University of Regina | FACULTY OF ENGINEERING & APPLIED SCIENCE

ENSE 405 Project report-out & lessons learned

Earth Wells

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Project sponsor & course facilitator

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Business need/opportunity

Clean water is an issue that continues to persist across the world there are still areas in developed countries that don't have access to clean drinking water. Oftentimes this due to no or poor water infrastructure. Unfortunately, the smaller the community gets the less likely it is to have reliable clean water. But there are some amazing breakthroughs in natural water filters. Natural water filters are using water filters that usually only used naturally occurring material to filter water and oftentimes do not require any electronics or motors to operate. There are many Non-Governmental Organizations and Charity Organizations that are actively installing some natural filters all across the world in order to increase water security. Additionally, there are many filters that are only installed in certain location due to the availability of the materials which limits how many can be installed until an alternative material is found.

Earth wells will impower the user to take clean water back into their own hands, it will provide a community forum for natural water filters. The forum will provide not only knowledge on a plethora of natural water filters but the forum format will support any questions users may have. These questions could range from part modification and adaption to scalability limitations. The forum will also support users in adapting any natural water filter to their geographical location allowing more natural water filters to be implemented overall.

Reflections on project planning (3-5 pages)

- State and discuss the United Nation's (UN) Sustainable Development Goals (SDGs) selected and your "why" for selecting the one(s) you did

For Earth Wells I focused on one main UN Sustainable Development Goal #6 – Clean water and salination; ensure availability and sustainable management of water and sanitation for all. The why I had comes from multiple facets of my life. Clean water has been a theme in my life. I currently live in the Rural Municipality of Sherwood No. 159, which is the rural area that surrounds Regina and, we do not get access to the public service of drinkable water. Instead, we have our own water well and several sediment filters installed to have potable water. So, access to clean water is something that affects me in my day-to-day life. Additionally, my extended family live in rural Punjab, and they have the same situations except their filters are much lower tech which is partly what inspired me to pursue natural water filters for my project. They are lower tech as the electricity supply in rural areas tends to be more unreliable therefore the filters are designed to be mostly independent of electricity. I have also been exposed to many different types of natural water filters throughout my education, in my Environmental Systems and Societies Class we had a lab to create the most effective natural water filter, from a variety of soil types and other materials commonly found in filters. So, the combined experience of my past is what drew me to UN SDG #6, I felt like I already knew quite a bit about the topic, both academically and experientially, and that I would be able to come up with a solution that would positively benefit the community. I chose to focus on the target 6.1 "By 2030, achieve universal and equitable access to safe and affordable drinking water for all", as it was the target the most resonated with me since UN SDG #6 covers much more than just clean drinking water. Besides my project I feel like there are many more opportunities we can use tech to help reach UN SDG # 6 such as using technology for water testing and monitoring for both humans and animals.

- Discuss key findings from your community research and understanding/requirements gathering (Community characteristics and technology configuration inventory),

There were a few findings from my research. I'm terms of the community I found that it was mostly powered by individuals who were quite spread out and specialized. There were educators in the form of DIY filter providers or blog post writers who put out content to the general web. There are also researchers looking for new water filtration technology from many universities across the world who

posted their findings on scientific journals. There were also those affiliated with NGO's or charities committed to improving drinking water quality. The community was a combination of various valuable view points from many different sectors across the world. However, the community mostly operated individually with each person putting their content on their own sites and then sharing them outwards in hopes to help others. In terms of technology configuration, it supported the individualistic nature of the community through blogs and research paper journals, there were also some charity websites for their respective organizations. There was also a presence of Facebook groups where people who were more concerned about raising awareness would come together and share interesting articles and blog posts about clean drinking water and natural water filters. Although the focus of the groups was much more towards clean water overall rather than natural water filters. A subgroup of blog posts were DIY sites where a user could go and learn how to step by step make a natural water filter but those posts were more geared towards kids with no scientific backup for whether or not the filters were actually effective.

- Discuss your professional opinion of the processes and documentation used in this course for project planning. Did they help/hinder and how?

