Individual Lab Report 7

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Team A / The Avengers

Teammates: Tushar Agrawal & Pratik Chatrat

ILR06

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1. Individual Progress

Over the past two weeks, I've (a) modified packages to interface with the NicaDrone "Gripper" and (b) refined the underbelly design of the drone

a. Package Modifications

Early in the design process we completed a trade study of different ways of carrying packages by drone. This can be seen in *Table 1* below. We initially considered only using a claw or bay for packages. However, both processes were mechanically complex and would significantly increase the weight of the drone (thus limiting the weight of packages would were able to carry). On the recommendation of a classmate, we investigated an electro-permanent magnet produced by NicaDrone.

Metric	Weights	NicaDrone Electro-Permanent Magnet	Claw	Package Bay
Payload	20	8	8	10
Mechanical Complexity	20	10	2	2
Ease of Interface	30	8	6	6
Package Flexibility	30	8	8	2
Total	*100*	*8.4*	*6.2*	*4.8*

Table 1: Gripper Case Study

As you can see, the electro-permanent magnet stood out in all four categories that we evaluated it in. The final piece two this puzzle was determining what method best allowed the electro-permanent to attach to a package.

I settled on an approach (similar to that used for RFID tags) of implanting a magnet underneath an adhesive pad. This approach is demonstrated in Figure 1.

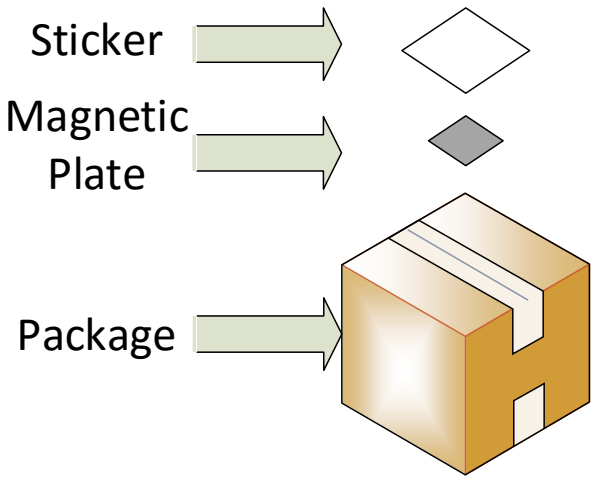


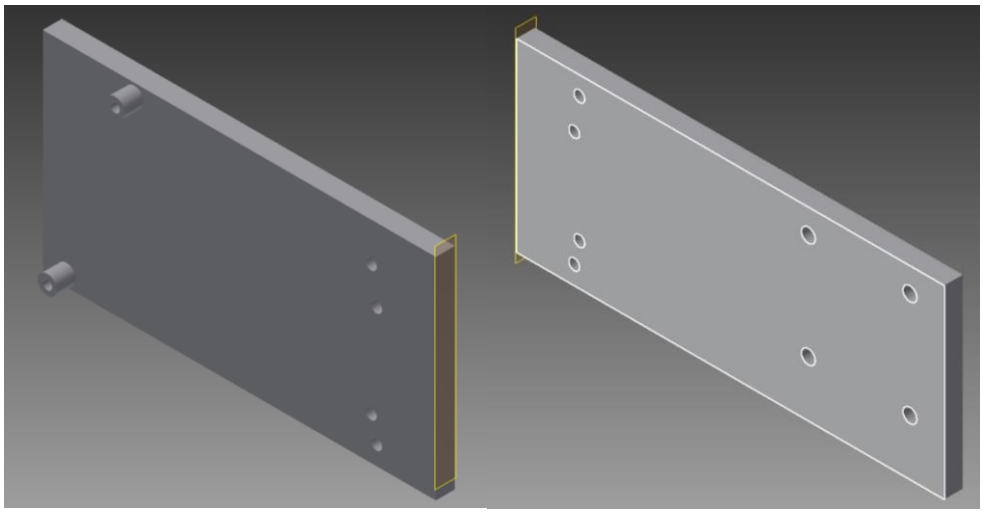
Figure 1: Method of Attaching Magnetic Plate to Packages

The approach was the most feasible for shipping companies to implement. It does need to be centered on the package, however it does not require special boxes or opening packages to insert a plate.

During testing, this method was able to hold 5 lbs of tension with the electro-permanent magnet. The package was released under its own weight in under a second. This approach worked best when the NicaDrone was physically touching the package. The only limitation was with the adhesive strength, which came off around 15 lbs, not the magnet.

b. Underbelly Refinements

As explained in the last ILR, the modular nature of the underbelly allows us to tweak the components of the design. Talking to Tushar, the optical-flow sensor was identified as not necessary at this stage. Smaller, lighter sensor mounts were designed for the LidarLite and camera. The mounts are approximately 50mm shorter. The new designs can be seen in Figure 2.



(a) (b)

Figure 2: Redisinged Sensor Mounts. (a) camera mount and (b) LidarLite mount

II. Challenges

There were no significant challenges this sprint. There were minor issues dealing with the MakerBot and measuring PCBs to be mounted. However, these were easily overcome.

III. Teamwork

Team A is returning to schedule, but still behind. Each team member took on different components of the task. This allowed the team to build their individual skillsets while expediting the work.

Tushar Argawal

Tushar has continued progress with the Odroid. He was able to demonstrate control of the drone via laptop. Additionally he integrated the LidarLite and camera into the Odroid which is connected to the PixHawk.

Pratik Chatrat

Pratik continued working on the navigation stack for the drone. The navigation stack is able to calculate a path and velocities to a selected point using information from odometry, Hokuyo, and a transform. In simulation, he is now able to run a successful “lawnmower” pattern that will be used to search for the AprilTag.

IV. Plans

Before the next PR, the team has four main goals:

1. Navigation Stack integrated with Pixhawk (Pratik)
2. Hokuyo & Odroid Mounted (Sean)
3. Contol UAV using Odroid (Tushar)
4. NicaDrone integrated with Pixhawk (Sean)