

The following represents the 11 weekly reports we, Team 1, have submitted to our Industry Sponsor and Academic Advisor. The reports below are presented in the original form with the respective week and date bolded for easy viewing.

Team 1 Open Source Air Quality Monitoring

Week 1: January 2nd 2022 - January 9th 2022

Sponsor: Dr David Burnett

Advisor: Dr John Acken

Team Members: Adam Dezay , Manuel Garcia , Brandon Hippe , Mercedes Newton

Team Review:

- Team established meeting times.
 - Team will meet with John Acken every Monday at 4:30.
 - Team will meet independently every Tuesday at 6:35.
- Team scheduled a meeting for Monday January 16th with Dr. Burnett to discuss questions and project proposals.
- Team established a shared drive, github and trello for record keeping and collaboration.
- Team curated questions and discussed our project proposal in preparation for our first meeting with Dr. Burnett. Questions listed below:
 - What percent accuracy do we require for our CO2 sensor?
 - Should we use Eco2 to estimate CO2 or a Real CO2 sensor?
 - Can we use the other microcontroller or should we use MSP430?
- Team conducted initial research and began brainstorming potential solutions.

Individual Review

Adam Dezay: Agreed to create wiki for team Github.

Brandon Hippe: Began python script for component power consumption estimations.

Manuel Garcia: Conducted initial research and began weighting benefits of specific components.

Mercedes Newton: Curated team Report.

Team 1 Open Source Air Quality Monitoring

Week 2: January 10th 2022 - January 17th 2022

Sponsor: Dr David Burnett

Advisor: Dr John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team further curated questions and discussed our project proposal in preparation for our first meeting with Dr. Burnett. Questions listed below:
 - Size constraints? (Will affect battery life)
 - Sensor accuracy requirements, Eco2 vs Real CO2?
 - Our current constraints are that the Ec02 sensors we have looked into require extensive autocalibration and would have too long of start ups for a low power application.
 - Anemometer implementation?
 - Indoor applications will have low air speed so traditional anemometers might not make sense unless we placed it in an air duct.
 - Micro controller requirements?
 - We are currently looking at the esp32 because it has built in wifi and a deep sleep.
 - Web server preferences?
 - Current thoughts are to use a raspberry pi, running a web server, that we are able to access remotely.
 - Should we use open WSN and if so what microcontroller should be implemented?
 - Our team would prefer not to.
 - What is our budget? What will be provided by our sponsor?
 - We will require a maximum of \$300 to create 1 unit, factoring varying prices and component requirements.
- Team conducted research and began brainstorming potential solutions.
- Team discussed power consumption in components
- Team developed rough draft of project proposal
- Team delegated tasks for the current week with emphasis on the project proposal and research, specific tasks are listed below.

Individual Review

Adam Dezay: Developing project Gantt chart, documented project in the project proposal

Manuel Garcia: Conducted initial research and began weighting benefits of specific components, assisted in documenting projects in the project proposal.

Brandon Hippe: Further developed python script for component power consumption estimations, sensor research, assisted in documenting project in the project proposal

Mercedes Newton: Curated team Report, further documented project in the project proposal

Team 1 Open Source Air Quality Monitoring

Week 3: January 16th 2022 - January 23th 2022

Sponsor: Dr David Burnett

Advisor: Dr John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

This week, we met with Dr. Burnett for the first time

- After our first class meeting and meeting with our industry advisor, our team has come to the following decisions
 - We must produce 3 prototypes, with a chance of producing the initially requested 10 due to funding.
 - We shall further research and discuss how frequently our sensors take in data as informed by power requirements.
 - Spreadsheet and protocol was established for obtaining equipment from both Dr. Burnett's lab and the EPL.
 - Team established another meeting time and workshop time.
 - Team assigned Brandon as point person and Mercedes as leader.
 - Team created a discord for communication.
- Gantt chart was revised to be more informative.
- Using a CO2 vs ECO2 sensor is still being debated.
- Team assigned each member with a sensor to specialize in.
- Team finished rough draft of project proposal
- Team delegated tasks for the current week with emphasis on the research and planning.

Individual Review

Adam Dezay: Created and revised gantt chart during team meeting, began CO2 sensor research

Manuel Garcia: Continued Smart mesh and kicad research

Brandon Hippe: Finished python component power analysis script. Graphs and text outputs are available on github. Started basic tests on viability of custom ultrasonic anemometer, will continue and develop final anemometer pending results.

Mercedes Newton: Reached out to faculty about HVAC system used at PSU, began PM sensor research. Organized team trello/documentation.

Team 1 Open Source Air Quality Monitoring

Week 4: January 23rd 2022 - January 30th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team submitted project proposal draft to Dr. Acken.
- Team reviewed rough draft of the project proposal and made adjustments according to the feedback from Dr. Acken.
- Team submitted rough draft of project proposal to Andrew Greenberg before our final review.
- Team received feedback from Dr. Elliott Gall in regards to HVAC systems in PSU.
- Team delegated tasks for the current week with emphasis on the research.
- Continued HVAC research and discussed the possibility of scheduling a tour with engineering building facilities, this will be a topic during our 4:30 meeting with Dr. Acken.
- Checked with EPL for parts availability, found sensors not available. How should we go about purchasing sensors? We're currently building spreadsheet(s) with our necessary components, would we be able to send that information to Dr. Burnett for him to order?

Individual Review

Adam Dezay: Continued CO2 sensor research.

Manuel Garcia: Continued Smart mesh and kicad research.

Brandon Hippe: Started basic tests on viability of custom ultrasonic anemometer. Continues to develop final anemometer pending results.

Mercedes Newton: Reached out to faculty about HVAC system used at PSU, continued PM sensor research. Organized team trello/documentation.

Team 1 Open Source Air Quality Monitoring

Week 5: January 31st 2022 - February 6th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team submitted project proposal to Dr. Burnett.
- Team prepared project proposal presentation for Dr. Acken.
- Team continued prototype sensor/smartmesh development.
- Checked part availability in the EPL.

Individual Review

Adam Dezay: Continued CO2 sensor research. Worked on presentation.

Manuel Garcia: Continued Smart mesh and kicad research. Worked on presentation.

Brandon Hippe: Continued ultrasonic anemometer research and design. Worked on presentation.

Mercedes Newton: Continued PM sensor research. Organized team trello/documentation. Worked on presentation.

Team 1 Open Source Air Quality Monitoring

Week 6: February 6th 2022 - February 13th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Conducted first team check in with professor Greenberg.
- Further solidified sensor choices, aim to order sensors during Monday meeting.
- Looked into alternate microcontrollers that would fit our application better.
- Worked on getting example code working on our MSP 430s
- Working towards getting list of components ready to purchase
- Making final tweaks to project proposal before submission by Friday noon

Questions for moving forward

- Can we get the template for submitting order requests so we can order components soon?
- Is there any chance of using the STM32 L series chip?
- When is our next meeting with Dr. Burnett?

Individual Review

Adam Dezay: Continued CO2 sensor research. Updated wiki

Manuel Garcia: Continued Smart mesh and kicad research, worked on initial MSP430/ Energia / Code Composer Studio setup, Researched other microcontrollers that may fit our application better

Brandon Hippe: Continued to develop final anemometer pending results.

Mercedes Newton: Continued PM sensor research. Organized team trello/documentation.

Team 1 Open Source Air Quality Monitoring

Week 7: February 13th 2022 - February 20th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Conducted first in person team check in with Dr. Burnett.
- Solidified sensor choices.
- Worked on getting example code working on our MSP 430.
- Achieved working MSP 430/energia on ¾ team member computers.
- Created a list of components ready to purchase.
- Making final tweaks to the project proposal before submission by Monday the 20th.

Individual Review

Adam Dezay: Continued CO2 sensor research, decided on SGP30, worked on final project proposal, updated Wiki, Started on CO2 code, Updated final proposal.

Manuel Garcia: Continued Smart mesh and kicad research, worked on initial MSP430/ Energia / Code Composer Studio setup, assisted teammates with MSP 430.

Brandon Hippe: Continued to develop final anemometer pending results, organized ordering spreadsheet, updated proposal, assisted teammates with MSP 430.

Mercedes Newton: Continued PM sensor research, decided on SPS30. Organized team trello/documentation.

Team 1 Open Source Air Quality Monitoring

Week 8: February 20th 2022 - February 27th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Worked on getting example code working on our MSP 430.
- Achieved working MSP 430/energia on ¾ team member computers.
- Enhanced gantt chart
- Submitted final project proposal
- Began parts ordering process
- Discussed potential of moving team meetings to better accommodate schedules.
- Canceled in person friday meeting due to ice and snow
- Waiting on order to arrive

Individual Review

Adam Dezay: Continued CO2 sensor research, decided on SGP30, worked on final project proposal, updated Wiki, Started on CO2 code, Updated final proposal.

Manuel Garcia: Continued Smart mesh and kicad research, worked on initial MSP430/ Energia / Code Composer Studio setup, assisted teammates with MSP 430.

Brandon Hippe: Continued to develop final anemometer pending results, organized ordering spreadsheet, updated proposal, assisted teammates with MSP 430.

Mercedes Newton: Continued PM sensor research, decided on SPS30. Organized team trello/documentation.

Team 1 Open Source Air Quality Monitoring

Week 9: February 28th 2022 - March 6th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- All 4 members have access to Energia
- Ordered and received all sensors
- Began working individually on sensors/components
 - Adam - CO2
 - Manuel - SmartMesh
 - Brandon - Anemometer
 - Mercedes - PM

Upcoming week:

- Have all components and sensors work independently with generic code and breadboard
- KiCAD rough draft complete

Individual Review

Adam Dezay: began first draft of code & circuit for CO2 sensors, updated Wik and some documentation

Manuel Garcia: Completed Energia setup for team mate, continued SmartMesh Code, KiCAD draft

Brandon Hippe: Continued Anemometer code & circuit.

Mercedes Newton: Continued PM sensor code & circuit. Organized team trello/documentation.

Team 1 Open Source Air Quality Monitoring

Week 10: March 6th 2022 - March 12th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- After extensive feedback from both our advisor and industry sponsor, our team has dedicated additional focus on clear documentation.
- All team members are connecting to and coding in Energia.
- Team members are each working on specified sensor/component tasks.
- Enhanced gantt chart as shown in figures 1-4.
- Moved team meetings to better accommodate schedules.
 - New times, effective immediately are Monday @ 4:30pm, Tuesday @ 7:30pm, Thursday @ 7:30pm .
- Team discussed changing meeting time with Dr. Acken for the upcoming term
 - Potential advisor meeting times that work for the team: Thursday @2-4pm or Friday at 8am, set to be discussed during Monday meeting on 3/13/2023.
 - Starting april 6, 3pm meetings.

Individual Review

Due to recent sponsor and advisor feedback, we have produced a more detailed description of individual progress and current roadblocks.

Adam Dezay: CO2 sensor updates - working on connecting CO2 sensors to Energia. Having issue getting I2C to work, following previous years example, yet to have success connecting using msp430 and energia. Spent around 8 hours this week troubleshooting code, finding and importing libraries, will update when progress has been made.

Manuel Garcia: Attempted to get both Smartmesh and I2C working on the MSP430. Worked more on getting specific sensors into our KiCad schematic.

SMARTMESH - able to power on a node and connect it to the host PC via coin cell power and software from analog devices. Unable to communicate with the board or power it on via power pins, Also unable to get the previous years python gui to run, suspected issues with libraries and python being different versions, need to either spend time updating code to current libraries, re-write the application to better fit our needs, or try and locate all outdated zip files of old project in order to get running. I have

found that the documentation for the smartmesh system has been far less comprehensive than I was hoping for, I am not sure if I am just looking in the wrong places, however after several day long attempts I have not had success getting it to work or finding documentation on how exactly it should be set up for our purposes.

ENERGIA & MSP430 - Having issues with working with Energia and the MSP430, getting to the point where I might switch to code composer studio and re-write the whole project in C. Right now an error I get almost every time I turn on the energia IDE requires that I delete the whole "Energia15" folder from my %appdata% and reinstall it, I have not found a workaround for this. Deleting this folder has been a nuisance, however has been doable since it does not delete the code I have written. This however changes now that we are using I2C to communicate with our sensors and the smartmesh boards. I looked into how the previous year was able to use I2C and they showed how they needed to edit several files and values in the "Energia15" folder in order to get their code to run. We have not successfully re-done what they have shown because their documentation is for a different msp430 than we are using with a different pinout and chip, and the edits they made are chip specific. On Top of needing to do the work of editing these files in order to get I2C to work for our chipset, when I get this daily error requiring me to delete this subfolder I will also need to go back and make the same 20 or so code edits in order to program the IDE to work with our MSP430fr2355 chip. I also have not found good documentation on doing this online and would have to reverse engineer what last year's capstone team did and hope that with enough edits and iterations that it would work for our chip. This has led me to further consider using code composer studio because all of the official documentation from TI, as well as any other reputable source, uses code composer studio and the C language. This would require a severe overhaul of our code and take a significant amount of time to do, however I believe it would lead to more reliable and reproducible code for ourselves and any future team that was interested in continuing on with this project.

