Portal Box Team Learning and Development Report

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## **Project Manager: Axel Andrews**

## **Systems & Performance Engineer: James Powick**

## **Design Engineers: Peter Beaudette, Kevin Duong, Aidan Flynn, Colton Jiorle**

**Team Organization and Management Reflection**

When we first got our assigned project, the whole team was excited about the opportunity. We have varying levels of experience and usage of the on-campus makerspaces, but we all had prior experience using Portal Boxes for various projects in classes such as ECEG 100, 201, 210, 240, and more. It was exciting to be starting off from an already high TRL product that is effective at its job, because we thought and still feel that we could push the boundaries of what Portal Boxes do, the value they provide, and who they provide it to. The idea of getting the boxes outside of Bucknell was compelling for us when picking the project, as well as exploring professional fabrication options to make the product feel more “finished’.

In the first few weeks, prior to assigning our Project Manager, we worked as a team to cover the bases of the existing platform. We identified key contributors to the hardware, software, and web infrastructure for each of the iterations of the boxes, then began reaching out to them for interviews. Our team organized our research through Zotero, where we put all of our interview notes and research articles, as well as a shared Google Sheet where we tracked our points. In the first two weeks, Axel read much of the existing documentation, while Kevin immediately started looking into the ESP-32 microcontroller, which was strongly suggested for us to switch to. The rest of the team was involved in high-level interviews that sought to understand the history of Portal Boxes, how they work, and what stakeholders wanted to see as improvements. It was during this stage that much of the division of labor started to take shape, we each gravitated towards different elements of the project where we thought we would enjoy working on features. However, we got a little bit too in the weeds of the technical aspects early on, reflected by our initial System Map presentation in [Design Check-In 1](https://docs.google.com/presentation/d/1Mnqo4Ppkt6pd7zimhq-FA53fBiNY2Xuaz129qXXEhQM/edit#slide=id.p16). We essentially made a flow chart of how makerspaces operate, rather than making a map that illustrates the complex relationships at play.

In Phase 2, our interviews and research shifted from understanding the Portal Boxes to understanding makerspaces. We interviewed Bucknell’s Risk Manager, Lab Directors, and others that are knowledgeable about practices, policies, and operation of makerspaces to evaluate where Portal Boxes can provide value. These interviews helped to reform our System Map into what we presented in [Design Check-In 2](https://docs.google.com/presentation/d/1x1lxQVbTKvj2jU-WCMwro-aRt9yHrMJpcTMMCPkgEUk/edit#slide=id.g30873b35eed_0_0), which we were a lot happier with. It was during this phase that we settled on the notion that Portal Boxes make the biggest impact in the way of balancing security vs accessibility in makerspaces, something that we have carried with us the rest of the way. We began thinking about what new features could improve in these two areas, and how we can push towards the overarching goal of broadening expansion. The work breakdown during this phase relied on following the timeline provided for the class, and spreading our efforts across the various tables and representations that we made. We divided and conquered, with a few people working mainly on System Map improvements, while others worked on the NABC, GMA, and Design Stack Abstraction. After doing smaller group work, we returned to the team to review what each group created, then made any changes that we saw fit. This strategy worked well for us, and it helped us choose our nominees for PM, who were Axel, Colton, and Kevin. Axel had worked hard to research the overall scope of the project, acted as a spokesperson for the team early on, and led in some of the interviews, and the team was happy when he was selected PM. Not too much changed with the overall flow of meetings initially, but he became a central point of communication and helped drive meetings in certain directions.

Moving into Phase 3, we continued our divide and conquer approach. Kevin led the charge on the Block and Use Case Diagrams along with Colton and Peter, and Axel. James, and Aidan started working on a Flow diagram. All of these diagrams helped get the team on the same page with how the system works, and allowed us to move from general ideas to thinking about how they could actually be implemented. These diagrams helped guide our design throughout the rest of the semester and gave us a benchmark we could always refer back to. We spent time thinking about the features that we like with the existing system and things we wanted to add, and then prepared our presentation for [Design Check-In 3.](https://docs.google.com/presentation/d/14WIDRm6hgSC0SH96vfFQVYhhuoHuyNjiRs1Bf5DTsYM/edit#slide=id.g3111f739bf9_0_197) This was a challenging stretch for us health-wise, as several team members missed a few days with various illnesses. The effect was we became somewhat disconnected in the flow of our presentation and our ideas for the project. We were on different pages which lead to vague or different descriptions about the value we are adding to the Portal Box system. These flaws were all apparent when we presented, and it was noted that we lost track of the value throughout. However, we had met with Matt Lamparter earlier in the week to review where we were at with our design, and his confidence helped us realize that we did have good ideas, we just weren’t articulating them clearly. Axel led a concerted effort in the meetings following Design Check-In 3 to reevaluate the value-add of our project, and really make specific arguments for why our new features help with our broader goals.

