Hydroponics: Controlling the pump using the eTape liquid level sensor

Aims:

- To turn off the pump if the water level drops too low. We will damage the pump if it runs dry.
- To connect the sensor to the Internet so that we can read the water level in the reservoir at any time, and so that we can receive a warning email if the pump is turned off.

Research

We need to know how to wire up the pump to the Raspberry Pi. The best article was found here https://electronicshobbyists.com/raspberry-pi-analog-sensing-mcp3008-raspberry-pi-interfacing.

More information about the eTape can be found here https://www.whiteboxes.ch/shop/etape/?v=79cba1185463. I used the 5" eTape, as I only needed to see if the water level dropped below the top of the pump.

From these pages I built the system below.

The system incorporates:

- A Raspberry Pi running a Python program to monitor the water level in the reservoir
- A breadboard on which is mounted an analog to digital convertor (about which more later)

- A wire from the breadboard which will receive the signal from the eTape sensor (right hand picture)
- A relay connected to sockets which will power the water pump and air pump
- A power supply
- And a plastic box with lid to house the electronics

Equipment

My shopping list comprised the following items:

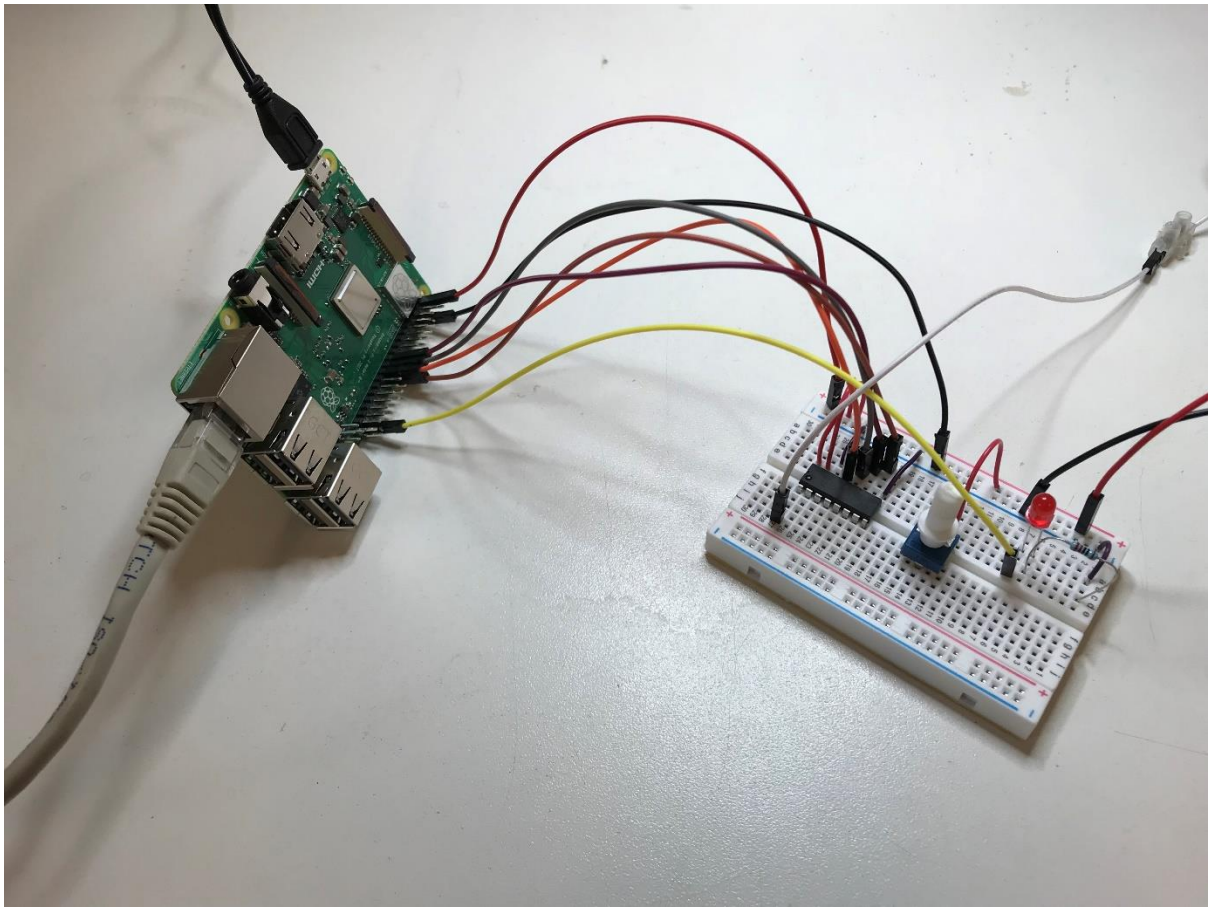
- Cool Components: Raspberry Pi 3 Model B+ £32.30
- Cool Components: 5.1V Power Supply for Raspberry Pi £6.78
- Cool Components: 16GB Micro SD Memory Card with adaptor £8.54
- Cool Components: 5” eTape Liquid Level Sensor with Casing £63.65
- amazon.co.uk: Adafruit MCP3008 A/D Converter with SPI Interface £3.30
- amazon.co.uk: Mains Switch Widget - Relay & Enclosure Bundle £20.00
- B&Q: Time core 2 pair telephone cable 0.5mm² 10 m £5.00
- B&Q: Masterplug 4 Socket 10 A Extension lead 2 m White £7.47

