

Need to do

Wednesday, January 4, 2017 8:55 AM

Real time clock

Air flow

<http://www.instructables.com/id/Raspberry-Pi-Launch-Python-script-on-startup/?ALLSTEPS>

Today I configured the Raspberry Pi to run a python program on boot. It runs a test program with temp measurements saved to a file.



Temperatur
e Sensor f...



launcher

$$\text{Energy} = \text{heat cap}_{\text{air}} \cdot \text{mass} \cdot \text{Temp diff}^{\circ}\text{C}$$

air heatcap mass

$\sim 1 \text{ kJ/kgC}$ = air density

• volume

$$1.125 \text{ kg/m}^3 = 52.8 \text{ g/l}$$

$0.047 \text{ m}^3/\text{s}$

$$\text{Energy} = \frac{\text{kJ}}{\text{kgC}} \cdot \frac{\text{kg m}^3}{\text{m}^3 \text{s}} \cdot \cancel{C} = \frac{\text{kJ}}{\text{s}} = \text{kW}$$

$$2.931 \text{ kW}$$

$$2.931 = 1.125 \cdot 0.047 \cdot X$$

$$2^{\circ}\text{C}$$

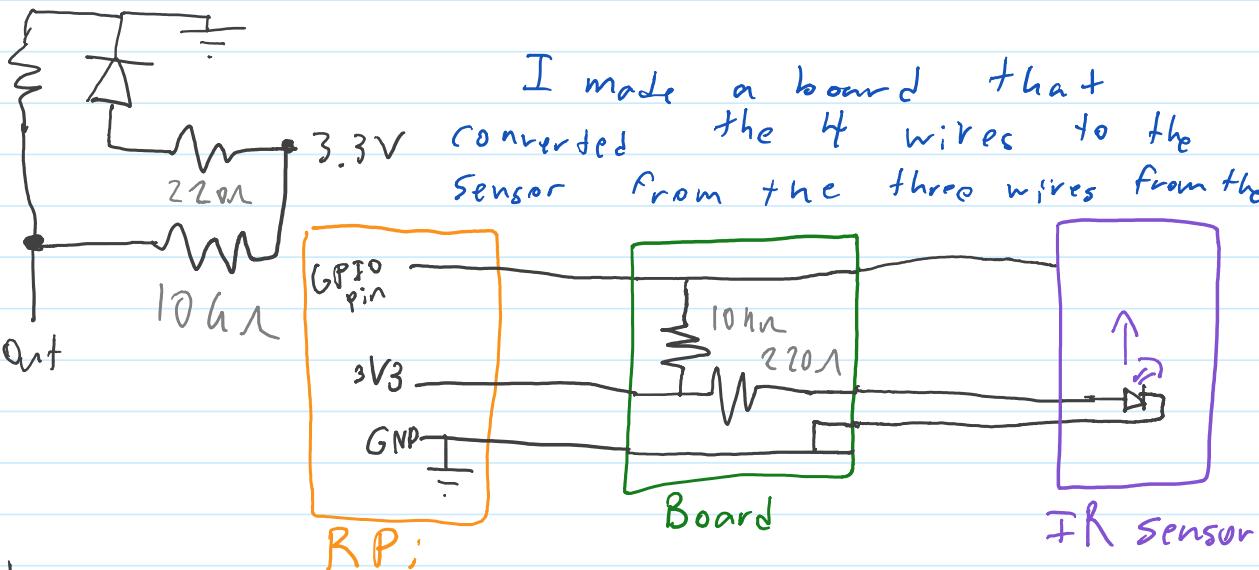
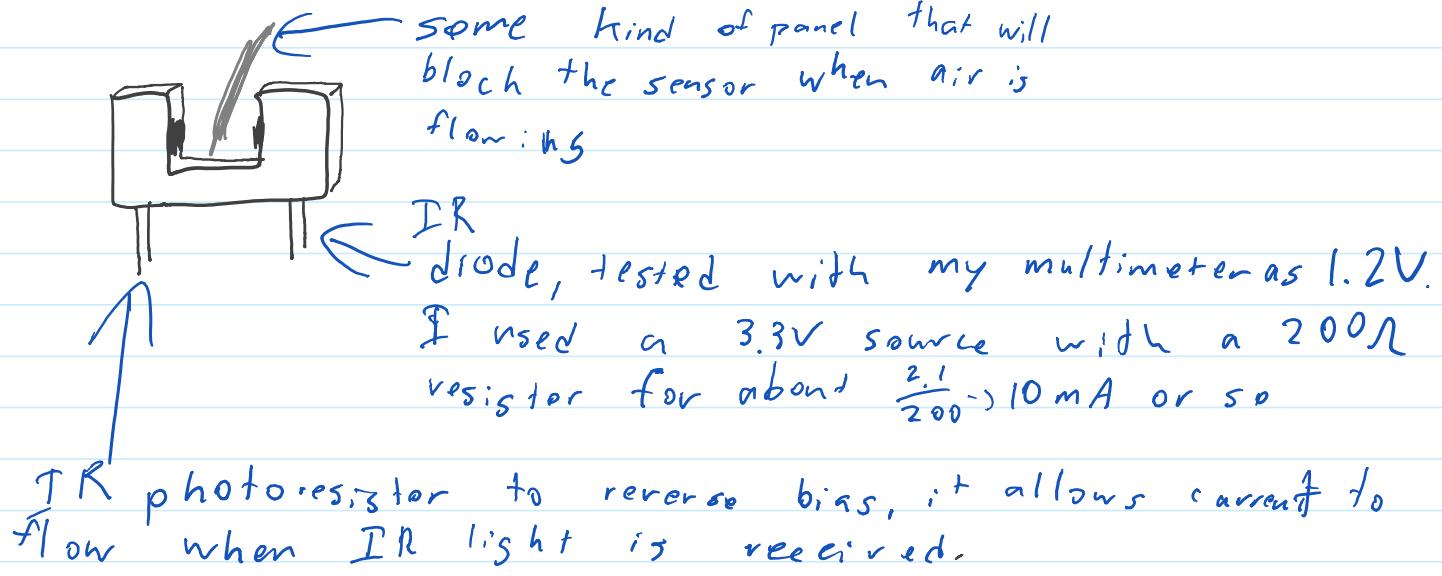
$$P = 1.52.8.2$$

