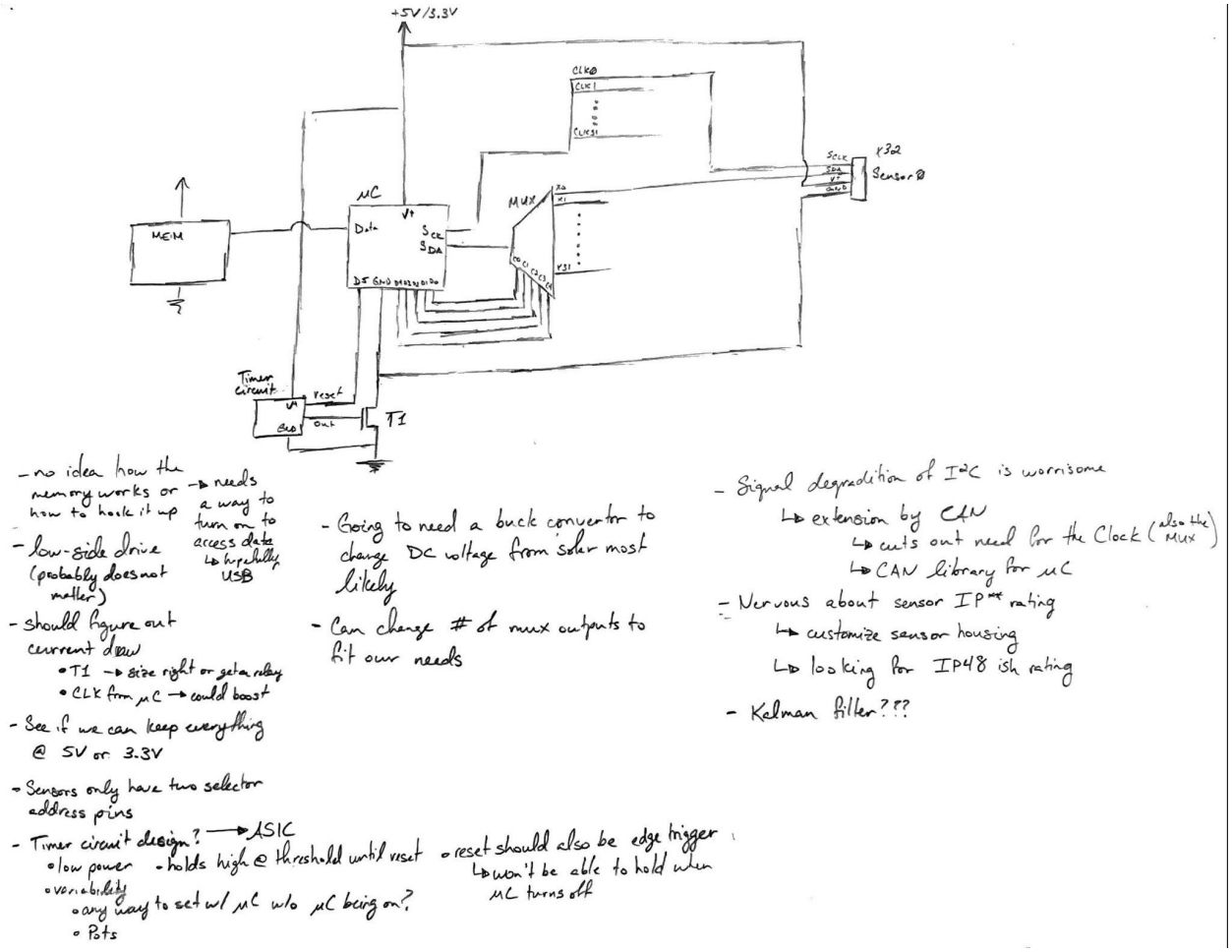


Initial Outline above with some questions.

AdaFruit Sensor:

My current focus this week is on rough schematic design and what sensor to use. Our initial finding (found by Thomas), was an AdaFruit sensor. The nice things about it are that it is already packaged nicely and it is relatively cheap. Its accuracy is decent enough in our operating range but we are slightly outside of the sensor's ideal range. A few things that make me nervous are that the sensor does not have an IP rating and might run into some issues with the environment in the cave, especially if water levels change during the spring. It uses I2C for communication which raises some concerns especially as it only has two selector address pins. Big concerns for I2C is signal degradation from the sensor to the DAQ and being able to easily daisy chain sensors together. A mux could be used to solve these issues but current draw and having to use repeaters to keep the clock signal readable. Finally this product uses the SHT30 sensor which is inferior to the SHT31 sensor in performance.

AdaFruit: https://www.adafruit.com/product/4099

Datasheet: https://cdn-shop.adafruit.com/product-files/4099/C13024-002+datasheet.pdf

Banner Engineering Sensor:
Following up looking for a more robust sensor with a better IP rating is a sensor from Banner Engineering. It has a much larger operating range and is IP68 rated which is really great. The issue is the price tag. It is pretty much overkill for what we are doing, but could be perfect for keeping track of the temperature of the cooling fluid in the system and outside. It runs RS485 for communication protocol which gives the distance and allows for good daisy chaining. The biggest issue with it is the price. It's five times the price of the AdaFruit sensor

Banner Engineering:
https://www.digikey.com/en/products/detail/banner-engineering-corporation/S15S-TH-MQ/17139389
Datasheet:
https://info.bannerengineering.com/cs/groups/public/documents/literature/224483.pdf

CAN Sensor with Custom IP housing:
A more custom solution is to "make our own". We would do a lot of copy paste to reduce design efforts. The idea would be to take the higher quality SHT31 sensor (there is also an SHT35 which is even better but is twice as expensive) and integrate into a I2C to CAN design from TI. We could then find an IP68 housing and place the device in it. This could give us the best of all worlds. It would be a similar cost to the AdaFruit sensor, with some important improvements in quality. Using CAN can really improve the distance we can push the signal and remove the need for the MUX and clock signal (finding a solid CAN library would make this much easier). A better casing would increase confidence in surviving and using the improved sensor will increase accuracy. The big concern is with finding that casing and how much effort will need to be expended to make this work (especially with the packaging of the SHT31 sensor; soldering might be a nightmare). A possible in between is to use the AdaFruit sensor and attach the CAN transceiver board to it in a weatherproof case.