Brandon Hippe:

Anemometer updates - UART communication with both sensors is inconsistent. Each one works individually, but both don't work simultaneously. I've been trying to use the same transmit pin for both so that they trigger at the same time, but I'll have to try to get them both working separately but at the same time before trying again. Otherwise, could use the pulse duration mode, but it seemed to be very inconsistently responding to airflow.

Mercedes Newton:

PM2.5 sensor updates - Working on connecting PM2.5 sensor to Energia and producing working code. Experiencing difficulty updating sensor libraries from arduino to Energia. Currently reviewing last year's capstone documentation and attempting to model the switch after last year's team. Exerting new focus on documentation in order to update advisor and sponsor on team progress.

Gantt Chart and Timeline Updates:

Below is both the general timeline of the project as a whole as well as a breakdown of the specific tasks that are left moving forward. Due to delay in selecting and receiving sensors, as well as team difficulty in implementing them, we have postponed several of our due dates to better reflect our progress. Additionally, we have switched our gantt chart format from Excel to Google Sheets to make editing more efficient and legible. All gantt charts are representative of the timeline for this term only. In the week eleven report we intend to have an updated timeline for spring term.

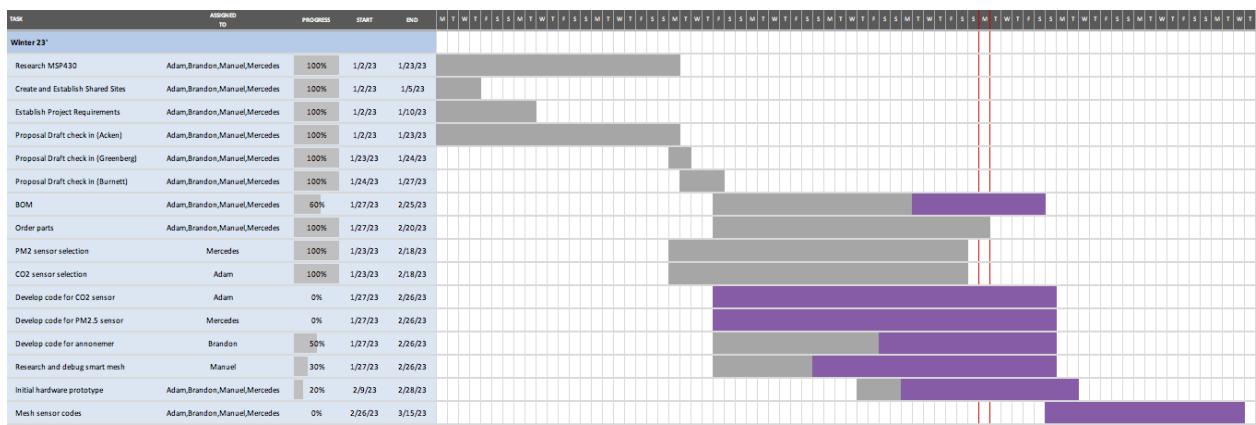


Figure 1: Original Gantt chart as seen on project proposal

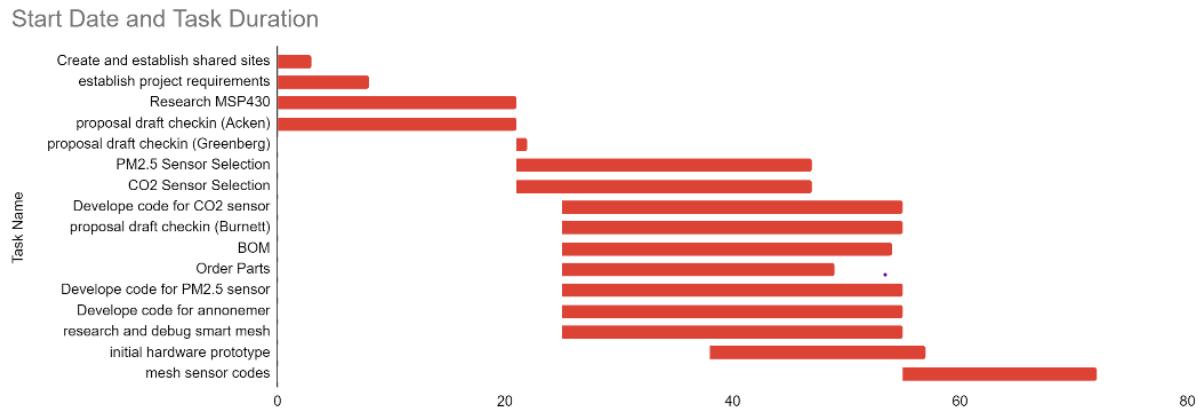


Figure two: Original gantt chart remade in Google Sheets

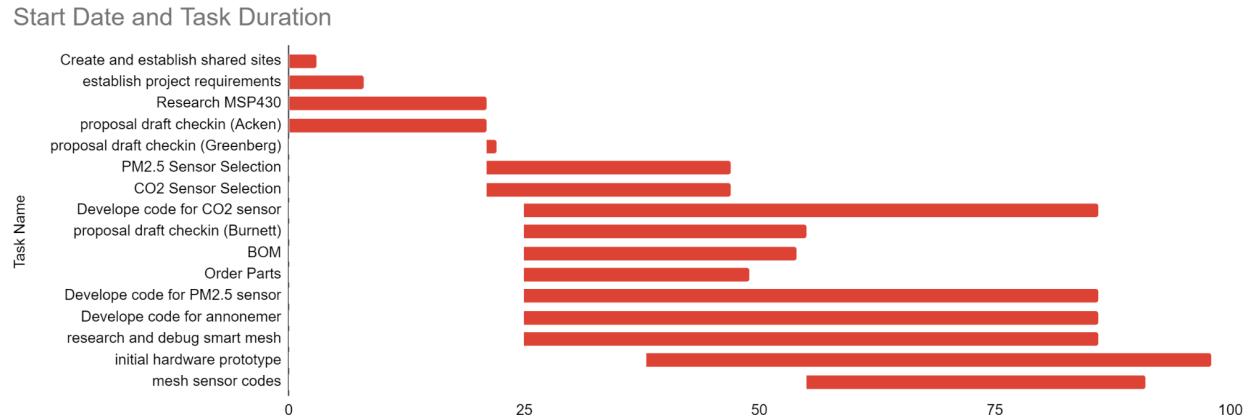


Figure three: New gantt chart with updated deadlines

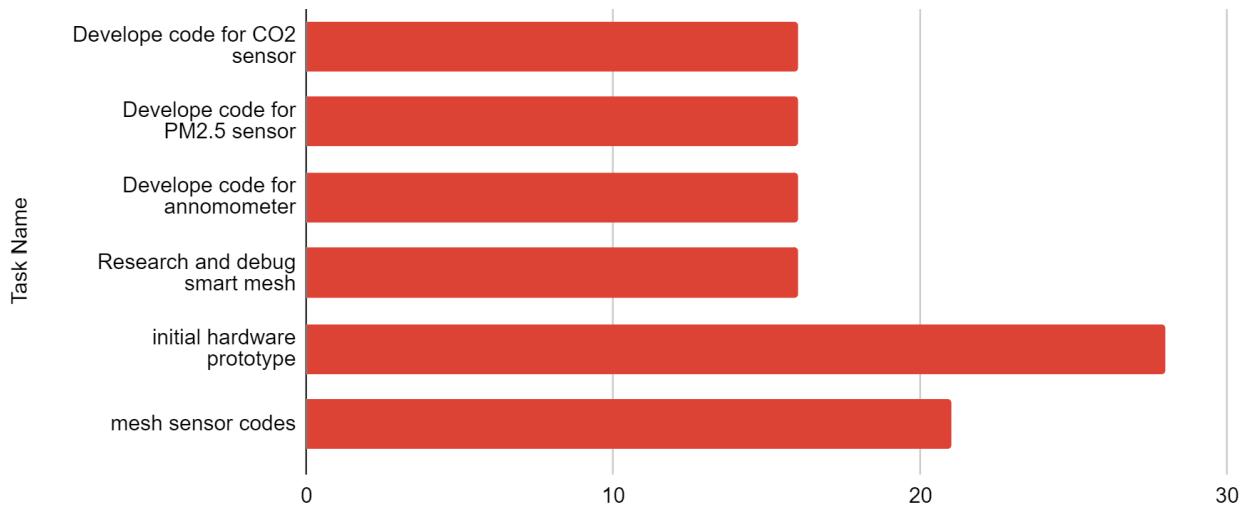


Figure four: Pending tasks with updated finishing dates in relation to current date 3/13/2023

Task Name	Expected Completion Date
Develop code for CO2 sensor	3/29/23
Develop code for PM2.5 sensor	3/29/23
Develop code for anemometer	3/29/23
Research and debug smart mesh	3/29/23
initial hardware prototype	4/10/23
mesh sensor codes	4/3/23

Table 1: current tasks with updated expected completion dates

KiCad:

Current Top-Level Kicad schematic, filling in internal subsheets with components and wires as we figure out what we need. Will post sub level schematics as we make progress in future reports.

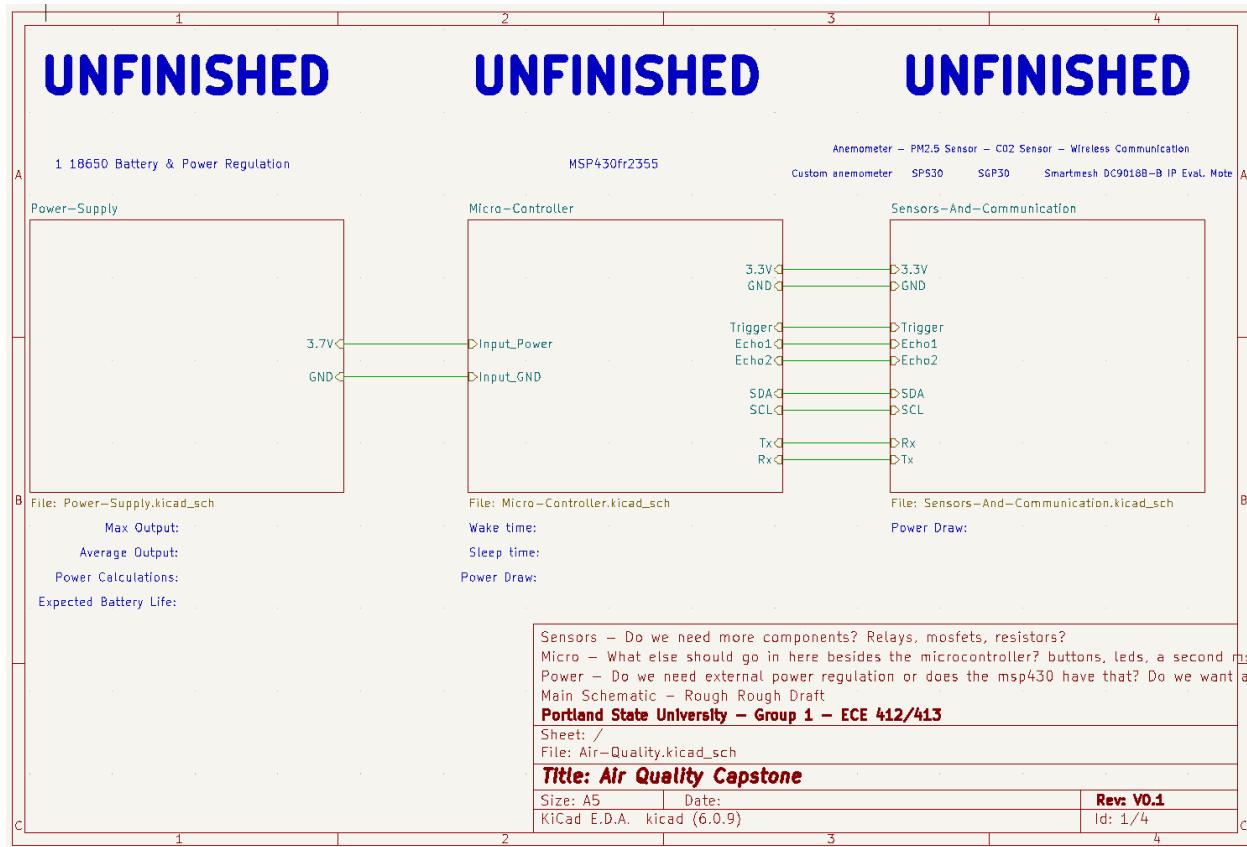


Figure Five: Top level KiCad Schematic

Team 1 Open Source Air Quality Monitoring

Week 11: March 13th 2022 - March 19th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- All team members are connecting to and coding in Energia.
- Team members are each working on specified sensor/component tasks.
- Enhanced gantt chart as shown in figures 1 and 2.
- Gantt chart and schedule for upcoming term (shown in figure 3).
- Moved team meetings to better accommodate schedules.
 - New times, effective immediately are Monday @ 4:30pm, Tuesday @ 7:30pm, Thursday @ 7:30pm .
- Team changed meeting time with Dr. Acken for the upcoming term.
 - Starting April 6 we will be conducting Thursday 3pm meetings.

Individual Review

Adam Dezay:

Worked with Brandon on getting I2C with energia working. Yet to have full success connecting with our hardware, however prospects look positive on making progress this upcoming week.

