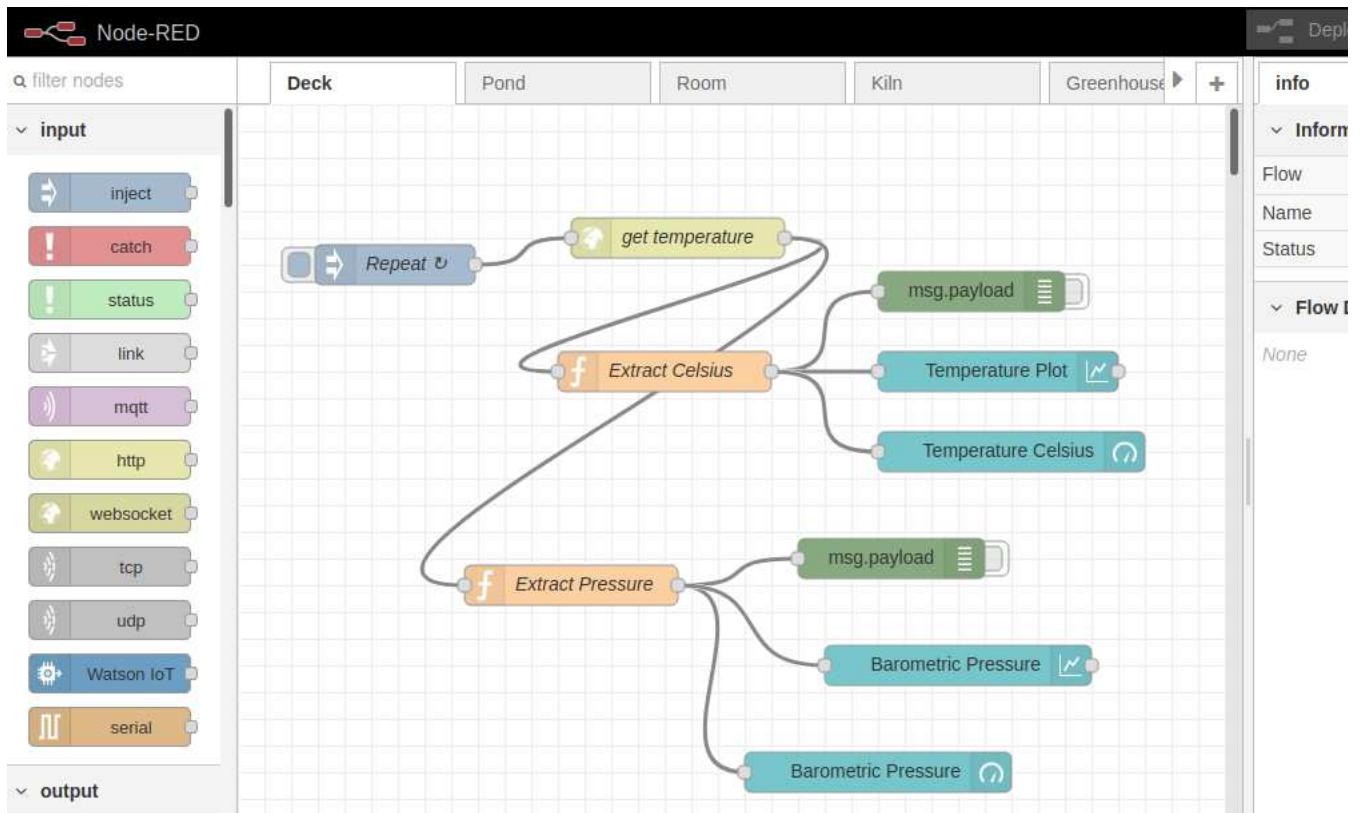


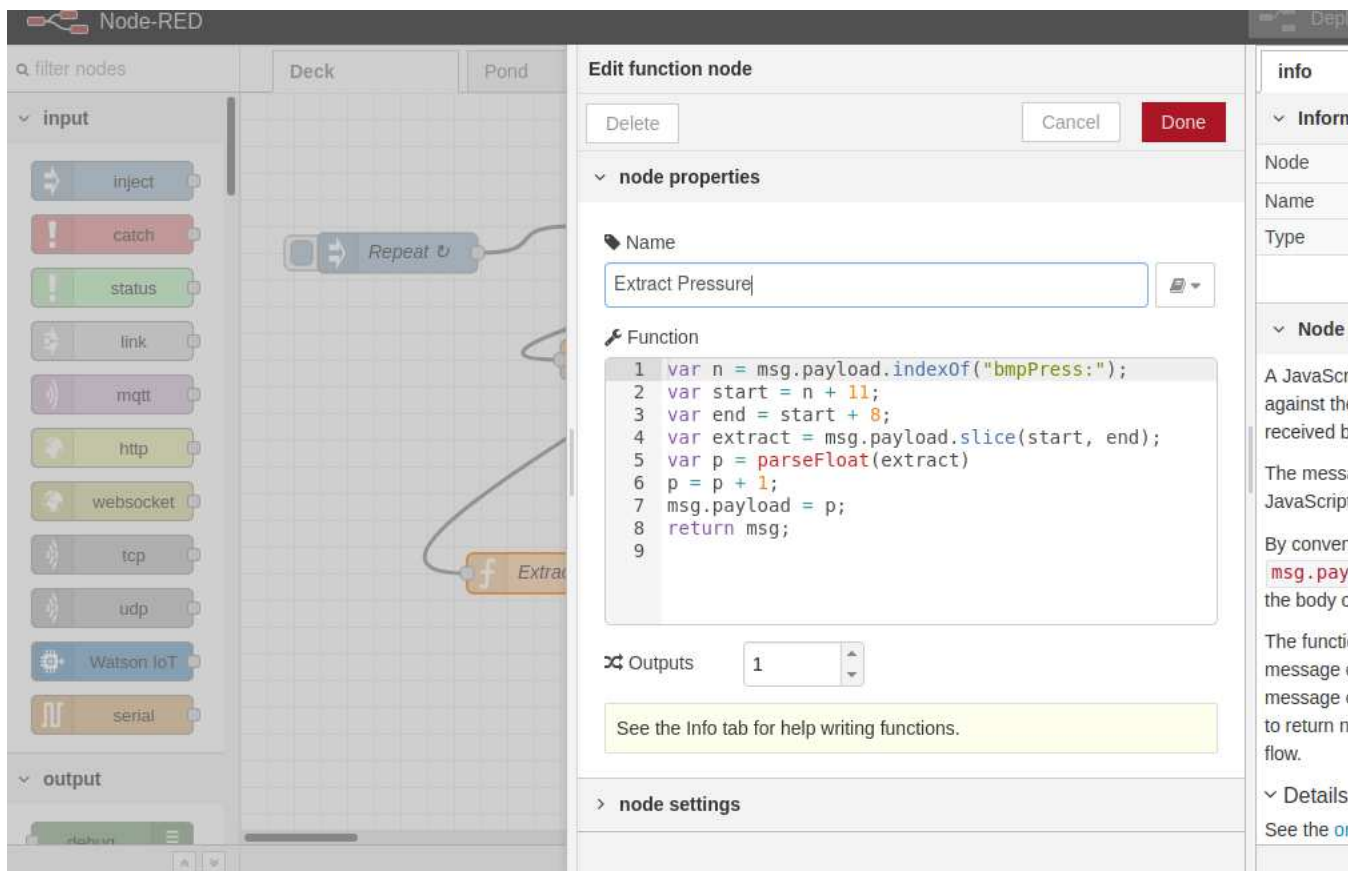
## Pressure

### Barometric Pressure



### Barometric Pressure kPa



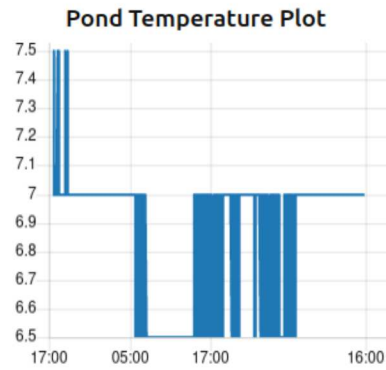


## Status Displays.

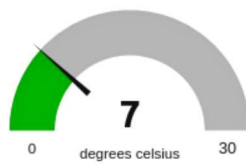
Each one of the following displays is fed by an ESP8266 with different types of sensors.