Already in stock:

- Solderless breadboard
- Assorted electrical components
- Plastic sandwich box (to contain the electronics)
- Cable ties (to secure the electronics in the sandwich box)

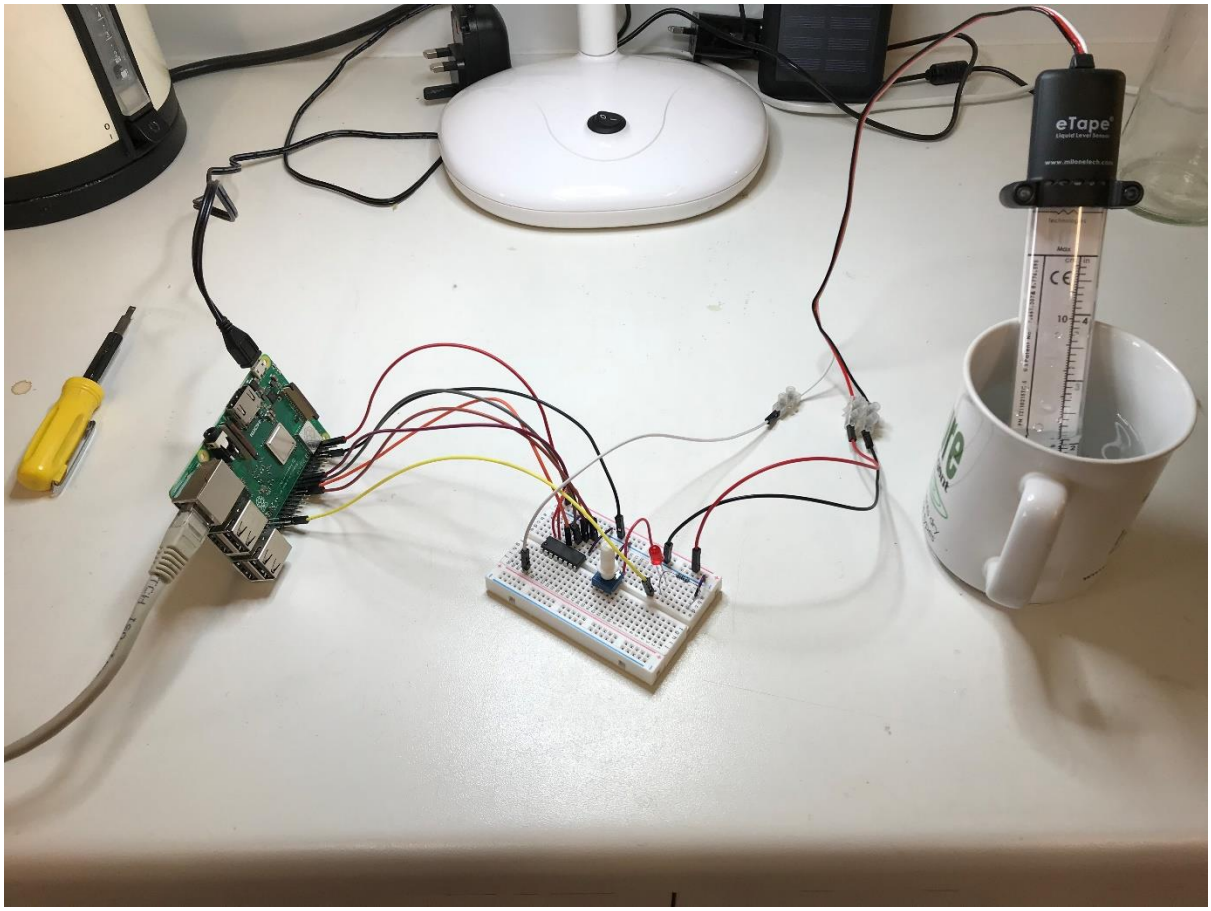
Procedure

I started by wiring up the Raspberry Pi exactly as in the first tutorial above including the 10K potentiometer. This enabled me to check that the MCP3008 digital convertor was working.



