COMPUTER SKILLS > ELECTRONICS

Build a Raspberry Pi Moisture Sensor to Monitor Your Plants

by Jeremy Blythe 16 Aug 2013

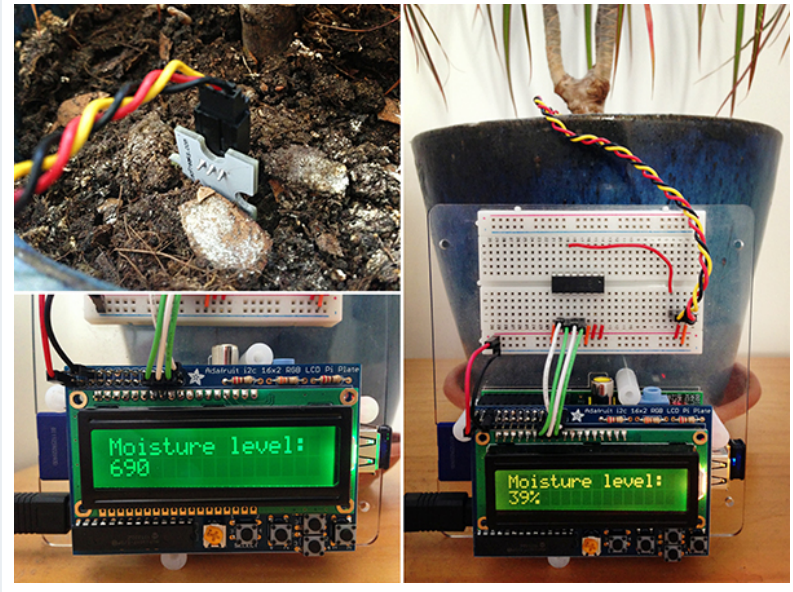
Difficulty: Advanced Length: Long Languages: English

Electronics Rasberry Pi

In this tutorial, I'm going to harness the awesomeness of Raspberry Pi to build a moisture sensor for a plant pot. You will be able to monitor the sensor locally on the LCD or remotely, via ControlMyPi.com, and receive daily emails if the moisture drops below a specified level.

Along the way I will:

- wire up and read a value from an analog sensor over SPI using a breadboard
- format the sensor reading nicely in the console
- display the sensor reading on an RGB LCD display
- have the Raspberry Pi send an email with the sensor reading
- easily monitor the sensor and some historic readings on the web

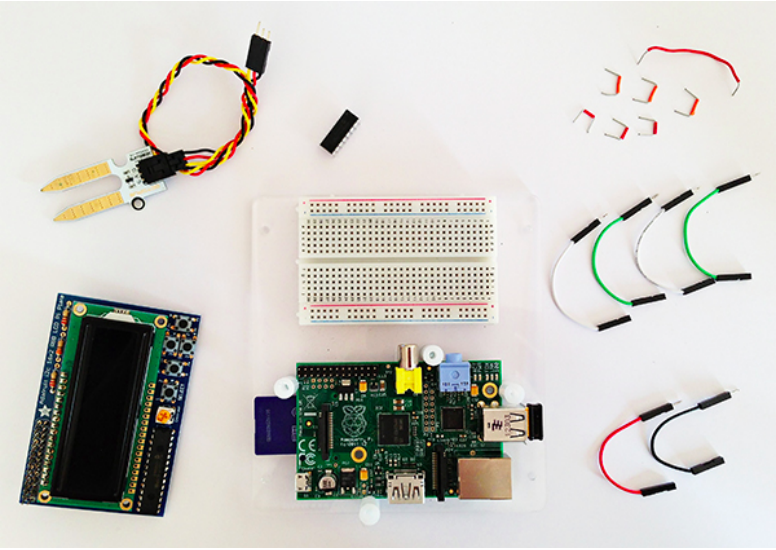


This is what we are creating in this tutorial.