Our [SWOT](https://3.basecamp.com/4075567/buckets/38928577/uploads/8009955655) analysis helped us with that process, clearly illustrating the areas where we had some gaps. The strengths and opportunities of our project we agreed about, and had already been conscious of most of them. On the weaknesses and threats, the most glaring issues were the lack of a value proposition and the disconnect among team members. The disconnect was partially due to the unavailability of certain team members, whether sick or otherwise, in the weeks leading up to the check-in, but the uncertainty of the value proposition also played a big role in that disconnect. We were not on the same page with what we were planning on changing, how the existing system works, or how our changes add value to the system. Having these flaws clearly spelled out for us allowed for a direct conversation about these issues, which certainly launched us back towards a better path. Since we had divided and conquered while working on some of our diagrams, some team members simply had not reviewed the others at a close level. We brushed up on these diagrams and flows, and first ensured that everyone understood what the existing system was doing at a high level. Launching from there, we went back to the features we’d talked about adding and evaluated how they add value. This was a critical point as we were about to start building our functional blocks, and diving in without a direction would have been risky and ill-advised. It has been noticed internally and externally that around this point there was a shift in our team. We had been disconnected, yet we reconnected and were once again on the same page. This allowed us to move into Phase 4 with confidence, both in the overall project plan and in the ability to build the blocks.

At the onset of Phase 4, the design engineers were provided with an initial [Work Breakdown Structure](https://docs.google.com/document/d/1D4QEfNe-m418LnQDhYBkuWGisYl1kHxAbgC0hXMl7sw/edit?usp=sharing) that attempted to guide their early development. It was clear that this was not overly thought out, and it served mainly to help people get started with their work. As the initial development unfolded, this informed the ongoing Gantt Chart and an updated [WBS](https://docs.google.com/document/d/1W7a28QRNVAOWKtMkqe78Ogq1D0TlNFcXmOVneI-hd5g/edit?tab=t.0) that had more specific tasks to help us move towards a prototype. Something that is apparent throughout our early development is that Kevin will need more help on the software side of things, as he is the main person working on the firmware and has acknowledged that the task is intimidating. The other design engineers have a clearer roadmap, they can test the components individually, design their flows and how they will integrate with the project, and prepare their datasheets based on that information. Kevin’s work on the other hand does not move in such a logical pattern, as the code migration does not have a clear order required. Something that can certainly be improved in the next semester is providing Kevin with the same level of detail about what he should be working on and working towards as the other design engineers. Kevin’s goal is probably the clearest – we need the firmware functional on a new microcontroller – but the process is the most abstract and free-form which presents a large challenge in planning and organization. The fact that we only have two people on the team with significant coding experience – Axel and Kevin – was something we were aware of from the onset of the project. The good news is that our new features will not require much “new” code, and we are able to write in MicroPython so the migration isn’t too extreme. As other design engineers finish their hardware components, they will start learning more about the codebase and how they can contribute.

