KV6006 Practical Session - 4 - Putting it all together

At this point you have:

- Retrieved data from API endpoints, structured as JSON.
- Subscribed to sensor data feeds over MQTT, setting up a callback function to parse and handle new data when it arrives.
- Sent commands (formatted as JSON) over MQTT, to control a physical output device.

Broadly, you have inputs and outputs, and several fragments of Python which might help you glue those together.

Your challenge

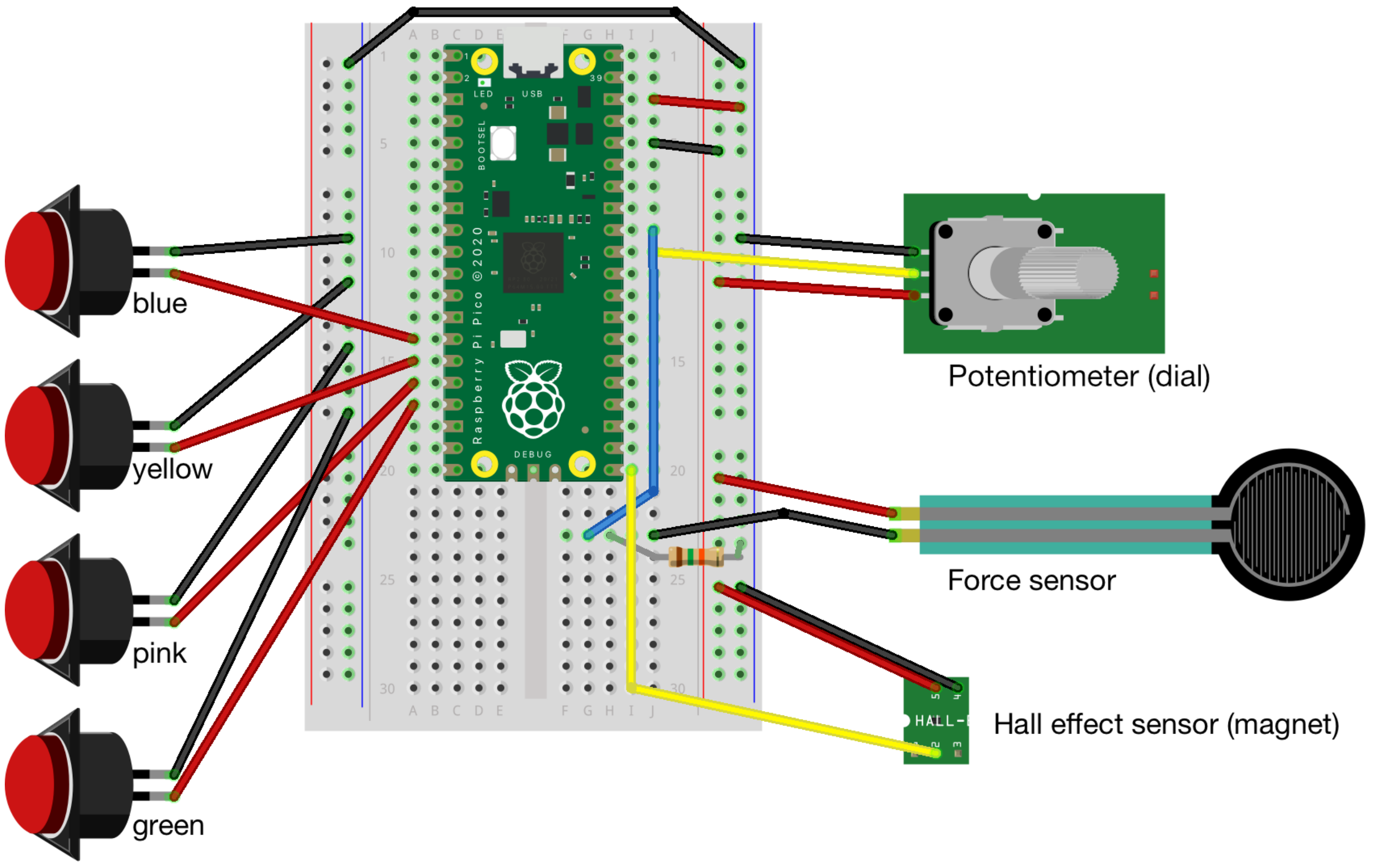
The sensor device is happily spewing data into the aether. It seems a shame not to do something with it. So:

> ***Pick some inputs, and hook them up to some outputs.***

You might turn your servo into a pointer on a scale, indicating some received value. Or use the colour of your LED to indicate the state of something.

Sensors

For reference, here's a diagram of the Pico sensor device with all the wires in the right places (which helps me if and when some of them fall out):



Pico W wiring diagram

The JSON output looks something like:

```
{
  "sensors": [
      { "name": "temperature", "value": 26.10811 },
      { "name": "magnet", "value": 1 },
      { "name": "dial", "value": 45931 },
      { "name": "force", "value": 688 },
      { "name": "blue", "value": 1 },
      { "name": "yellow", "value": 1 },
      { "name": "pink", "value": 1 },
      { "name": "green", "value": 1 }
  ]
}
```

As with the Mbed boards, `temperature` is taken from an on-chip sensor, so it's pretty hopeless as a room thermometer.

Things that might be useful

Code

Most likely, you'll want to graft the configuration parts of `basic_send.py` into `mqtt_subscribe-parse.py`. That's because you probably want to publish commands to your output device from within the `on_message` callback function. Gluing everything together in Thonny on the Pis is a bit painful, so there's a starting point file in `examples/mqtt_send/control_device.py`. Copy this into your `student_work` directory and hack away on it.

Materials

Cardboard, scissors, tape and pens are available, if you'd like to get crafty.

Range

You may need to investigate the min/max range the sensors might output. How could you do that?

Converting scales

You'll very likely need to convert a number that lies between two limits into the corresponding number that lies between two different limits. For example, scaling hue angle from 0..360 to 0..255. This Python function might help:

```python
def rescale(x, in_min, in_max, out_min, out_max):
    """Rescale a value from one range to another."""
    return int((x - in_min) * (out_max - out_min) / (in_max - in_min) + out_min)
```

To scale a value `input` which lies between `0..360` to the corresponding value which lies between `0..255`:

```python
output = rescale(input, 0, 360, 0, 255)
```

Make sure both ranges are positive, and non-zero.

I've included this function in the `control_device.py` example script.

Things to discuss

- How does your program store state? Does it need to?
- You're working on a Raspberry Pi, which is orders of magnitude more powerful than the Pico W and ESP8266 devices. Do you need all that power to achieve what you're doing?
- The sensor device is a spiky mess of wires, but where might you encounter similar sorts of sensors 'in the real world'?