REU Presentation:

Week 3

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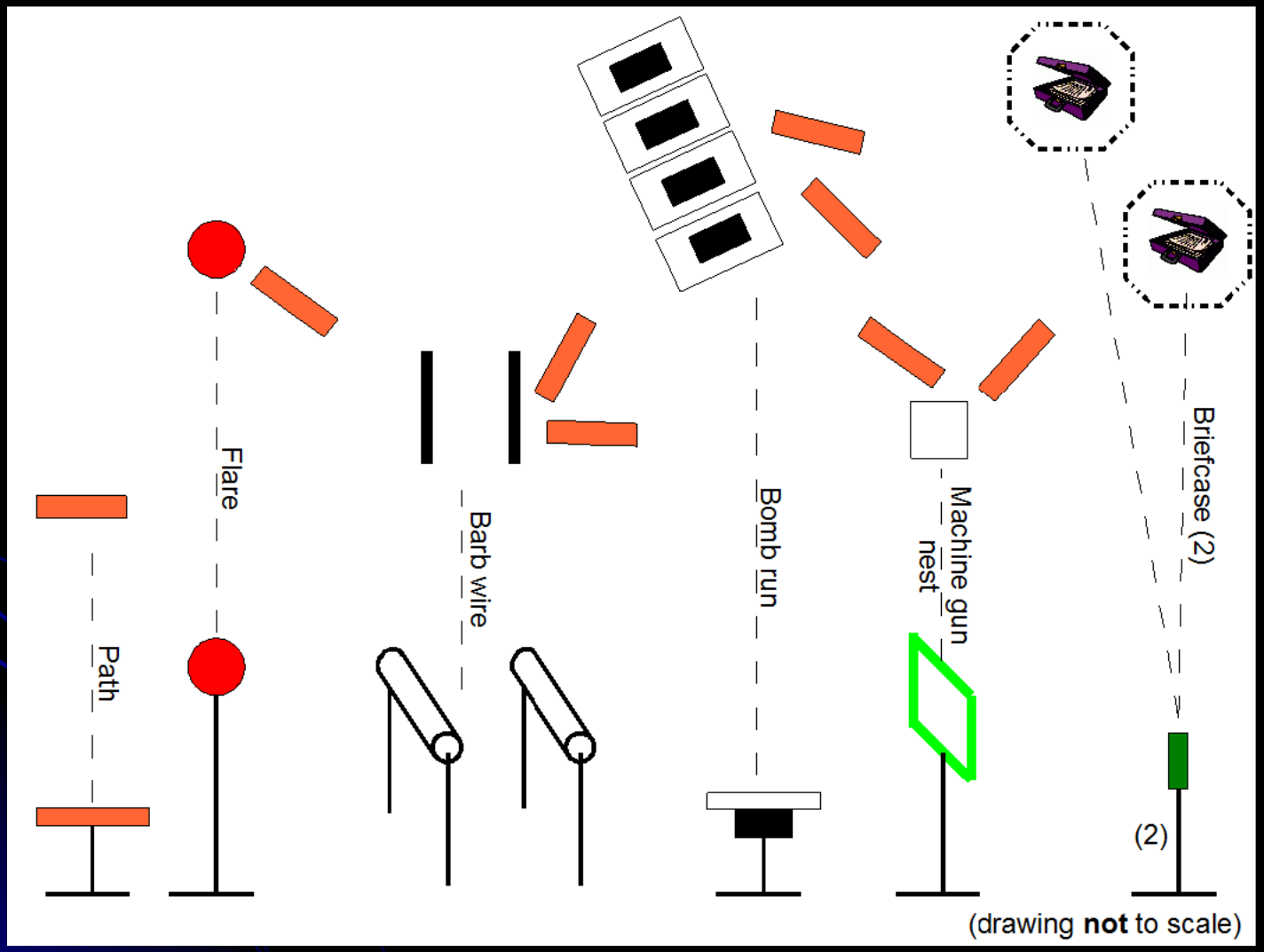
Project Outline

- Vision systems of AUV
  - AUVSI and ONR's 12th International Autonomous Underwater Vehicle Competition
- Two Cameras
  - Forward facing
  - Floor facing
- OpenCV and C++

The Tasks


Briefcase (2)
Machine gun nest
Bomb run
Barb wire
Flare
Path
(2)
(drawing **not** to scale)