Manuel Garcia:

Did not have a chance to do a ton of work on the project this week preparing for finals. Plans in place to dedicate time to the project before the next report.

Brandon Hippe:

Anemometer updates - Still no consistent changes in ultrasonic output values with respect to wind. Planning on removing transducers from sensors and reattaching with wires to space them out and follow [this guide](#). Also helped Adam figure out I2C communication with MSP430 in Energia, and going to start working on helping with making Energia I2C code for SPS30 and SGP30 sensors.

Mercedes Newton:

PM2.5 sensor updates - Working on connecting PM2.5 sensor to Energia and producing working code. Experiencing difficulty updating sensor libraries from arduino to Energia. Preparing for finals. Assisted team in planning for the upcoming term and created gantt chart

Gantt Chart and Timeline Updates:

Below is both the general timeline of the project as a whole as well as a breakdown of the specific tasks that are left moving forward. Gantt charts in figures 1 and 2 as well as table 1 are representative of the timeline for this term only. Figure 3 represents an outline of the schedule for spring term. Our team has factored in additional time for potential delays, however the current dates are subject to change. We intend to have our 3 modes built by the end of may, as displayed in our figure 3 gantt chart.

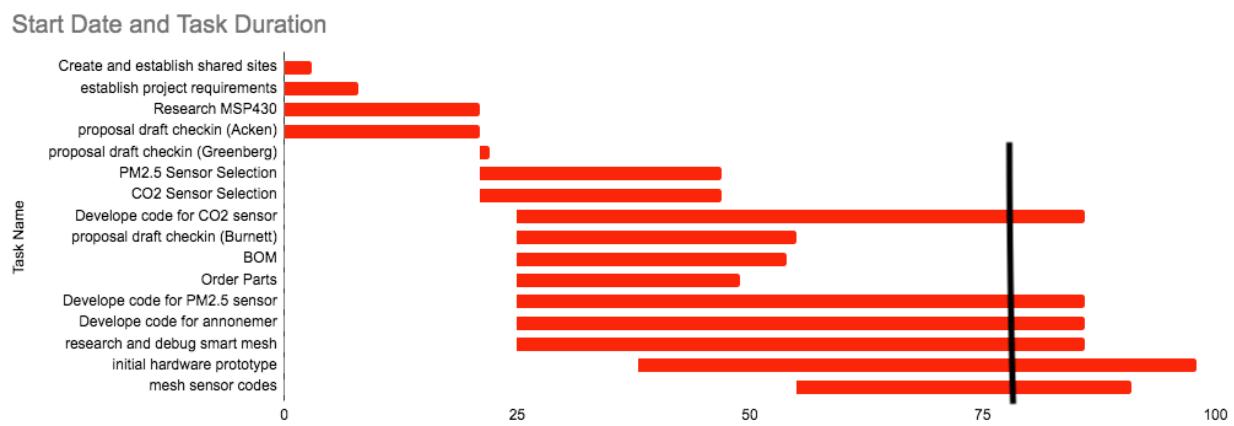


Figure One: Gantt chart with updated deadlines, black line signifies today's date, monday 3/20/23

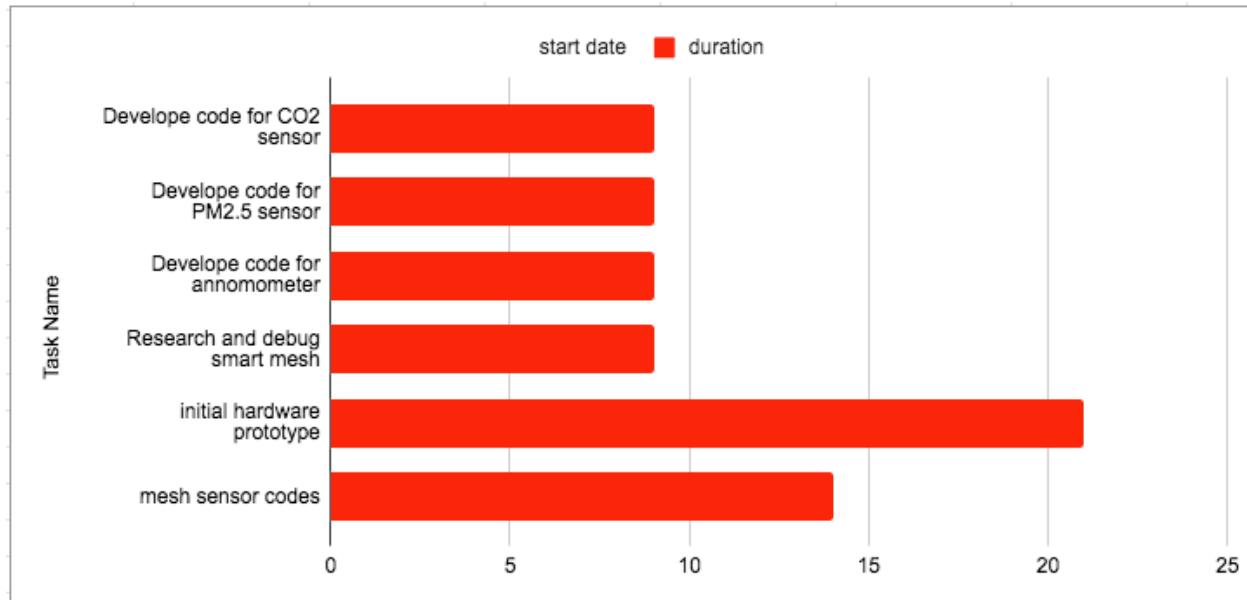


Figure Two: Pending tasks with updated finishing dates in relation to current date 3/20/2023

Task Name	Expected Completion Date
Develop code for CO2 sensor	3/29/23
Develop code for PM2.5 sensor	3/29/23
Develop code for anemometer	3/29/23
Research and debug smart mesh	3/29/23
initial hardware prototype	4/10/23
mesh sensor codes	4/3/23

Table 1: current tasks with updated expected completion dates

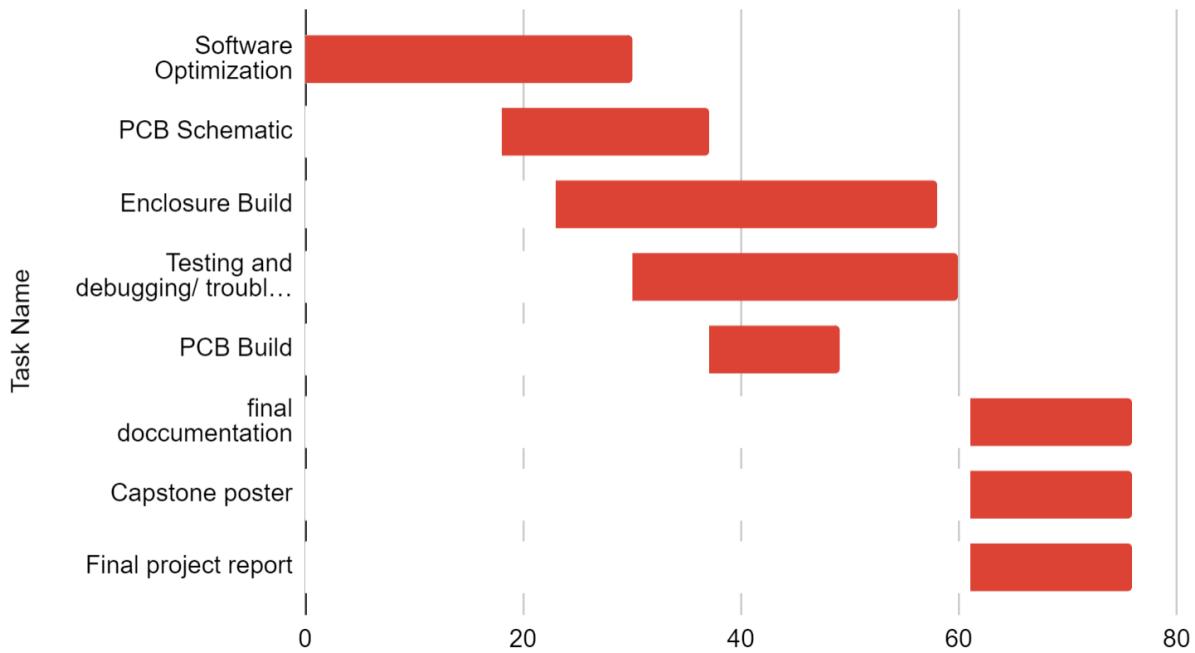


Figure three: Gantt chart for Spring term starting April 1st 2023

Task Name	Start date	End date
Software Optimization	4/1/2023	5/1/2023
PCB Schematic	4/19/2023	5/8/2023
Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table two: Tasks for spring term with expected completion dates *completion dates subject to change*

Team 1 Open Source Air Quality Monitoring

Week 12: March 20th 2022 - March 27th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- All team members are connecting to and coding in Energia.
- Team members are each working on specified sensor/component tasks.
- Enhanced gantt chart as shown in figures 1 and 2.
- Moved team meetings to better accommodate schedules.
 - New times, effective immediately are Monday @ 4:30pm, Tuesday @ 7:30pm, Thursday @ 7:30pm .
- Team changed meeting time with Dr. Acken for the upcoming term.
 - Starting April 6 we will be conducting Thursday 3pm advisor meetings.
 - Effective April 3rd Monday @ 7pm, Thursday @ 3 and Friday at 7pm
- Team intends to finish individuals codes and begin code meshing this week

Individual Review

Adam Dezay:

Worked with Brandon on getting I2C with energia working. Yet to have full success connecting with our hardware, however prospects look positive on making progress this upcoming week.

Manuel Garcia:

Did not have a chance to do a ton of work on the project this week preparing for finals. Plans in place to dedicate time to the project before the next report.

Brandon Hippe:

Shifted to working on making libraries for CO2 and PM2.5 sensors due to traveling for break. Finished coding them, but don't have hardware to test with. Code is uploaded to github.

Mercedes Newton:

PM2.5 sensor updates - No updates, planning on finishing up sensor code and connection this week.

Gantt Chart and Timeline Updates:

Below is both the general timeline of the project as a whole as well as a breakdown of the specific tasks that are left moving forward. Gantt charts in figures 1 and 2 as well as table 1 are representative of the timeline for this term only. Figure 3 represents an outline of the schedule for spring term. Our team has factored in additional time for potential delays, however the current dates are subject to change. We intend to have our 3 modes built by the end of may, as displayed in our figure 3 gantt chart.

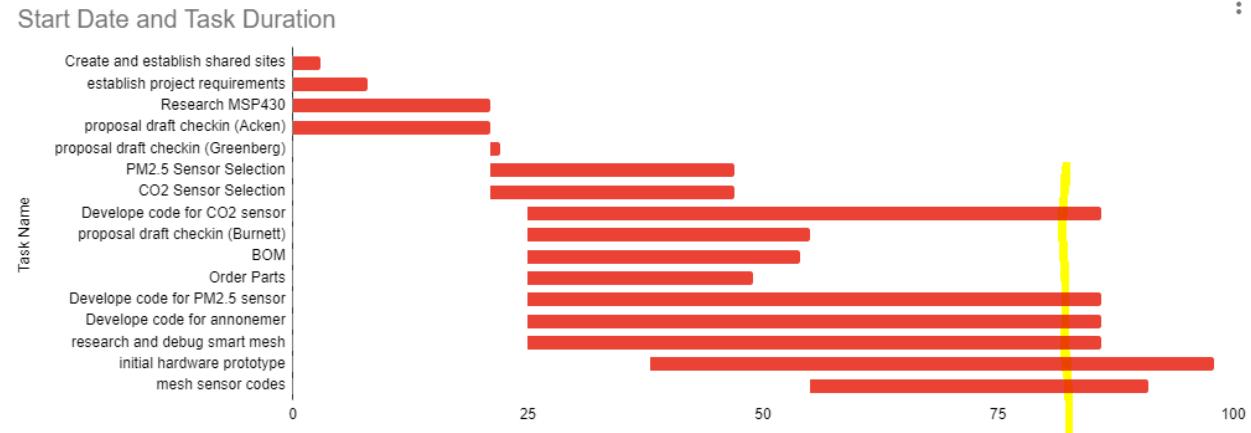


Figure One: Gantt chart with updated deadlines, highlighted line signifies today's date, monday 3/27/23