### Pond

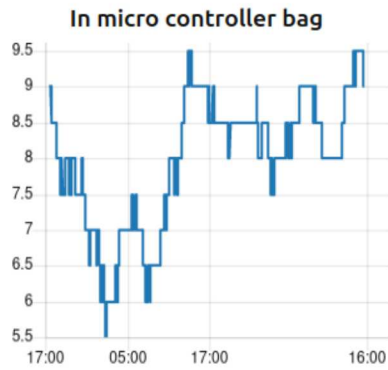
### ds18b gauge



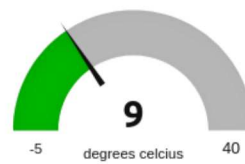
### Pond Temperature



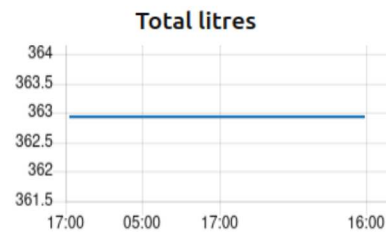
### Bag



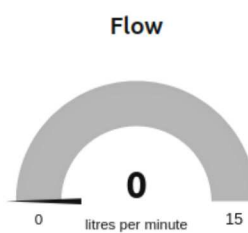
### By Pond Temperature



### litres

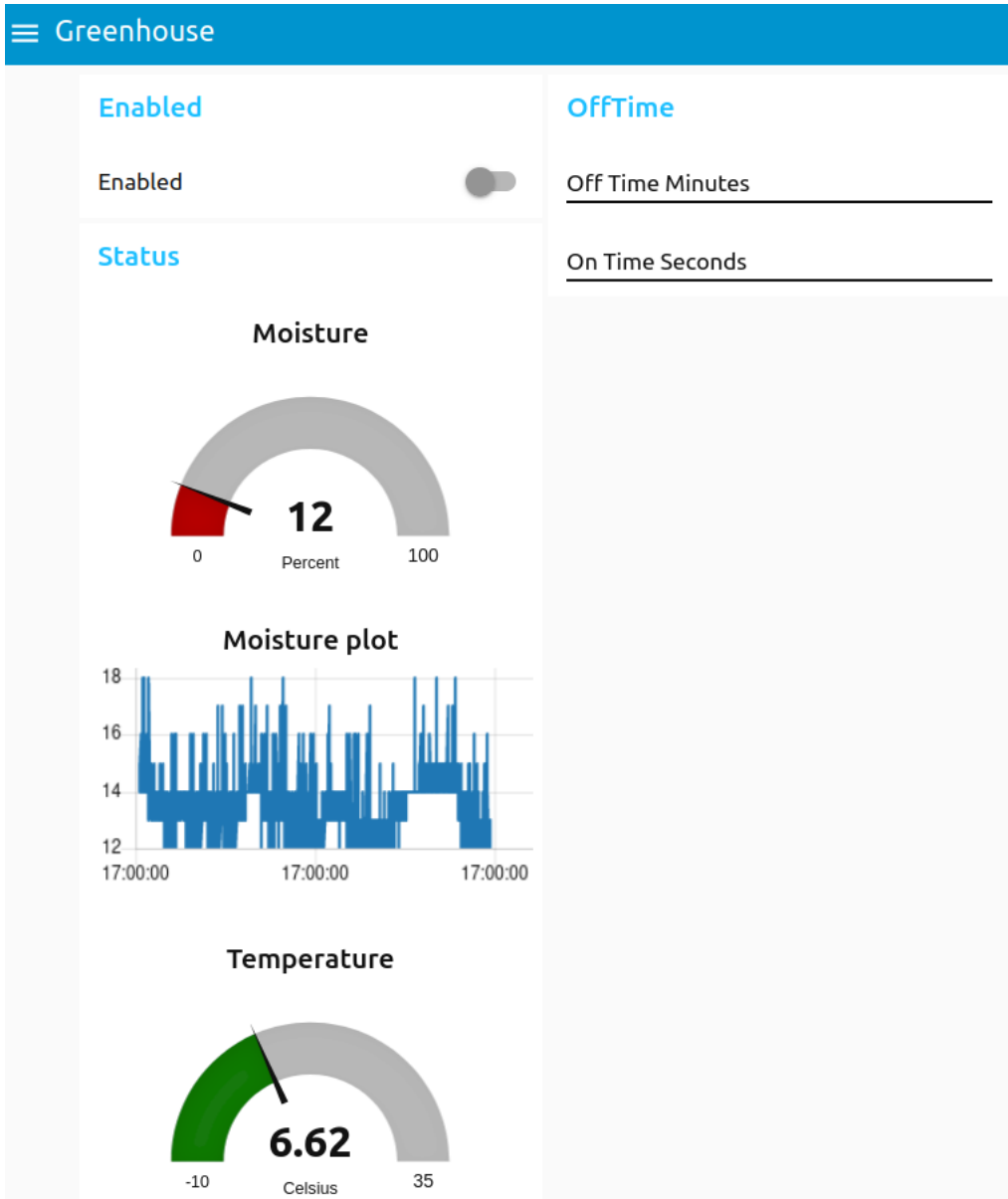


### flow



The pond has 2 DS18B20 temperature sensors and a flow sensor on the make up water. There is an independent level sensor (float switch) that