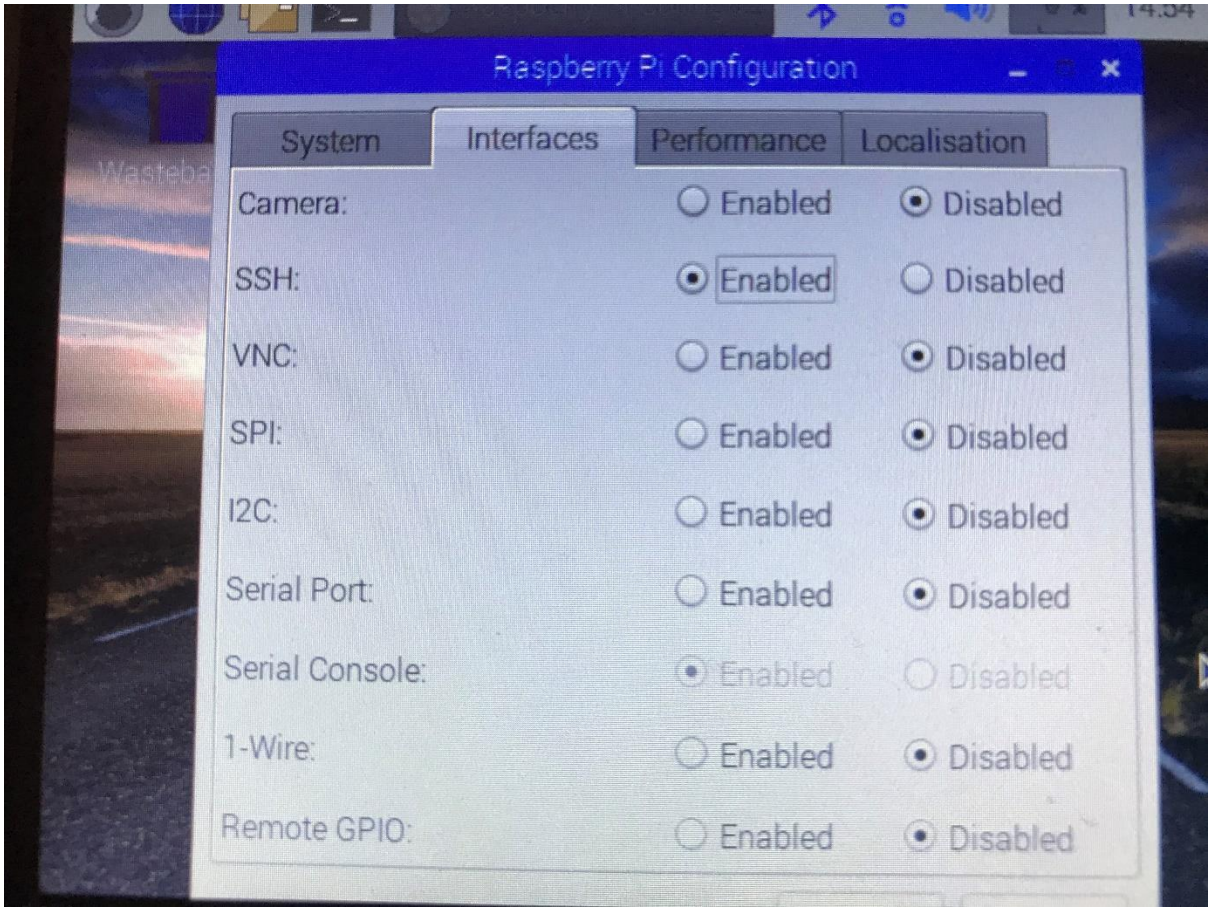
Once I had done this, it was just a case of removing the potentiometer and wiring in the eTape. The wires on the eTape exactly replaced the ones connecting the potentiometer.

- The red wire on the eTape connects to 3.3V
- The black wire connects to ground
- The white wire connects to CH0 of the MCP3008



When setting up the Raspberry Pi, I installed the Raspbian operating system, and then used a mouse and keyboard to configure the settings (rather than using SSH, as in the tutorial).