Hardware Supplies

In order to get the most out of this tutorial, it is recommended that you acquire the following:

- Raspberry Pi model B ($40)
- Wired or wireless Internet connection
- Half-size breadboard ($5)
- Six female-to-male jumper wires
- Male-to-male jumper wires (various lengths)
- MCP3008 ($3.75) - 8-Channel 10-Bit A/D Converter with SPI Serial Interface
- Octopus Soil Moisture Sensor Brick ($4.50)
- Adafruit RGB Negative 16x2 LCD+Keypad Kit for Raspberry Pi ($25) assembled with the Stacking Header for Raspberry Pi - 2x13 Extra Tall ($2)



The Components

Some Alternative Components

- Instead of the soil moisture sensor, you can use any type of varying voltage analog sensor or even just a variable resistor for testing.
- You can use a smaller MCP3004 (4-Channel ADC SPI) if you wish, but the wiring will be different.
- You can skip the RGB LCD or replace it with an alternative screen. You'll have to remove or change a few lines in the final script if you do.

The Cost

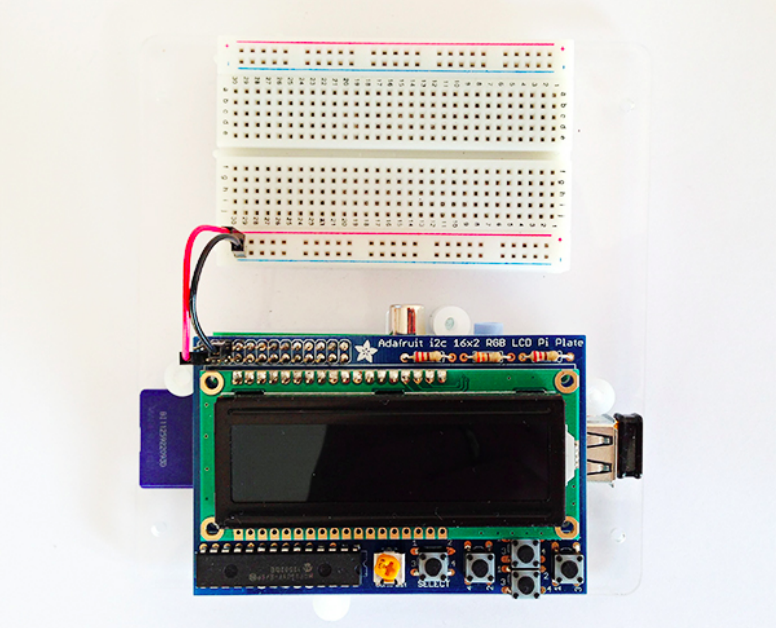
After adding on a few dollars for the jumper wires the total project cost works out roughly to $55 without the LCD and $82 with. Remember, though, that you're stocking your electronics kit – all these parts can be used again for other projects.

1. Wiring

If you are using the LCD with the stacking header then connect it to the Raspberry Pi now. The first two stages of the software don't use the LCD but it will save you some re-wiring time later if you attach it now.

Warning: Incorrect wiring could cause damage to your Raspberry Pi. Make sure to double check all your connections carefully before powering up.

Step 1: Power and Ground Rails



Power and Ground Rails

On the left in the photo you can see the red and black jumpers going to the + and – rails on the breadboard. To help describe the connections from the header please refer to this wire colour table. Each cell in the table refers to a pin on the Raspberry Pi header. The colour of the cell corresponds to the colour of the jumper wire as seen in the photo:

