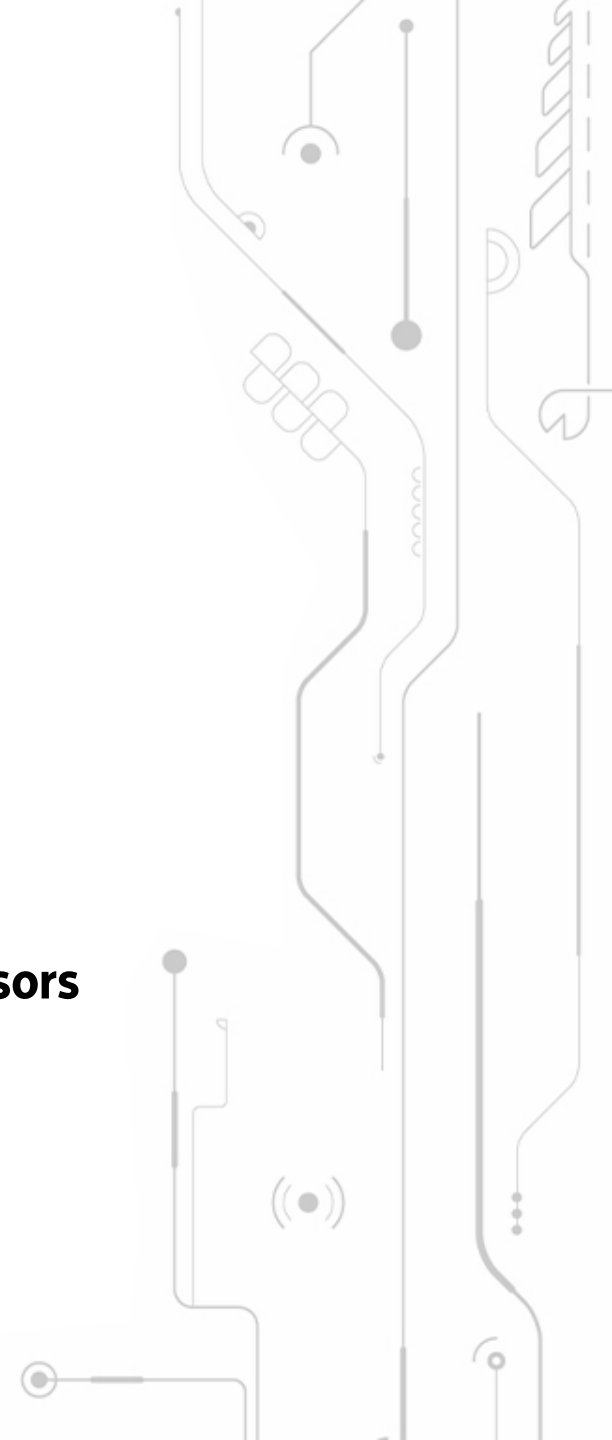




Open Source Building Science Sensors

Built Environment Research Group

19th June, 2014





Open Source Building Science Sensors

The Open Source Building Science Sensors (OSBSS) project demonstrates how to build inexpensive building environmental and operational sensors for long-term studies of the indoor environment using open source hardware and software.



ALFRED P. SLOAN
FOUNDATION

Built
Environment
Research

@ IIT



ILLINOIS INSTITUTE
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Why OSBSS?

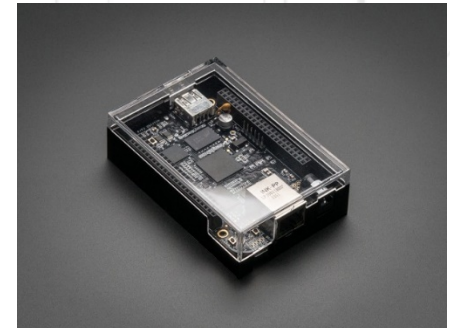
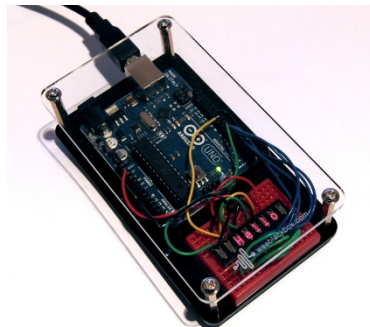
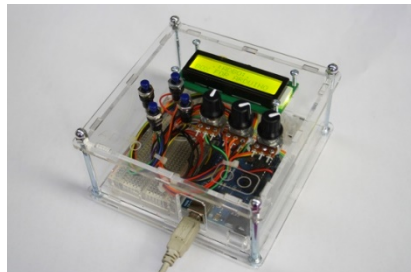
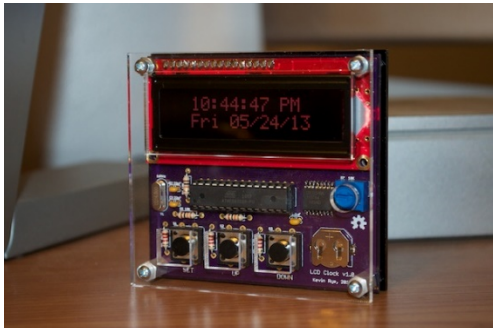
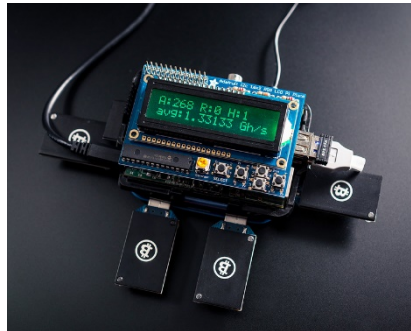
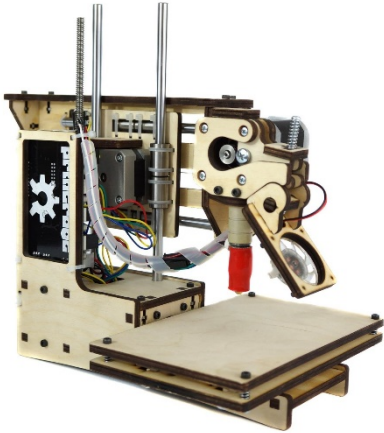
- Most environmental sensors are expensive
- Require proprietary software (buy, learn, train)
- Various limitations: low storage memory, unusual USB interface, battery issues, bulky, lack of wireless capabilities
- Sometimes too complicated to understand/use/debug
- Manufacture documents don't always help
- Customer service isn't very helpful





Why OSBSS?