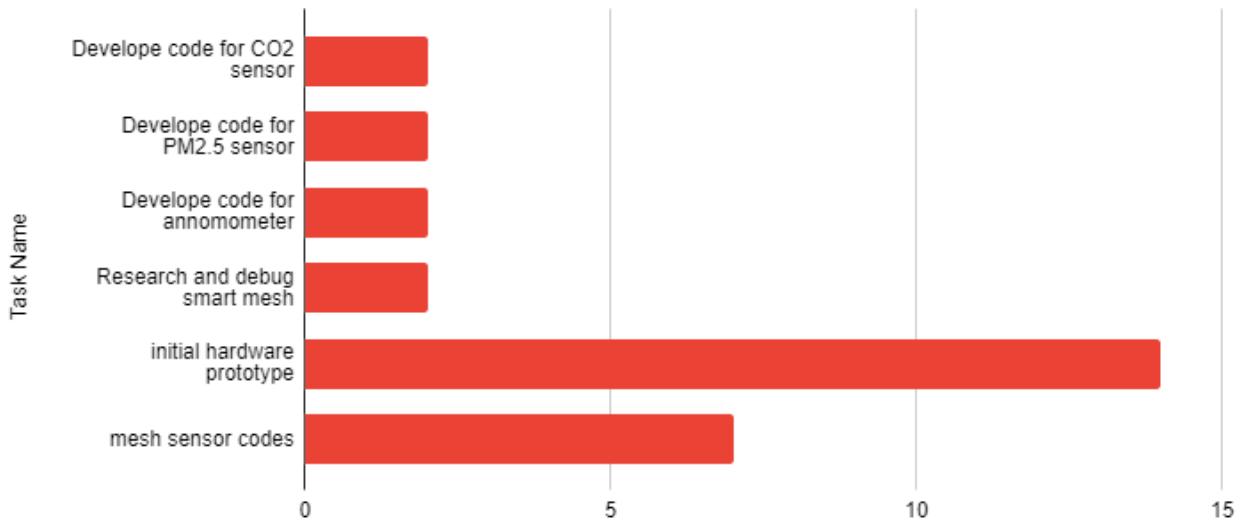


Figure Two: Pending tasks with updated finishing dates in relation to current date 3/27/2023

Task Name	Expected Completion Date
Develop code for CO2 sensor	3/29/23
Develop code for PM2.5 sensor	3/29/23
Develop code for anemometer	3/29/23

Research and debug smart mesh	3/29/23
initial hardware prototype	4/10/23
mesh sensor codes	4/3/23

Table 1: current tasks with updated expected completion dates

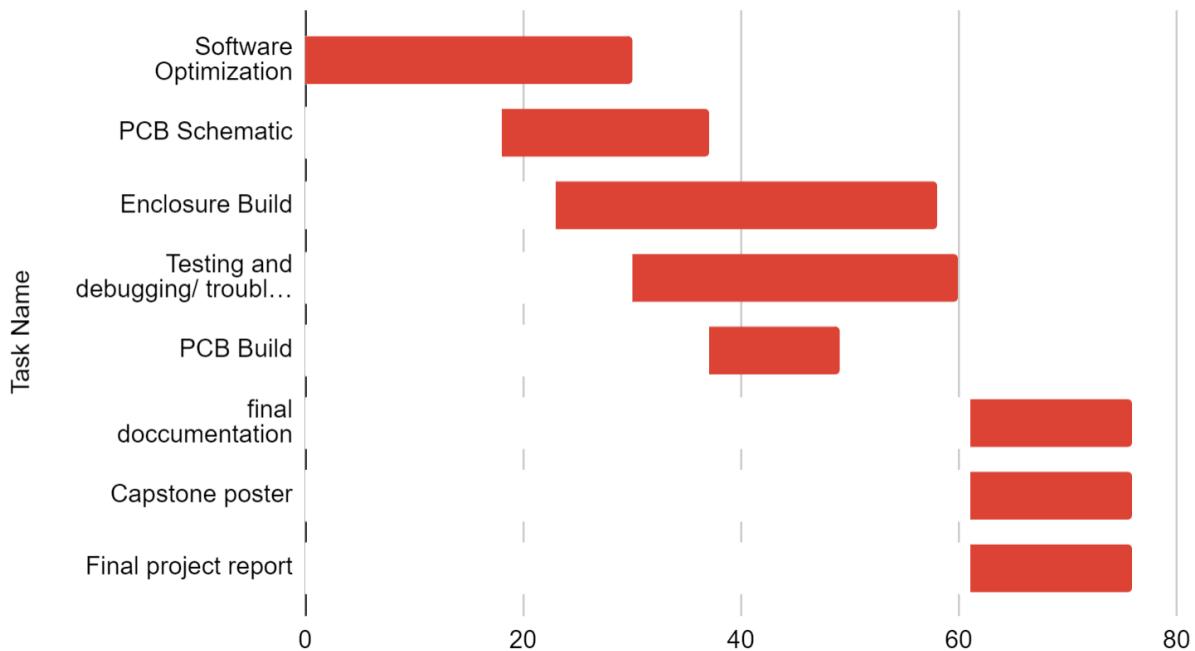


Figure three: Gantt chart for Spring term starting April 1st 2023

Task Name	Start date	End date
Software Optimization	2023-04-01	2023-05-01
PCB Schematic	2023-04-19	2023-05-08
Enclosure Build	2023-04-24	2023-05-29
Testing and debugging/ troubleshooting code	2023-05-01	2023-05-31
PCB Build	2023-05-08	2023-05-20
final documentation	2023-06-01	2023-06-16
Capstone poster	2023-06-01	2023-06-16
Final project report	2023-06-01	2023-06-16

Table two: Tasks for spring term with expected completion dates *completion dates subject to change*

Team 1 Open Source Air Quality Monitoring

Week 13: April 3rd 2022 - April 10th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team members are each working on specified sensor/component tasks.
- Enhanced gantt chart as shown in figures 1 and 2.
- Gantt chart and schedule for upcoming term (shown in figure 3).
- Moved team meetings to better accommodate schedules.
 - New times, effective today, are today Monday @ 7pm, Thursday advisor meeting @ 3pm and friday at 7pm
- Team changed meeting time with Dr. Acken for the upcoming term.
 - Starting April 6 we will be conducting Thursday 3pm meetings.
- Team prepared Thursday progress presentation for Dr Burnett
- Shifting emphasis to meshing codes

Individual Review

Adam Dezay:

Worked with Brandon on getting I2C with energia working. Yet to have full success connecting with our hardware, however prospects look positive on making progress this upcoming week.

Code finally compiles thanks to brandon. Connections to breadboard are too short so soldering might be needed.

Manuel Garcia:

Worked on planning logistics for the upcoming term and project goals. Spent a brief amount of time trying to integrate microcontroller with wireless network.

Brandon Hippe:

Got EnergyTrace working, and found the sleep() function in Energia, which puts the MSP430 into LPM3 mode. Created libraries for the SPS30 and SGP30, although they haven't been tested yet. Started work on the main code for the node.

Mercedes Newton:

PM2.5 sensor updates - Working on connecting PM2.5 sensor to Energia and producing working code. Experiencing difficulty updating sensor libraries from arduino to Energia. Coordinated team planning for upcoming term and updated gantt charts.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

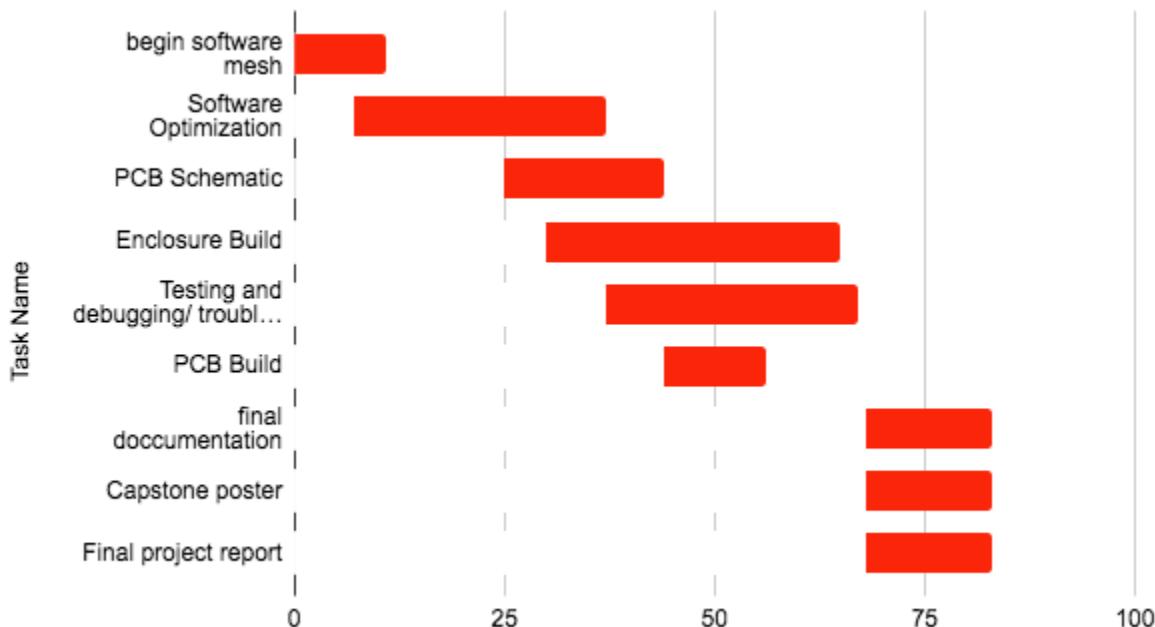


Figure One: Gantt chart for Spring term starting March 25th 2023

Task Name	Start date	End date
Begin software mesh	3/25/2023	4/5/2023
Software Optimization	4/1/2023	5/1/2023
PCB Schematic	4/19/2023	5/8/2023
Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023

Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*

Team 1 Open Source Air Quality Monitoring

Week 14: April 10th 2022 - April 17th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team members are each working on specified sensor/component tasks.
- Team submitted new equipment request
 - Alternative anemometer
 - Jumper cables for PM sensor
- Gantt chart and schedule for current term (shown in figure 1).
- Team decided to meet in person each week on campus at 2pm on Thursdays before advisor meetings
- Team will meet with Dr. Burnett for the next two weeks while Dr. Acken is at conferences.
- Shifting emphasis to meshing codes

Individual Review

Adam Dezay:

Worked Soldering connections to see if I am able to get a proper signal from the sensor. Debugging code once uploaded to the sensor

Helped prepare update 1 presentation.

Manuel Garcia:

Worked on learning more about UART & setting up a ESP8266 web server connected to the MSP430 to show proof of concept. Unable to currently get the smartmesh system working, but think the problem was with my individual module. I will be testing a few more modules this week and attempting to finalize the smartmesh portion of this project preparing for integration.

Brandon Hippe:

Worked to debug issues compiling sensor code. Discovered that we need cables for PM sensors. Worked to find a new anemometer alternative. Still working on ultrasonic anemometer.

Mercedes Newton:

PM2.5 sensor updates - Working on connecting PM2.5 sensor to Energia and producing working code. Libraries are created and code runs on ½ computers. Waiting on jumper cables to connect sensor to energia.

Coordinated team planning for upcoming term and updated gantt charts.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

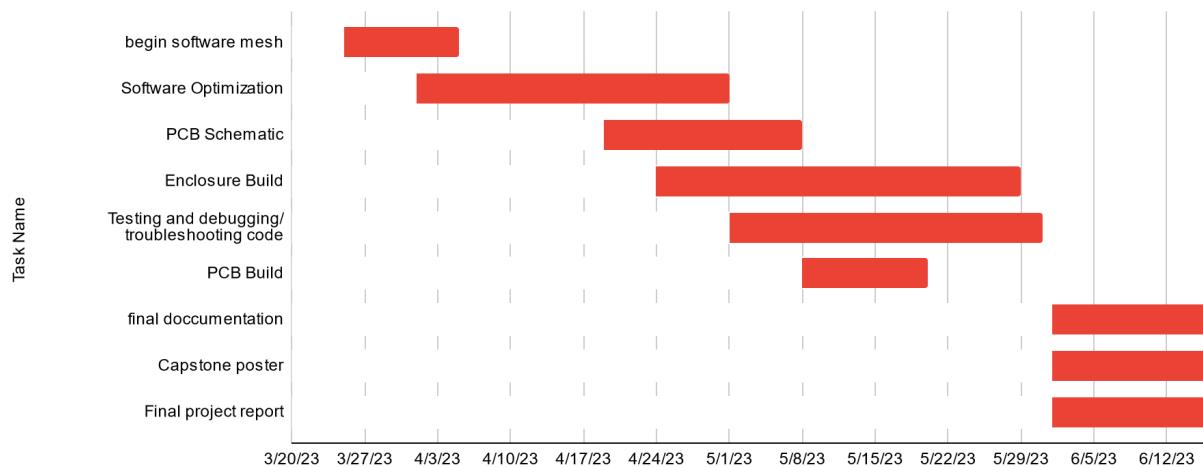


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

Task Name	Start date	End date
Begin software mesh	3/25/2023	4/5/2023
Software Optimization	4/1/2023	5/1/2023
PCB Schematic	4/19/2023	5/8/2023
Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*

Team 1 Open Source Air Quality Monitoring

Week 15: April 17th 2022 - April 24th 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team members are each working on specified sensor/component tasks.
- Team submitted new equipment request
 - New MSP430 boards
- Team received new equipment
 - PM sensor cables
 - Still waiting on anemometer
- Established communication with PM and eCO2 sensors! Data is coming in!
 - PM and eCO2 sensor code is complete and (hopefully entirely) debugged
- Breadboard prototype (minus anemometer and SmartMesh) is ready (shown in figure 2)
- Gantt chart and schedule for current term (shown in figure 1).
- Team decided to meet in person each week on campus at 2pm on Thursdays before advisor meetings
- Team will meet with Dr. Burnett for this week while Dr. Acken is at conferences.