$$P = 105.6 \text{ W}$$

IR Sensor

Monday, January 16, 2017 10:49 AM

I made a small board to go with an IR sensor so I can connect it to the raspberry pi and read it with the GPIO.



This configuration allowed me to easily measure whether there was something in the way of the sensor. I may use this to detect if a check valve is open so I know that air is flowing, and I can begin to take measurements.

It will also be useful if I separate the two halves

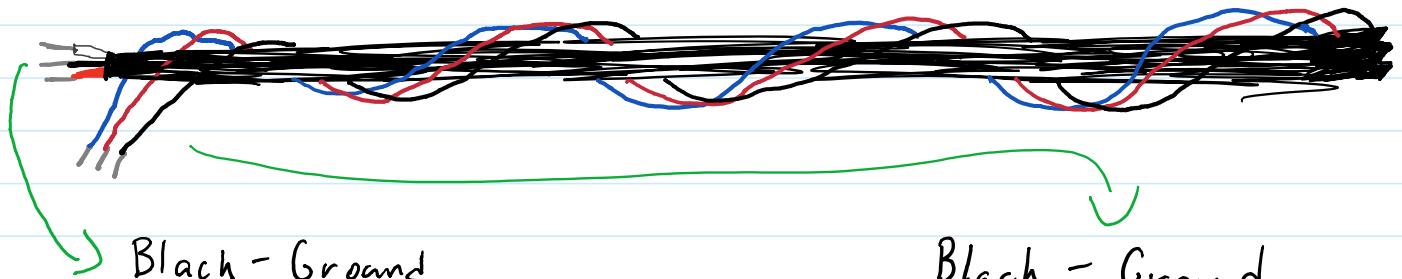
of the sensor, I can run two sets of wires independently from the board.