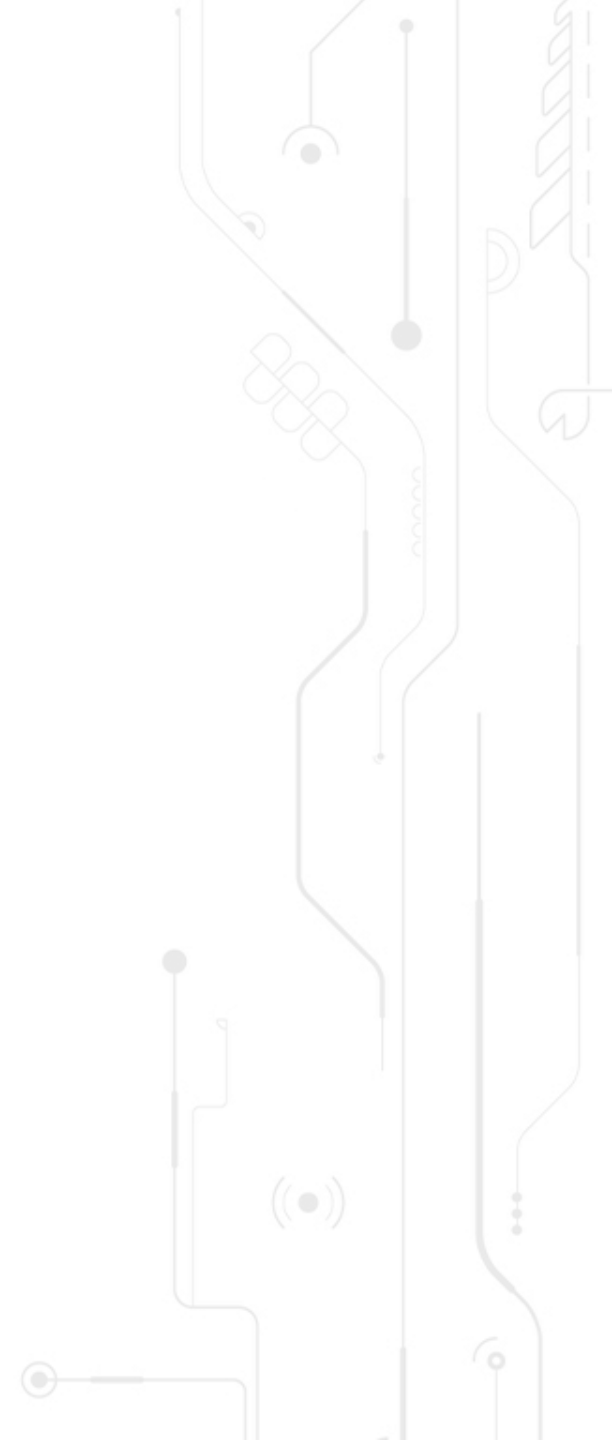
- Open-source hardware and software provide much cheaper alternatives
- Can integrate missing features (memory, USB, battery, WiFi)
- Highly customizable to specific project at hand
- Huge online/offline community for support
- Provide better understanding of data measurement
- Enable more researchers to use environmental sensors in their studies





Current Progress

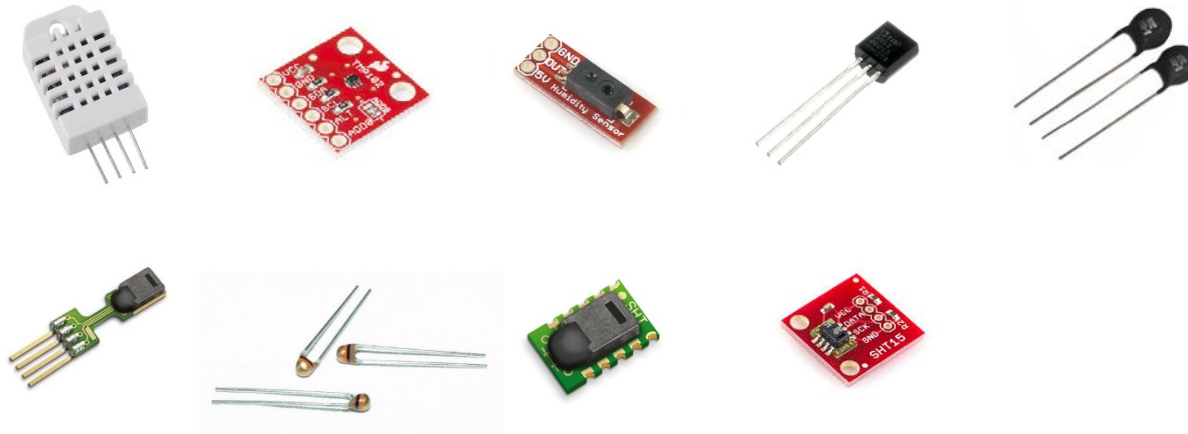
- Temperature & Relative Humidity Sensor
- IR beam break Occupancy sensor (+wireless)
- CO₂ sensor
- Surface temperature
- Light intensity sensor
- Generic Datalogger





Current Progress

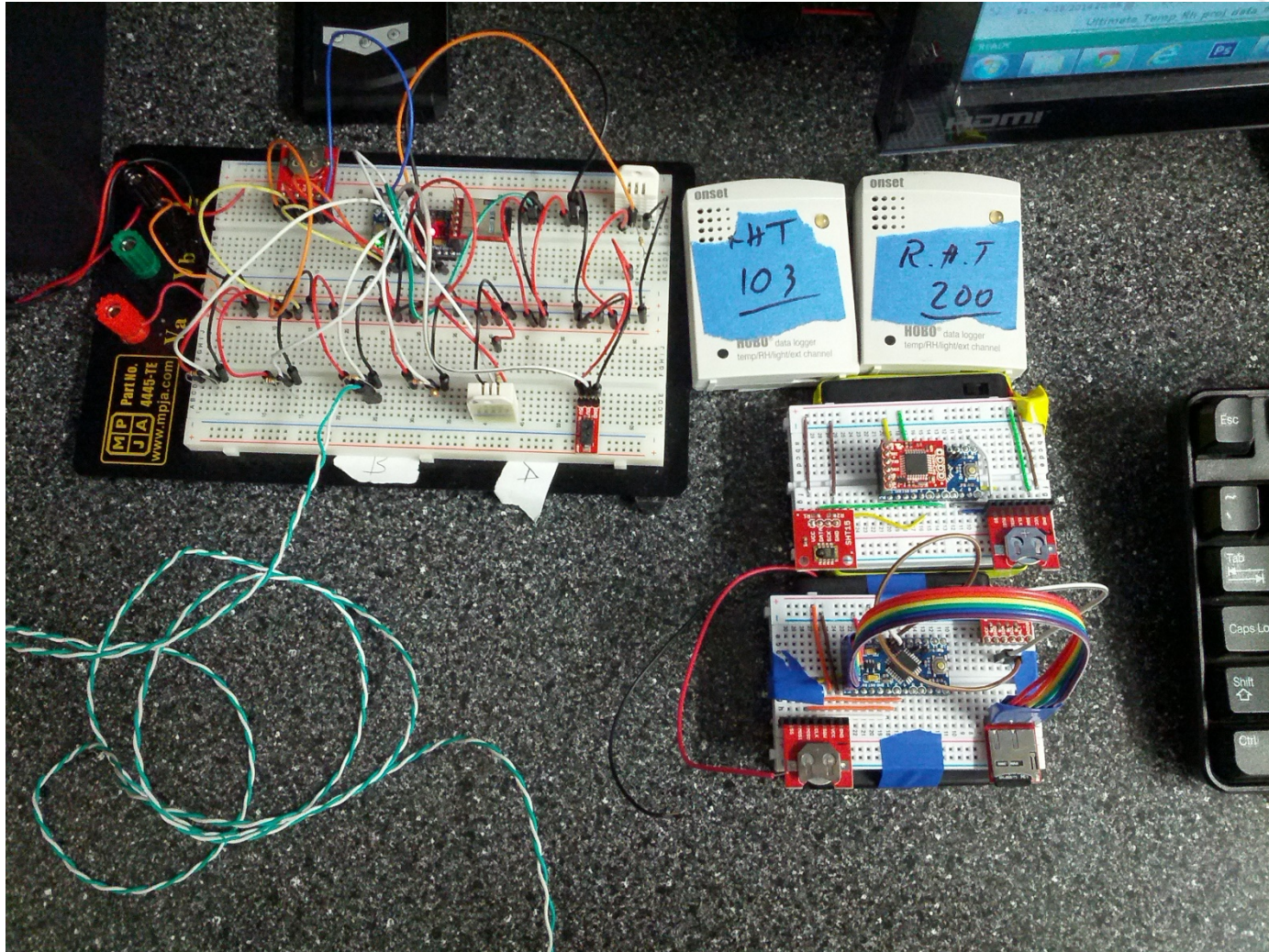
- Temperature & Relative Humidity Sensor