I would say both. The processes and documentation definitely helped me understand my community and north start customer better. Without the documentation I would not have researched who my community was currently past a shallow Google search. I also would not have discovered that many professors at different universities are actively researching natural water filters which ended up being quite an important factor in my final project choice. Overall, the documentation defiantly helped me define my why and who part of the project. I was hindered a little bit by the logistics, more specifically the time we had as well as the fact that it was an individual project. For time, I worked throughout this semester and also had a few extracurricular commitments so while the workload was manageable I did at times feel hindered and desired to simply move on to the coding part of the project. I also faced a little bit of hindrance form the documentation because it was an individual project, I didn't realize how valuable discussion with my teammates was to me until I was working on this project alone. I feel like sometimes I overlooked issues with my documentation when a teammate would have pointed them out which led me to checking my documentation more often this semester.

- State selected north star & carryover customers. Why are these customers important to your project's golden circle (why, how, what)?

There isn't a persona per say that I was targeting but instead I was targeting those in need of or those who have knowledge about natural water filters. Part of my why is that I wanted to help educate people on natural water filters and foster a place where innovation and adoption of such filters could commence. So my goal for the project was to connect educators and pupils, or in my case those who knew a lot and those who wanted to learn more about water filters. These customers are therefore vital to my golden circle as they are part of my why. My carryover customers are educators, researchers, bloggers, activists, university students. The carry over customers would share the common factor of wanting to know more or to gain a new perspective of natural water filters. The carry over customers are also key as the platform only functions if there is a handful of users to post and reply on the platform. If there is no one the platform will be of no value to those looking for info or to get questions answered.

- Summarize assumptions made and constraints uncovered, re: drafting an emerging picture

There were a few assumptions made. I feel like the biggest one is that the community would continue to use the platform after their initial interest subsided. This is a platform based on a network, essentially it provides very little value if no one is using it. If no one uses it then it also falls out of date further dropping in value. The platform assumes that users will have the time to commit to the platform in addition to what they are providing to the community now. It might be that the community members choose not to commit any time or commit time by taking away form what they were previously doing which are both negative outcomes. There are a few constraints, one of them being that the community is very individualistic currently so we need a solution that brought them together but still kept their effort separate and under their control which is why things like meetings and group projects were not implemented in the MVP's created for this project as they would not be supportive of the current community behaviour.

- Discuss initial & the evolution of your technology stack selection, drafted prototypes, and initial Minimum Viable Products (MVPs)

My project has changed in a few distinct ways since the beginning. Starting with the Technology stack I wanted to create a mobile application but I had already created a small project in React Native and the

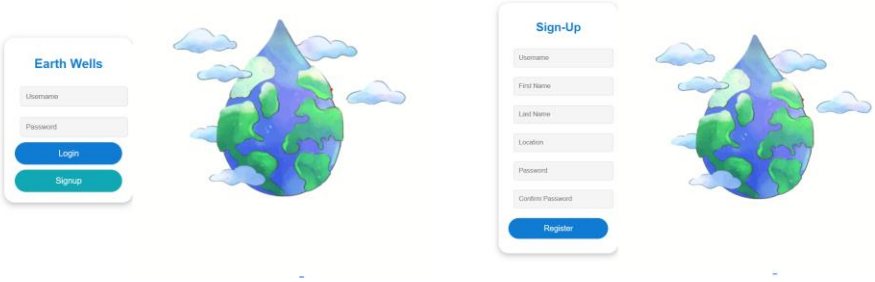
other mobile frameworks seemed like a bit too much to learn. For example, flutter another very popular mobile development language was assigned for us in a lab in one of my previous classes and I really struggled to grasp the language so I was hesitant to tackle any mobile language I deemed complicated. So I settled on web development and decided to learn React as I had not worked with that front end language before. From my front end came the backend and since then my technology stack has remained pretty consistent. In terms of drafted prototypes, I only created a Lo-Fi prototype and my design has changed quite a bit since then, I moved a lot of elements around, I am glad I didn't create a high fidelity prototype as I would have been less willing to adapt my design to fit my new MVP outlines. I was able to use a pen and paper to quickly make changes to my prototype as my project changed. In terms of MVP the biggest change is the shift to focusing on the materials within natural water filters. After my first scrum there was some feedback that I felt like my project wasn't quite unique it was just a basic forum so I pivoted form focusing on the forum to focusing on the material tags. I expanded upon the tags adding locations, descriptions, and alternatives. Things that were specific to natural water filters. I made this change because I wanted to support the natural water filter community specifically so the material feature tailors the platform more for water filters.

Reflections on project results (4-5 pages)

- Discuss what you created. Provide key images/screenshots illustrating core functionality

I created a forum-based website with different types of tags. One of those being a detailed material tag that provided description, location, and alternatives for the material listed. A user can create a post with a question or point of intertest about natural water filters and tag it with the materials it is made out of and then the users can reply or discover what the materials are and if they are available to them.

