COS 495 – Autonomous Robot Navigation
Fall 2011

Lab Manual 3

Figure 1: OceanServer Iver2 AUV

3.1 Goal

In this lab, your team will modify your Iver2 control software from labs 1 and 2 to allow the Iver2 AUV to complete the following task:

3.2 Task definition

You are required to design a robot control program that can guide the Iver2 Autonomous Underwater Vehicle (AUV) to repeatedly visit two task point locations in Carnegie Lake. The AUV will start just beside our launch dock. The task point locations will be assigned as GPS waypoints in lat/long format.

Input Arguments to Robot Control Program:
- The start location 0, the south side of the dock's end, at depth = 0.0m
- The location of task point 1, 40.340150, -74.649465, at depth = 0.0m
- The location of task point 2, 40.340010, -74.649605, at depth = 0.0m

Constraints:
- The AUV must start within 5.0m of the start location, but at any yaw angle
- The AUV must first visit task point 1, then task point 2, then repeat 1, 2, 1, 2, … (as many times as possible within the task duration of 5.0 minutes).
- The AUV is considered to have visited a task point location if it comes within 5.0m of the location
- The AUV cannot go to another task point location until it has visited the other location
- The AUV must not hit the dock, bridge, shoreline, or any other obstacles.
- Maximum prop speed is 170

Criteria:
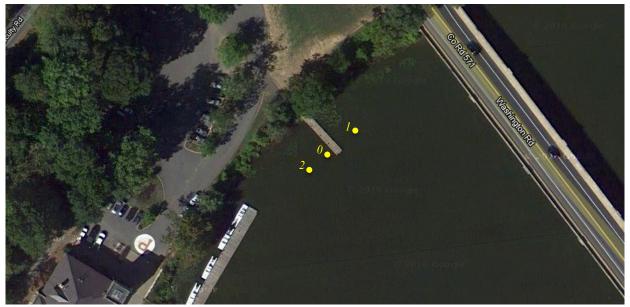- Maximize the number of task point visits within 5.0 minutes.

Figure 2: Example task point locations

3.3 Time out

To make sure your vehicle doesn't just drive off into the sunset, add a time out that stops the Iver2 mission after 5 minutes. During each iteration of your RunThread method, check to see if the mission has been running for longer than 5 minutes. If the mission has lasted longer than 5 minutes, set all actuators to 128.

If it helps, you may use the following code. Think hard about where this type of code should be placed.

```
// An example of global variables that may be useful
DateTime currentTime, lastTime, startTime;

// An example to be placed somewhere in your code
currentTime = DateTime.Now;
TimeSpan elapsedTime = currentTime - startTime;
double totalTime = elapsedTime.TotalMilliseconds / 1000.0;
if(totalTime > maxMissionTime){
    desiredDepth = 0.0;
    desiredSpeed = 0.0;
}
```

3.4 Logging data

For lab reporting and debugging purposes, each team should add some logging capabilities to their code. For every time step, be sure to record the AUV's longitude, latitude and yaw (plus whatever else you think maybe helpful.) Also indicate in the log when the AUV is considered to have visited a task location.

3.5 Deliverables

Each team must submit their executable file to the instructor by 9:00pm, on Thursday, October 6st. We will demo the code at Lake Carnegie on Friday, October 7th. As well, students must submit one lab report per group, due on Friday, October 14th. Reports should be formal with the following categories:

- Title
    a. Course Number
    b. Lab Number
    c. List of all students
- Abstract
    a. Clearly and concisely define the goals of the lab.
    b. Briefly describe experiments conducted
    c. Describe outcomes of experiments – i.e. what they demonstrated to you
- Introduction
    a. Quick intro to the context of the usefulness of the related technology
    b. Include relevant theory, mathematical tools SPECIFIC to this lab
    c. You may use citations where necessary
- Design
    a. Some labs, (like lab 3), require students to design something like a navigation routine. This section should be used to detail any hardware or software design choices
    b. A control flow block diagram is generally a good idea to describe how your navigation software works for lab 3. Provide relevant details of each block.
- Description of Experiments and methodology
    a. Describe any equipment
    b. Use figures to explain experiments
    c. Use tables when necessary to document each experiment, especially when they are repeated with different parameter values (e.g. P controller gain).
    d. Describe the number of times each experiment, was repeated.
- Results and Discussion
    a. Show any relevant plots – ensuring all axis are labeled with units
    b. Try not to show tables of data (maybe in the appendix).
    c. Discuss success of the lab based on experiment data. Were goals met? Use experiment data to back up your claims.
    d. Discuss problems, issues, etc. based on experiment data
- Conclusion
    a. Provide an overview of what was demonstrated in the lab and what goals were met.
- References
    a. List any publications cited
- Appendix with list of students and which sections they wrote for the report.

Note, writing should be concise and precise. Do not personalize the report with statements like "our group couldn't login to the robot until …". Don't discuss issues that are not relevant to the goals or lessons of the lab, e.g. "our code wouldn't work because we set the propeller speed after sending it to the main processor".