Overall, the initial development through the first two build videos went fairly smoothly. We ordered components for the prototyping stage before Thanksgiving, and when we came back everyone had what they needed to build their part. All DEs except for Kevin had clear instructions for what we wanted done by Build Video 2, and they all met their goals, setting us up to come back in January and make great progress right away. Communication between DEs, the SPE, and the PM was smooth, and we spent a good deal of time in the Maker-E working independently, yet together. This allowed us to share findings and support each other in the building process. In general, we’ve shifted to holding most of our meetings in the Maker-E, as it allows us to feel the makerspace environment, see people using Portal Boxes, and potentially ask them any questions if we see something particularly interesting about their usage. Our communication throughout the semester has taken place mainly over text message, where our team has a group chat. We text to remind each other about research, upcoming interviews and deadlines, and to inform others of the status of our work. We have not followed a formal meeting structure, although Axel will often text an agenda of things that we should cover during a class period. As we move into next semester with an increased focus on individual building and development, we will implement a “stand-up” type of introduction activity at each meeting, where each member can share a quick status update about what they’ve done recently and what they hope to achieve before the next meeting. It has been noticed throughout the year that some team members are far more active than others, whether that is in meetings, interviews/research, or report writing, but taking the time to share how we are each contributing will help to improve the common sense of accountability, as well as keep us on track in the critical phases of development. We’ve so far been solid as a team at meeting deadlines, although some individuals have at times been late or disconnected from the team’s assignments. Reviewing the Gantt chart quickly during our Stand-Up will allow us to evaluate where we are at, and make any adjustments if necessary. Procrastination had not been a major issue for our team, at least in deliverables, up until our reports. We prepared early and often for the Design Check-Ins and never had to meet the night before to throw things together, but we did not plan the writing of our report effectively. This resulted in a few members of the team doing significantly more work than the rest, and in the second semester we seek to write throughout the year to prevent this from happening again. Especially as we are developing new features, it will be crucial for everyone on the team to thoroughly document their work regularly.

All in all, our team is confident about where we are at technically as well as organizationally. We have all worked together in various combinations on projects and labs in the past, and we enjoy working together. We are proud of our work so far this year and hope to deliver a powerful and innovative iteration of the Portal Boxes through hard work and dedication.

**Individual Reflections**

**Axel Andrews:**

When we first saw the four projects available, I was most interested in the Portal Boxes and I was really excited to get assigned to the team. I’ve also worked well with all of the members of my team in the past, in a mixture of social and classroom settings. James and Peter are in my fraternity so I spend a lot of time with them eating food, playing video games, and hanging out. Once I was named the PM, I was a little worried about balancing our social interactions and the project management, but it has gone really well and I’ve found that I feel most updated about James and Peter’s progress due to their close proximity. To eliminate any bias with how I am preparing my design engineers for their tasks, I will schedule brief meetings with everyone on a regular interval in the second semester to ensure I get that same quality of communication with everyone. I do not think this was an issue so far, but it was something I noticed that worked well and can be applied in a more structured and reliable form. From the onset of the project, I was thinking about project management and the broad scope of our project.

In the first week, I wrote on Basecamp, “In order to be able to think about what we can improve, I took time to look into what currently exists,” which is a strategy I have continued to employ over the last few months (9/8 Basecamp). I took it upon myself to explore the existing infrastructure and understand the various elements of the Portal Box deployments, and that set me up to manage the project and push us towards providing more value. We met with Matt later that week, and after the interview I posted a lengthy reflection summarizing the main goals that Matt sees for our project. I’ve come back to this post a few times as we’ve worked on our reporting, as it helps me center my thoughts on the value we are adding to an already solid system. I wrote, “This was a week where I really felt like a sponge just absorbing a ton of information… I'm a true believer that we are working with a powerful and valuable product,” and this sums up my initial process of needing to understand what we had in order to make meaningful changes (Basecamp 9/15). I went on to say that “I'd be really proud if we can get another university to adopt at least one portal box,” something that is still a huge goal and would help me to consider our project a success (Basecamp 9/15).

In the weeks after interviewing Matt, we expanded our research and talked to more stakeholders in Portal Boxes, makerspaces, labs, and risk management. This helped us build our system map, which I reflected on in my 9/26 reflection. Our initial system map iteration was basically a flow chart, and I admit that I was reluctant to change it before the first design check-in despite concerns from some of my teammates. This ended up being okay, as we spent some time and made a new representation that better served the purpose, and the process of making the two iterations helped us understand the system and Portal Boxes’ role in it in a much clearer light. Before, we hadn’t really been thinking about the system of makerspaces, we were thinking about the operation of a specific type of makerspace. After the renovation, our map showed how makerspaces work and we were able to identify areas where Portal Boxes “directly intervene” to make an impact, specifically in accessibility and security (Basecamp 10/9). I went on to elaborate by saying, “If security is highly prioritized, the barrier to entry often increases, making it more challenging for new users to enter a space. On the other hand, if accessibility is the primary concern, there can be security loopholes that can leave equipment vulnerable or expose other risks,” which is why we determined that a new iteration of Portal Boxes should improve on these two elements (Basecamp 10/9).