Individual Review

Adam Dezay:

I finally got a signal to the sensors thanks to help from Brandon and Mercedes. We are getting CRC code error but were unable to quickly debug it. Needs more work.

Wiki caught up to week 14 of work. Gave my MSP430 to Brandon since his got fried

Manuel Garcia:

Got UART working on the MSP430. Successfully pulling outside data on the msp430, transmitting that data over UART to an esp32, hosting that data on a local server via the esp32 that is accessible via the web browser. Have not had successful transmissions with the smartmesh yet, but now that we can tell that we are successfully transmitting data we just need to figure out proper smartmesh pin settings and baud rate.

Brandon Hippe:

Fried an MSP430 (lesson learned: don't short 5V and ground together if you don't want a glowing inductor/resistor and magic smoke). Wired up breadboard prototype (shown in figure two) and worked on debugging PM and eCO₂ sensor code. Both are working fully as intended. Wrote a library for anemometer so debugging can begin as soon as it arrives.

Mercedes Newton:

PM2.5 sensor updates - Continued debugging efforts for PM sensor and worked to connect to UART with brandon.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

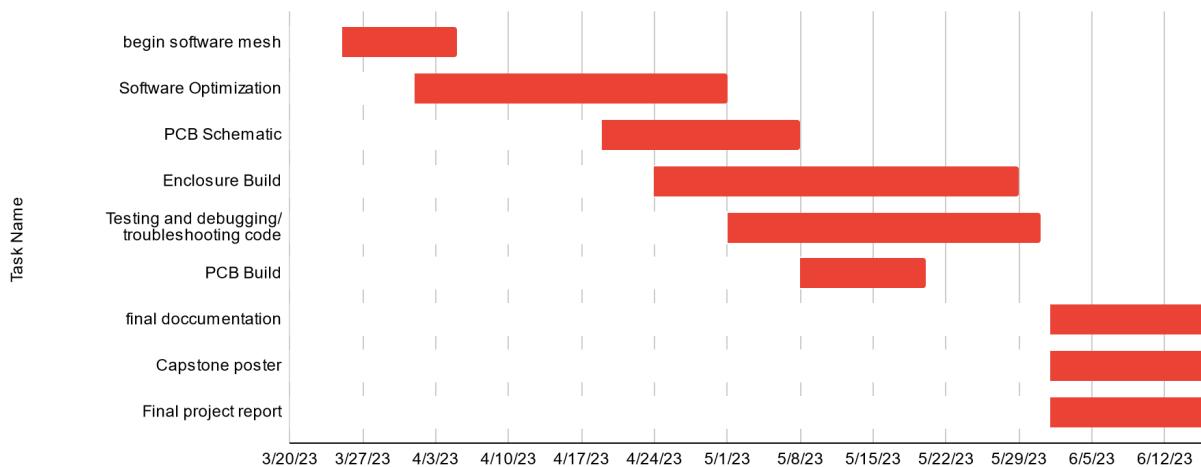


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

Task Name	Start date	End date
Begin software mesh	3/25/2023	4/5/2023
Software Optimization	4/1/2023	5/1/2023
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Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023

final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*

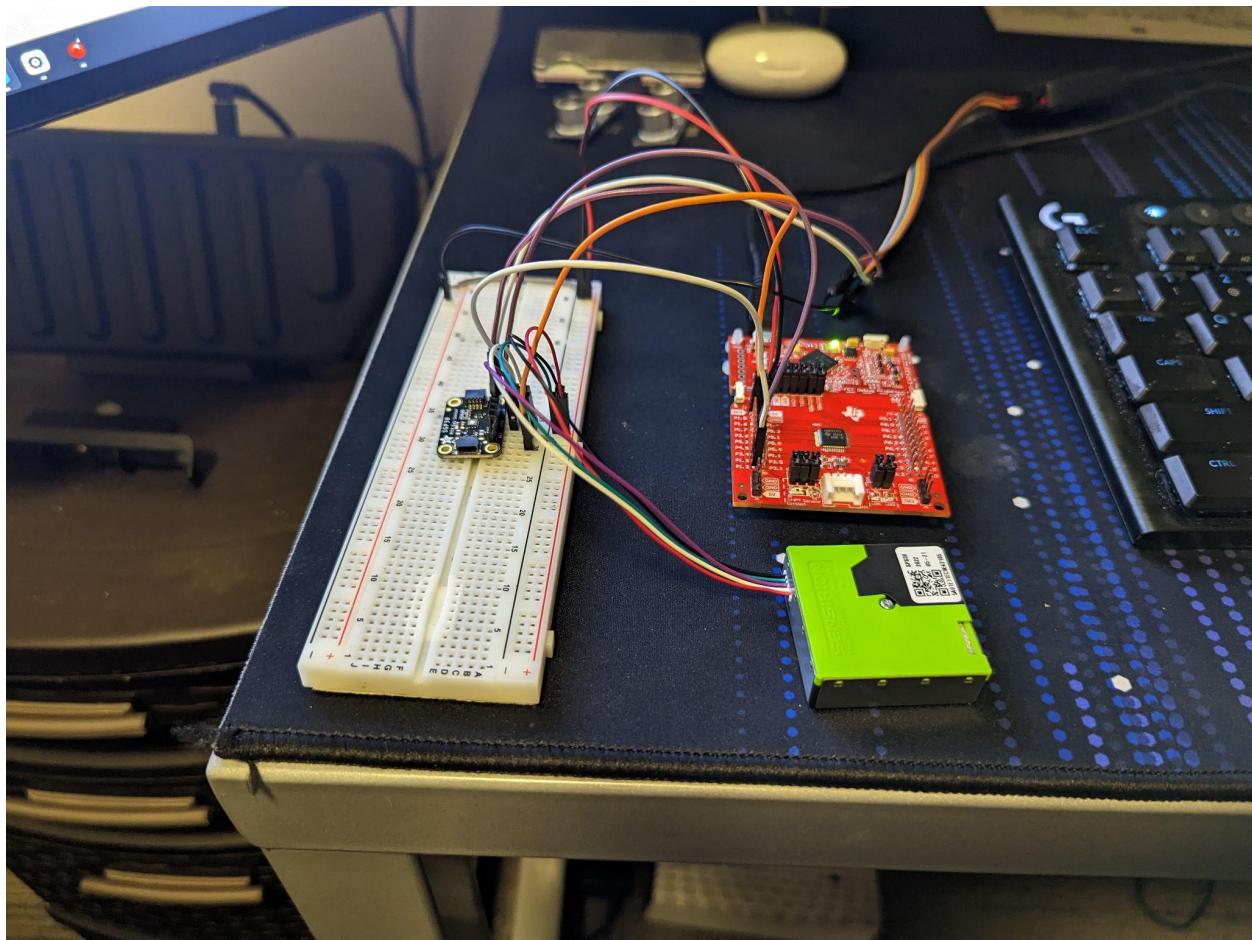


Figure Two: Image of Breadboard prototype

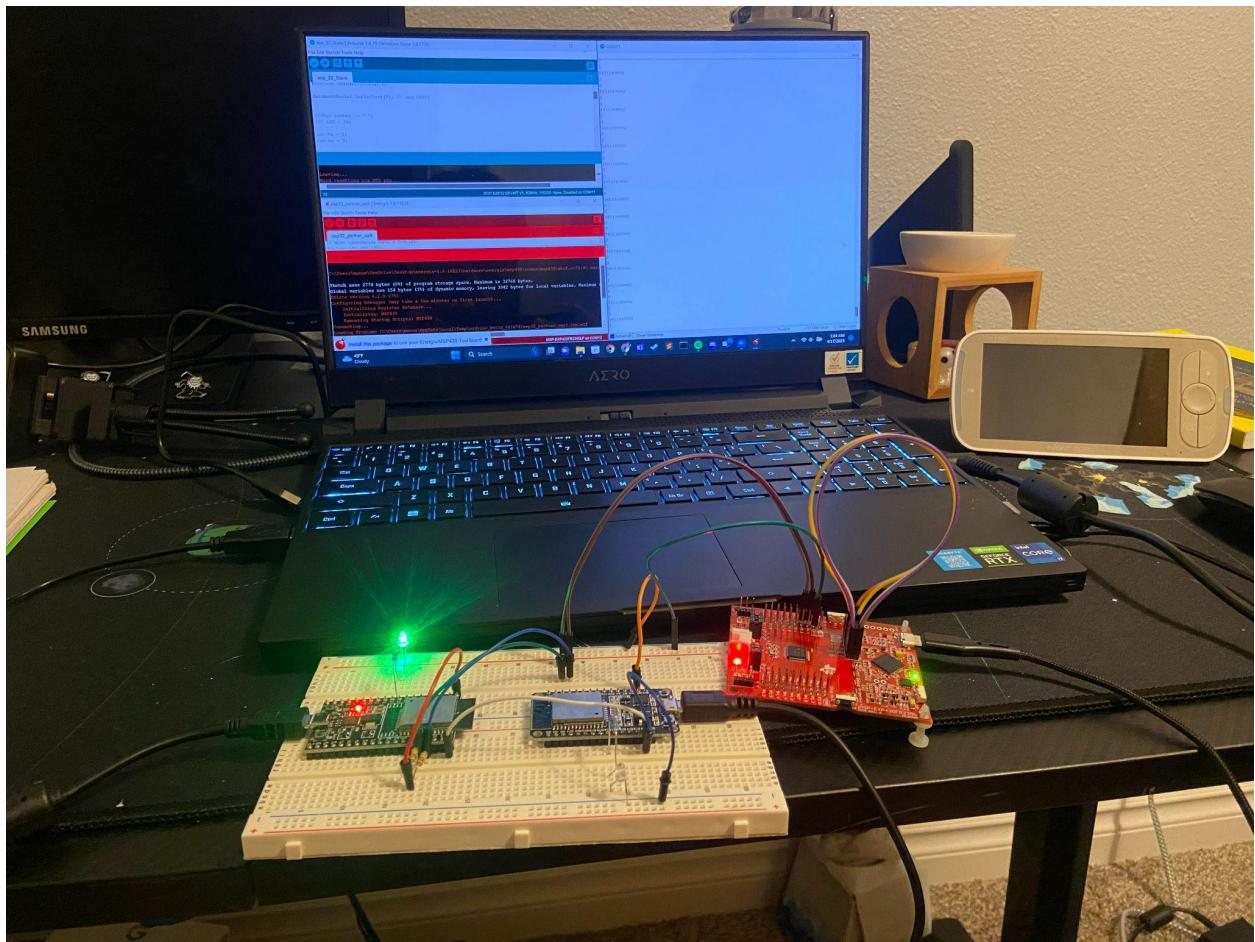


Figure Three: MSP430 transmitting to esp32 webserver

Team 1 Open Source Air Quality Monitoring

Week 16: April 25th 2022 - May 1st 2022

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Met with Dr. Burnett to discuss progress as well as giving a demo of the first working prototype of PM and CO2 sensor.
- Discussed switching gears on the Anemometer
- Splitting teams into 2 when we meet for our weekly workshop time
 - Manuel and Brandon will work on code optimization and getting Smartmesh to work
 - Adam and Mercedes will work on PCB design and enclosure
- Moving away from EnergyTrace due to the voltage/current requirements

Individual Review

Adam Dezay:

Learning how to design PCB and how to use KiCAD. Updated Wiki. Teaming up with Mercedes to make the enclosure. Writing meeting notes for the week as we make decisions on how we are going into the last stretch of the project.

Manuel Garcia:

Troubleshoot briefly Smartmesh with Professor Burnett. Attempted to connect last years capstone project with the host node, however still unable to connect smartmesh node. We are digging into the code for the smartmesh to see what we are missing. Worked on the battery regulating circuit, almost fully complete, however need to find 3.7 to 5v power conversion.