Current Progress

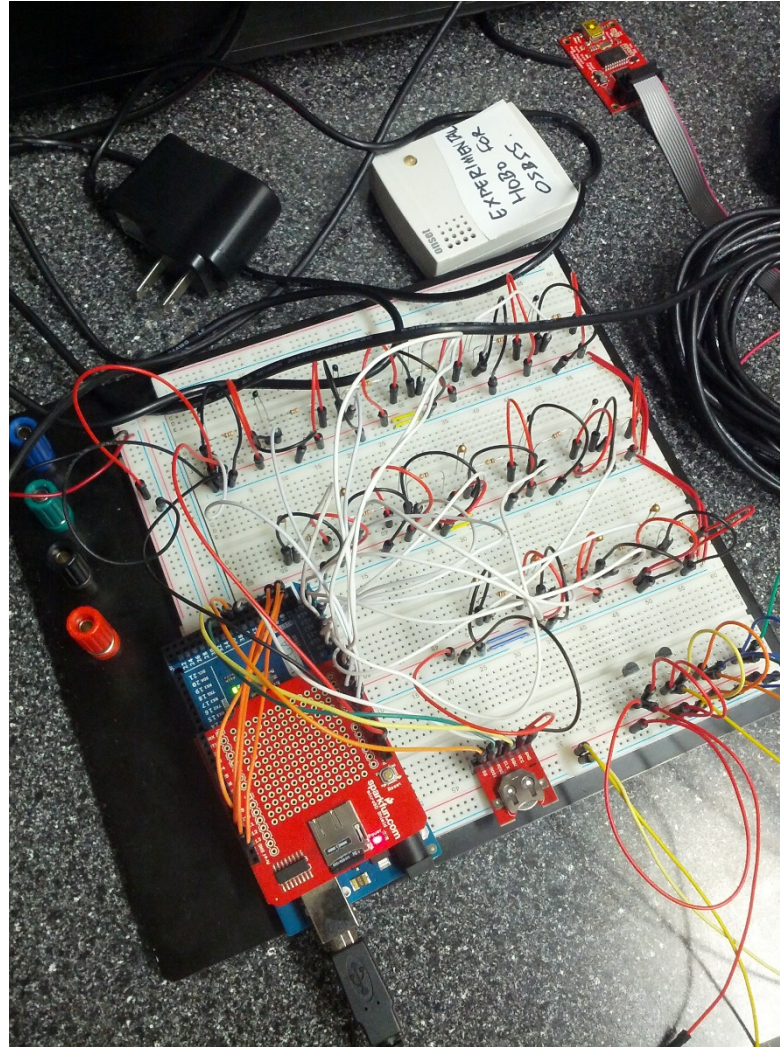
- Temperature & Relative Humidity Sensor