This focus swayed through October and we seemingly got too focused on security, while neglecting accessibility. I think this was because security improvements are easy to imagine, we can visualize screws, ATM pins, and things like that, but it’s hard to visualize a screen display or other features without actually having designs. I addressed these shortcomings, writing that we’ve been heavily focused on security, yet had been neglecting accessibility features, “which actually would have a negative impact on the main loop of our system map that we shared at the last check-in,” (Basecamp 10/29). We were aware of this moving into the third design check-in, but did not do a good job of evenly presenting the new features. I addressed this in my 11/7 post, where I noted that we actually did have some good ideas, we just did not bring a lot of attention to them. As we moved into implementation planning and actually building, the balance has returned and I feel good about our project’s ability to deliver the improvements.

I had never done any formal project planning before this course, and I have gained a lot of experience and confidence over the semester. From my initial Work Breakdown Structure to my Gantt chart, the improvement in attention to detail is obvious. The PM meetings have been really helpful for me in my planning, as a lot of wisdom is shared. Focusing on deliverables as deadlines rather than tasks is something that has guided my planning, and it really makes sense to do it this way. After the building for the semester was complete, I reflected that “The last three weeks I've spent a lot of time thinking and materializing plans for the rest of the year, and it seems like the team is really buying in and understanding their respective roles,” and I’m happy that my team seems confident with our plans (Basecamp 12/9). I spent a significant amount of time weighing and researching options for how we can achieve broader acceptance, and my team as well as stakeholders are buying into the multi-tenant platform that is proposed for code deployment. This is the next element of the project that I need to break into tasks and put on the Gantt chart, and I am excited to talk to Bucknell and external cloud experts to make this happen.

I am a proud person who cares a lot about succeeding in whatever it is that I am doing. Failure is always a learning experience, but I hope to guide my team in a way that our failures lead to us delivering a great product at the end of the year. We will make mistakes, things will go wrong, but being able to keep the team on its feet and moving forward will be critical next semester. I feel a deep connection with the project already, and I am excited to continue that ownership over into the next phases where the product will materialize. Overall, I have learned a tremendous amount this semester in technical timeline management, people management, and many small technical aspects of the project. I am so glad that I ended up with this team, and I believe we will achieve great things together next semester.

**Peter Beaudette:**

My first semester working in Senior Design has opened my eyes to some of my greatest strengths as well as weaknesses. I had a positive experience with Junior Design last fall and was eager to see how it would compare to the increased effort and involvement required of senior design. While there were some hurdles, Senior Design so far helped me improve as a student as well as prepare me for my future career.

Currently, my role is to design the enclosure for the Portal Box and decide how the user physically interacts with it. So far, I have worked toward this goal with sketches and models of the enclosure (week 11/11 - 11/15), as well as sketches and physical representations of the E-Ink screen’s interface (week 12/2 - 12/6). I have spent noticeably more time on the screen as of late, although next semester I intend to switch course to focusing on the design of the box. I would like to get a physical representation of at least one of my models as soon as possible. As my interests lie mostly in hardware, I thought then and still do now that this is a great fit for me.

Like every other member of this group, my role for this project has shifted and evolved over the months. Going into the project, we were all by and large working together on the same deliverables (block diagrams, flow diagrams, etc.) before splitting up into our specific design roles (week 10/21 - 10/25). Towards the start of the project, I was more expecting and hoping that I would be able to do more work with circuit design and testing. That being said, I am more than satisfied with my current role working on the enclosure. When my role was assigned, I was a little worried that I wouldn’t get to work with any actual electrical components but I was glad to be disappointed once I started working on the screen. I also hope to be somewhat involved in the PCB design as it directly influences the size of the enclosure.

My greatest contribution to this project so far has definitely been my work on the design for the screen on the Portal Box (week 12/2 - 12/6). While it is far from a dynamic, interactable system, I have gotten a few messages to display alongside a QR code on the E-Ink screen. I was also able to get us some valuable research, like the interview with James Wayland of Queen Mary University of London (week 9/8 - 9/15) that we continue to use to inform our project decisions. Not only was it nice to get a reminder of my time abroad, it was really great to see someone working at a makerspace in a city as significant and prestigious as London take an interest in our project and give us some useful information and feedback.

