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Engineering+ Service Learning

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# Reflection #1 – Pre-Project

The entire scope of our project is to provide students and faculty direction to an available parking stall on campus. This will provide convenience that will create incentive for students to utilize on campus parking. To execute this project, we have an electrical engineering component and a computer science component. The computer science side of the team will create an app that users can interface to find open stalls. The electrical engineering team will create nodes that will detect vehicles and update the status of stalls on the app.

# Activity Summary

As a part of the electrical crew, I was tasked to deliver a working prototype of our node. During this build my teammates and I identified 4 pieces of the node that needed to be incorporated. The first part of the node is the LoRa module. This piece provides communication via a LoRa signal for the status updates of each stall. The second piece is the sensors. These devices can detect a vehicle’s presence providing the data needed for the LoRa module to send parking stall updates to the app. For the third component of the node, we needed a power supply that can power the lora module and the devices. The future intent of the node is to be wireless, and battery powered however, for the first working prototype we want laptop connectivity. This connection will allow us to power the devices, interface with the LoRa module, visualize sensor data, and manipulate code as needed. To provide this connectivity we needed to install a micro-USB into the node. Lastly all the hardware needs to be housed and enclosed for protection from the agricultural environment.

# Limitations

During this build there were a few limitations that had to be mitigated. The Time-of-Flight sensor needs line of sight to detect an object. The sensor also must be offset a minimum of half a millimeter away from any transparent window if used. The Micro USB has a bend radius of 1-inch so the spacing for the housing must be suitable. To get the devices connected and wired up properly, the placement of the lora module and the magnetometer must be mounted towards the top of the housing. Lastly, the antenna to transmit and receive data must fit inside the housing.

# Goals

To solve the issues of the build I started by placing the devices in an ideal configuration and took a measurement of all the hardware. I then gave my self huge tolerances so that we have more room to mount and wire the devices. Based off the measurements and extra tolerances I shopped for an enclosure that would fit our needs. I specifically looked for an enclosure that had a clear top so that we could utilize the Time-of-Flight sensor. I found a suitable small electrical enclosure that met the NEMA and IP ratings of an agricultural environment. I ordered this enclosure and a subpanel (stand-off plate for mounting) from a company called poly case. The extra tolerances I provided allowed me to connect a micro-USB with a 1-inch bend radius to the Lora module. The micro-USB chosen was a female flush mount to male connection allowing for a sleek and professional look. To mount the devices in suitable locations within the enclosure I used brass 2.5-millimeter standoffs of different lengths that I can easily mix and match for custom heights. This allowed me to install the Time-of-Flight sensor relatively close to the half millimeter offset needed for operation. Lastly, I disassembled the antenna from its plastic casing and cut the ends to fit within the enclosure.

# Perspective-Taking

My computer science counterparts perceived the build as very professional. From the limitations identified, the goals created to mitigate, and the execution of the goals, we gave our teammates confidence that we can deliver. I recognized that it is important to be able to provide the hardware and working prototype for the CS team to utilize for app integration. As for my electrical engineering teammates, they see that my contributions have helped catapult our team ahead of schedule. For the supervisors and professionals that are concerned with our product delivery they know that we have rose to the occasion and have displayed determination to get the job done and get it done well. As a larger group we have a higher standard, and we are expected to meet those standards throughout the project.

# Teamwork

As mentioned above the SmartPark team is a larger group consisting of 5 CS and 4 EE. Due to the size of our team, learning to spread the workload evenly, identifying strengths, and utilizing those strengths has been important to our success. Working with students from a different career field has been very beneficial. Being able to lean on CS for code manipulation and the logic of the sensors has sped up productivity considerably. I personally feel lucky to have been paired with individuals that are equally driven to accomplish goals. I have experienced teammates making a conscious effort to be inclusive and hear out all individuals on the project. We have allocated time to bond as a group outside of the school environment and get to know each other to increase team chemistry. Our team’s willingness to be cooperative and gel as one unit has allowed for tasks to be accomplished quickly. I’ve learned through the project how important communication is and being able to articulate ideas and thoughts as well as comprehend other member’s ideas and thoughts. It’s helped me define the realities of engineering in the work force. I’ve realized that communication and being able to work in a team to solve problems with ideas and designs is what this career field is all about. I as an individual have helped vigorously brainstorm our product and how it can be utilized in various ways. These conversations have helped us identify potential customer bases and applications for our product.

# Measures of Success

Our measure of success for this project is high. Our goal for this semester is to have a working sensor/stall that will detect a vehicle and push our status update to the app. For next semester we plan to have a polished product. I define polished as having a solution to every foreseeable problem. We plan to have durability for harsh environments, false detection mitigation, diagnostics, compact hardware, completely wireless, and cost effective. As annotated in our technical specification paper, we understand that this is a luxury product. The user does not NEED this product and therefore it must be of high quality, and it must be convenient for the user. We want to instill confidence in the customer (university) and in the users (faculty and students). So far, I believe we are ahead of schedule and meeting the intended quality of our product. Beyond the commercialization of our project, I believe this will not only create an incentive for students to pay and utilize on-campus parking, but it will also provide WSU with a unique feature that may increase admissions. Colleges are all about innovation and leaping into the future of problem solving and making things better. Most universities across the nation have less than subpar parking solutions and charge student’s fees for this service. We are interested and improving the experience for all parties involved.