Images of the Loging and Sign Up Screen:



Images Of Home Page and Post Submission Form:

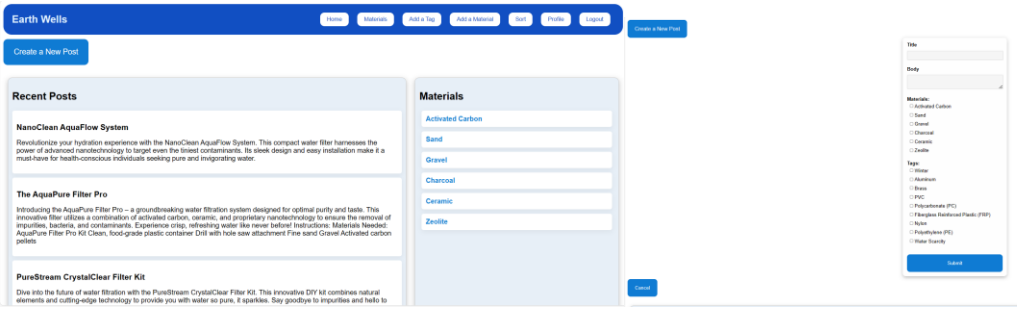
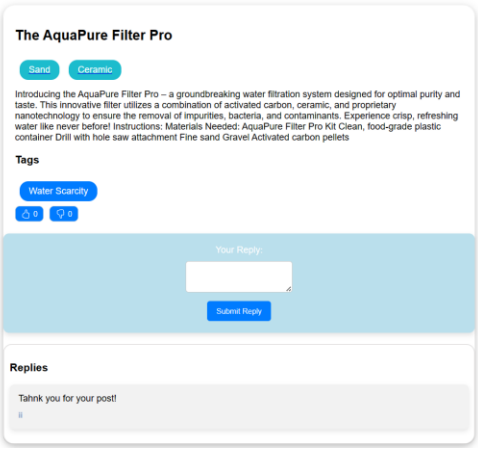
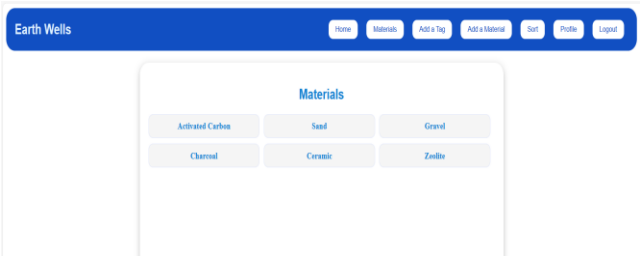
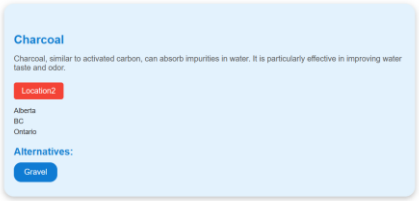


Image Of a Sample Post:

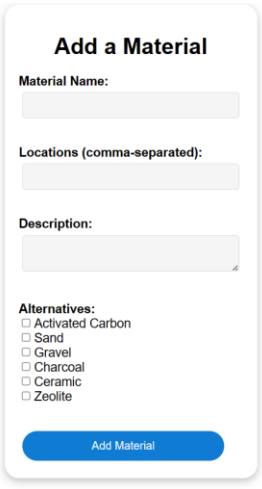


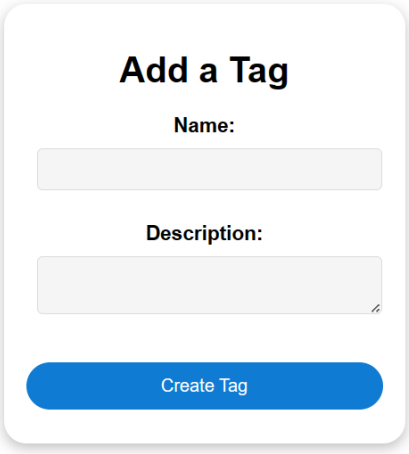
Images of Material Library and Sample Material Detail:

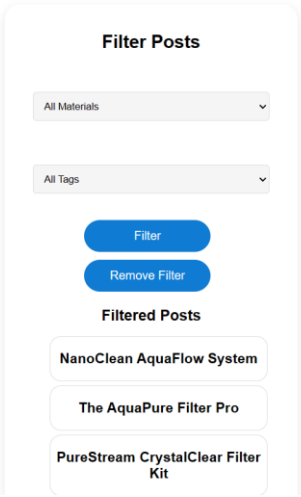




Images Of Material and Tag submisson form as well as Sort Form:







- Review your initial “Planning and initialization” video created for the first deliverable. How close did you come to realizing the solution/product you initially envisioned?