When on the Raspberry Pi desktop, click the Raspberry icon in the top left corner, then select Preferences > Raspberry Pi Configuration > Interfaces. You can turn On SSH and SPI here. Don't forget to save the settings. The 'OK' button has scrolled off the bottom of the screen in my setup, but I could just click on the top of the button. It's the one in the extreme bottom right.



After connecting the Raspberry Pi to the Internet, I could upload the Python script using FTP. The script I used was based on the one in the tutorial.

I wanted to run the script automatically from power up, so this required writing a daemon program, which has been covered in another document. As this required modifying some files already on the Raspberry Pi, this was done while the mouse and keyboard were still attached, but could just as easily be done by SSH once connected to the Internet.

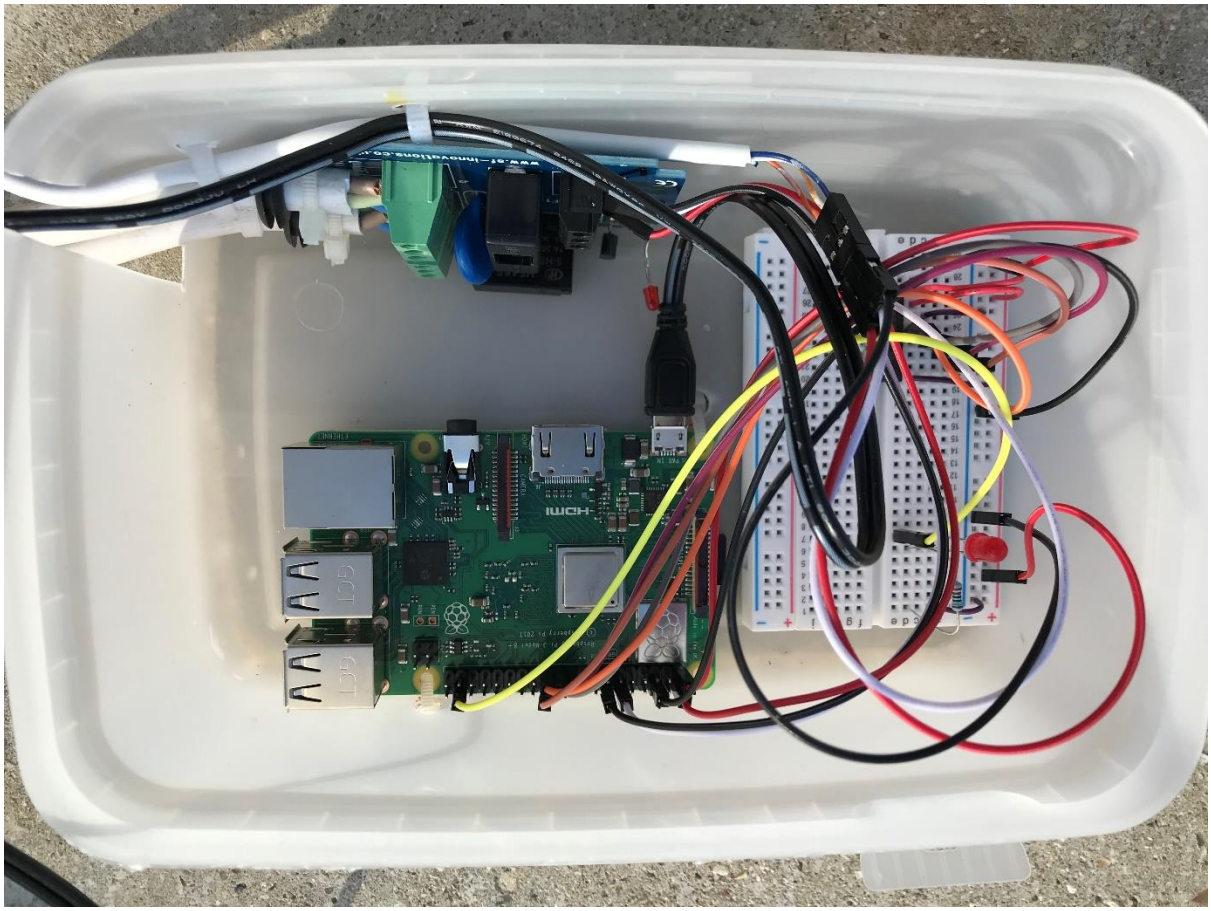
Here is a link to the final script:

https://github.com/mkinross/etape-sensor

Script has to:

- Monitor water level in real time
- Turn of pump by means of relay if water lever is less than 20L
- Send email alert if pump is switched off

Completed assembly:



You will notice I have left the red LED in place from the tutorial. Sure enough, the brightness varies with the water level.