Signoff Request - 5/4 -Temperature Sensor

Wednesday, May 4, 2022 8:42 PM

For the humidity sensor, combined temperature and humidity sensors were avoided to maintain modularity. This will also help keep the data separate which will make it easier to send over bus communication with an associated tag. Another way modularity will be maintained is through the use of small individual MCUs for each sensor. The MCU chosen was the Arduino mini based on the following criteria [1]. (This was chosen over the trinket due because the I2C and SPI pins don't overlap, it is only 0.1" longer and 0.1" wider)

- SPI and I2C capabilities
- 5V power supply
- Small form factor

The criteria for the temperature sensor is listed below. This is based on the expected conditions that will be found in the crawlspaces as well as system limitations.

- At least -20° to 40° C to cover the normal outdoor temperatures found in America
- Operates off of 5V or 3.3 V as this is what the MCU can supply
- Accuracy within 1° C for good readings
- Digital Bus output so that filtering is not needed

Based on these criteria, a sensor was chosen with the mouser part number 1782. This product is made up of an MCP9808 sensor on a PCB with through holes for soldering wires to. It can be supplied 2.7 - 5 volts and has a range of -40° to 125° C with an accuracy of 0.25° C [3]. It outputs through I2C which means it will interface the same way as the humidity sensor. Extra pins are also included for alert and to modify the bus address, however, these will not be needed because the alert is for a different application and there is only one I2C device being used so the standard address should work fine.

As with the humidity sensor, this system will be controlled through a trigger on one of the trinket GPIO pins. This trigger signal will start its measurement protocol in which multiple recordings will be taken and averaged together. As with the humidity sensor, half-duplex communication is all that's needed for the communication between the Trinket and the Pi which allows PB0 to be used for I2C instead of MOSI.

Figure 1 shows how the circuit will be set up. Only the data out pin is being used for the SPI communication since duplex communication between the Arduino Trinket and Raspberry Pi will not be necessary. The new microcontroller was chosen over the trinket because it features separate pins for the BUS protocols. This was necessary because putting everything on one system means each sensors MCU and sensor output are going to everyone and the data will not only get hard to track, it will become significantly less modular. This circuit may look familiar after seeing the humidity sensor circuit. This is because they will interface to their individual MCUs in the same way.

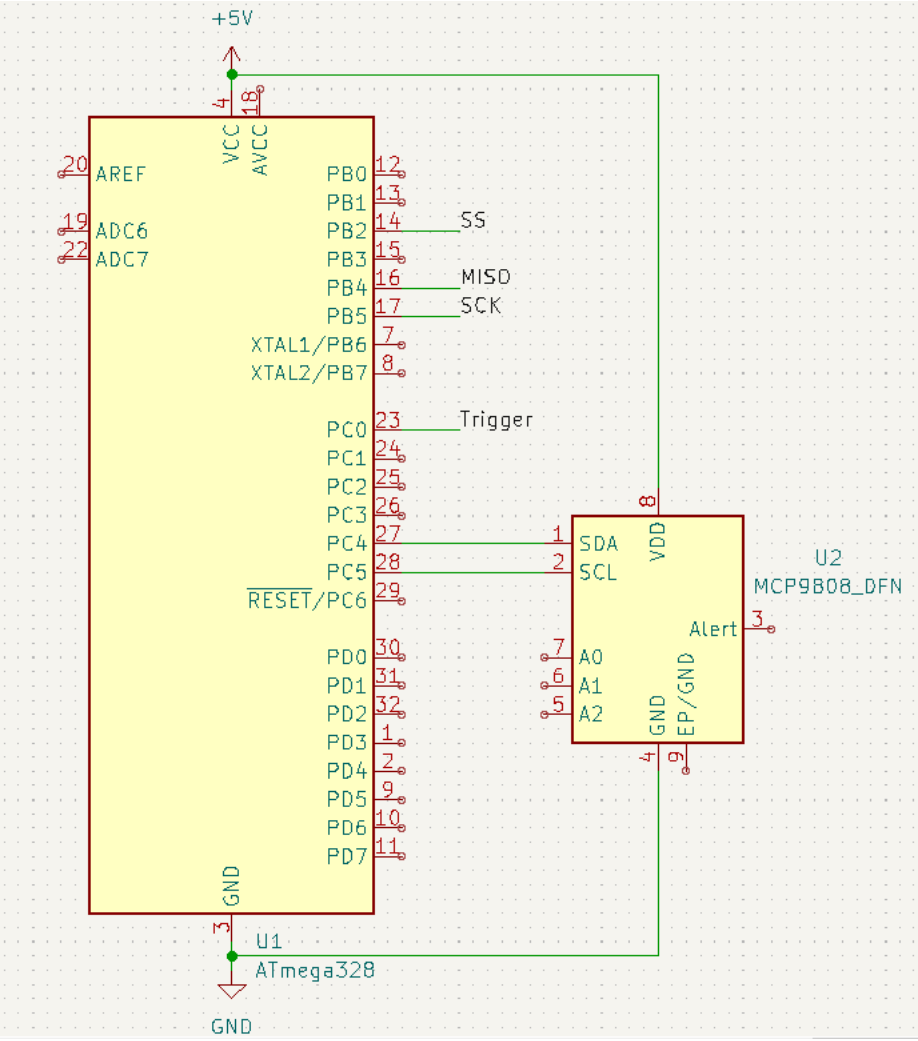

Figure 1: Temperature Sensor and MCU Schematic

[1] https://www.sparkfun.com/products/11113
[2] https://www.mouser.com/ProductDetail/Adafruit/1782?qs=GURawfaeGuDb33OvJbnOMQ%3D%3D
[3] https://www.mouser.com/datasheet/2/737/adafruit_mcp9808_precision_i2c_temperature_sensor_-932839.pdf