Working Title – “Semi-Autonomous Monitor Fleet”
Technical Directors: Profs Swaszek and Vetter Technical Assistant: Alex Page

Summary:
Autonomous and semi-autonomous vehicles have been an important research and development topic for engineers over the past 10 years; interest in this area has spawned a number of design contests suitable for university teams. With applications in the areas of harbor monitoring and vessel tracking, the U.S. Coast Guard Academy (USCGA, in New London CT) has been pursuing projects on autonomous vehicles; over the past two years, senior level cadets have been constructing an autonomous sailboat. They have constructed a hull with mast, sails, rudder, etc., and instrumented it with wind and GPS sensors, computer controlled winches, etc.; May 2011 saw her maiden voyage. To further develop their vessel and improve their sailing tactics algorithms, extensive testing of the vessel is required. To facilitate this testing, a fleet of radio-controlled powerboats is desired to track and assess the sailing performance of the sailboat.

The goal of this ELE480/481 capstone project is the development of such a prototype fleet. We envision COTS radio controlled boats with additional equipment: GPS for navigation, cameras to find and monitor the sailboat, radio communications links to both coordinate fleet activities and to provide status information to on-shore individuals, and on-board computers to control each vessel. While expected to provide their own final product, the URI team is expected to interact with a parallel capstone team at USCGA (3 cadets) as well as students at Connecticut College working on artificial intelligence implementations of tracking and tactics algorithms. To facilitate such interaction, URI students are expected to employ electronic communications tools (e.g. Skype and blogs) as well as visit New London CT frequently each semester.

Scope of Work:
To design, construct, test, document, and demonstrate a monitor fleet consisting of three boats:

- Specification of and purchase of a fleet of radio controlled powerboats; initially we plan to employ ground based vehicles (small radio controlled cars) for testing purposes
- Instrumenting the boats for on-board computer control to replace/augment radio control, radio communications (possibly both WiFi and cellular), and a variety of sensors (GPS navigation, vision equipment, and wind measurement sensors, potentially arduino based)
- Development of semi-autonomous strategies to control the boats themselves (individually and as a fleet) with minimal or no shoreside intervention

- Development of algorithms to process camera data to assess the status of the sailboat
- Development of communications protocols
- Development of an application to provide sailboat data to shoreside monitors (likely to be iPad based)
- Interaction with CGA and Connecticut College students throughout the academic year

Skills Needed:

- ELE (1-2 students) – ability to interface desired electronic hardware (radio control, boat actuators, sensors, computers, etc); arduino experience/interest is a plus
- CPE (1-2 students) – software development of the control strategies and communications protocols, writing of an iPad application for shoreside monitors – enrollment in Prof Ohley's ELE546 during Fall 2011 would be ideal!