RoboSail Short Course, Community Boating, Inc, Boston, Spring 2016

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Goals and Course outline

Course Goals – you will:

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. Program effectively in C in the Arduino development environment
4. Create computer code to control the servo motors on the RC boat
5. Take in data from digital sensors and use it in your code
6. Have an improved understanding of sailing principles
7. Enjoy your time in the course and in working as an engineer and developing a variety of engineering skills
8. Be inspired to continue coding and explore other engineering fields

CBI-RoboSail Course Outline:

Class		Activity
1	40 min	Intro – goals, materials, rules Team building exercise – google form entries Meet mentors and kids Review Sailing principles Introduce boats and mechanical/electronic parts
	1 hr	Characterize boats on water (no computers in boats) Take notes on performance Exercise in '"robot sailing"
	1 hr 20 min	Set up computers with test code and libraries Downloads –Arduino IDE in class or sometime before next class Intro to Arduino: Serial I/O program test. Tutorial1: Coding basics and exercises using Servo Motors (Program structure, syntax, variables, logic, functions)

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2	30 min	Arduino refresher and tour of hardware and IDE Complete Arduino tutorial
	2 hr	Review parts of a boat: mechanical and electronic Investigate each hardware component using Arduino Unos, test code, and test wire harnesses. Students rotate through the exercises. • Servos: Rudder and Sail • RC Receiver: Rudder and Sail, • Sensors: Wind, Compass, GPS • RCPassThrough test
	30 min	Coding exercise 1: "Rudder follows windvane" Use BoatCodeStarter.ino and write code to demonstrate that servo can be controlled by a sensors
3	20 min	Learn and practice RoboSail Frame of Reference using hand-held boat models
	40 min	Arduino Tutorial2: Use serial monitor to get user input and display data.
	30 min	Create algorithms for Automatic Sail Control from Windvane data Use plastic boats Diagram on paper, whiteboard, etc.
	90 min	Coding exercise 2: Automatic Sail Control from Windvane Use BoatCodeStarter.ino and write code to implement automatic sail control (where user still controls rudder). May use "heel" data from accelerometer to improve sail trim Test on land, then on the water Debug/revise
4	30 min	Discuss/learn how RC Transmitter can be used during autonomous sailing Create code for a manual/automatic sail switch.
	30 min	Create algorithms for using automatic rudder to sail to a specified point of sail (POS) as defined by the windvane Try out with fans on people and define problem clearly Brainstorm/generate algorithms for rudder control from the windvane data.
	120 min	Coding exercise 3: Write code to implement automatic rudder control to a POS using data from the windvane. Include manual/automatic switch from sail lever. Build on previous code or restart with BoatCodeStarter. Test on land then on the water Debug/revise Revise code to tack/gybe appropriately

5	30 min	Develop/review algorithm for changing POS (Point of Sail) using the cues from the RC Transmitter. Consider algorithm for tacking/gybing appropriately Review Regatta challenges and discuss how this code can be used for them
	120 min	Coding exercise 4: Add code that uses the RC Transmitter to change the specified POS with cues from. Build on previous code that includes manual/automatic switch. Test on land then on the water Debug/revise
	30 min	Plan for Regatta challenge and choose sailing tasks for your team/boat
6	30 min	Review Regatta challenges Each group chooses events and makes a plan
	2 hr	Regatta – all boats demonstrate maneuvers Judges keep notes and score
	30 min	Debrief Awards/certificates Closeout