03/29/2022

Jacob Feltman, Brayden Bekker

Goals:

1) Complete the setup of the LiDaR system
2) Complete the setup of the optics table
3) Complete the initial data set with a paper background at varying distances to measure change in error.
4) Gather a set of similar measurements for the glass at different distances.

Safety:
See previous lab notebooks for this project.

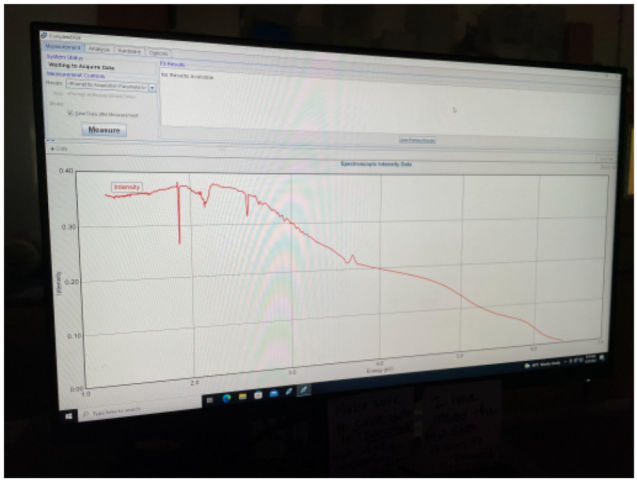
Timeline:
We are several days behind however, if we are able to complete the measurements listed in goals today we should be at a good point.

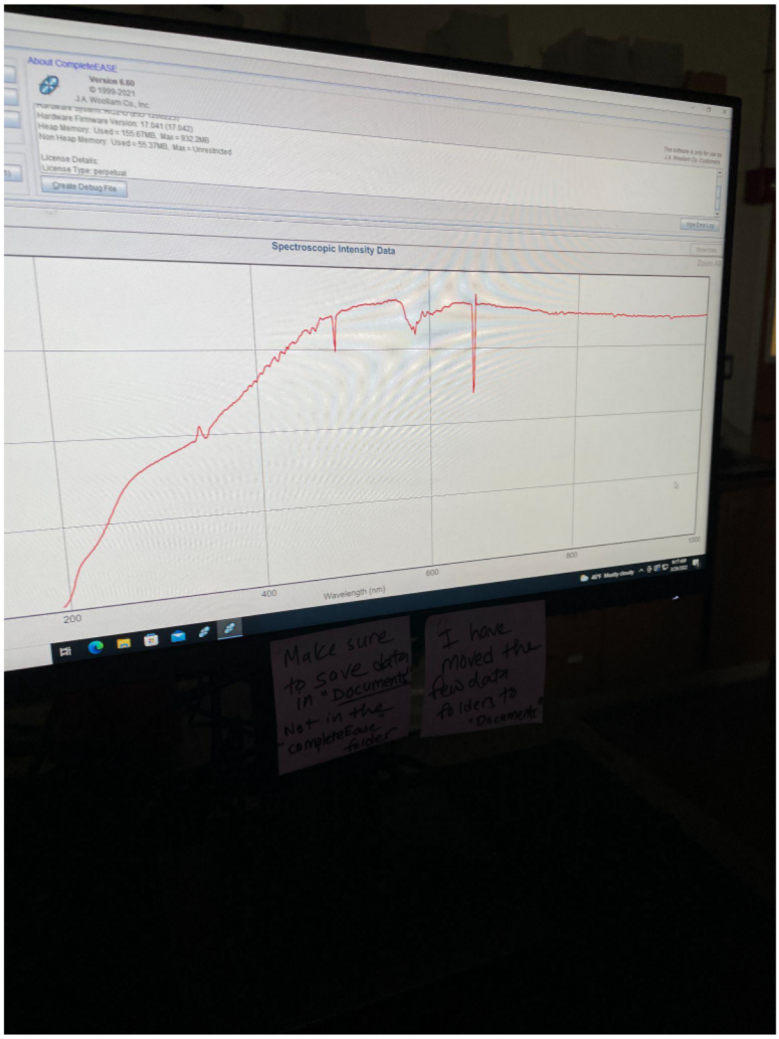
Notes:
We worked outside of the lab period yesterday. We determined during that time that the Arduino Uno was bricked and we found a teensy to use instead. We also got back the 3d-printed parts and learned that the housing for the LiDaR sensor was designed for a previous iteration of the board which had the sensor at an end of the board instead of the middle. We will need to tape some parts of the 3d printed enclosure together to make it work and it will not be able to spin.

Brayden is working primarily on the lab notebook today. Jacob is going to work primarily on the software setup for the teensy and data gathering.

We finished the setup of the software for the teensy and finished the python code to gather N data points from the LiDaR board and save the results to a CSV.

We gathered the transmission spectrum data for the beam sampler we will be using over at the Chemistry building with an ellipsometer. We found that the transmission is remarkably flat over the IR spectrum around 940nm with about 35% transmission.





We had to rewire the VL53l0x and the teensy with longer colored wires.
Red: xshut and vin
Green: sda
White: scl

Black: ground

We will gather a stream of data for the white paper at 5 different distances between sensor and paper: 1200mm, 900mm, 600mm, 300mm

This is our beam sampler we are using for the window:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=913
It appears that the material of the beam sampler is UV fused silica. Thorlabs has a graph of index of refraction that will help us :
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=6973&tabname=UV%20Fused%20Silica

We were able to gather a single data set for the base error with paper as the object being measured. We measured the distance from sensor to paper as 100+-5mm. With 948 measurements, our sensor gave:

```
mean: 100.0
median: 100.0
std: 1.718883393989082
se: 0.055826737334403284
```

Conclusions:

1) We are far enough along in the experiment to recognize areas where pre-planning could have made the experiment go more smoothly. If we had set up a timeline for the software development and assembly that we hoped to achieve prior to the first day we may have realized that there was more work to be done there than we had initially hoped. We have spent the first three days in the lab and one day outside of the lab just to get the experimental setup working.
2) Without the precision of our 3d printed parts we have had to make some adjustments to the setup that will introduce some error. We will need to see how this error impacts the ability to draw conclusions.
3) One of the decisions we've had to make because of being behind schedule is concerning the precision of our experiment. If we had more time, we would be able to measure distances and angles much with more accuracy. We are estimating that we will have about 5mm uncertainty in measured distance and 5 degrees uncertainty in incidence angle. We are not sure if this is too much uncertainty to have good data or not, but it might be all we can do.