The Plan

- Generally, forward camera will be “search” camera
  - Tasks: Flare, Barbed Wire, Machine Gun Nest
- Floor camera will be “follow” camera
  - Tasks: Pipeline, Bombing Run, Briefcase
- Create a state machine for CV tasks
- Each week, focus on a different task

This Week's Progress

- Becoming familiar with OpenCV library
- Learning Codelite IDE
- Created basic logic for the state machine
- Focused on flare task
  - Most simple
  - Easiest task to learn OpenCV

The “Flare”

Task description:

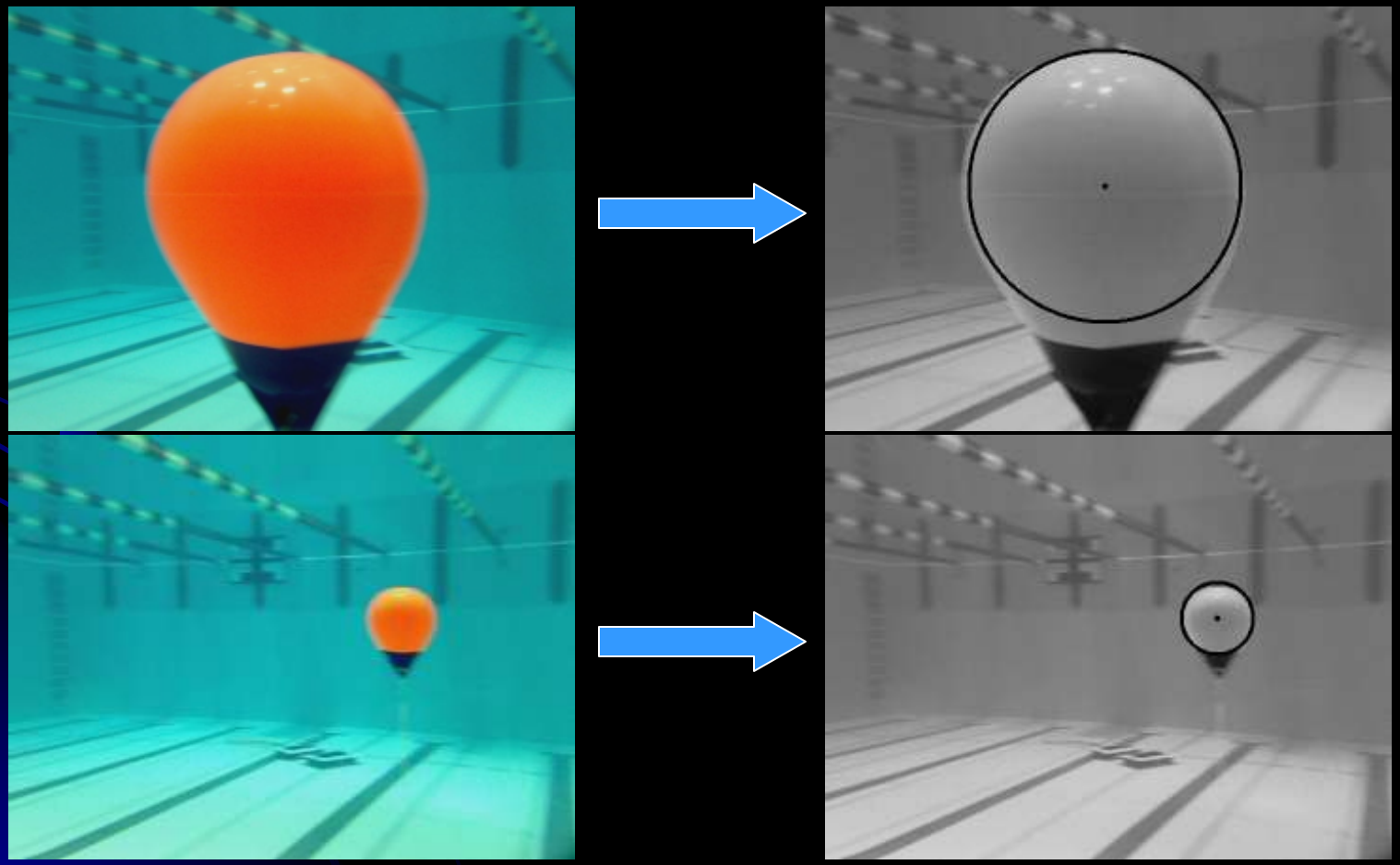
This tasks consists of a moored 9” (23 cm) diameter, **RED** buoy. The buoy will stay moored to the floor of TRANSDEC. The goal is to strike the buoy (Fire off the flare).

