EE/CprE/SE 492 STATUS REPORT **5**
03/14/2025 - 04/03/2025
Group number: sdmay25-15
Project title: Millimeter-wave 3D Scanner
Client &/Advisor: Mohammad Tayeb Al Qaseer
Team Members/Role:
Nathan Reff
Luke Post
James Peterson
Daniel Ripley-Betts

Period Overview

The past 3 weeks have been a bit of a roller coaster for the MAVinator team. Right after the last report on that Friday we figured out how to connect to the sensor successfully and process its data for display, which felt like a massive accomplishment at the time. Later that day Aaron, who designed the sensor, mentioned that he might need to take the sensor that we made over the weekend in order to work on his graduate project. Though that would have little impact on us, it hinted at the coming storm. Upon returning to the center for non-destructive evaluation on Monday of spring break there was an attempt to run the working code off of the BTT Pi and Aaron had yet to take back the sensor. It was then that we learned that the digital acquisition device that we had been using would not work on the BTT Pi. Since then we mourned the DAQ and have worked to implement a new amount, digital acquisition device, and the new sensor while continuing work on pre-existing design requirements.

- **Key Accomplishments:**
    - Nate: I continued with working on the front end and implementing the next functionalities. I updated the color scheme and aesthetic look of the user interface. I worked on implementing the positional sliders to track the location of the scanner when moving to a location or doing any type of movement.
    - Luke: I worked on the SAR page of the frontend and SAR calculations on the backend this week. Several files had to be converted into python from matlab to do these calculations. I also added a way to import a file to have the SAR done on and made a rudimentary plotting method.
    - Daniel: I was able to establish a connection with and configure the alternate radar that we have to integrate to replace the previous one. I did this by creating a class that inherits from the TRA_120 class we used to interface with the previous radar(sensor), overwriting some of the methods in there, and initializing with the new DAQ. I was able to write a python script that configures the new Diligent Analog Discovery 2(AD2)

oscilloscope which we use as a DAQ, to take 201 samples within 0.01ms storing them inside its internal buffer, then read those back out into numpy arrays. I was able to design and 3D print a new mount in ABS to work for our scanner (Voron motion system) toolhead.

- James: Developed software for saving .scan files. Added input as textbox for the filename the user would like and store that (with a default value if left blank) in the code. I also developed software for an emergency stop button to stop all operations and require a restart of the system to resume operation. This was added to the message status widget.
- Collectively:
  - Very few deliverables remain to be fulfilled

- **Challenges/Issues:**
  - Nate: very little but the last week I was busy with exams and projects post-spring break and wasn't able to make it into the lab to work on the project as much compared to other weeks
  - Luke: Plotting the SAR data is proving to be a bit of a challenge, and also hopefully figuring out a way to make an interactable 3D plot of the SAR layers.
  - Daniel: I was incredibly stressed out when we were told that we needed to replace our radar, and this compounded when I found out that the original DAQ we had been working with all semester would not work on Linux. These maybe could have been mitigated through a modular (plugin) based design from the get go, and if we had double checked that NI DAQ's supported debian linux (what our BTT pi needs).
  - James: Needing to decipher given matlab scripts to understand what data needs to be saved and in what format to save it in.

Individual Contributions

Name	Individual Contributions	Hours this period	Hours cumulative
Nate	Improved UI and frontend, implemented motion sliders to track the movement of the scanner head.	8	88
Luke	Made the front end for the SAR page, converted matlab files to python, started figuring out how to do the sar calculation	12	85
Daniel	Designed and 3D printed new mount, created python script for new DAQ, created new class for SD radar.	35.5	117.5
James	Developed software for both saving .scan files and for an emergency stop button to halt all operations requiring a restart.	12	85

Plan for next Period

- Nate: Positional sliders
- Luke: SAR code integration, with Download/Save scan button
- James: saving received data to an array on backend and saving to a temp .scan file, add a download button for users to download complete scan.
- Daniel: DAQ reading from sensor - I need to take the script I've written and modify it to read two channels with a higher sampling rate and then decimate them most likely. I also need to modify the script so that the AD2 DAQ outputs a digital rising edge signal to trigger the sensor. In order to make sure the measurement timing lines up, and add a physical connection between Digital IO, radar, and a pin on the DAQ configured to trigger measurement.

consolidating the z offset and height, add labels to the scan dimensions and fix start scan button cosmetically