First Prototype

Wednesday, January 18, 2017 8:46 AM

I got the check valve to go onto the heater from James so I can build a prototype with it.

I drilled holes through it so I can route the wires, I will need to include a temp sensor and three wires for the IR sensor



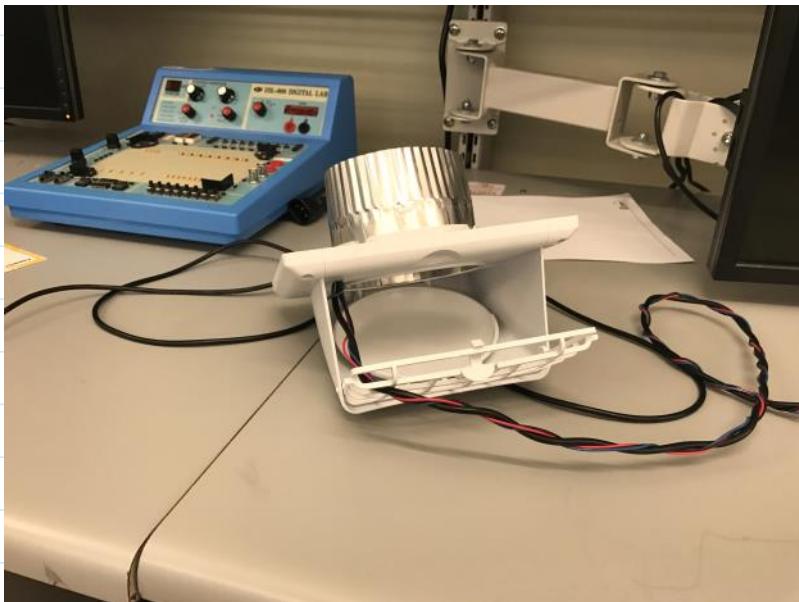
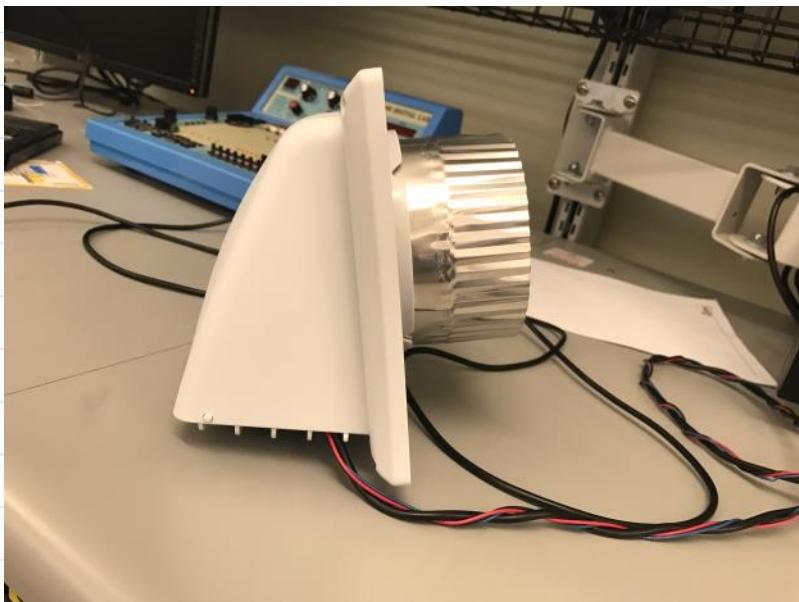
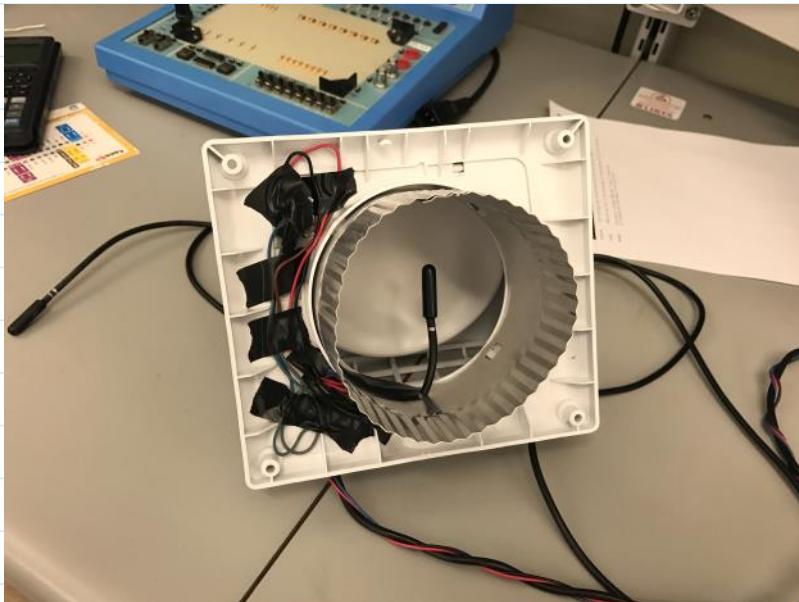
Black - Ground
Red - 3V3
White - Data

