ILR #3: Progress Review 2

Zihao (Theo) Zhang- Team A

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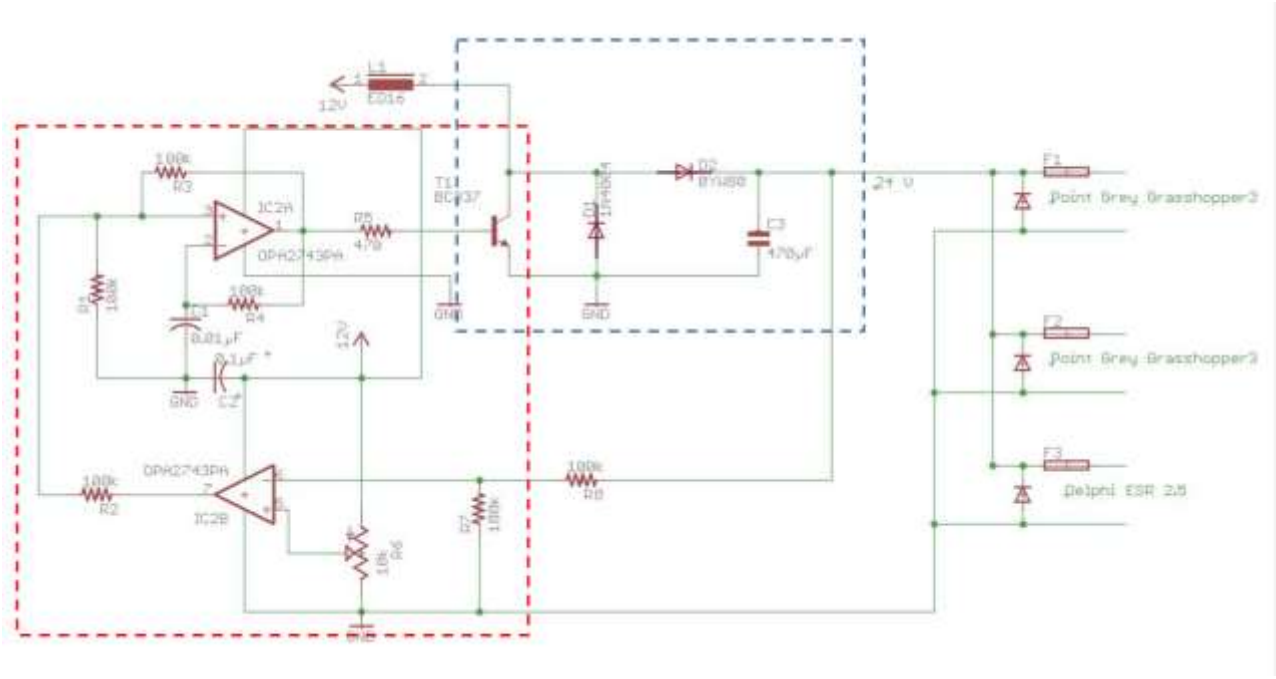
Individual Progress

The team has been making progress on the physical mounting structure, the cameras, as well as the radar during the week of October 23rd. In terms of individual work, I contributed most of my time on developing the power distribution system for the project as well as tasks related to the cameras.

The power distribution system for our project is mainly composed of a DC to DC power booster. Since our perception system will be eventually installed on a testing vehicle, the most accessible power source that the team has realized would be the cigarette lighter socket in the vehicle. For the cigarette lighter installed on most of the commercial vehicles nowadays, it is able to provide a voltage of 12V DC with up to 15A current. At the same time according to investigation on our sensor specs, both our cameras and radar have a recommend voltage of 24V. Therefore, the team decided to develop a DC-to-DC power booster that convert the input voltage of 12V to an output voltage of 24V.