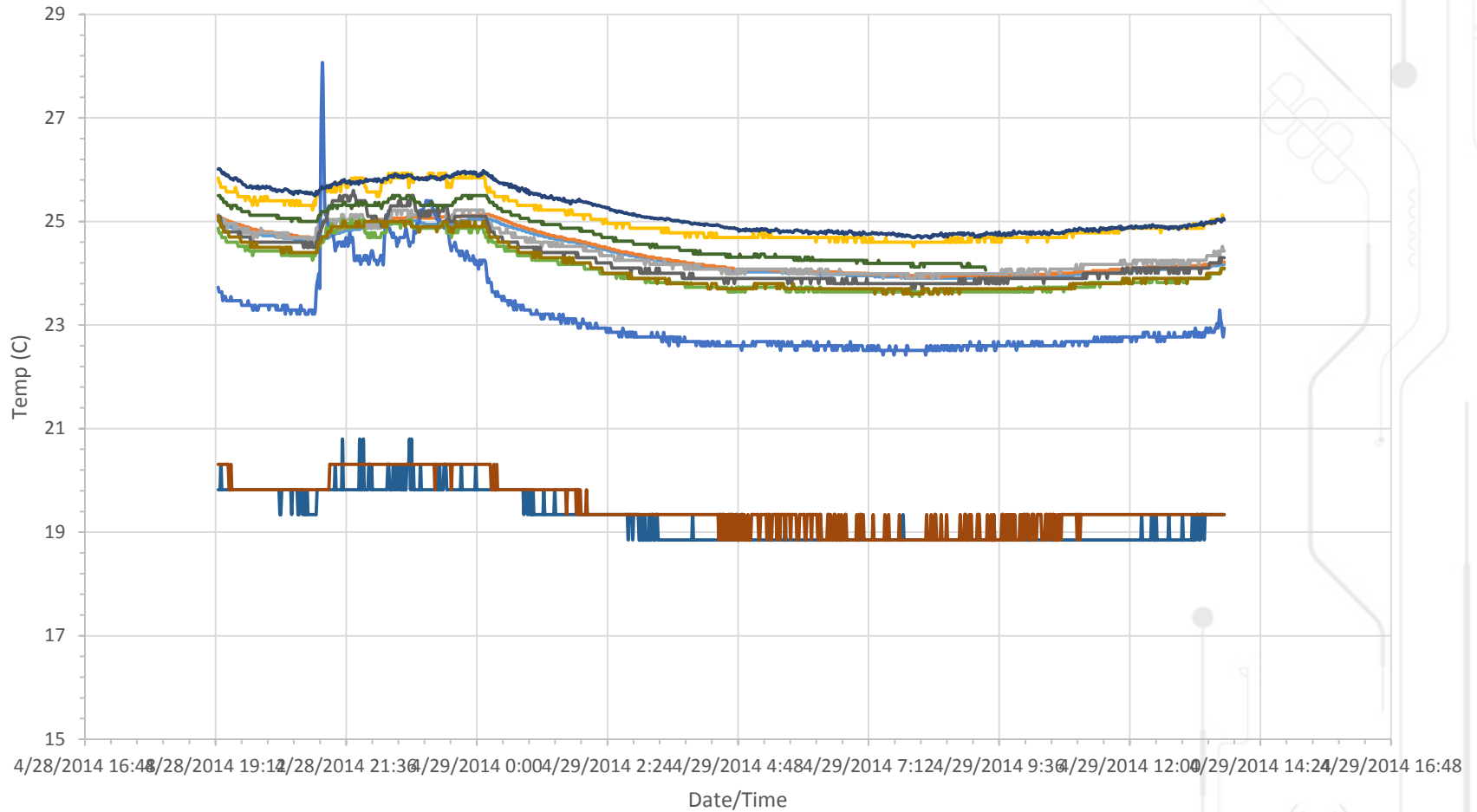
Current Progress

- Temperature & Relative Humidity Sensor





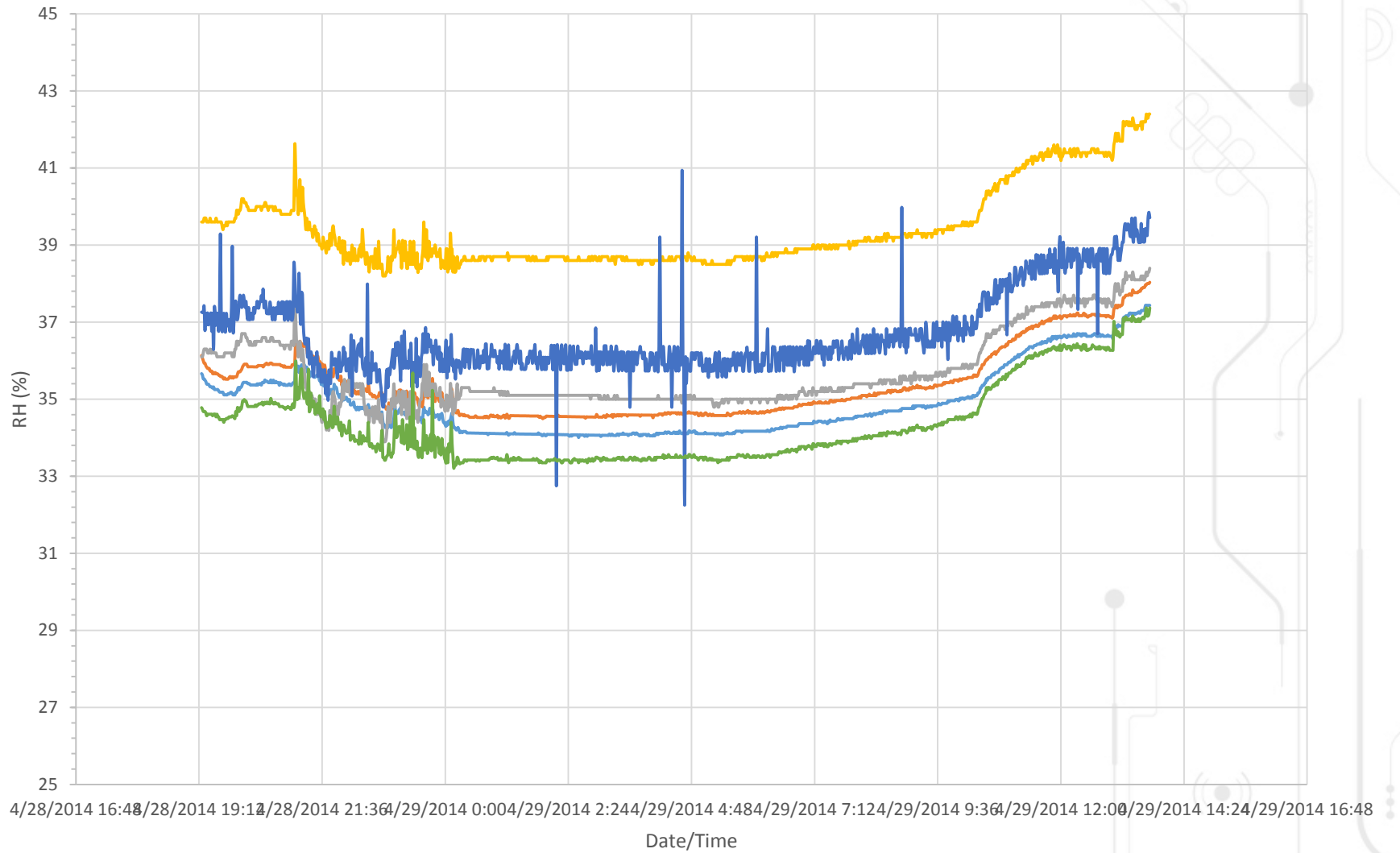
All Temperature





Data

All RH



HOBO 1 - Rh HOBO 2 - Rh White RH 