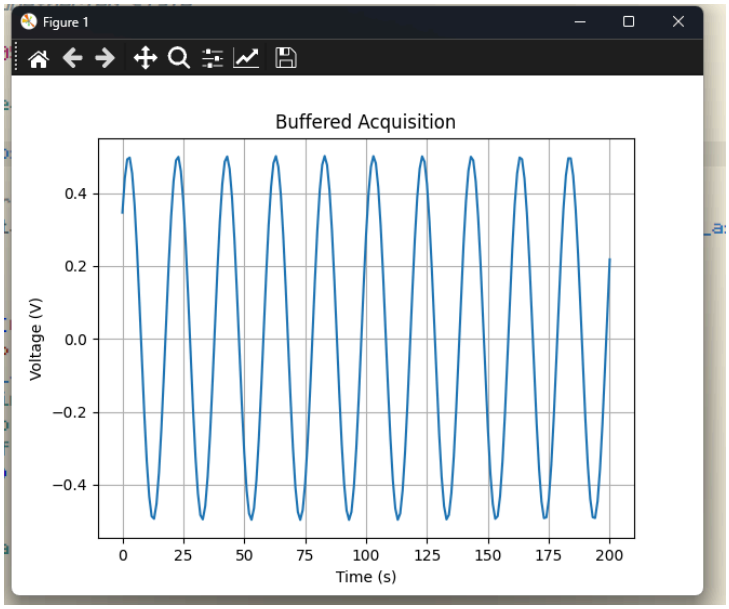
Advisor Meeting Summary

- **Key Discussions:**
    - Next week is the deadline before we need to start switching gears to testing, documentation, and presentation.
    - Dr. Tayeb met with our team and provided us with a new DAQ.
    - Our advisor really dove into how the new DAQ should work and to think of it as an oscilloscope.
    - Dr. Tayeb also extrapolated on his earlier critiques of our design and would like us to work towards a “physical” design that looks like the lab equipment buttons and layout.
- **Action Items:**
    - Get the new radar + DAQ working.
    - Add save functionality
    - SAR integration

Pictures, Videos, and Mock-ups

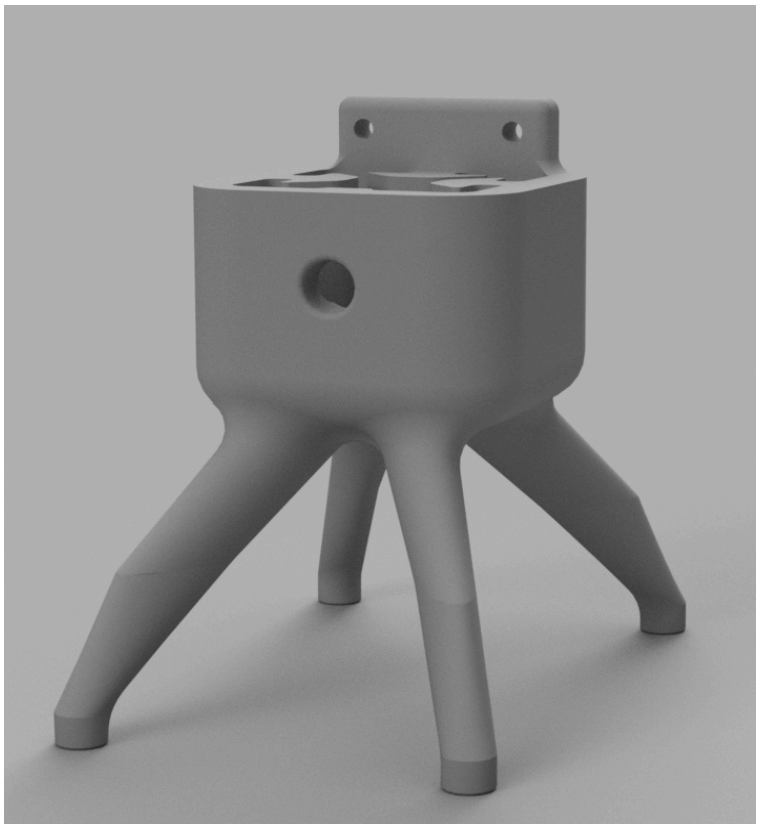
UI so far:

Output from a 201 point measure of a 1Vpp sine wave in 10ms measured in Python using AD2:



Old sensor and NI DAQ working as we performed an actual scan from the laptop: https://photos.app.goo.gl/BSWGyGZNwCyCzxXS6

New mount:



How we had it wired: