Since the end of the Fall semester I both feel like so much has happened but also not that much. I think this is largely because the Spring semester was mainly focused on design, where our team split up to focus on our specific systems. Most of my semester I was zoned into a select few components and didn’t really have an appreciation for what had been accomplished by our team overall until the acceptance test. So a lot was happening but I wasn’t always clued into what that change was.

My semester started out incredibly rough. Pretty soon after getting back to campus we had our unit tests to prepare for which required a whole bunch of testing and formatting in order to get ready for. To be fair though, on its own this wasn’t that monumental of a task for me since very little about the scope of my systems was changing from the V3 portal boxes. I did have to deal with a lot of swapping out components since many of the original ones have been rendered obsolete by the manufacturers, but the layout and design of the systems remained mostly intact. One system I did have to think a lot about though was the USB relay. It had been known for quite a while that there was a pretty major design flaw in the previous iterations. After talking with Matt, I had resolved to relay the D+ and D- lines in order to deny access. This was pretty challenging for me initially though because I knew very little about USB and there were some concerns about the relays affecting the data rate of the USB signal. However, after some testing, we did come to the conclusion that this setup had the possibility to work.

However, at the same time as preparing for my unit test, I was also knee deep in starting the process of getting our PCB transferred over from Altium to KiCad. Long story short, this process ended up taking much longer than expected for a few different reasons. However, I was also working on a time crunch in terms of the PCB since we knew that we had wanted to have a few different revisions before the end of the semester. So it was kind of rough for me to justify working on something that didn’t have an immediate impact on my grade like the unit test but also was very necessary to get done as soon as possible for the benefit of the team. Eventually though, I was able to get both of these projects done and honestly, after this point my workload had started to lighten.

This is around late February where my role on the team really started to transition to more solely focusing on the PCB and assembly. Once the first round of PCBs had arrived I would go through all of the components in our cabinet and begin to populate each board. Since our PCBs are fairly big each time I did this it was a fairly time intensive process. However, I think I’ve gotten much better at soldering by doing this so often so I guess I can appreciate the improvements to my skill set. Also around this time, I was starting to become more and more familiar with the components associated with the board so I also started to help out with filling out the BoM in some small ways to make sure we didn’t have any gaps in what was required for the board. From this point on, my contributions were fairly routine, mainly consisting of populating and testing our PCBs, making design changes to the PCBs, and receiving the new batch of PCBs and starting the cycle over again. Probably my most common fix between each revision was the USB interlock, somehow always being miswired. Entirely my fault but still frustrating nonetheless. Other changes included switching around different headers based on which peripherals we had decided on for each revision and some minor tweaks to things like LEDs, the fuse, and some new systems. Between all three revisions I think I populated at least 8 boards successfully which was pretty surprising for all this only happening in the span of 2-3 months. Overall, I’m pretty proud to have gotten three separate revisions to the Portal Box done over the course of the semester, I think each time there were some significant improvements and I’m glad to have put in all that effort at the start of the semester in order to get everything done. On one hand, I feel like my contribution was pretty inconsequential. The core value of the V4 Portal Box is really in the microcontroller and cloud changes. However, it is nice to think that my work was still incredibly necessary in order to have such a successful project.

Though much of my work went smoothly, I definitely have a lot of areas for improvement and places to grow. I think a lot of my mistakes throughout the semester were due to rushing to get things done. Especially with some of the dumb mistakes I made for the USB wiring, many of these accidents were probably avoidable if I had just done a thorough review of the schematic and PCB. Finally, probably my biggest frustration though was with some of my soldering jobs. At least once we got to the 4.2 version, we knew that everything on the board worked as intended, so whenever a problem occurred, like the LEDs not working at the expo, the only explanation was that I had messed up the soldering. I do think part of this was rushing but also some of it was just because we were using such small components that errors were bound to happen eventually. I think for future revisions it's probably best to avoid these high error prone components anyway, because we do want these to be as easy to assemble as possible.

Overall, I’ve had a really great experience with senior design. I can’t speak highly enough of my team and I’m really proud of what I’ve accomplished. I also think I fully flipped views on my outlook of the project from last semester. I was pretty suspicious of the value that we would actually be able to produce but seeing our feedback from the acceptance test, I really do think we’ve created something that has potential to go way beyond Bucknell. While the work isn’t done yet and there’s some polishing to do, I think we’ve really done something special that I think I’ll look back on fondly.