1 (%) White RH 2 (%) HIH RH (%) SHT15 RH



Data

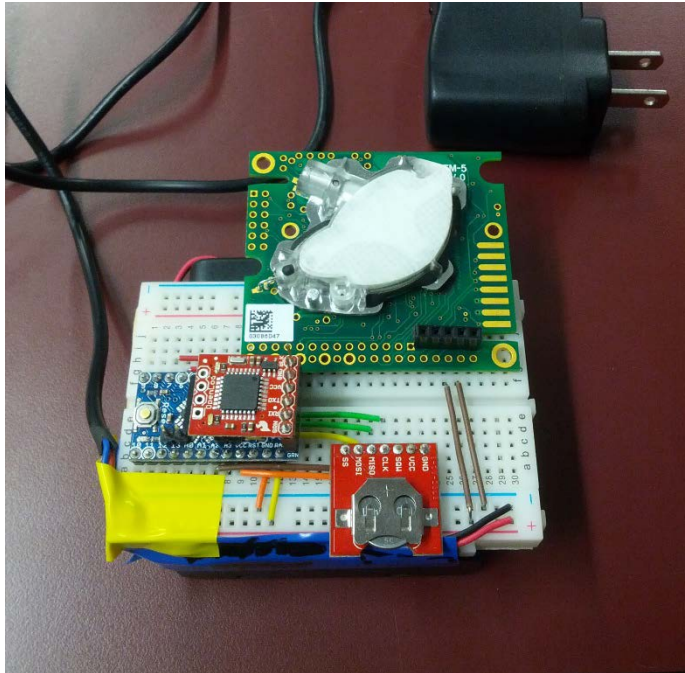
- Other Excel Data





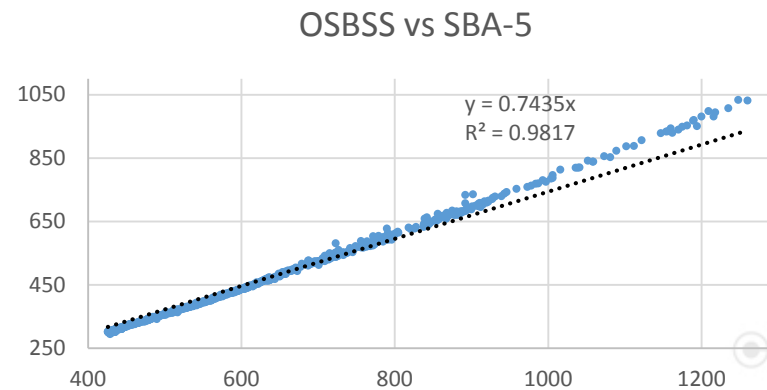
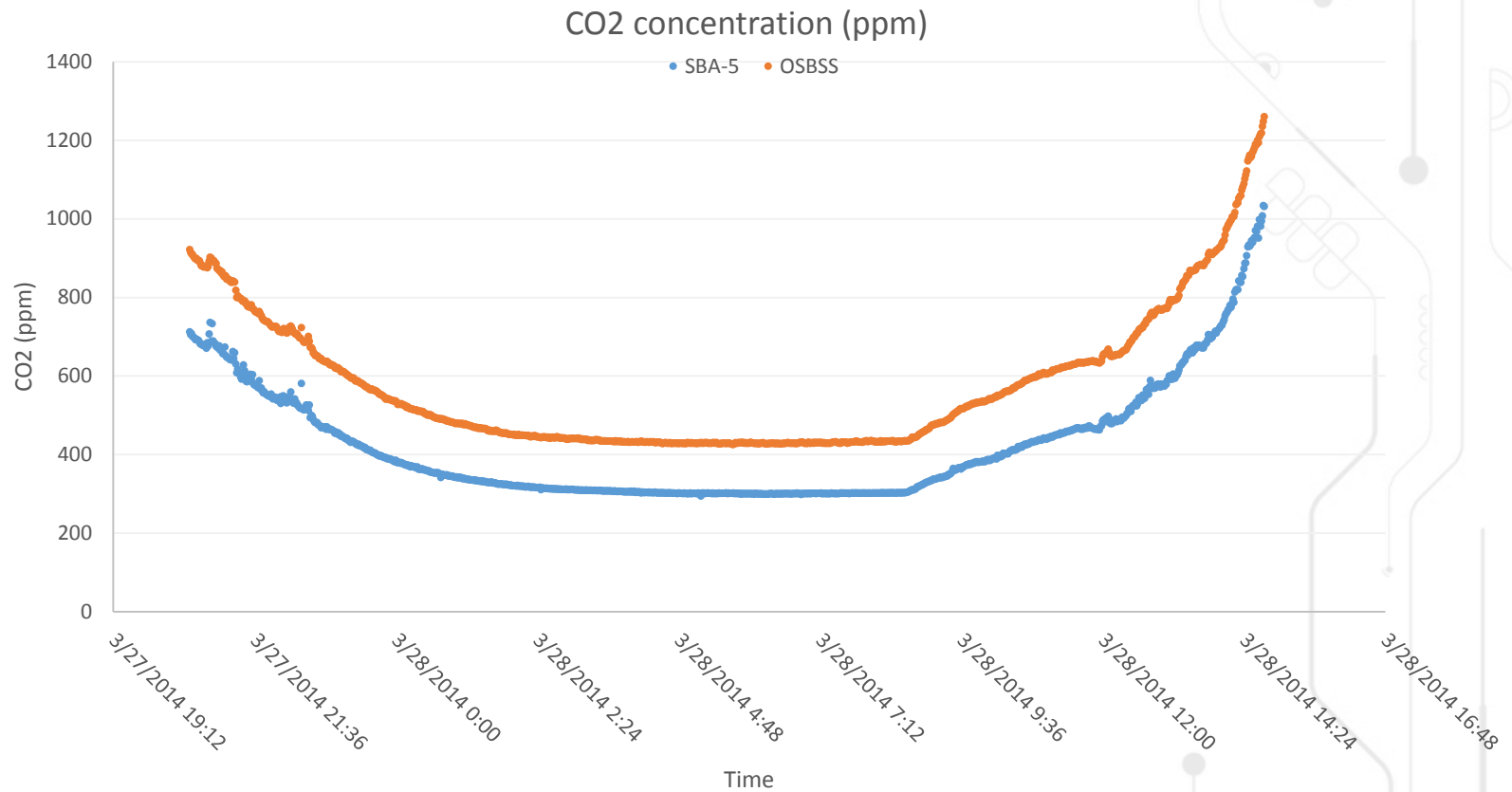
Current Progress