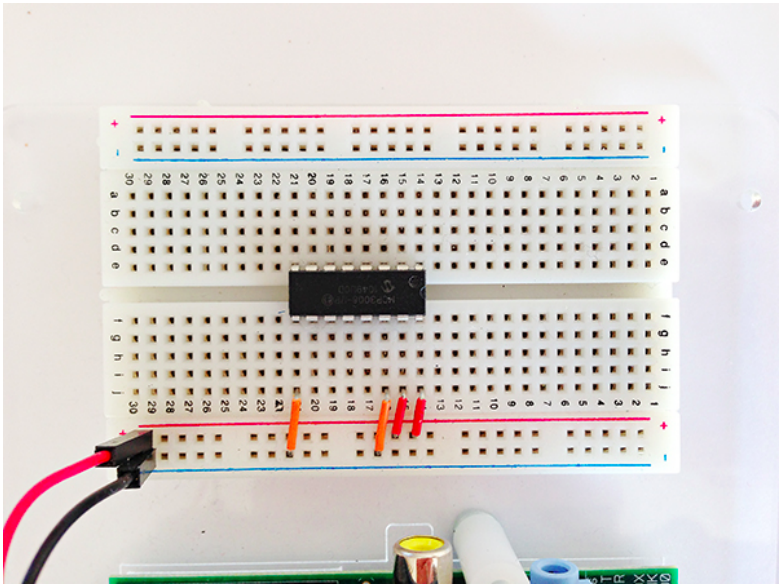
2	4	6	8	10	12	14	16	18	20	22	24	26
1	3	5	7	9	11	13	15	17	19	21	23	25

Wiring Chart

Connect pin 1 to the positive rail and pin 6 to the ground rail.

Step 2: MCP3008

Important: The chip must be located over the valley in the breadboard with the pin 1 indicator, the indentation, top right as in the photo.



MCP3008

Refer to this wire colour table and the datasheet when wiring up this chip:

CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0
DGND	CS	DIN	DOUT	CLK	AGND	VREF	VDD

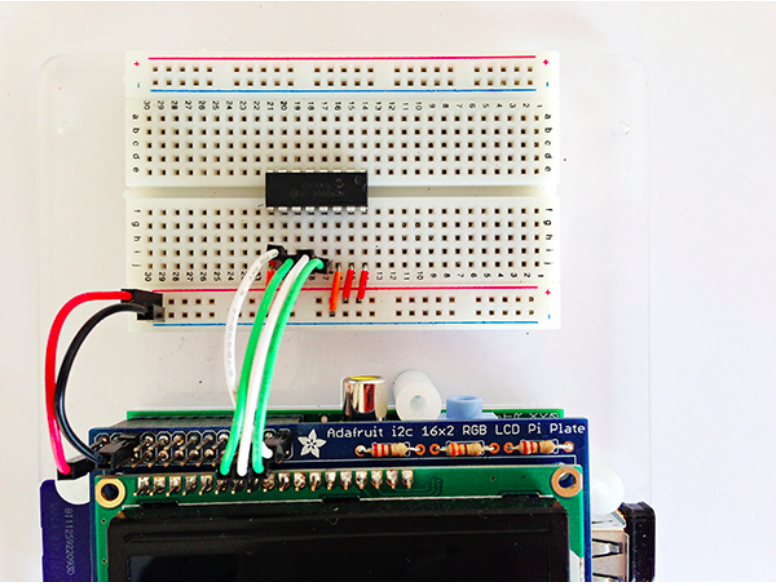
Wire colour table

All the connections from the rails and the header to the MCP3008 chip go neatly along the bottom row of the chip in this orientation. First connect the power and ground as show in the photo above:

- Ground rail to DGND
- Ground rail to AGND
- Power rail to VREF
- Power rail to VDD