adds water if the level drops. The flow sensor ensures that it can only add a specified amount in a period of time as sometimes the flow switch sticks.

### Green House



The on off times are watering intervals. There is no closed loop control. The watering intervals are set manually.

**Kiln**

Chart 1 hour

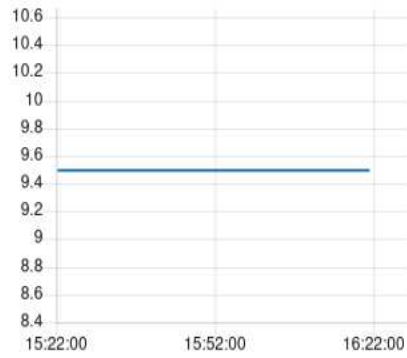


Chart 4 hours

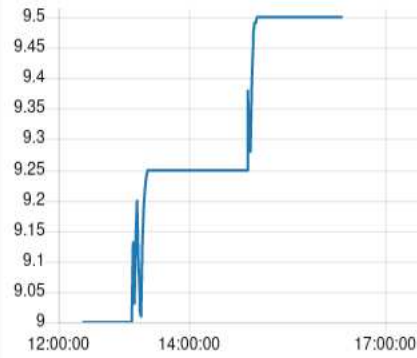
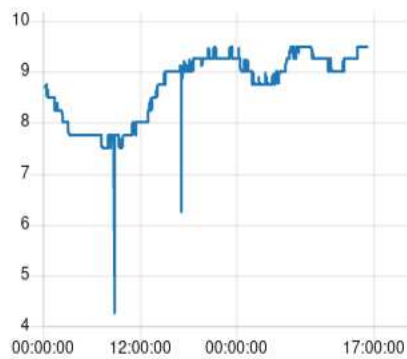