Brandon Hippe:

Started work on power measurements, using Joulescope instead of EnergyTrace due to 5V requirement and current specs. Wrote a python program to calculate measurement periods based on power consumption. Fixed CO2 sensor not sleeping

Mercedes Newton:

PM2.5 sensor updates - Worked on debugging some of the pm2.5 sensor code. Started the process of designing our PCB and physical CAD model. Making key decisions that will affect where things go and mount and should start serious drafting in the coming weeks.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

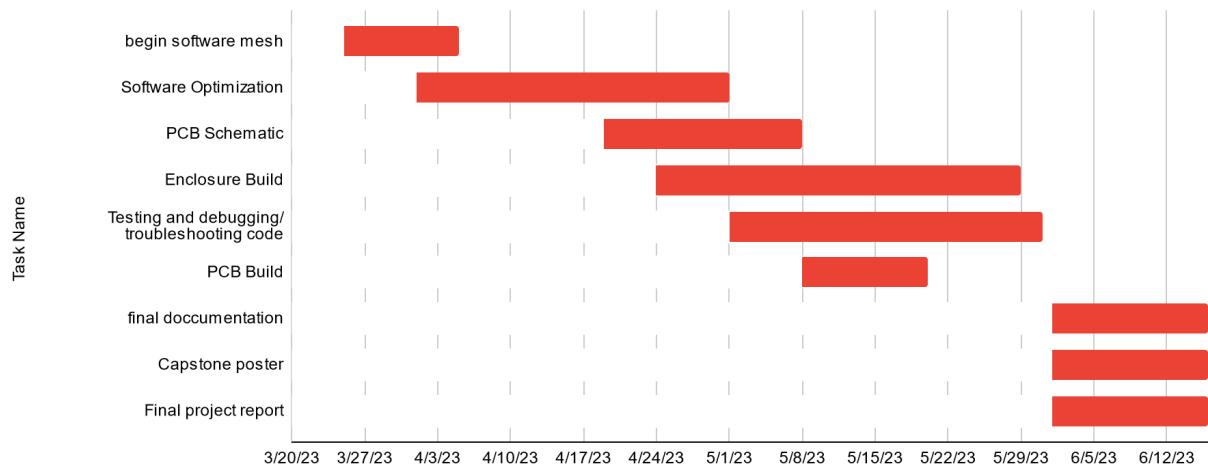


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

Task Name	Start date	End date
Begin software mesh	3/25/2023	4/5/2023
Software Optimization	4/1/2023	5/1/2023
PCB Schematic	4/19/2023	5/8/2023
Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*

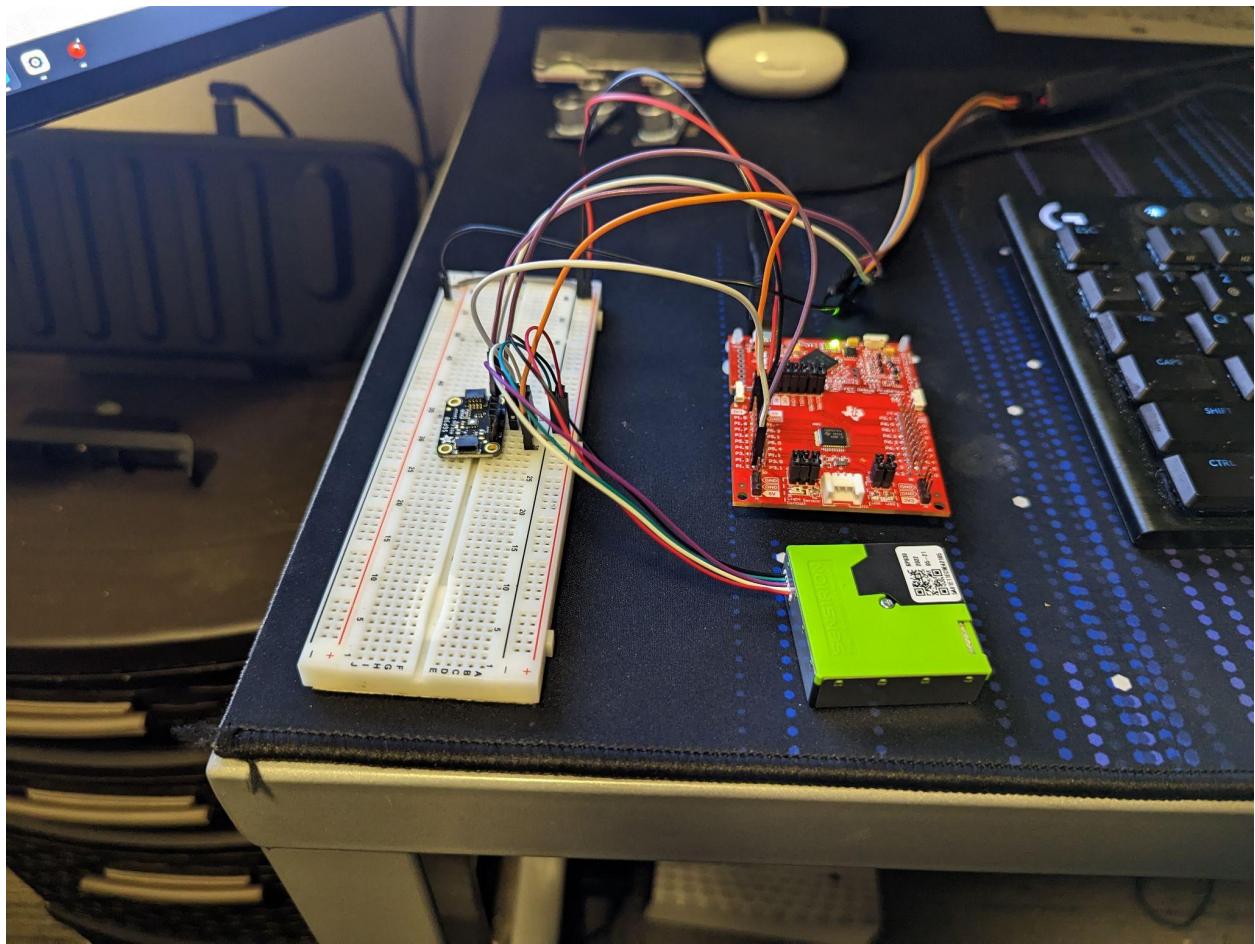


Figure Two: Image of Breadboard prototype

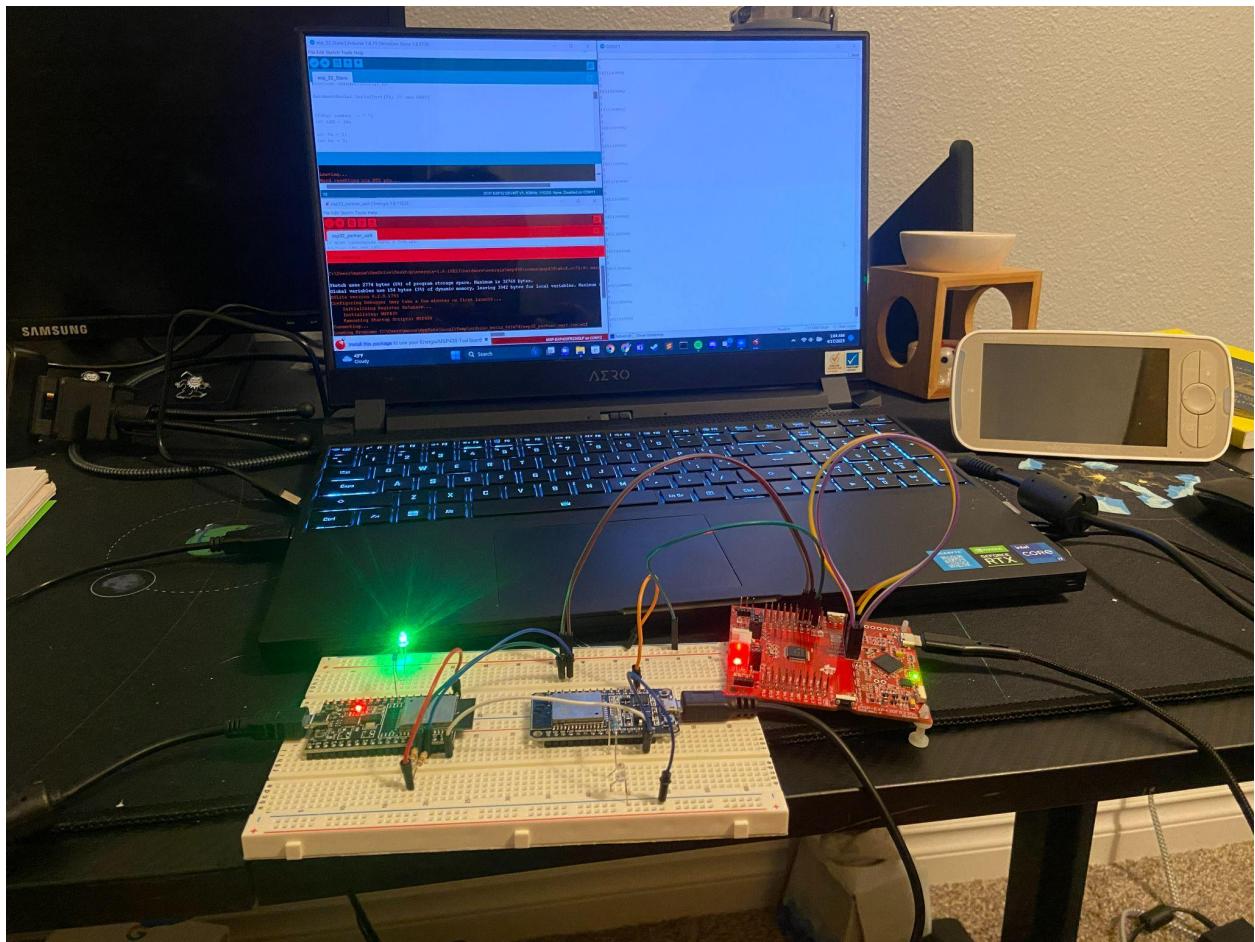


Figure Three: MSP430 transmitting to esp32 webserver



Figure Four: Team working during one of our three weekly meetings

Team 1 Open Source Air Quality Monitoring

Week 17: May 1st 2022 - May 8th

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Met with Dr. Acken in person to update team progress and outline a plan for the upcoming month.
- Finished PCB schematic, now focusing on PCB routing
- Pushed enclosure build date forward to give time for anemometer calibration
- Began enclosure design to be completed this week

Individual Review

Adam Dezay:

Updated wiki and began on making the manual for the machine including instructions for build. Focusing on learning how to design and build PCBs and learning how to use 3D printers in the EPL so I can be better help for Manuel and Mercedes

Manuel Garcia:

Turned over smartmesh progress to Brandon, and switched focus to PCB design and layout. After troubleshooting for a few months we are almost certain that we have the correct hardware configuration for the smartmesh, but still do not have code functioning for communicating the smartmesh with the host node. Going to continue making smartmesh progress while our PCB is printing.

Designed the first round PCB schematic, as a team we decided to make a hat for the msp430. Made key decisions on some components to use such as the battery management circuits, as well as what mosfets to use in order for proper voltage level shifting and putting sensors to sleep. Working on making the correct layout for the msp430 hat, so that it will fit right on top of the pins of our microcontroller. Should be able to send a board out for production within the next couple of days. Planning on using OSH park for the first round prints.

Brandon Hippe:

Switched to working on smartmesh integration with breadboard prototype. Running into a problem where smartmesh boards indicator LEDs don't light up when power is supplied, except when physically pressing on the header pins with my fingers. Manny hasn't had this issue, so I'm waiting to get my hands on one of the boards he's been working with. Indicator LEDs not lighting up likely isn't an issue for the project as

long as the smartmesh boards are actually working, but troubleshooting the connection with the host node isn't easy without them.

Mercedes Newton:

Focused on designing physical CAD models in FreeCAD. Began a 3d printing draft to be completed and put in the printing queue for the EPL by May 6th (designing to be printed by "Hyde" machine in EPL).