BOM: https://www.ti.com/lit/df/tidryi8/tidryi8.pdf?ts=1695387783506
Schematic: https://www.ti.com/lit/df/tidryi9/tidryi9.pdf?ts=1695387785322
Guide:
https://www.ti.com/lit/ug/tiduei0/tiduei0.pdf?ts=1695322842424&ref_url=https%253A%252F%252Fwww.google.com%252F
Sensor:
https://www.digikey.com/en/products/detail/sensirion-ag/SHT31-DIS-B2-5KS/5872252?utm_adgroup=Sensors%20%26%20Transducers&utm_source=google&utm_medium=cpc&utm_campaign=Dynamic%20Search_EN_Product&utm_term=&utm_content=Sensors%20%26%20Transducers&gclid=Cj0KCQjw9rSoBhCiARIsAFOipll58EoAr91enbkbbIdgSBwkGj2YocfsPgOuniutXcj8cCJBx9U2888aAhe3EALw_wcB

Overall with sensor selection the biggest issue is we need information from John. We need to see the cave and know the budget. Without that, it is so hard to make a decision. Currently, I lean towards getting the AdaFruit sensor and attach a CAN transceiver to it. I do really want to get the SHT31 sensor and kinda think we could replace the SHT30 sensor on the board, but that might not go well.

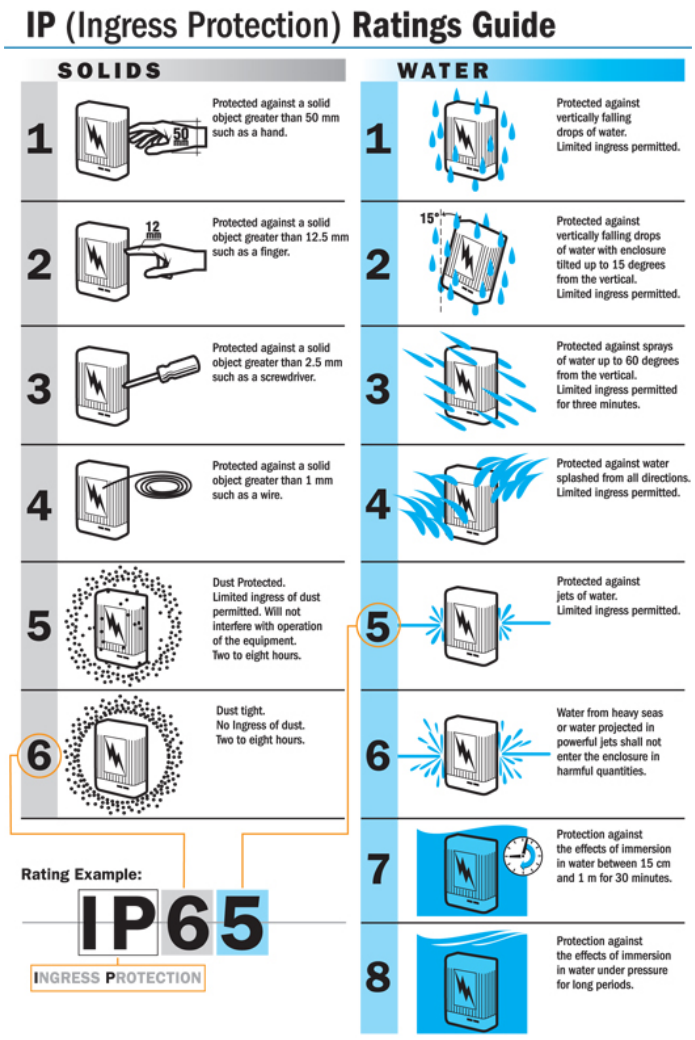
Additional Notes:

- To improve accuracy of results, oversampling and/or a Kalman filter could be useful. A Kalman filter would have been a good value added goal.
- Voltages for the SHT** sensor, CAN transceiver, and microcontroller (most likely) are compatible with each other (3.3V-5V). The Banner Engineering sensor is a 12V system which is not a big deal, but is still something to note.
- Weatherproof casings will be an important detail for this project
- Still timelining to try to have a full design by CDR with hope to get funding for prototyping. Would like to prototype the DAQ and two sensors (to test serial communications).
- Attaching the sensors in the mine is still a big question mark.

Next steps:

Next week I am thinking I will look into picking out a microcontroller and memory system. Also I will probably start looking into a timer ASIC to wake up the system. After that, without information from John the DAQ may stall out. We need to know the scale of the mine, the general environment of the mine to select the correct IP** level, attachment points, and budget constraints (can we spend $2000 on sensors?).

Appendix



RS485 Guide:
https://www.renkeer.com/what-is-rs485/