Since I was primarily responsible for designing the power distribution system, I finished the draft PCB schematic of a DC-to-DC power booster that intended to convert 12V to 24V. The designed booster should be able to take an input of 12V DC and successfully power two Grasshopper3 cameras and one Delphi ESR radar at 24V DC consistently and simultaneously. The draft schematic is shown as the following:



Besides, I also worked on the initialization of our two cameras. I successfully installed the FlyCapture2 SDK on my Linux system but kept encountering problems on displaying image data from the camera connected to my laptop. Specifically, the computer can only receive data at an

extremely low frequency (usually around 1 FPS, given the maximum frame rate at 121 FPS) and therefore had trouble displaying the real-time image smoothly. In order to keep the project progress moving in time, I instead helped Menghan setup the camera SDK on her laptop and successfully initialized both cameras on her laptop.

Challenges

For designing this power distribution system, the main challenge came from my relatively weak background in electronics engineering and, more specifically, circuit design. To solve the problem, I spent extra time collecting the background information, recapping useful concepts from online tutorials and textbooks, as well as turning to other classmates with expertise in this area (Maitreya and Juan) for help so that I could finished the draft schematic in time.

For camera initialization, my laptop encountered difficulty acquiring data smoothly in real time, due to either technical issues from hardware or software or both. Due to the tight schedule of our project, I finally decided to shift the camera initialization task on Menghan's laptop in order to avoid any unnecessary delay on the project progress, instead of spending too much time on troubleshooting on my own laptop.

Teamwork

Amit Agarwal:

Amit continued to follow up on remaining issues about our Delphi ESR radar from the past week. More specifically, he reached out to one of the major suppliers of the Delphi ESR radar called AutonomouStuff (http://www.autonomoustuff.com/) and have established the contact with one of the technical stuff there. The person has expressed strong willingness on helping out on issues related to setting up our Delphi ESR 2.5 model.

Harry Golash:

Harry redesigned and fabricated another camera housing prototype with the water-proof feature.

The new prototype had a cap with convex surface added to the front of the camera housing, and thin acrylic sheet can be inserted as a shield to prevent water from going into the camera housing.

Harry also modified the GPIO cables for the cameras. With the modified cable, we will be able to send pulse signals to trigger the camera for the camera synchronization task.

As the project manager, Harry drafted the work-breakdown structure (WBS) and a more complete project schedule for this semester. The team further refined them based on his work.

Yihao Qian:

Yihao continued to work on testing the cameras throughout the week. He has been exploring more features of the FlyCapture2 SDK for the cameras from Point Grey. He successfully acquired data from our Grasshopper cameras on Linux system and was able to store the color image data in sequence on his laptop.

Menghan Zhang:

Menghan worked mostly on camera initialization. After troubleshooting on various technical issues, she successfully installed the FlyCaptutre2 SDK on the Linux system and made it functional on her laptop. Besides, she has been assisting Yihao on data acquisition from our Grasshopper cameras.

Yihao, Menghan, and I also conducted physical experiments on cameras after this week's progress review. Specifically, we designed the experiments to test both the resolution as well as frame rate of our cameras. The experimental setup is shown as the following:

In the experiments, a Grasshopper camera was mounted rigidly on the testing cart. For the resolution experiment, the testing cart remained stationary. We printed several checkerboards with different square size and placed them at increasing distances in order to test the limit of the camera to recognize object with a certain size (the square size in this case). For the frame rate experiment, the checkerboards' location was remained unmoved. Instead, we moved the testing

cart (with the camera rigidly mounted on it) toward the object (checkerboards) with approximately speeds. A more detailed illustration about the experiment will be in next week's Individual Lab Report (ILR) and more analysis on our experimental results will be also included.

Plans

Before the next ILR/ progress review, our team would like to achieve the following goals on our project of developing the perception system using Stereo Vision and radar:

1. Install required drivers for Delphi ESR radar

2. Acquire data from the radar

3. Test dynamic range of the cameras (outdoor)

4. Test stereo vision using April-tags

5. Test the camera housings in rough weather conditions

6. Write program to trigger and acquire camera data from both cameras

7. Work on the PDS PCB towards completion

In term of individual work, I will be mainly involved in tasks related to the radar (Task 1 and 2 listed above), as well as the outdoor testing for the cameras (Task 3 listed above). In addition, I will keep working with Harry on completing the design of our power distribution system PCB (Task 7 listed above).