Initial Idea

- Use command cvHoughCircles(…) to locate the flare

Initial Images

Output Images



Problems

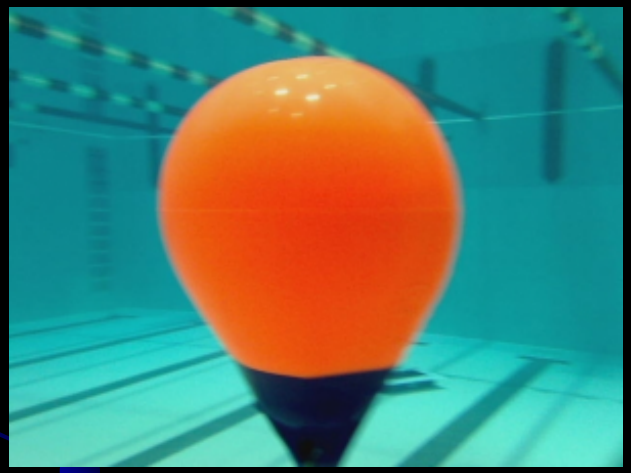
- Returns a lot of false circles if other objects are in the frame.
- cvHoughCircles() has a lot of parameters, so it is difficult to find uniform parameters that work effectively when the flare is near and far.
- Only takes in grayscale images, so you lose the advantage of the recognizable color.

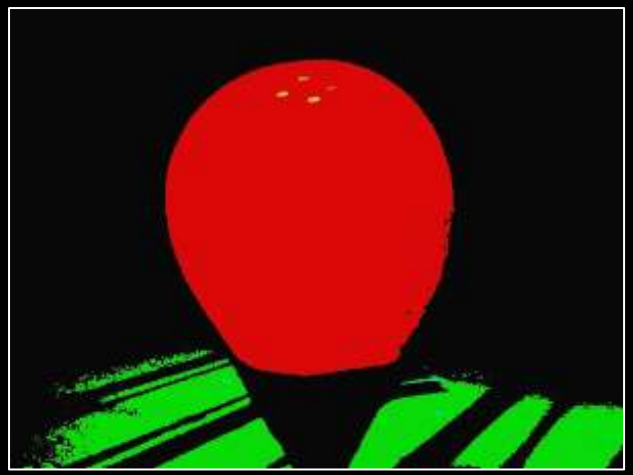
Thresholding

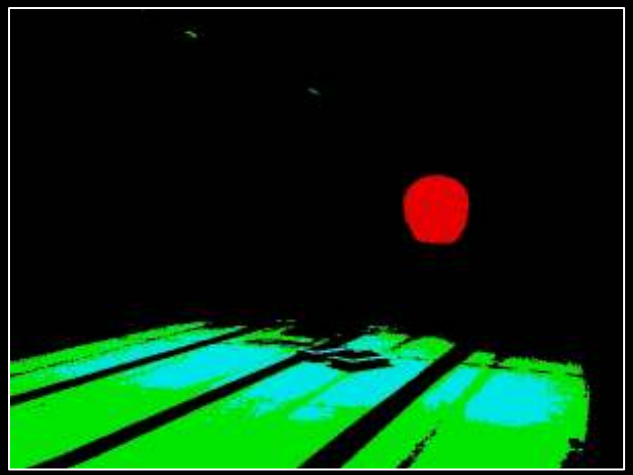
- I decided to use cvThreshold(…) to try to isolate the red flare in the image.

Initial Images

Output Images







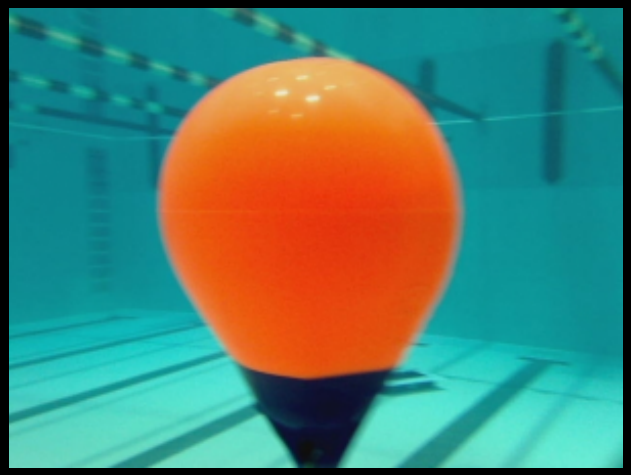
Problems

- Could not isolate the red flare alone using this method – the greens of the floor always remained.
- To solve this problem, I isolated the red color channel from the original image, and then used the threshold command.