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

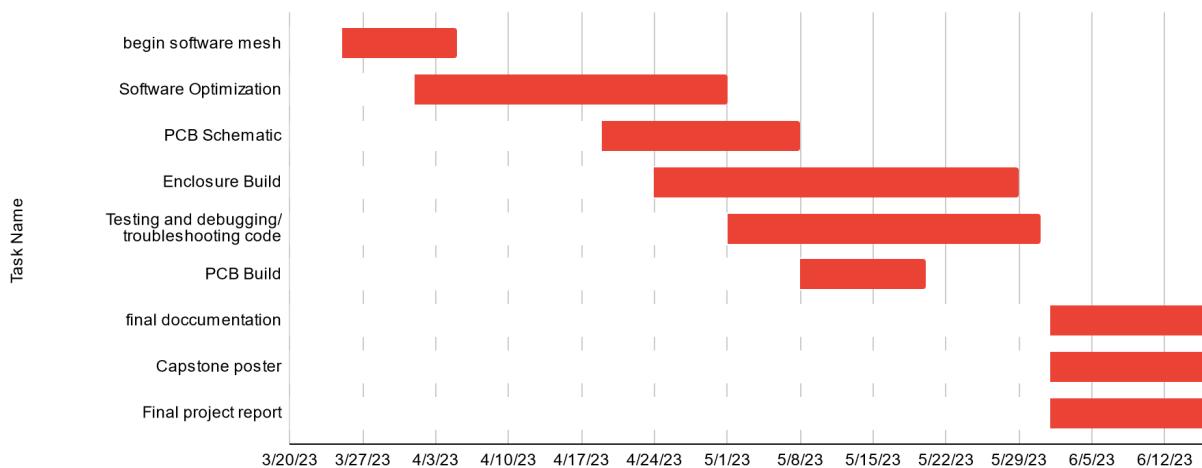
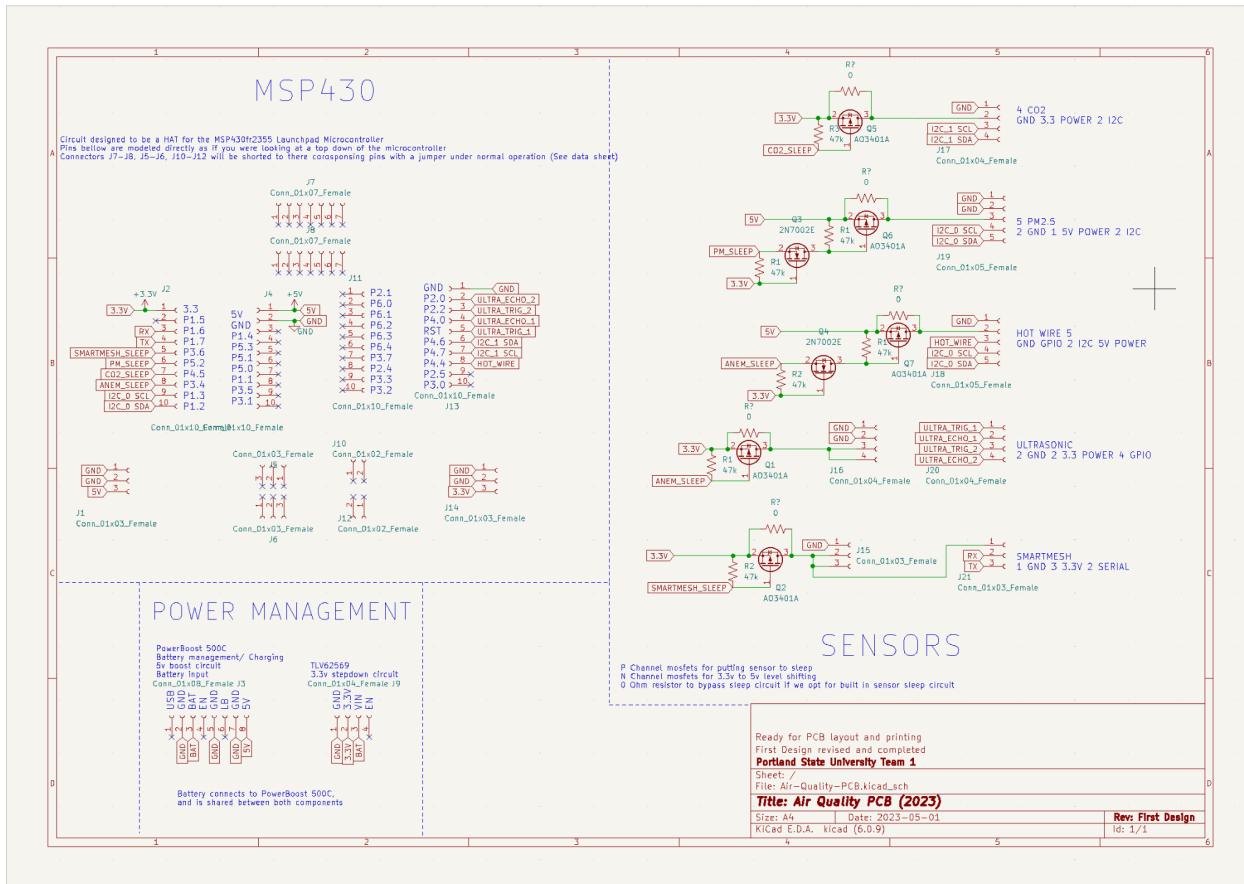


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

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Begin software mesh	3/25/2023	4/5/2023
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PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
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Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*



Completed PCB Schematic (Revision 1) ~ PCB layout in progress

Team 1 Open Source Air Quality Monitoring

Week 18: May 8th 2022 - May 15th

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Met with Dr. Acken and Dr Burnett in person to update team progress and outline PCB, enclosure, and mounting plans
- Finished PCB version 1, waiting on arrival
- Enclosure 3D Models being finalized, getting ready to print in EPL
- Figured out SmartMesh IP functionality, ran 3hr test during WEST Lab Group Meeting obtaining CO2 and PM data

Individual Review

Adam Dezay:

Updated wiki to include last week's report as well as the home page for the Wiki. Received the enclosure files from mercedes and am looking to get started on printing it and making adjustments as we see fit to match any of our components using FreeCAD. Also got more of the manual/instructions complete to include any trouble we encountered.

Manuel Garcia:

Made several small changes to the original PCB schematic. Sourced and ordered components for PCB. Found footprints and designed KiCad model. Ordered PCB with express shipping. PCB should be in within the next week (Hopefully before friday). Finalized battery/ power management design and ordered those parts as well.

Brandon Hippe:

Figured out SmartMesh issues, fixed up main code and ran first tests. Starting to work on modifying last year's python scripts to fit our use case.

Mercedes Newton:

Drafted several concept designs for final project enclosure. Got the go ahead on one model with several different configurations depending on included sensors. Designed in FreeCAD, the first edition of our

enclosure to be made on the “HYDE” 3d printer in the EPL. Turned over to Manuel & Adam to get 3D printed this week. Adjusting and editing 3d models as changes are suggested and discrepancies found.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

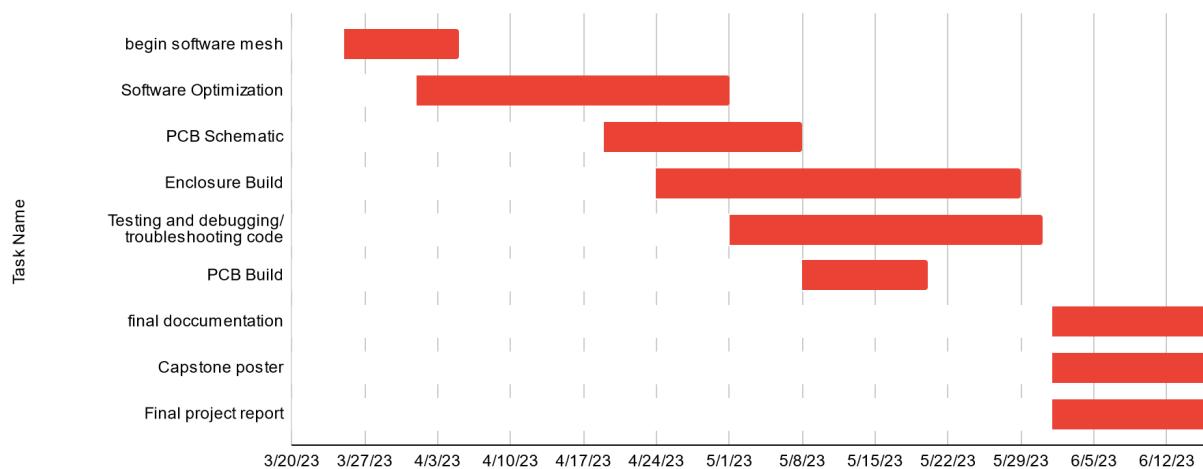


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

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Begin software mesh	3/25/2023	4/5/2023
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PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*

Team 1 Open Source Air Quality Monitoring

Week 19: May 15th - May 22

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team 3d printed the enclosure in the epl and decided to utilize laser cutting as opposed to 3d printing in interest of selecting a more price efficient option
- Discussed starting on documentation soon as opposed to waiting until June 1st
- Discussed increasing number of batteries, based on initial power consumption testing, 1 will not be enough for 1 year battery life. Enclosure will have space for 4 18650 cells, so ultimately it's a matter of cost vs measurement rate. Measurement periods calculated using current power measurements are shown in table two.
- Discussed PCB revisions. New PCB order will be sent out this week, if necessary.

Individual Review

Adam Dezay:

Started on the final report rough draft as well as finishing up the BOM and manual. Updated Wiki

Manuel Garcia:

Built 2 different PCB configuration, one with high side mosfet and the other with low side mosfets. Having issues with power draw still in both configs, attempting to troubleshoot solution.

Brandon Hippe:

Started on power consumption testing. Figured out high idle current issue, for some reason setting one of the GPIOs to high on the MSP430 consumes ~10mA of current, even though the pin isn't connected to anything. Tried connecting a load (used 1.8 kΩ resistor) to see if that would bring the current back to expected levels, but that just added to the current used for setting the pin high. Upon further testing, it turns out setting pin 8 high draws ~10.2 mA of current and setting pin 32 high draws ~29.7 mA of current, but all other pins do not have any noticeable current draw, so those will be used instead. Also worked on laser cutting model, and did first test cuts.

Mercedes Newton:

Reviewed the first 3d printed model and discussed steps moving forward. Switching focus from enclosure to assembly and documentation.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

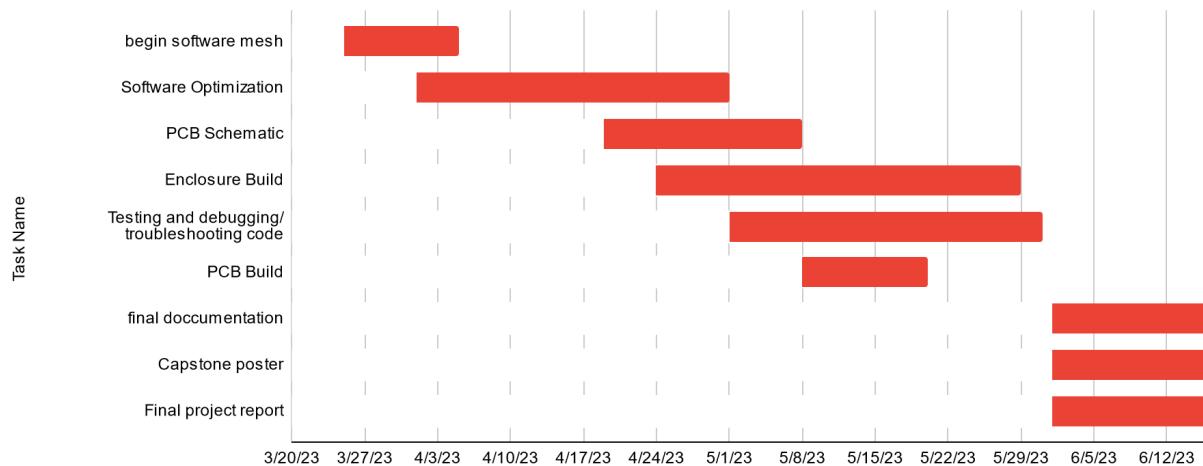


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

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final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Table One: Tasks for spring term with expected completion dates *completion dates subject to change*

	4 Cells, sensor	4 Cells, full	3 Cells, sensor	3 Cells, full	2 Cells, full
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	sleep modes	sensor shutoff	sleep modes	sensor shutoff	sensor shutoff
PM2.5	90 min	87 min	160 min	140 min	325 min
CO2	33 min	26 min	74 min	40 min	95 min
Anemometer	No Data Yet	No Data Yet	No Data Yet	No Data Yet	No Data Yet
Battery life (W/O Anemometer)	366.37 days	365.68 days	367.61 days	365.33 days	365.19 days

Table Two: Sensor measurement periods and battery life estimates for 2-4 cells. Full sensor shutoff numbers are just estimates; haven't tested power consumption with shutoff transistors yet.

Team 1 Open Source Air Quality Monitoring

Week 20: May 22 - May 29

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team began working on a rough draft of the final report as well as an academic report per Dr. Burnett's suggestion
- Team is writing a website to show our work then adding a QR code to our final poster that links to that. We hope to get it hosted by the university.
- Building the last 2 enclosures and soldering the last nodes
- Working on having 2 working final nodes to present on Thursday to Dr. Burnett

Individual Review

Adam Dezay:

Almost finished with the first draft of a website. Still need to figure out how to get it hosted on the university's website. Finishing up the draft of the final report. Updating Github.

Manuel Garcia:

Built 2 more PCBs, finished modifications of PCBs and made changes to existing ones. Order and built batter supply modules, and tested them with our ful built circuit. Prepared test setup for week 20 demo

Brandon Hippe:

Continued to work on ironing out hardware issues, graphing script, and power testing. Planning to work on demo builds this week and cleaning up GitHub.

Mercedes Newton:

Began documentation process and transferred team documentation to final report in LaTex. Soldered and modified PCB boards.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

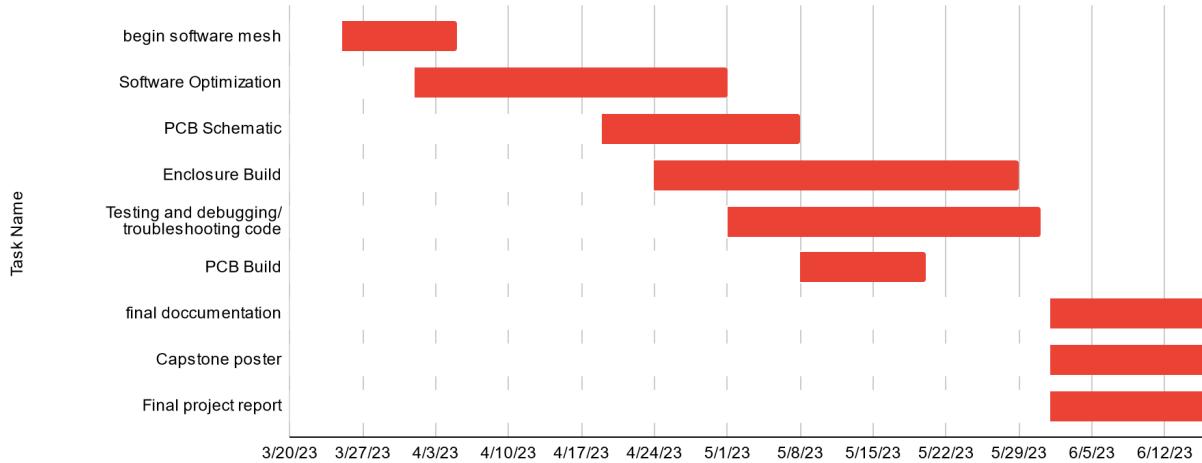


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

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Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Team 1 Open Source Air Quality Monitoring

Week 21: May 29 - June 5

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team continued working on a rough draft of the final report as well as an academic report per Dr. Burnett's suggestion
- Demonstrated 2 working nodes, received feedback on small additions to add
- Preparing to add low battery notice, update graphing script, and build 2 more nodes.
- Began working on the final poster

Individual Review

Adam Dezay:

Almost done with the final report draft (90%done), almost done with the website (75%), started on the final poster. Finishing up Wiki + github for clarity and to include latest information (95%), started on the academic report for Dr. Burnett(10%).

