Title: Autonomous Sea Surface Vehicle (ASV)

Team Members: MyAsia A. Reid[1], Linda K. Buame[2], Amadi Sefah-Twerefour[2], Prosper Y. Adiku[2], George Owusu Fordah[2] [1]Elizabeth City State University, 1704 Weeksville Rd, 27909 N C [2]Department of Oceanography & Fisheries, University of Ghana #LG 99 Legon-Accra and Center for Remote Sensing of Ice Sheets

Team Mentor: Dr. Eric Akers

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Introduction

The response of organisms to changes in water quality parameters enhances our understanding of aquatic environments and the long term effect of anthropogenic activities on these systems and humans in the long term (Abowei, 2010). Data requirements for this purpose are important much as they are costly due to the limitations of the environments in which they occur.

Data from sensors such as the Moderate Resolution Imaging Spectroradiometer (MODIS) and Sea-viewing Wide Field of View Sensor (SeaWIFs) are data sources that require limited human efforts hence easy in acquiring. However, these have errors as calibrations are based on the assumption of uniformity in deviation between remotely sensed data and few in-pixel-in-situ data. This assumption has been found not to be consistent under all conditions; for instance deviations in the *chl a* concentration of coastal waters compared to water offshore *(*Yuan *et al, 2005).* Remotely Operated /Autonomous Surface Vehicles (ROV/ASVs) are a group of small automated vehicles capable of carrying out hydrographic surveys, security operations as well as salvage, environmental monitoring and scientific sampling and mapping. The Oceanographic Systems Laboratory, at Woods Hole, is involved in the construction of a number of ROVs including the REMUS series for Hyperspectral Remote Sensing of the Coastal Ocean (Chris von Alt, 2001). Constructions of various Remotely Operated Vehicles enhance efforts at meeting real time data needs for aquatic studies.

Methodology

The objective of this research is to build a prototype ASV that is capable of navigating to specific waypoints to collect water quality data. The vehicle body would be constructed mainly with polyvinyl chloride (PVC) pipes. For the data collected by the ASV to be increasingly useful, the precise location of that data must be known. Good routing is essential for the safe deployment, operation and recovery of an ASV but a major challenge that limits the capability of most AUV/ASVs (Leonard *et al*, 1998). The three main methods for navigation of AUVs include dead-reckoning and Inertial Navigation Systems (INS), acoustic navigation, and Global Positioning Systems (GPS) navigation techniques. Given that our ASV is small in size and for cost and power constraints, high performance INS cannot be integrated in to it, we would use GPS resets for water (Arvind Antonio, 2007). The vehicle's activity would be controlled by a microcontroller board that serves as a control for the coordination of all components and sensors. The Arduino microcontroller provides an environment for programming the board (http://www.arduino.cc/). The microcontroller board would be integrated with the GPS unit and a gyro or compass for navigation, an SD card reader for data logging and sensors that would do measurements. Waypoint navigation would be carried out by determining the bearing and distance to the various sampling points. Data transmission would occur through National Marine Electronics Association (NMEA) strings that the GPS provides. Frequency of data collection by the sensors and subsequent storage by the SD card reader would be determined by the board.

Conclusion

At the end of the project, a prototype ASV capable of specific waypoints navigation and having the potential use by Oceanographers for continuous sampling in the future would be built.

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