I would say like 60% there, I defiantly shifted focus a bit since then but generally stayed on the same

track. I had most of the research down very little has changed in term of my community more so on what my focus was and how I felt I could bring something of value to the users. In terms of my exact product the lo0fi prototype is a little bit off. In terms of features I would stay I kept quite a few of them I didn't implement some of the features from MVP #3 that I had planned but I shifted towards adding more to materials feature after this Initial Vlog.

- Summarize software design activities and findings. Ensure you discuss how you/your team either linked or envision links to design ideas back to topics discussed in class lectures

There were many software design activities in this project which include:

1. From the community orientation document we found that the natural water filter community had the main community orientations of Access to Expertise and Open Ended Conversations which makes sense for my community as it is made up of researchers and educators and also those who like to share and discuss different natural water filters. In terms of class concepts I would argue that I made sure to go over the change in behaviour of my community to make sure that the orientation aligned with what they were now and what they seemed to be headed towards.
2. In the technology inventory document it was found that the users were very separated and mostly used their own websites or journal publishers there was a significant population that shred materials form these sites on Facebook groups to raise awareness.
3. From the business case document it was decided what gap in the community Earth Wells would fill. Earth Wells would bridge the gap of communication between the experts and those who needed help. It would also host resources openly so that anyone could browse the resources freely. It is important that the knowledge of Earth Wells is accessible to the public as it helps the common good, if we were to add too many barriers then we would prevent innovation from happening as quickly.
4. From the Stakeholder document it was decided who the Noth Star Customer was and who else had a say on the project and those who were impacted by the project. For Eraths Wells that those who need water filters and those who are experts in them.
5. The drafting and emerging picture document helped in deciding the Earth Wells should be an open community focused on individual contributions. I also decided the level of commitment needed to make Earth Wells successful which would be some casual commitment. This is achieved through gamification which implements features found in games to keep people engaged and some principles from group undertaking. I made sure that

Earth Wells was designed so that there was as little barrier to entry as possible so the user could either browse or simply click a few buttons to start participating.

6. For the Lo-fi Prototype I implemented iteration, as my design requirements changed I changed my prototype on paper. Iteration is an important aspect throughout this project as without it I wouldn't have been able to shift the project to address some important issues and fit the customers needs.

- Summarize how you felt about this project (likes/dislikes), from your experiences with the technology stack selected, translating prototypes into real solutions, and the creation/realization of your MVPs

Overall, I felt really good about my project. My technology stack had a lot of online resources so whenever I got stuck there was a lot of resources, I could turn to help me out. The most difficult part about the tech stack was the auth/jwt token. I wasn't originally going to implement authorization token into my code, but I wanted the users account info to go from page to page and I couldn't use session variables easily as I had before in previous projects, but I was able to figure out how to implement tokens for my use. I really liked having a lo-fi paper prototype as it allowed me to move design elements around as my design evolved and gave me a base to build my UI from. Using the agile structure defiantly saved me some effort in this project. If we didn't have the scrums, I would have realized a bit too late that my web application was lacking something and my application would not have turned out as well.

- Summarize what went well during the project

I feel like overall the project went well, I had a lot of flexibility within what I was doing which naturally led me to be very motivated in creating this project. I felt like I had a lot of control over the finial vision of the project. My tech stack was fairly easy to find resources for and I shifted to a new prototype which was very easy to implement. I was mostly on track for my MVPs throughout this project and I was generally on schedule as well. The documents went pretty well, it was quite a bit of research which I found interesting I learned a lot about natural water filters from the research papers I skimmed when researching my community so that was an added bonus.

- Summarize what not went well during the project

Most things went well. Some minor roadblocks would include the learning curve for React was not

accounted for in my project planning and scheduling which caused some stress around Scrum #1 but I shifted my goal posts in terms of project work as well as what my MVP was going to be so afterwards I felt pretty on track. I wish we had like a Scrum 0.5 where our prototypes were presented, I feel like the feedback for creating something more unique could have been caught a bit earlier saving on some development time. I struggled a bit with the Progress Check In documents as I felt like I wasn't able to express in detail the state of my project. That is something I would like to work on in general, being able to succinctly describe what you've done so far and what you plan to do is very important for any job that involves the agile process which is most development jobs.