- CO₂ Sensor



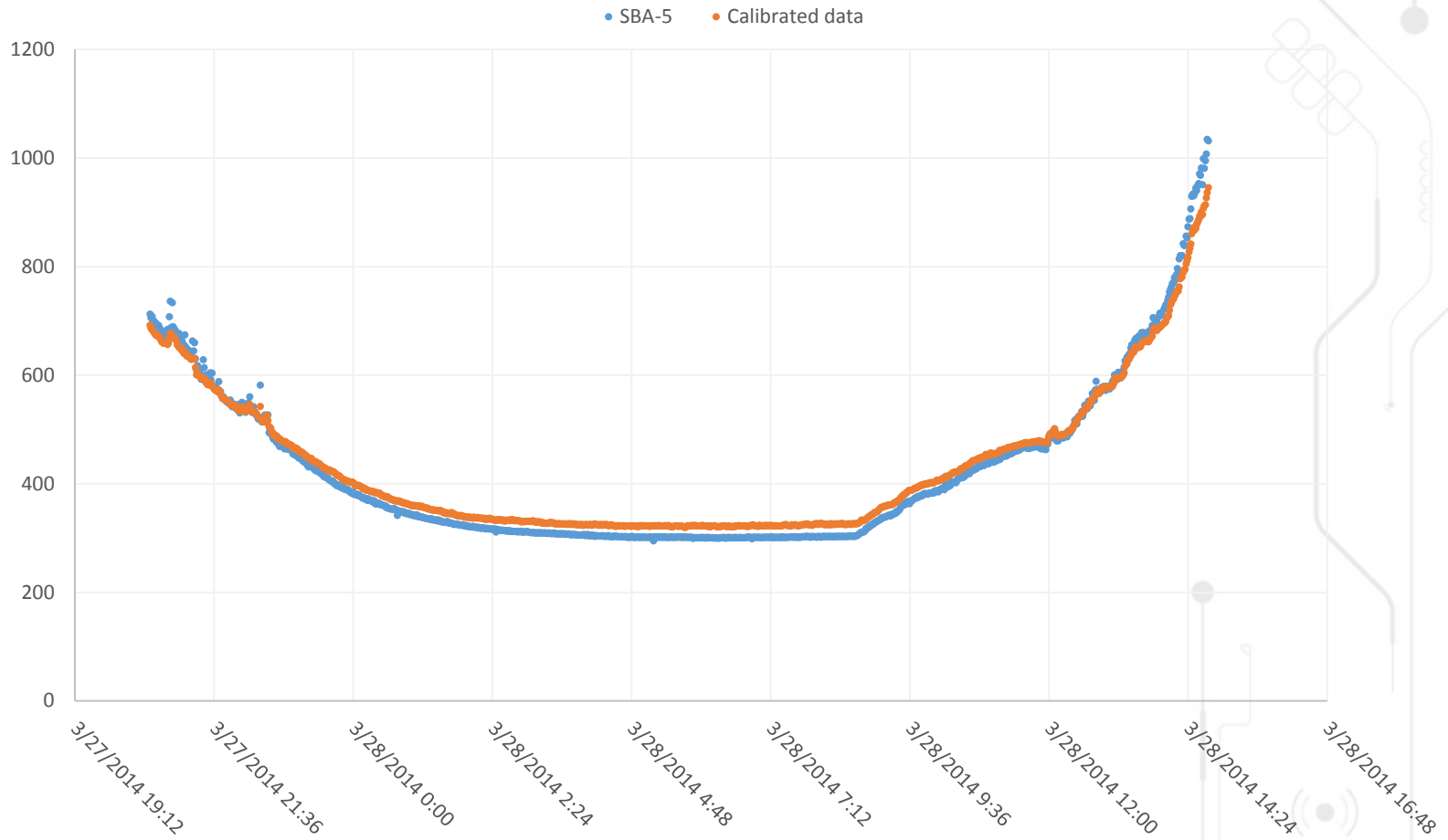


Data





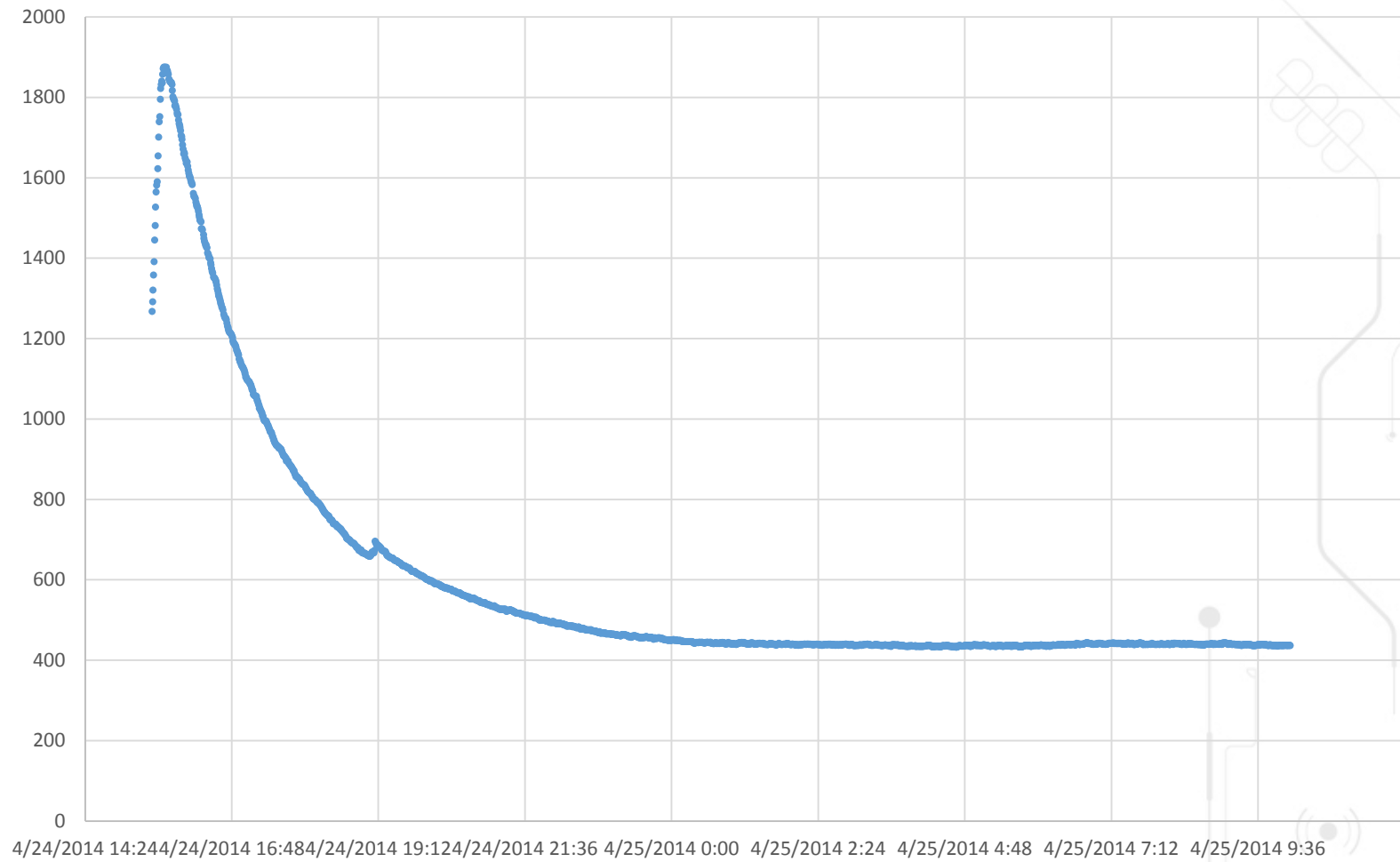
CO2 concentration (ppm) - After Calibration