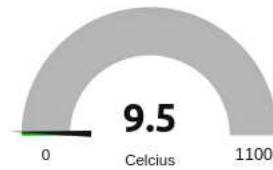
Chart-30-hours

Chart 40 hours



GUAGE

Current Kiln Temperature



Slope

0.000 degrees per hour

fallAlarm

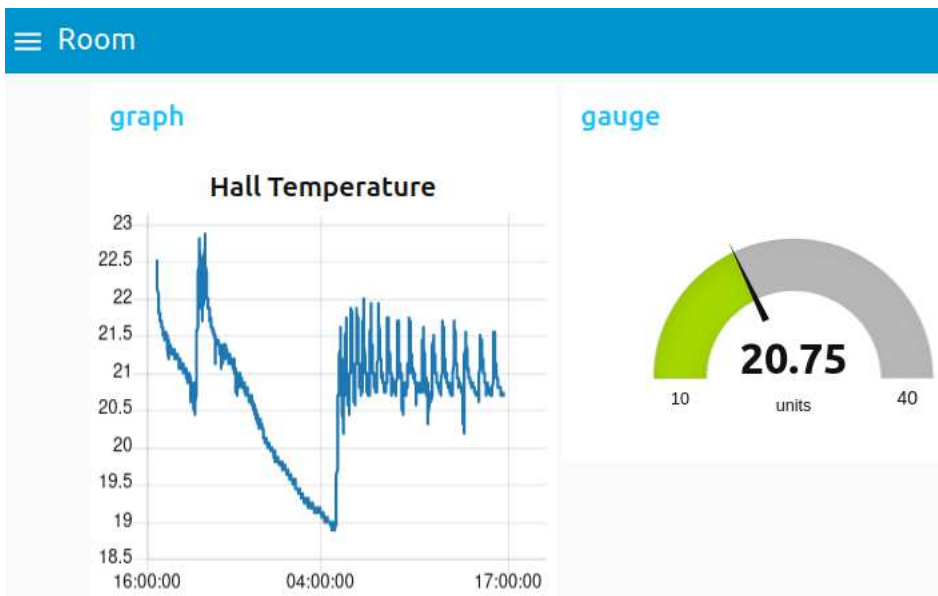
Enter - minus number for falling.

Fall Warning



Again no closed loop control. The fall alarm will warn us if the temperature starts falling. This will happen if the cone sitter trips and sometimes it trips sooner than we would like. Then it can be overridden.

## House



The temperature by the thermostat. Some day I will replace the thermostat.

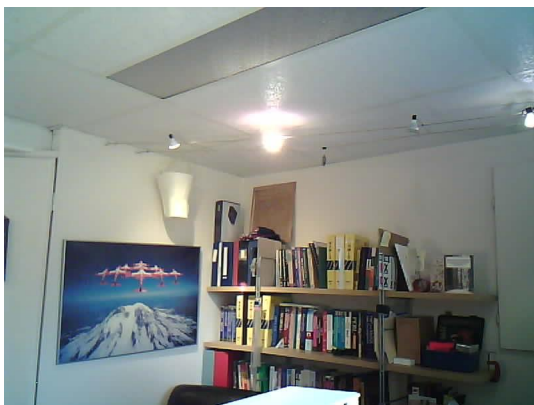
## esp32cam camera



A picture of me - thinking



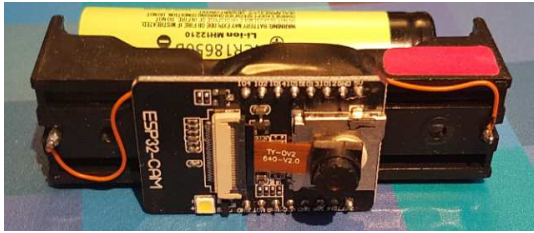
Also thinking



My messy office



The kiln. It's not on fire inside about 1000C



This one is a portable.



This watches my deck.

Said deck.

- <http://drsol.com/~deid/pi/esp32cam/index.html>
- <http://drsol.com/~deid/esp32cam/setCaptureInterval.php> (password protected)

## External Platforms

Internet of things IOT - I like my own but and [Node-Red](#):

- <https://www.sparkfun.com/news/2413>
- <https://www.g2.com/categories/iot-platforms/free>
- <https://www.devteam.space/blog/10-best-internet-of-things-iot-cloud-platforms/>
- [https://dzone.com/articles/12-iot-platforms-for-building-iot-projects?utm\\_source=dzone&utm\\_medium=article&utm\\_campaign=iot-projects-cluster](https://dzone.com/articles/12-iot-platforms-for-building-iot-projects?utm_source=dzone&utm_medium=article&utm_campaign=iot-projects-cluster)
- <https://blynk.io/>
- <https://developers.mydevices.com/cayenne/features/>
- --
- <https://medium.com/accenture-the-dock/esp8266-aws-iot-core-guide-c640f2622a51>