- What would you do the same on future projects?

I would defiantly keep up the scrum progress checks even if it is just within my own team members I think it is a good was of being accountable and showing progress on a project that definitely cannot be done 1-2 nights before it is due. I would defiantly use React as a front-end again, it was good at structuring the page how I wanted and the component wise structure also helped keep my code more organized and clear. Overall I think it is a good skill to have and I will definitely be creating more projects to help grow my skill in this language. I would also like to use the GitHub Kanban boards in the future, I feel like it is the most versatile of Kand=ban boards I have come across so far and it is very easy to learn how to use.

- What would you do differently on future projects?

In future projects I will strive to learn a new backend as well as this time I only tackled a new front end I think learning how to create APIs in more than one language is a very valuable skill to have. I will also spend longer cresting my schedule and account for tasks such as learning and reviewing as I don't not do that this time around. I would also like to create a UI prototype after my APIs project is complete. I feel like creating prototypes before functionality in place is difficult as you miss a lot of small things that have a big impact on the UI especially during shorter projects. So I would wait to create UI prototypes until my back-end was in place I feel like this would lead to less re-done work.

- Discuss opportunities and design ideas for future work

I have a few design ideas to add to this project, I would add a map of materials to provide visual aids to users, I would add more details to the other tags so that users can use them better, I would also allow users to upload images and videos within their posts so that they can better get their issues and solutions across to the rest of the users. I would also like to add a filter visualizer, if there is a standard filter out there I would like to implement a tool that helps users create an exploded view of the filter, as exploded views are often used in instruction manuals for better understanding I think it would make it easier for community members to explain their filter if they had this type of visual aid. I hope that the project can be one day launched for usage by the actual community so that it may have an impact on the UN SDG.

General reflections on the class & project experience (3-5 pages)

- Before taking ENSE 405, were you aware of the UN SDGs?

I would say yes but not to the extent that I am aware of them now. I knew that the 17 SDG's existed as I had attended an event where pamphlets on the 17 UN SDG's were handed out. There was also other UN materials available such as the universal human rights. I knew more about the targets I would say than about the actual UN SGDs. A few years ago our class attended a ME to WE event. ME to WE is an organization that helps those in Least Developed Countries(LCD) have some economic opportunity. And they would be attempting to help solve some of the UN SDG's such as no hunger and no poverty and that is where I would hear about the different targets and how ME to WE was planning on contributing to them. For example, they would say their goal is to reduce poverty by a certain amount lets say 75% in ten years which is similar to the target present within UN SDGs. So overall I was touched by some awareness campaigns related to the UN and the SDGs but not directly.

- Typically, before taking this class, when you engineered software solutions, were you concerned with areas encompassing the UN SDGs?

I was not really concerned specifically about the UN SDGs or the areas around them, and I did not consciously program many software solutions to help advance the UN SDGs but some of the software projects I have done could help in some way move the UN SDGs forward.

In ENSE 375, I created a Howitzer simulator for my class. It was a Java program where you could enter different types of shell parameters and the program would tell the user where the shell would land if fired from a howitzer. I would argue that this could help contribute towards UN SDG #4 Quality Education specifically the part of continued education, military training can often open up many job opportunities for individuals. Especially those in LCDs where military service may offer incentives such as free higher education or free health insurance.

Another project I did for ENSE 374 was a web based marketplace where users could sign up and sell items. Very similar to Etsy or eBay, This could possibly fall under UN SDG #12 Responsible Consumption and Production as the marketplace is meant for used second hand items, users would be more responsible consumers by purchasing something used versus something new is a part of responsible consumption. It could also fall under UN SDG #11 Sustainable Cities and Communities as item reuse is a key part of building more

sustainable societies. The more we can reuse and repurpose the items that we already have the more sustainable we become as a society.

For ENSE 271, we created a member website for the Regina Mandolin Orchestra, this project was mostly for the members themselves to upgrade and consolidate their online activities. I would argue this falls under UN SDG #11 Sustainable cities and communities. Digital sustainable practices are also very important, we need to be mindful of how many digital resources we consume as they in turn run on hardware that is often not manufactured sustainably and run 24/7 consuming power. So having your community centred on one platform is beneficial as it consumes very little hardware in comparison to being spread out across multiple services and servers.