Data

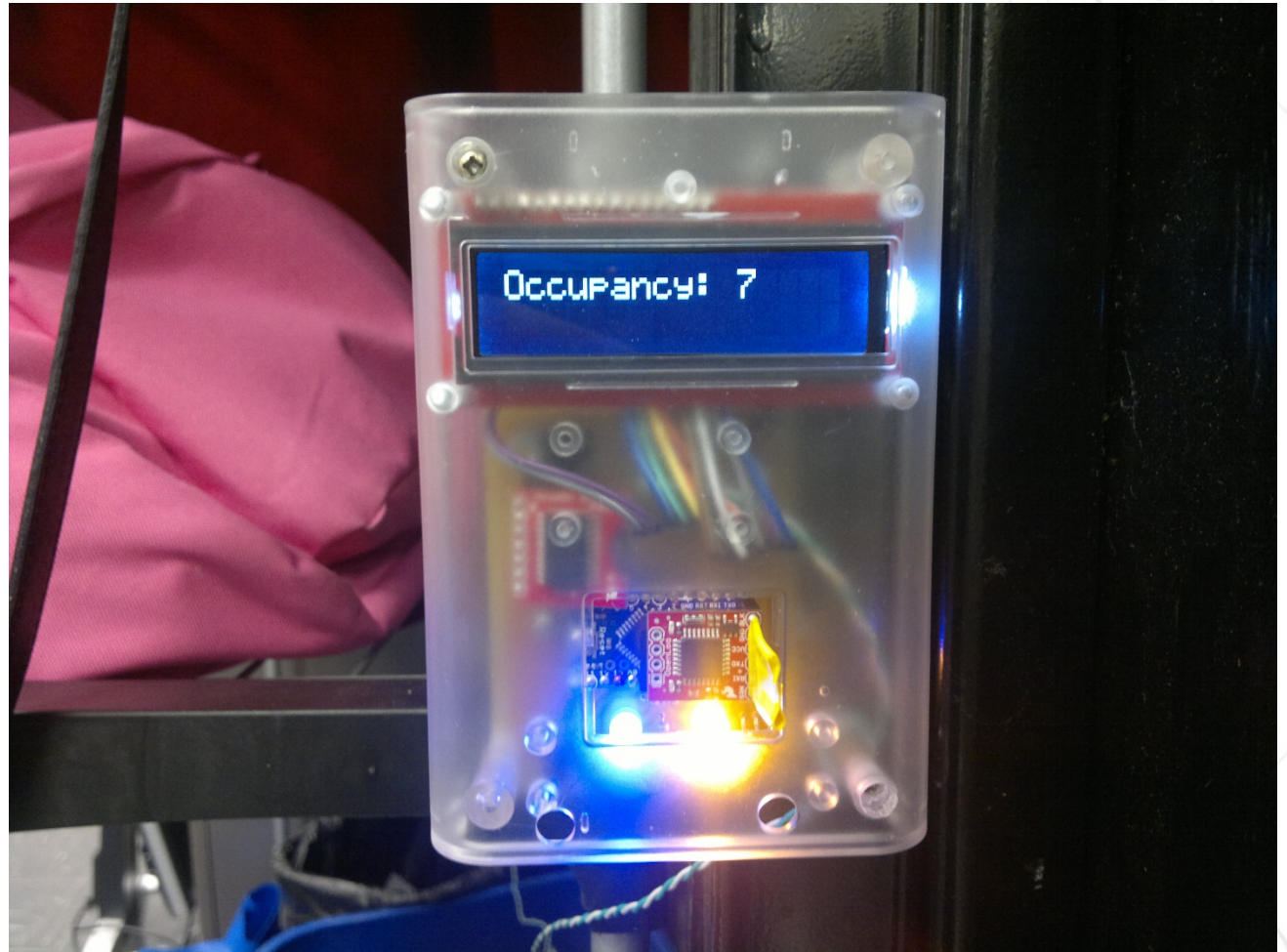
CO2 concentration (ppm)





Current Progress

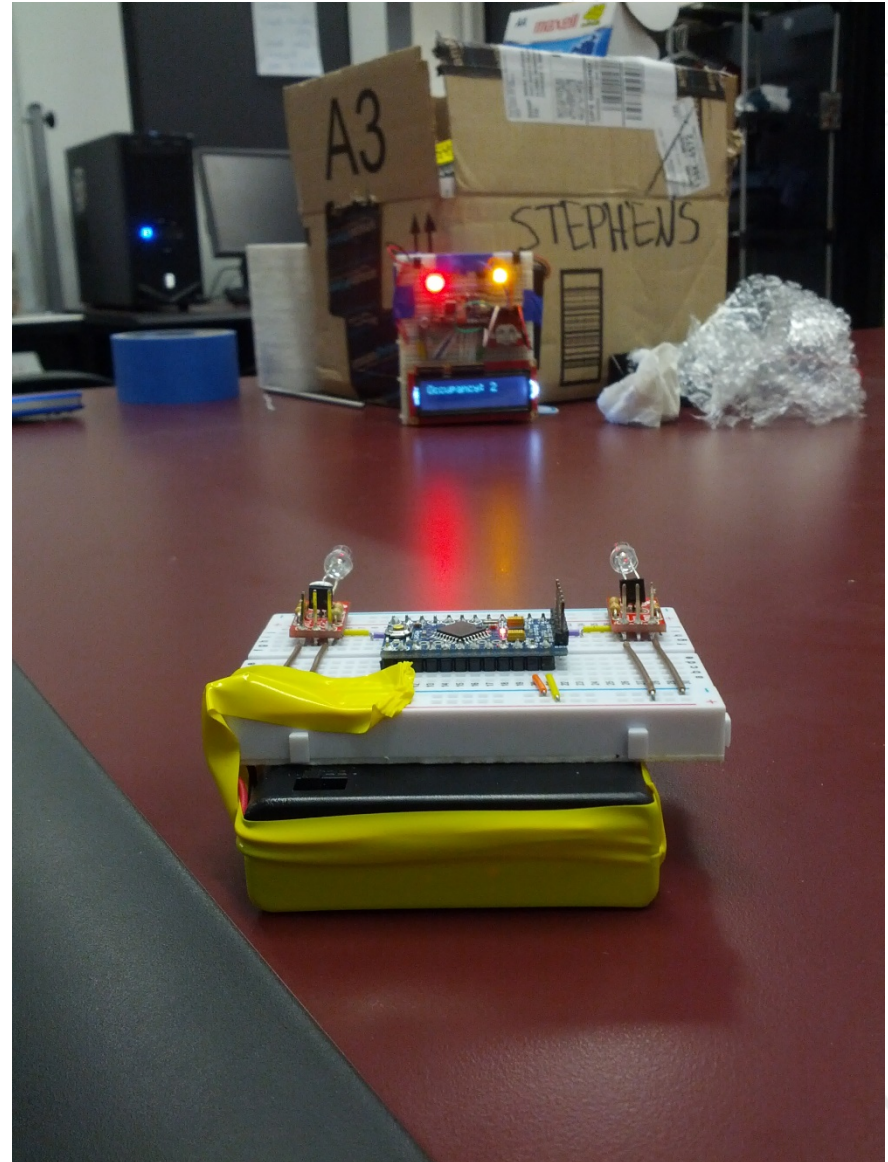
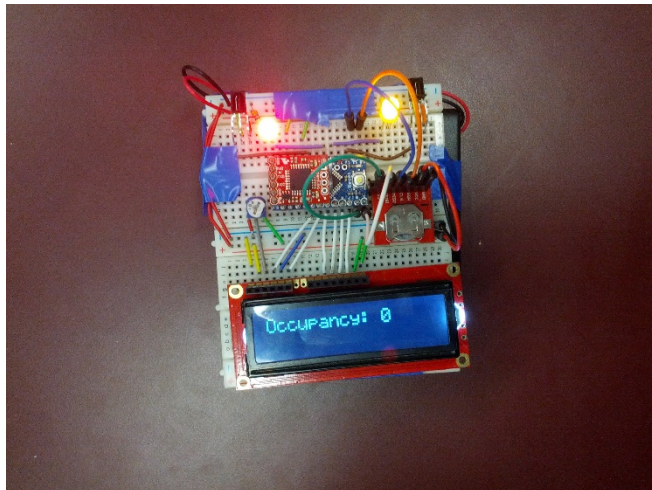
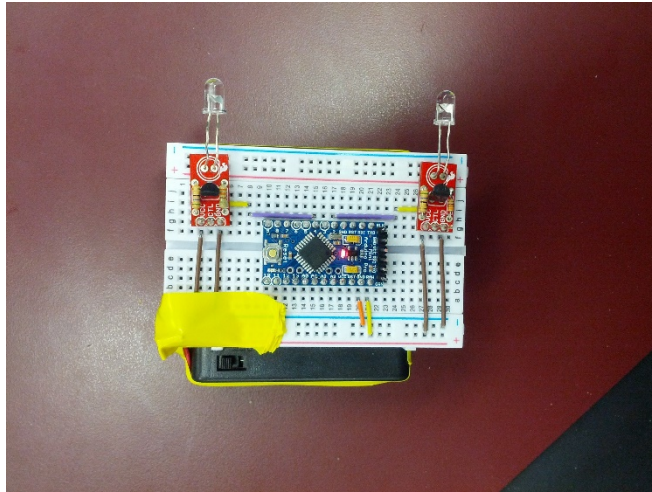
- IR beam break Occupancy counter