Used to get Data
from the temperature
sensor in the vent

Black - Ground
Red - 3V3
White - Digital High/Low
Used to get the
status of the IR
sensor in the vent

All of these wires will connect
to the pi and the vent

On the front of the vent I put the IR LED the rest of the components are routed to the back of the vent. On the back is the board for the IR sensor. the IR sensor LED is routed to the front and the receiver is attached in the back so when the vent opens it can be detected. The vents temperature sensor is coming up from the bottom and is in the middle of the vent



I altered the program to add a column to the data file that is True/False based on whether or not the vent is open

When the vent is closed the program will log the temperature every minute and when it is closed it will take measurements very quickly, approximately every 4 seconds.

Lights when logging
temp

Lights when the temperature measurement process is running

Lights when
the vent is
open

Lights when the vent
temperature is greater
than the ambient temp

Next I need to show this to James and test how it will work.

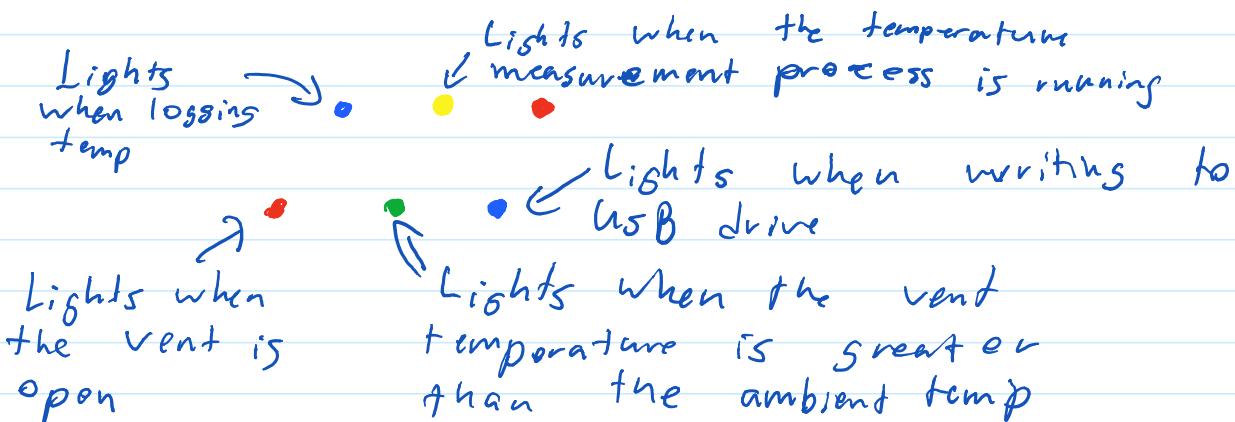
Improving...

Tuesday, January 24, 2017 8:46 AM

I showed this to James and there's a few things I should improve on but it worked great.

