Concepts and Ideas - 4/22

**Agenda Items**

1. Finalize resolution of images for flight and for camera calibration (HIGH PRIORITY)

* **Progress: Completed**

1. Implement code to capture 3 images of each released payload after surveillance phase (HIGH PRIORITY)
2. Collect training images of chessboard with updated resolution and repeat calibration procedure (HIGH PRIORITY)

* **Progress: Completed**

1. Embed text boxes of GPS coordinates for each of the identified targets and tarps in the generated map (HIGH PRIORITY)
2. Integrate payload and image recognition team’s algorithms together and test communication (HIGH PRIORITY)
3. Deliver undistorted images to Ryan and Preston to enable them to study the impact the calibration matrix has on the accuracy of target identification, image stitching, and GPS calculations. (MEDIUM PRIORITY)
4. Parallelize the target recognition, map generation, video capture, and image capture of released payload features (MEDIUM PRIORITY)
5. Implement Pymavlink code in bash script to pull roll properties from pixhawk at the same rate as image frames and associated GPS coordinates are being stored (OPTIONAL)
6. Implement code to discard or “deprioritize” images captured under particular roll ranges(OPTIONAL)

**Ideas for Target Recognition**

* As a way to confirm that the ATR algorithm doesn’t store more than 5 GPS coordinates for identification of tarps, and targets, we can iterate through each of the vectors of GPS coordinates (where each vector corresponds to GPS coordinates for a particular identification), and check if the coordinates are all within the bounds of the GPS coordinates of the field boundaries. If yes, then average the GPS coordinates in each vector and store only the five whose values have the smallest standard deviation

**Ideas for Stop Conditions:**

* We can modify the algorithm to stop capturing video and identifying targets and storing GPS coordinates once a certain number of GPS coordinates (3 or 4) are recorded for one of the targets (by checking the length of vector storing coordinates). We would need to make sure that each successive GPS coordinate is reasonable so that we are not appending non-useful data).
* Additionally, we could program the script to stop capturing video and identifying targets after the search phase is completed which can be checked by reading in the waypoint numbers for the first pass and timing the flight for a full loop, and then when the elapsed time is four times this value then we would stop the ATR algorithm
* Similarly, for the map generation, we could run a timer starting at first pass (end of pass identified by waypoint number read in from Pixhawk) and then when time reaches four times the initial pass duration, we would terminate map generation algorithm

**Ideas for When to Run Map Generation**

* Depending on computational speed (number of images being processed), it may be reasonable to start running the script during the Surveillance phase and have the script collect multiple batches of images of the same locations to refine image stitching
* We can explore maximizing the frame capture rate for the first pass, or first couple of passes to increase the volume of images that the Image Stitching Algorithm can iterate through, and theoretically, improve the accuracy before decreasing the frame capture rate back to 3-5 for the successive passes in search phase
* **We might be able to run during the first 5 passes of the field at 320 feet, before we go into search.**
* **Might (?) be able to use waypoint count and pull that from Mission Planner to be able to classify which part of the mission we are currently on. Certain parts of the mission are repeated, such as the “cruise out”, which is repeated 4-5 times.**

**When to capture images for map generation**

* **Pull in roll properties from Pixhawk continuously at same rate as images are being sliced and GPS coordinates are being stored**
* If roll value is outside of expected search phase range then do not store image for map generation (for example > 4 degrees).
  + **What happens when there is a gap in images for stitching?**
* The pre-search phase will have specified waypoints. We can load these waypoints into mission planner to gauge the maneuvers and determine if it’s feasible to capture images for map generation given the estimated bank angles
* **Perhaps, we can implement a conditional that checks the roll for image at particular GPS coordinate and if its value is the smallest of that of the roll of all images for that same GPS coordinate, then overlay the image, else if it is the first image for that GPS coordinate assign to map, otherwise, do nothing with image**.