While I am now satisfied with the effort I have put into this project, I think it could have been stronger going into it. I had a rough start to this project for the first couple design check-ins due to poor time management skills on my part balancing the work on the project with work from my other classes (week 11/4 - 11/8). One part of this class I am very thankful for would be the mandatory peer evaluations done after each check-in. They have really helped me understand and overcome some of my weaknesses and ultimately has helped me become a better member of the group.

Overall, this semester has been of immense value to me. I am really glad I was able to pull myself out of that slump earlier this semester and am looking forward to continuing working on the Portal Box next semester as we translate more of our design into reality. Knowing that our work here can help improve makerspaces all around the world is an excellent motivator.

**Kevin Duong:**

At the beginning of the semester, I was fully expecting to do a majority of the code and while I wasn’t expecting it to be easy since I am the only Software Engineer on the team. It was a relief to find that there were people on the team that had some experience in software such that I can talk and work through problems with. While I think my role has largely stayed the same, with where the project is headed, I certainly wasn’t expecting such a large workload prior to starting the project. Prior to discovering that I had to translate the Raspberry Pi’s CircuitPython to the ESP32’s MicroPython, I was fully expecting to just understand the previous code and add a couple functions which improves the functionality of the entire project, but I believe that the work that I need to do will make a great impact as it can benefit many makerspaces across the nation which makes me want to work harder because I believe that it has great significance.

Currently, I am quite slow to making much significant progress as I am still trying to understand and understand the software since I have to base it off of a 15 state FSM as well as several thousands lines of code. As I was starting to read James Howe’s code, I was quite frustrated that I have not made substantial progress over the course of the several weeks in Phase 4a, but taking complex code revised over the course of several years and translating it to another language over the course of several weeks is a task that is expected to both be difficult and time consuming. While it is frustrating, as a software developer to struggle with understanding and writing software, this means that there is room for improvement such that I need to learn. I have always had a history of struggling to read other people’s code since I am someone who prefers to code from scratch rather than base my code off of someone else’s so this is when I can learn to be more patient while I slowly dissect the code. Another thing that frustrated me was the time constraint and how much we wanted to get done by the end of the semester and feeling that I have not made substantial progress in our allotted time. While I was looking through the code there were a multitude of things that I am still new to and I can learn and add to my repertoire of coding techniques which will greatly benefit me in the future. Something that I took to heart and realized as I started working on the software was from Tom Egan as I stated in week 10/16 - 10/18 “He also taught us an important lesson which is that we should pick and choose our fights wisely.” and I feel like there was a lot we wanted to get done, but may not have time to do realistically. When interviewing with James Howe and Professor Hass there were a lot of different features he wanted to add features such as implementing a dashboard, more control over the system and that we want to adopt, but going back to Tom Egan’s advice, it may be outside the scope of our project and we will have to decide once we can get our system into a stable position.

Overall, as we near the end of the semester, I feel a lot more confident in being able to complete our project. I am satisfied with everyone’s efforts in preparation for linking it back to the software, I intended to work on it over break to keep my brain engaged while giving me a bit more time to be able to process the software and possible come back with a substantial amount of progress so we can come back to next semester strong and prepared to work on new tasks. While still nervous about being able to complete it while also balancing my other classes and social life, it also fills me with a sort of excitement to see the potential project that we can create because this is a chance for us to take what we have learned and really apply them to make something truly amazing.

**Aidan Flynn:**

Throughout this semester, my experience with the Portal Box project has been transformative, marked by significant personal growth and collaborative achievements. We began in early September (9/2 - 9/6) by establishing roles and brainstorming potential interviews. My interview with Ben, a Bucknell graduate previously working on the Portal Box, was a key accomplishment. His insights helped us realign our project's scope and introduced me to the technical aspects of the Neopixel ring we were considering.

The following week (9/9 - 9/15), we interviewed Matt Lamparter, the head of Maker-E at Bucknell, who clarified our project goals, particularly the need to replace the Raspberry Pi 4 with a more efficient ESP32 to reduce power consumption and costs. This meeting solidified our direction and laid a foundation for future discussions. During our first design check-in (9/16 - 9/20), I focused on identifying other entities working in this space, which enriched our understanding of potential users. As we progressed into late September (9/23 - 9/27), we refined our system map based on feedback from Professor Cheville, recognizing gaps in our initial iterations, such as the need for a comprehensive tracking system for equipment usage.