Current Progress

- IR beam break Occupancy counter





Current Progress

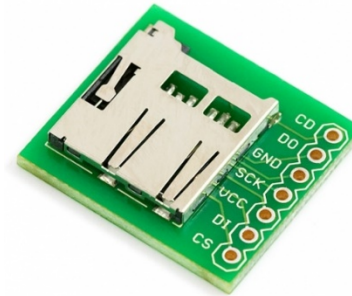
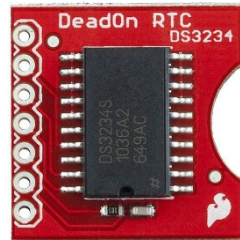
- IR beam break Occupancy counter





Current Progress

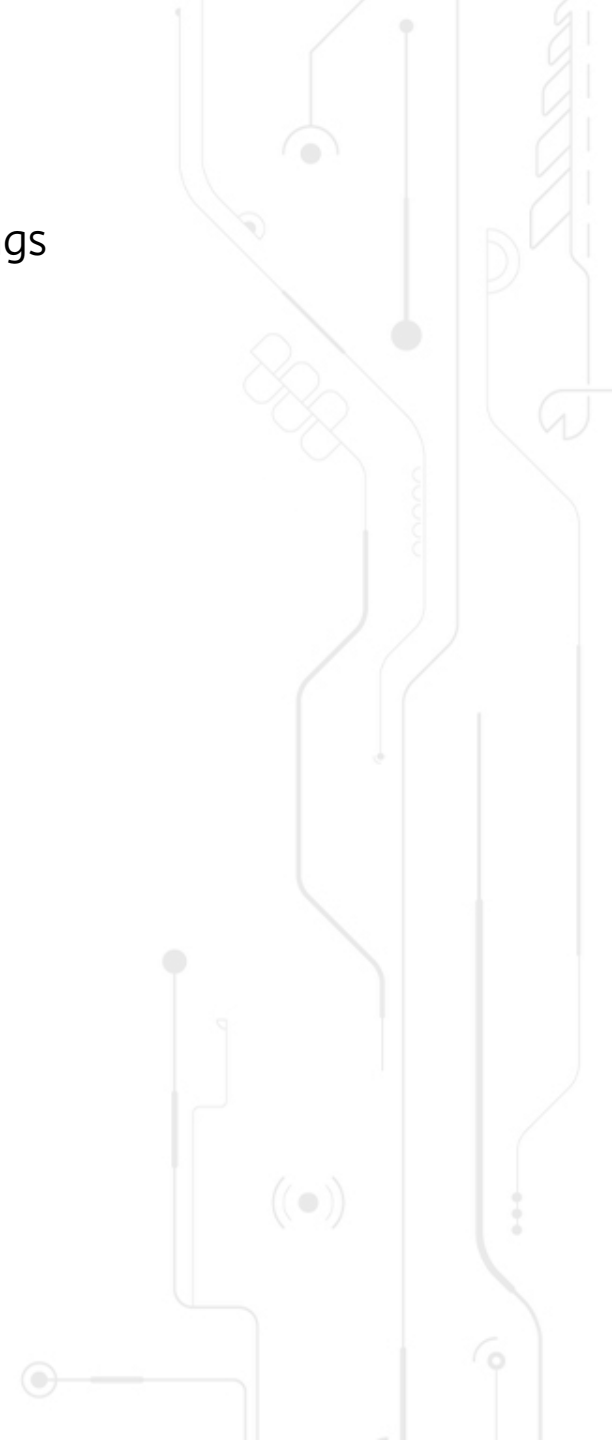
- Power draw measurements
- Low-power data logger





Current Problems

- Exposed wires – no proper enclosure – inaccurate readings
- Some open-source sensors aren't always accurate
- Some aren't easily available open-source
- Writing to memory card fails sometimes
- Sensors die randomly sometimes
- IR beam break is affected by glass doors/other factors





Future work/in Progress

- PM₁₀ and PM_{2.5} sensor
- Distance sensor (windows, office desk) & motion sensor (light control)
- Wireless/wired sensor networks
- Design proper robust enclosures (possibly weather-proof) – Roy's flow meter, SMPS
- Calibrate sensors with existing accurate ones
- Add many exception handling in code – account for different situations
- Test extensively against existing off-the-shelf sensors to verify integrity of data
- Create easy-to-understand tutorials for the sensors



Thank You