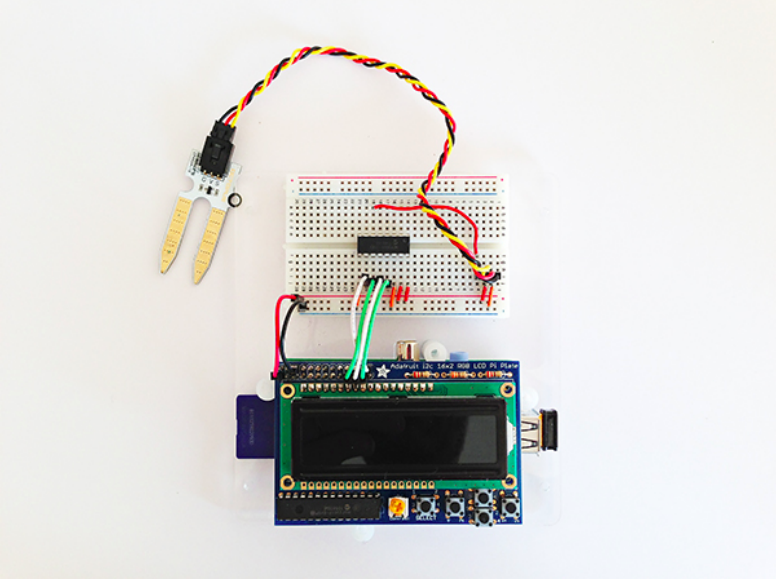
Next, connect the Raspberry Pi SPI header pins to the chip:

- Header 26 to CS
- Header 19 to DIN
- Header 21 to DOUT
- Header 23 to CLK



MCP3008 Wired up

Step 3: Sensor

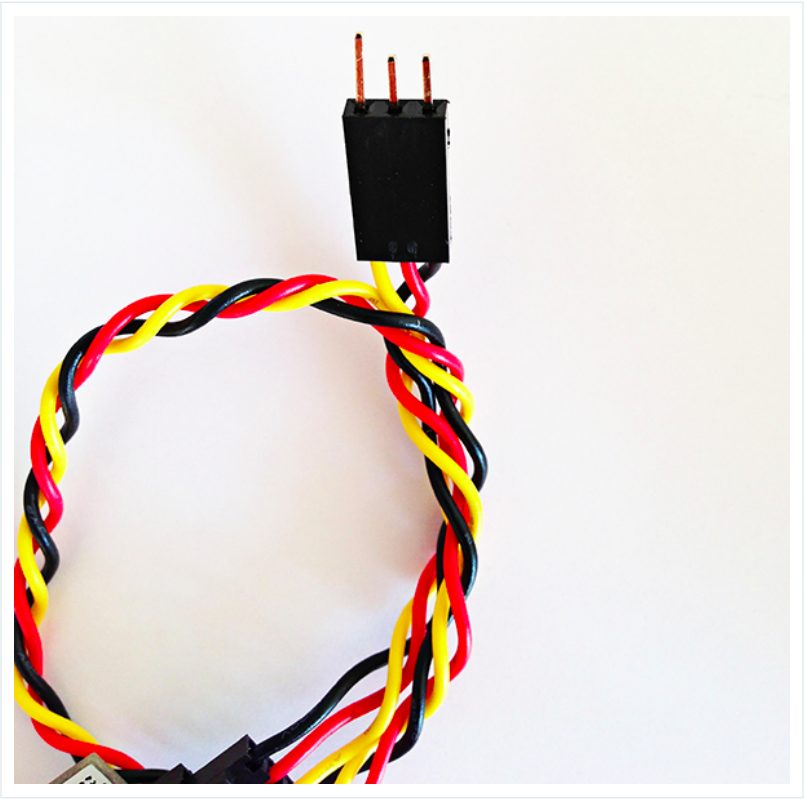


Wiring up the moisture sensor

The sensor wiring is simple; there are three connections to make:

- Sensor yellow to CH5
- Sensor red to power rail
- Sensor black to ground rail

Tip: If you have some spare header pins in your toolbox, you can insert these into the female plug on the Octopus sensor to form a three pin plug. This makes it easy to insert into the breadboard. Alternatively, jumper wire can be used directly into the plug.



Sensor wiring

Finally, if you have your plant pot to hand you can insert the probe into the soil now. Make sure not to push it too deep, just cover the prongs:

The moisture sensor

2. Preparing The Software Environment

Step 1: Operating System

This project was built using Occidentalis v0.2 from Adafruit, which comes with the hardware SPI driver ready to go. Follow the instructions on the Adafruit site to install it on your Raspberry Pi.