We completed our second design check-in in early October (10/7 - 10/11), emphasizing the balance between accessibility and security in maker spaces. This pivotal moment was when I felt our team began to gel. By late October (10/28 - 11/1), I took on a more hands-on role by working on flow diagrams illustrating the Portal Box's operational stages. My focus shifted towards improving accessibility, crucial for encouraging user engagement.

As we neared the semester's end, I felt accomplished regarding my contributions. I successfully wired and coded the RFID card reader, a critical component for user access control. Our team completed a comprehensive report reflecting our findings and progress throughout the semester by 11/15.

Looking ahead, I am excited about continuing this project next semester. The progress we've made—from initial brainstorming sessions to developing concrete components—has been remarkable. I eagerly anticipate how our efforts will culminate in a functional Portal Box that enhances accessibility and security in maker spaces across campuses.

**Colton Jiorle:**

Starting off the semester, I was very excited to have been assigned to the Portal Box team. I’ve been a frequent user of the makerspaces on campus so I was very interested to learn more about how they worked and delve into how they could be improved in different ways. Additionally, I knew going into the project that it had a very unique mix of different engineering elements. While there obviously is a technical side to the project, it was especially interesting to be able to think about the social side of the problem when I myself was both someone who had used the machines and will use our new one in the future. While my focus as a design engineer is mainly on the power electronics within the box, I’m also glad that I’m a part of a team that has a large software/embedded focus too since these elements are things that I’m interested and want to challenge myself to know more about even if I don’t work on them directly.

Immediately moving into the research/interview phase of the project was pretty stark but it makes sense. We had a lot of new information to sift through on top of collecting new information that could give us clues into how the Portal Boxes could be improved. I think one huge challenge for me was breaking my own previous conceptions on how makerspaces needed to work. Bucknell is the only place where I’d really run into makerspaces up until this point so I naturally just assumed that most followed the model that we had. I also quickly discovered that a lot of my assumptions about how to collect user input wasn’t necessarily the best approach. Many of my early interviews were very specific and narrow which really limited the scope of what we were able to obtain from interviewees, almost like “leading a witness”. As we went further, however, we started asking a lot more open ended questions that gave interviewees an open space to talk about their frustrations and we saw a lot more success from this approach. “I think I took a wrong approach to this interview because I was being very portal box forward when asking questions about her space and looking for how it might integrate.” (Week of 10/16-10/18).

As we moved further into the semester, I began to really enjoy getting to know my teammates both personally and professionally. At first, I felt a little overwhelmed as things seemed disorganized, and the whole process appeared unclear. Especially early on, I think we each had our own idea for how the project was going to work and didn't really communicate that super well to each other. "... it became very obvious during our presentation that a lot of our team wasn't necessarily on the same page about everything" (Week of 9/16-9/20). However, as time went on, we started to pull things together, and I found myself feeling like I could rely on my teammates more and more. It was rewarding to see how we slowly began to find our rhythm, and I began to feel more confident in our collective progress.

I think this semester I've started with a little bit of work on a lot of different assignments, so I don't really have one big accomplishment. However, of the things I've done I think one notable one is the pinout. While it’s not finished yet, taking the first step to create a draft forced me to dive deep into understanding how the system works and how everything is organized. I could see how the pieces of the project fit together, and it gave me a better understanding of the bigger picture. "These [systems] are all things I'm very excited about and want to learn more about anyway so having this project is a very convenient way to force myself outside of my comfort zone" (Week of 11/11-11/15). This process of tackling the pinout also led me directly into working on the PCB. At first, I was really worried about having to redo everything in KiCad, but as I started to get the porting process down, I felt more at ease. I really enjoy doing PCB design so, though I know it'll take a long time and be challenging, I'm excited to delve in deeper into the board for next semester.