- Did learning about the UN SDG(s) help you understand better your role and responsibility as an engineer to society?

  Yes, it helped frame my responsibilities in a different light. I understood my ethical responsibilities as an engineer which were along the lines of not creating products and projects that would harm society. A part of my understanding of my responsibility also stems from the programmers oath from which I understood how I could specifically apply ethics and good practices to my work in more concrete ways evolving to how it is my responsibility to always be improving not only myself but as well as my solutions. The UN SDGs helped me understand that every project that you are working on has the potential to help advance the UN SDGs, maybe its just and extra tool that needs to be implemented or just simply making non-personal data free for use for the public. These changes and opportunities are our responsibility to look out for so that we can contribute to society whenever possible. So the SDGs are a vital part of my responsibilities as an Engineer as we are some of the most uniquely positioned members of society who are capable of designing change into their solutions.

- What was your experience(s) in engineering your specific software solution to address the UN SDG(s) selected?

  It was a very good experience, I learned a lot about myself and what I am passionate about as well as allowed me to uncover even more opportunities to develop applications that could be beneficial to different SDGs. For example, I want to create a website that maps Saskatchewan with where wells will provide the most naturally clean water. In terms of my current project the experience was unique, having to really dive deep into what my community needed and not just going with what I wanted to develop. I

had to figure out what framework and features would be best to support my communities activities. For example, I wanted to focus on visualization because I find that very interesting but that would not have been a good focus for my community. I also had to figure out which gap in the community I should fill to provide the most benefit. There were several gaps, such as connecting researchers to each other or allowing those in Least Developed Countries access to charity organizations that could help them set up water infrastructure.

- As a future engineer, what are your thoughts on the UN SDGs as a whole? Do you think they can help or hinder our work as software engineers?

I think the UN SDGs are very valuable as a whole as they ensure that the whole world is progressing positively and fairly, the goals and metrics help us clearly see what is missing and exactly what we need to change to ensure that the world is more fair. So, I feel like the UN SDGs should be advertised more so that more people are aware of them and maybe the awareness will help inspire some individuals to make change. I think it can both help and hinder our work. I think it can hinder in the ways that we must change the way we are living life now to achieve the SDGs which may temporarily lead to some lowered productivity as we transition application towards helping the UN SDGs. It will help us as we will have many more people who were being held back form becoming software engineers due to one of the issues addressed in the SDGs which means we will now have a lot more brain power at our disposal which will lead to more innovation to help achieve the UN SDGs even faster, similar to a snowball effect. In the end I believe the help aspect outweighs the hinder aspect so the SDGs and how to design applications and products for them should be a topic that is more often taught in Universities across the world.

- Should we use the UN SDGs to guide our work or is our work dependent on customer requests, regardless of the UN SDGs?

Most of the time we should use the UN SDGs as a guide to our work, the only cases I can think of where this would detract from the customers request is when the request would push progress on the SDGs back. In that case we should not be working with that customer as their request may be unethical. On the other hand, incorporating features or tools that contribute to the SDGs is a positive benefit for the customer as they are not only getting the product they requested but they also could advertise how their

product is helping the UN SDGs. So overall I do believe that the SDGs should be one of the focuses when developing the requests of the customer.

- Will you use your understanding of the UN SDGs in engineering solutions in the future?
    - Yes/No/Maybe – Please elaborate

I will be using the understanding of the UN SDGs in the future. Everything we create the next iteration could always be added option to become more useful and more useful may mean impactful for the SDGs. So during development I will always look for opportunities to evolve features so that they not only meet requirements but also advance the UN SDGs. I also would like my why to be an impact on another UN SDG for my capstone. I think there are lots of more opportunities out there to develop for the SDGs and I would like to explore that within my capstone. I feel like the 8 month format will allow me to create a bigger solution to a more complex problem.

- Will your experience learning about the UN SDGs inform your career path decisions in the future?
    - Yes/No/Maybe – Please elaborate
    -

I would like to work in the medical technology side of the industry so I will strive to help move UN SDG #3 Good Health and Well-being forward. I will try to advocate for the gaps I find that could be filled with something helpful and something that helps create change. One of the criteria for my future job is to find something fulfilling and for me that means having an impact, either on the community around me or across the globe. So I feel like learning about the UN SDGs gave me a more concrete why I can look at when looking for jobs, if a company's why aligns with a UN SDG it is more likely to be somewhere I may want to work.