I started by altering the program so after the vent is closed I will log data every 10 seconds for 5 minutes, then every 30 seconds for the next 10 minutes, then it will continue running every 60 seconds until the vent is opened again this will show better data on the lowering temperature after you close the vent.

I made a new function called "unsafe()". This program will check the /media/pi directory for USB devices. If a USB device is detected, it will light a blue LED and wait for the USB to complete being mounted; it will then navigate to the USB and delete old data if it exists. It will then copy all the data from the SD card to the USB Drive, unmount the USB, and continue with the program. I will be adding config files as well so the Pi can be configured by altering files in the USB.



I added a few lines that will write "Program has started" to the data file when the program starts so you can tell if the pi

loses power.

Next I need to add power calculations

Power calculation

Thursday, January 26, 2017 1:29 PM

I added power calculation to my program.
I used

$$\text{Density of air} \times \text{flow rate} \times \text{temp diff} = \text{power}$$
$$1.125 \text{ kg/m}^3 \quad 471 \text{ ps} \quad \times \quad \text{y w}$$

constant
constant
right now

Using the power, I can multiply

$$\frac{(\text{power} \cdot \text{time})}{\text{W s}} = \text{Wh}$$

The program will print these two numbers
and the energy will accumulate when the vent is
open

Today I made the vent a little more stable with zip ties and glue.

I improved my program by completing the power calculations, and allowing the user to change the flow rate over usb
I should be almost ready to test this prototype

Prototype

Wednesday, March 1, 2017 11:31 AM

Over the past month, the first prototype has been taking measurements. I just removed it and the data is very good, on a sunny day the system will output up to a kWh.

Real time clock

March 6, 2017 12:09 PM

The clock I got from Dale doesn't seem to work with the pi, I gave it back to Dale. Hopefully I can get another one that will work with the pi. Jamie's ordering a clock.

Jamie emailed me saying he ordered some things for air speed measurements.

Real time clock setup

March 14, 2017 10:19 AM

I got a real time clock from Jamie on Friday, yesterday I soldered it together, and today I will set it up. The clock uses I²C so I need to set that up and configure the clock..

The clock is detected so I wired it properly..

The clock is set up and appears to be working. I set the time and the clock held it when I rebooted without a WiFi connection. Now I want to edit my program so it will print a better time value to the spreadsheet.

In the first prototype the date was saved as

DAYOFWEEK MONTH DAY HH:MM:SS YEAR
e.g. Tue Mar 14 11:53:44 2017

Excel didn't recognise this format so I changed it to

"MONTH DAY, YYYY HH:MM:SS"
e.g. "Mar 14, 2017 11:53:44"

Excel automatically recognises this so it's much easier to work with. The " are so the comma isn't recognised, as this is a .csv file.

I changed my program to automatically add titles to the spreadsheet using tell(). tell() gives the files pointer position so when it's 0, it's a new file and the program adds titles.