I think my effort and contributions have been pretty fair throughout the semester. I do think though that I started off much stronger than I’ve been the past two months. I felt like I really had a rhythm the first few weeks where I knew what I was doing each week and could plan ahead to prepare. However, a huge contributing wall occurred about halfway through the semester when I was away for a conference for almost a week and a half. After this, I felt like I was always behind on work, not just for senior design but every class which really hit my ability to be proactive. “I think [being away] was alright in the sense that I was able to keep up with my research and I worked ahead a little to prepare for when I would be gone but I definitely noticed a shift when I got back for some of the developments from the past few days” ( Week of 10/28-11/1). A lot of critical things happened in this time frame that I regret not being able to give my feedback on, but overall I think everything worked out for the team and I’m impressed with where we are today.

Looking forward to next semester, I think the PCB is one of my biggest concerns. I worry about components or pinouts changing and how small mistakes I might make in the PCB might affect the final result. Even tiny errors can lead to bigger problems down the line, and I want to be extra careful to ensure everything is thoroughly checked. One of my biggest priorities moving forward is learning more about working with power electronic systems. I feel like I need to dive deeper into this area before next semester because I want to be comfortable testing components under full power. I know this is going to be a critical part of our work, and I want to feel more confident in my ability to troubleshoot and ensure everything runs smoothly. “I got a little bit of results using the power supply for a DC load but I think I'm missing something big with experimental design for getting an AC dummy load. This is something I really want to get tested before the end of break because I want to know if it should be included in the PCB design or not.” (Week of 12/2-12/6 ). I'm excited for the challenges ahead, but I also know there’s a lot to learn. Overall, I'm very excited to see where our project takes us next and seeing all of the different systems come together.

**James Powick:**

Starting this project, I was very happy that I got assigned to the Portal Box group. After having been in the Maker-E many, many times over the course of my time at Bucknell, I always wondered about how the Portal Boxes came to be. I had never seen a system like this before in any other similar space and I was happy to have the opportunity to explore this. The other part of this project that appealed to me was that I had the opportunity to create something that could be used at Bucknell (and hopefully other spaces) for a long time after I was gone. The prospect of leaving something here that would be used daily and that I had a part in making sparked my passion for this project.

The first few weeks of this project were challenging. While we were able to create representations and start moving in a positive direction for the project as a whole I began to worry about our ability to see the space the portal box exists in and how we would change and improve it to create value for the stakeholders. In my basecamp reflection for the week of 9/16 - 9/20, just after the first design check-in, I said “But the system map deliverable was lacking in some respects. While it described the interactions and relationships of the Bucknell makerspace very well, it missed some of the overall relationships of the space we were working in. One thing that helped clarify this to me was how the answers to the questions we had should be answered or represented in the system map.” It was hard for me to see the overarching relationships that we needed to understand in order to develop a new version of the Portal Box that was better than the previous iterations. After this point, I worked very hard on changing the system map to create this picture and most of my research was spent reading about challenges in these spaces and making them accessible. I feel that this was one of the most important things I did in the project and it led me to want to become the System and Performance Engineer on the team. I felt like I understood what this project's end goal was through my research and work on the system map and I believed in myself that this made me a great person to be the SPE as I could ensure that the system not only worked but would achieve this end goal.

Refining the system map also stood out to me as important because this showed me how our project isn’t just something that could be used at Bucknell, but how it is a system that could create a lot of value for many different spaces. “The system map now has a large focus on showing the negative reinforcing loop that is created between accessibility to a space and the security of that space. This is far better than our previous system map iteration… Once we got away from this way of thinking it became easier to generalize the relationships we have been exposed to through interviews and research to represent the authentication space as a whole.” (Week of 9/30 - 10/4) I felt like our team had trouble exactly identifying how our iteration of the Portal Box would create value and not just have a couple fancy new features. Creating a representation that showed this important relationship of security and accessibility in our project helped begin to push us in the right direction. In my opinion, earlier on in the project we were on different pages about why we were pursuing certain features. Relating it back to the system map helped clarify why we were doing it and how it created value.

Reflecting back on this past semester of senior design, I am happy with the contributions I have made. However I want to be more vocal in expressing my opinions and concerns to the team in the coming semester. This is always something I have struggled with, I find that I tend to listen much more than I talk in team environments to understand the perspectives of everyone else on the team. In addition to this, I want to be more involved with all the design engineers and what blocks they are working on. I think I have done a decent job talking with them about where they are but I know I can do better. Overall, I am very happy with the progress our team has made so far and am excited to come back refreshed and ready to continue making great progress on this project.