Reflections and Lessons Learned

MSE 4499

Ziqin Shang 250890594

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Problem analysis & Design

At the beginning of the course, I had limited amount of experience in design and develop an entire robot, I had experience in working on mechanical component, but for other aspects such as electronics and software, I have a little prior experience from second year design project, so this project challenged me to work with electronics and write corresponding code.

For the development of drive system, firstly I calculated the required torque and speed for the motor, then based on that specification, I started to look up online to see if there is any motor fits given specification, unfortunately all motors can be found here that fits the specification is wildly expensive for a price of around $200 each, then I looked up on Taobao, a Chinese shopping website, and found that I can purchase a motor with that specification for $60 each, and on the same website I also found the magnetic line tracker, drive and driven wheel with competitive price, so I went ahead and placed the order, the shipment arrived after two weeks. I immediately started building the prototype after shipment arrives, I spent about 20 hours in mechanical prototype development thanks to my previous workshop experience, however, some difficulties was encountered during the electronics development, the motor driver board came with the package did not work at all so I ordered another one from Digikey, I also had trouble communicating the magnetic sensor due to lack of knowledge, then I asked for help in Arduino community forum and the help was effective. The driving code was then written, and drive system functions as expected.

I found that my strongest aspect, and the one that I developed the most over the project, is that I can absorb new knowledge and technique quickly, whenever I encounter something that confuses me, I look up online and it will be sorted out quickly. and I have strong problem analysis skill and design skill proven by a fully functional drive system. However, my weakness would be sticking to the ideas that I prefer even though there is a better, more effective way.

To improve my design skill, I plan to work on some personal project in different specialization of engineering, working on multi-disciplinary project will help to improve my skill in general engineering design as well as exposure to other disciplinary-specific design.

To improve my problem analysis skill, I would stick to the original way, which is learning continuously, usually I go to YouTube to watch online tutorials, however, in a more advanced level of engineering, there is no online tutorials that specifically teach that area, a better way is to read papers that published by authorized scholars.

Individual and teamwork

Firstly, me and my teammates discussed what our capstone will be, after numerous number of research, we decided to make an autonomous fruit harvesting robot, or fruit picking robot, then after serval sessions of brainstorming and few iterations, we finalized the overall structure of our fruit picking robot. Then, we separated the tasks into different components, including drive system, manipulator and machine vision, and each person was assigned to a subsystem and that person is responsible for the development of that subsystem, I took drive system because I had experience in building robotic vehicles from robotics competition. However, one of my team members did not dedicate enough into the project, under this circumstance, most of the work including paper writing and prototype development was done by me and Alex, as a reflection, I learned that it is necessary to choose your teammate wisely at first place, there is nothing can be done if one person in the group is incapable and not dedicated.

After this project, I found my strength is that I always got my tasks completed with quality and before deadline, personally l take my responsibilities very seriously, and I will always get things done as expected, however, not everyone in my team performs like me, which reveals my weakness: unable to push my teammates to achieve expected outcome. During the project, some of my teammates is not dedicating enough and I did not push them hardly to achieve their tasks.

To improve my teamwork skill, I can start taking some leader role in teams in order to enhance my leadership, I can also participate in team building activities such as team sport.

Use of engineering tools

During this project, I had to use Solidworks to model and simulate the prototype, since I had an extensive amount of prior experience in Solidworks modeling, I did not encounter many problems. One thing good about computer-aided engineering tool is that you can modify it as you want with a little or no cost, during the development process, I went through about 4 iterations to optimize the overall structure, and the outcome was great, if I had no access to Solidworks, I have to play around with the prototype, make the engineering drawings by hand, assemble and disassemble frequently to achieve a better outcome. However, with the assistance of Solidworks, I just have to make a final version of prototype model and stick with it during the prototype construction process. As well as FEA analysis, I performed FEA analysis in various of parts including frame, connector and wheel hub etc. with the knowledge I learned from third year FEA course, I am able to perform different analysis under different loading scenario and fixture circumstances.

The strength I discovered during this phase of project is that I am able to use Solidworks proficiently thanks to the previous education and experience in mechanical construction. However, the weakness I have is that sometimes I am not able to construct extremely complex Solidworks model due to lack of experience, in order to improve my Solidworks skill, I can start taking the next level CSWA exams which are CSWA-Professional and CSWA-Expert, and construct CAD model from the physical things I have access to is also a good way of practice Solidworks skill.