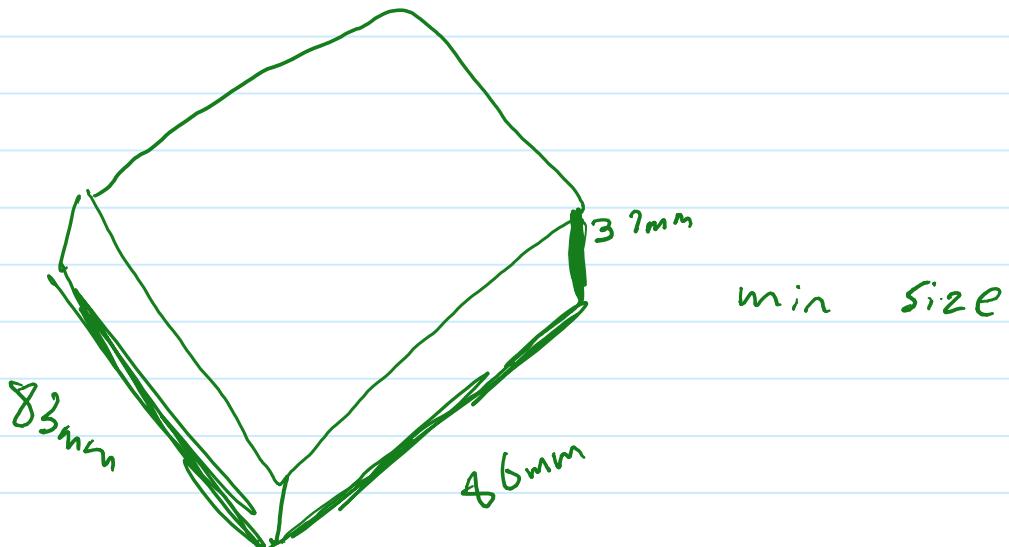
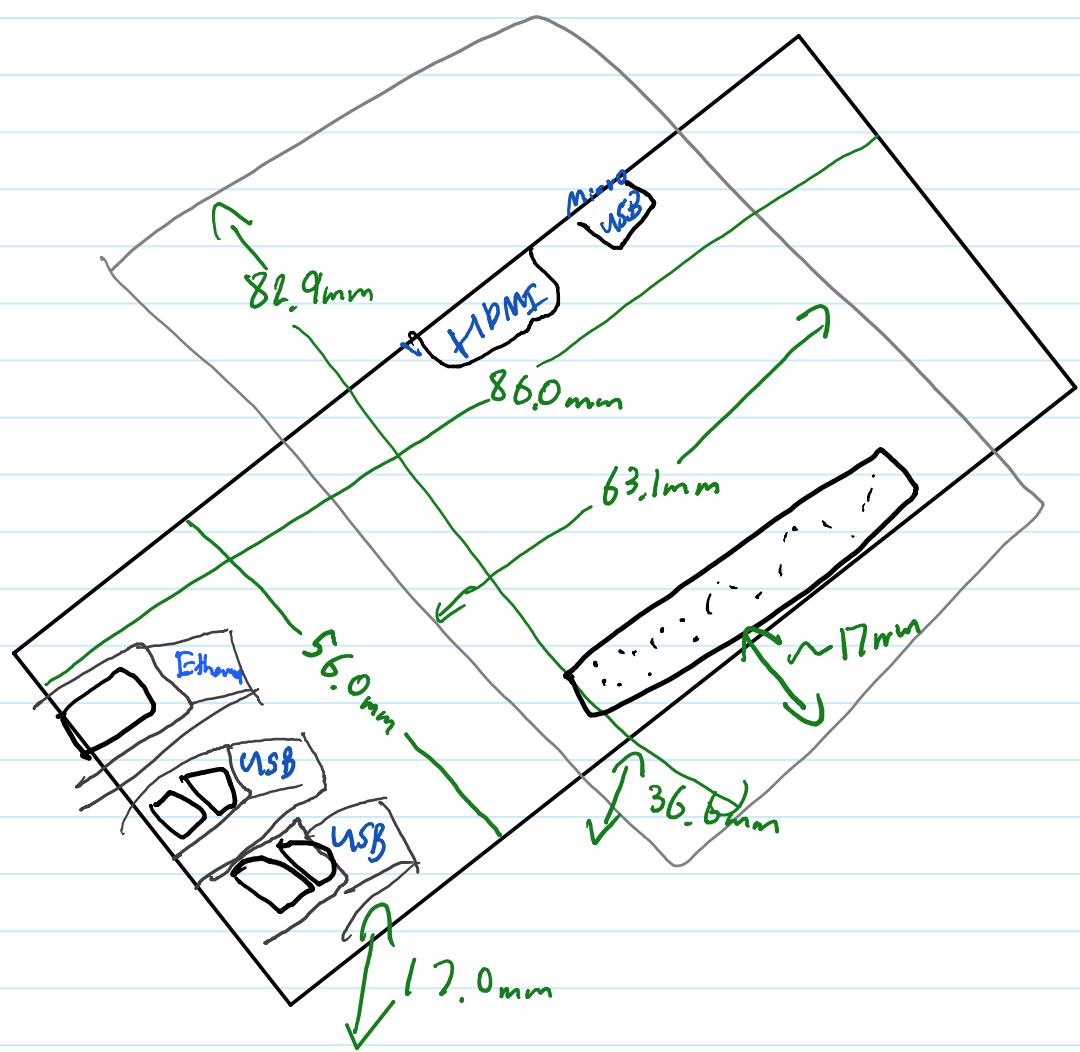
I also added zeros to blank spaces in the csv to make the import easier

