RoboSail Short Course, Community Boating, Inc, Boston, Spring 2015

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Goals and Course outline

Goals of the course – you will be able to:

1. Have new skills in programming, electronics, mechanisms, and design.
2. Think at a high level and create algorithms that translate sailing knowledge into code for a robot
3. Sail a robotic sailboat using scientific sailing principles
4. See connections to real-life robotics problems such as unmanned vehicles in challenging environments.
5. Enjoy your time in the course and in working as an engineer and developing a variety of engineering skills
6. Be inspired to explore technical subjects and Engineering fields

Technical Concepts:

    a. Program in C in an Arduino development environment,
        i. have good programming style,
        ii. use functions, logic, and variables appropriately
        iii. research commands as needed,
    b. Use servo motors, both remote control and computer-controlled
    c. Use a variety of sensors and interface them with computer
    d. Translate your knowledge of sailing into algorithms for a computer
        i. Points of sail (POS) with correct sail trim
        ii. Maneuvers: head up, bear off, tack, gybe, get out of irons, beat, run
    e. Code your algorithms for an autonomous sailboat
    f. Understand basic robotics – "Sense, think, act"

CBI-RoboSail Course Outline:

Class		Activity
1	1 hr	Intro – goals, materials, rules Team building exercise – google form entries Meet mentors Parts of a boat mechanical and electronic
	1 hr	Characterize boats on water (no computers in boats) Take notes on performance Exercise in '"robot sailing"
	1 hr	Set up computers with test code and libraries Downloads –Arduino IDE in class or sometime before next class Get Arduino running with serial I/O programs and blink programs
2	1 hr	Intro to Arduino: coding basics and exercises using Servo Motors Program structure, syntax, variables, logic, functions) Show set of hardware test code, assign 1 to each student, will rotate through the exercises Review Serial I/O program with all
	2 hr	Investigate each hardware component using test programs: Rudder servo, sailwinch servo, receiver signal, wind sensor, compass, gps, rc_passthrough
3	¾ hr	Coding exercise to warm up Introduce Boat Code Starter code that combines all the hardware programs together. Add your logic to control the boat. Introduce sailing challenge
	1 1/2 hr	Discuss sailing principles – use plastic boats Develop algorithm/ pseudocode /flowchart for automatic sail Program. Sail boat with manual ruder automatic sail
	¾ hr	Develop algorithm/pseudocode for basic maneuvers that only use windvane (brainstorm/draw/write). Use plastic boats to visualize. • Head Up • Bear Off
4	¾ hr	Coding exercise to warm up (TBD – see what skill students need) Discuss On-the-Water sailing challenges and pick some for today
		Discuss how to include GPS, Compass as possible
	2 hr	Develop algorithm/pseudocode for chosen maneuvers. Use plastic boats to visualize. Debug programs Test/debug/revise Demonstrate in water and try competition

5	1/2 hr	Plan for Regatta challenge and choose sailing tasks for your team/boat
	2 1/2 hr	Develop algorithm/pseudocode for chosen maneuvers. Use plastic boats to visualize. Debug programs Test/debug/revise Demonstrate in water and try competition
6	1 hr	Test/debug/revise
	1 hr	Regatta – all boats compete in sailing upwind/downwind, racing to a point or other tasks Parade of Sail
	1 hr	Debrief Closeout