Manuel Garcia:

Troubleshoot and repaired two PCBs, designed and started modifying the PCBs to have additional functionality (improve the charging circuitry and make the design more robust). Designed an integration for the low battery indicator to output to the msp430.

Brandon Hippe:

Worked to build 2 demo nodes, finalizing code and planning on working to build 2 more units to deploy. Finished power consumption testing and calculated sensor periods for all configurations for 3 month, 6 month, and 1 year battery life. Measurement periods were calculated so that each of the sensors in the configuration used approximately equal power on average. These results are available in tables 1, 2, and 3 below. Also calculated approximate log file size per node for each configuration and battery lifetime, shown in table 4.

Mercedes Newton:

Continued documentation efforts with Adam in regards to converting report to latex.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

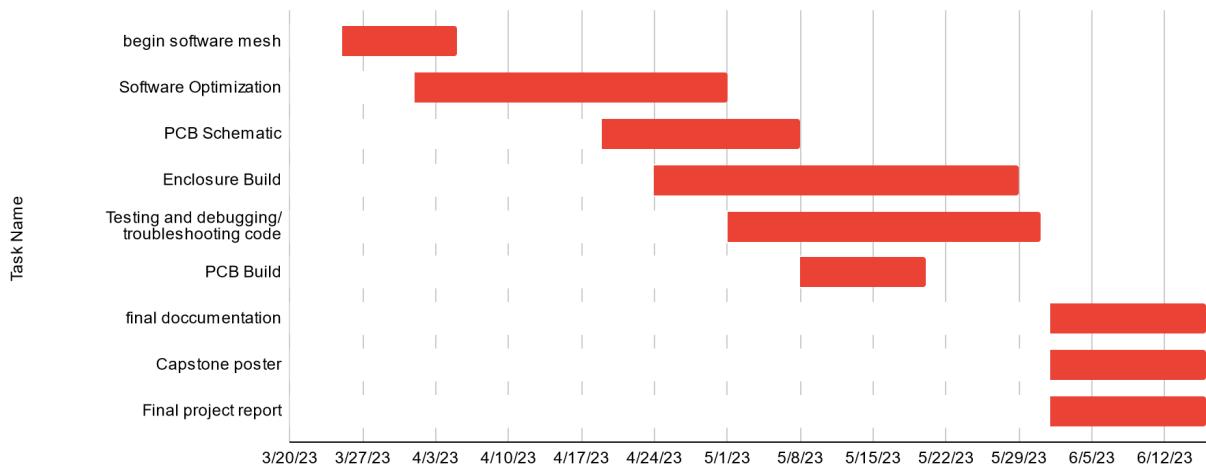


Figure One: Gantt chart for spring term (first task starts 3/25/2013)

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Begin software mesh	3/25/2023	4/5/2023
Software Optimization	4/1/2023	5/1/2023
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Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

Sensor	3 Months Battery Life	6 Months Battery Life	1 Year Battery Life
CO2	8 min (480 sec)	17 min (1020 sec)	37 min (2220 sec)
PM2.5	15 min (900 sec)	32 min (1920 sec)	72 min (4320 sec)

Table One: Component Measurement Periods for 3 month, 6 month, and 1 year battery life for units without anemometer

Sensor	3 Months Battery Life	6 Months Battery Life	1 Year Battery Life
CO2	11 min (660 sec)	22 min (1320 sec)	51 min (3060 sec)
PM2.5	20 min (1200 sec)	43 min (2580 sec)	105 min (6300 sec)
Ultrasonic Anemometer	0.167 min (10 sec)	0.333 min (20 sec)	0.667 min (40 sec)

Table Two: Component Measurement Periods for 3 month, 6 month, and 1 year battery life for units with ultrasonic anemometer

Sensor	3 Months Battery Life	6 Months Battery Life	1 Year Battery Life
CO2	37 min (2220 sec)	83 min (4980 sec)	220 min (13200 sec)
PM2.5	43 min (2580 sec)	97 min (5820 sec)	260 min (15600 sec)
Hotwire Anemometer	15 min (900 sec)	33 min (1980 sec)	86 min (5160 sec)

Table Three: Component Measurement Periods for 3 month, 6 month, and 1 year battery life for units with hotwire anemometer

Configuration	3 Months Battery Life (Log file size after 3 months)	6 Months Battery Life (Log file size after 6 months)	1 Year Battery Life (Log file size after 1 year)
Without Anemometer	~820 KB	~810 KB	~700 KB
Ultrasonic Anemometer	~16.15 MB	~16.14 MB	~16.27 MB
Hotwire Anemometer	~370 KB	~334 KB	~258 KB

Table Four: Log file sizes after draining batteries for each configuration set to 3 month, 6 month, and 1 year battery life

Team 1 Open Source Air Quality Monitoring

Week 22: June 5 - June 12

Sponsor: Dr. David Burnett

Advisor: Dr. John Acken

Team Members: Adam Dezay, Manuel Garcia, Brandon Hippe, Mercedes Newton

Team Review:

- Team finished rough drafts of final report and poster
- Team built the 4th unit and conducted a successful test of all 4 units running over the weekend.
- Team finished graphing script, shown in figure two.
- Team ordered batteries to fill the sensor units with
- Questions:
 - How do we give over code and design files and documentation?
 - Where in the Lab should the sensors be put up?
 - What computer should Host Node and graphing script be run on?
 - How to host our website

Individual Review

Adam Dezay:

Completed report, website, poster, and github. Helped Mercedes with Latex report

Manuel Garcia:

Helped finish the assembly of the last nodes. Worked on cleaning up documentation for the end of our capstone project. Reviewed poster, and worked on writing the final report.

Brandon Hippe:

Worked to build the 4th sensor node, and ran test of all 4 nodes over the weekend. Two of the nodes stopped running, one due to a wire coming unplugged, and the other just needed to be reset. Worked to finish the graphing script. Got the ultrasonic airflow sensor detecting airflow from a fan, but found that it is unlikely it will be able to respond to the very low airflow from the vent(s) in the lab.

Mercedes Newton:

Completed LaTex conversion of final report. Reviewed poster. Submitted report to Andrew Greenberg.

Gantt Chart and Timeline Updates:

Below is both the timeline of the projected project progress for spring term. Figure 1 represents the gantt chart for the term with expected completion dates beginning March 25th. All specific dates for the upcoming term are specified in the table below.

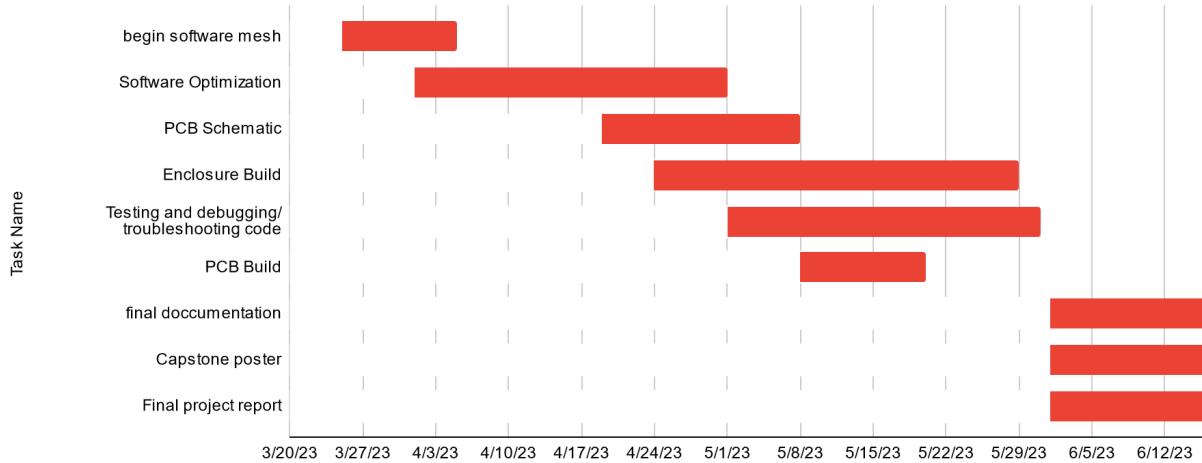


Figure One: Gantt chart for spring term (first task starts 3/25/2023)

Task Name	Start date	End date
Begin software mesh	3/25/2023	4/5/2023
Software Optimization	4/1/2023	5/1/2023
PCB Schematic	4/19/2023	5/8/2023
Enclosure Build	4/24/2023	5/29/2023
Testing and debugging/ troubleshooting code	5/1/2023	5/31/2023
PCB Build	5/8/2023	5/20/2023
final documentation	6/1/2023	6/16/2023
Capstone poster	6/1/2023	6/16/2023
Final project report	6/1/2023	6/16/2023

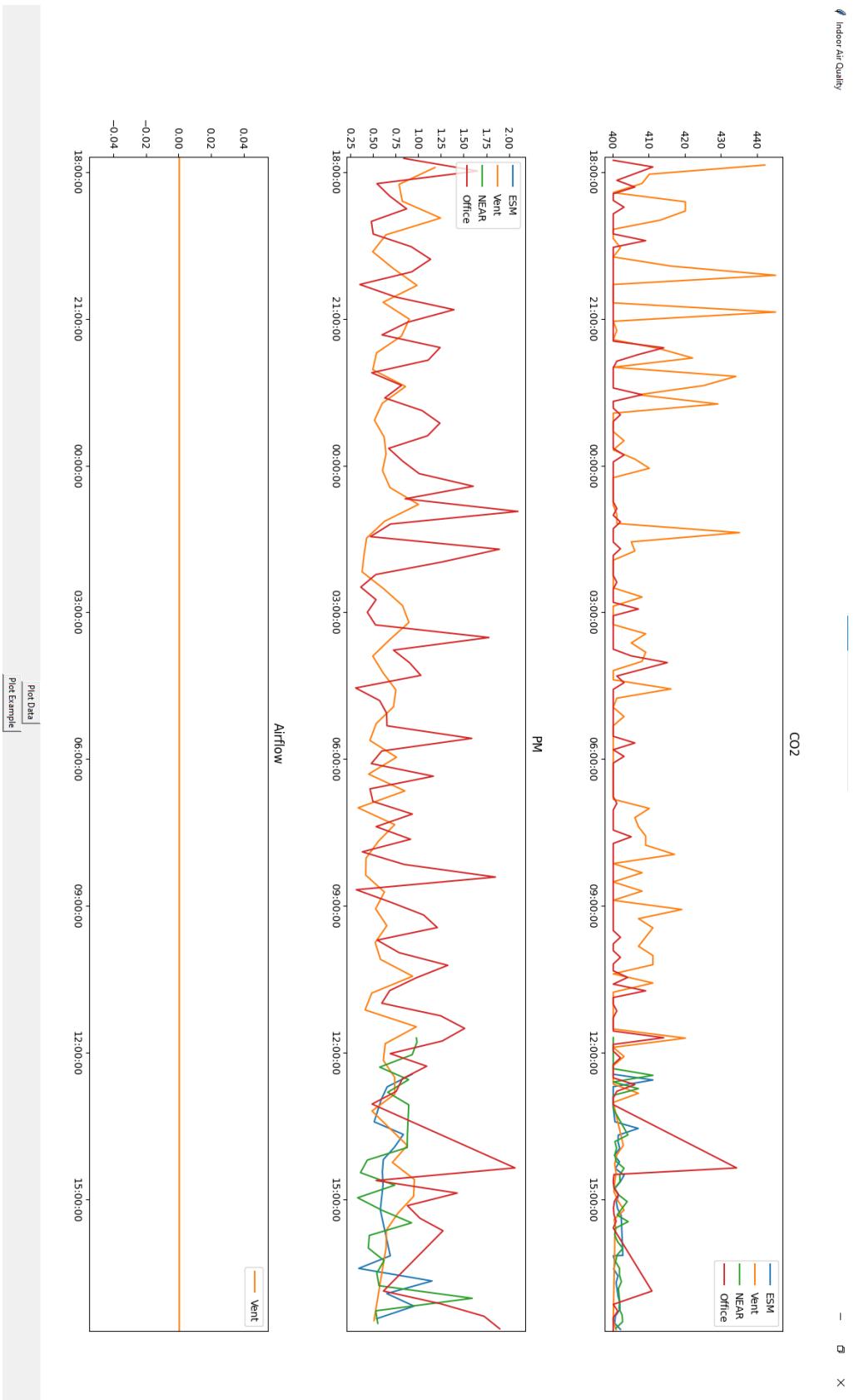


Figure Two: Graphing python script displaying data collected from 4 sensor nodes