Because the sensors are still at the header
I had to make a test program and carefully
change the original to update it. If I made
any errors I won't know until the program crashes
while it's taking measurements

Daily Power calculation

March 20, 2017 4:16 PM

Today Jamie and I set the Raspberry Pi board and sensors and I made sure everything is working. I added to my code so now, at the end of every day, the raspberry pi will save the daily power in kWh to a spreadsheet.



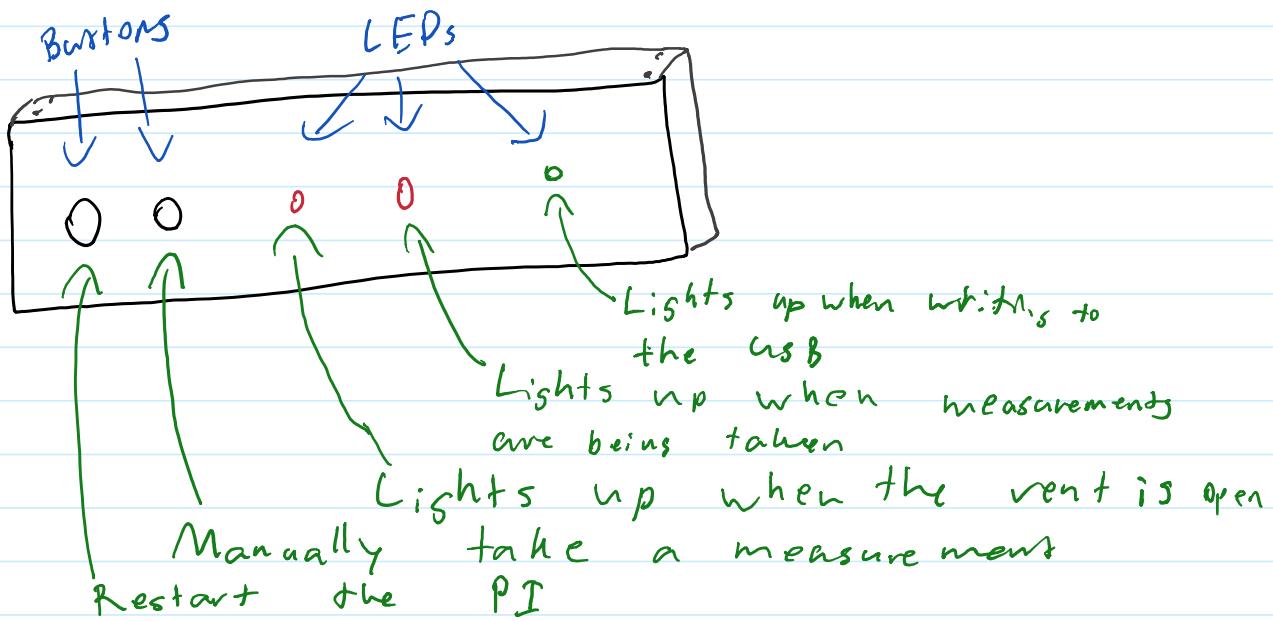
I'm working on an enclosure

Final Prototype

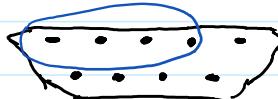
March 27, 2017 10:25 AM

I finished my prototype so on Friday Jamie and I installed it so it can take measurements for a week.

I added labels and screws to the DB9 connector to securely connect it to the box, and I added labels to the LEDs and buttons. I am nearly done.



I used a DB-9 connector for the sensors



I used these four pins for
Power - 3.3V
Ground - GND
Data - One Wire Bus Data from temp sensors
Data - D/O from IR sensor