Final Method

Initial Images

Output Images

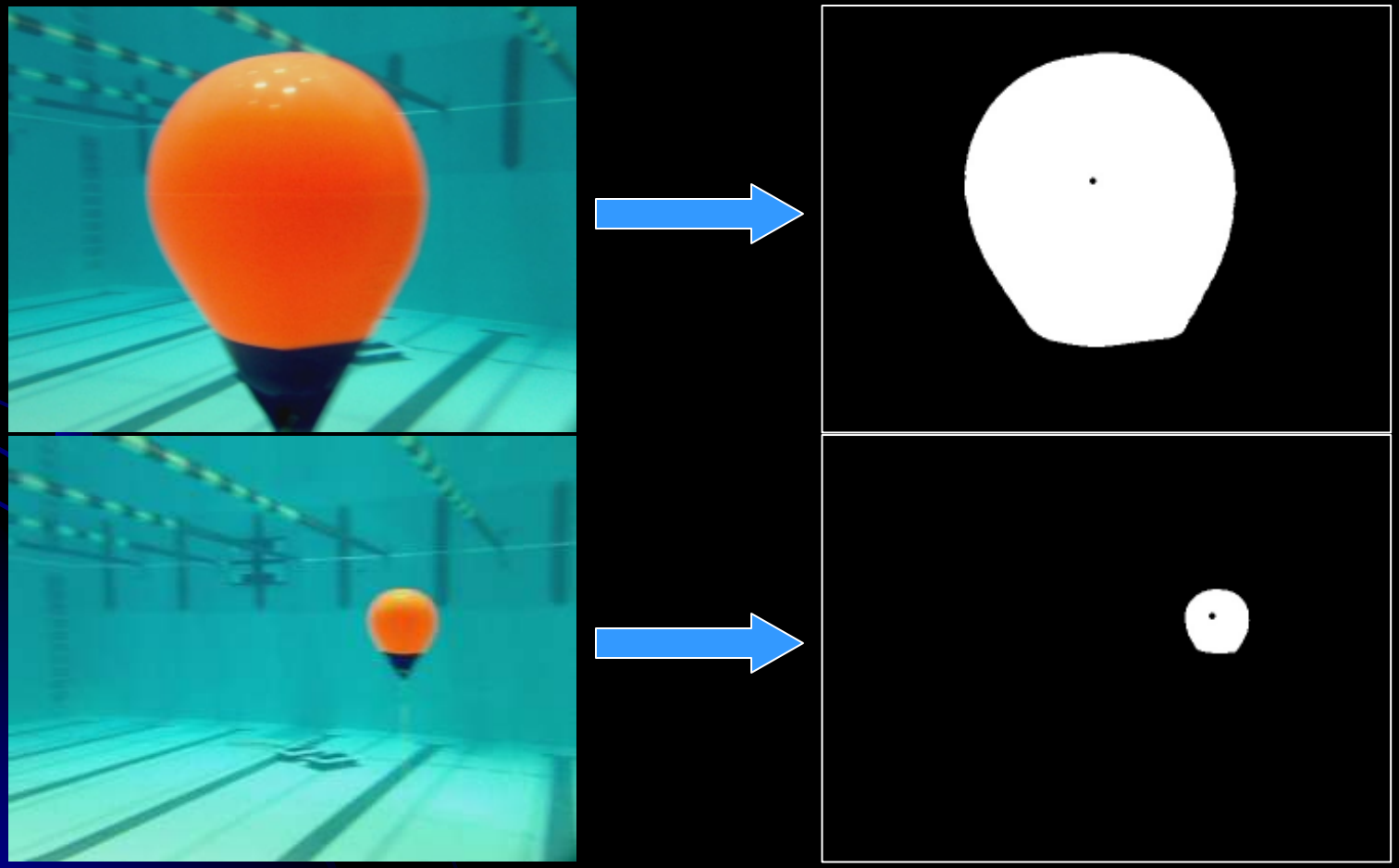


Finding the Center

- Next, the AUV needs to find center of object to decide on a new heading.

Initial Images

Output Images



Next Week

- Will use similar method to follow the underwater pipeline.
- Once that is complete, will start work on the bombing run, which I expect to be the most difficult.