Title
ACT4: Networked Aquatic Sampling System

Authors
Amit Dhariwal
Bin Zhang
Eric Shieh
et al.

Publication Date
2005

Networked Aquatic Sampling System

Amit Dhariwal, Bin Zhang, Eric Shieh, Beth Stauffer, Carl Oberg,
David Caron, Aristides Requicha, Gaurav Sukhatme
Robotic Embedded Systems Lab, USC – http://www.cens.ucla.edu/portal/marine_microorganisms/

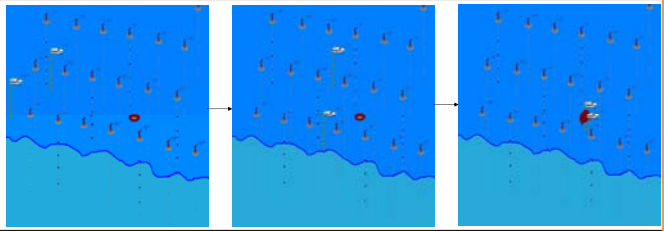
Introduction: Development of an Autonomous Networked Aquatic Sampling System

Research Goals

- Development of an autonomous network of heterogeneous sensors to sample and track changes in aquatic environments using a combination of static and mobile platforms for sensor mounting.
- The network should be able to adapt itself directing the mobile entities (robotic boat) to areas of interest (as described by marine biologists).
- The network should be able to locate, track and study the growth and migration patterns of harmful algal blooms like those caused by brown tide algae at scales relevant to the organisms.

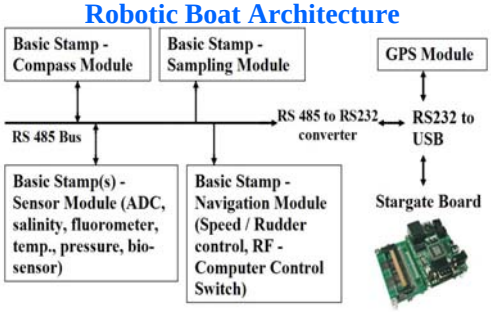
Problem Description:To develop an autonomous network for monitoring aquatic environment

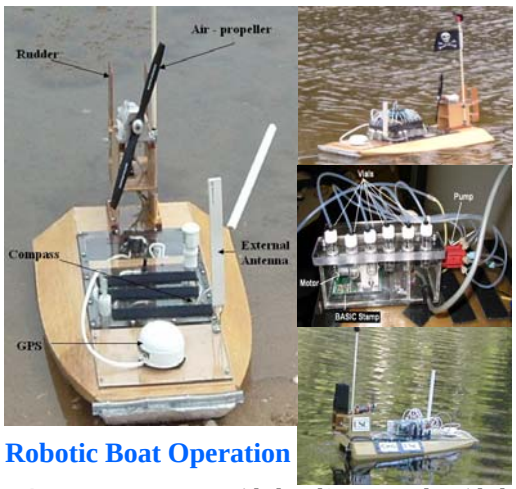
- The static network regularly monitors the environment at low resolution and directs the mobile node (robotic boat) for fine-grained sampling.
- The robotic boat moves to the location of interest, collects data and samples for lab analysis.
- Typical sensor suite: Thermistors (temperature), Fluorometer (chlorophyll) , Light intensity, pH, Opacity, Salinity (conductivity)



Proposed Solution: The Autonomous Networked Aquatic Sampling System

Robotic Boat Architecture



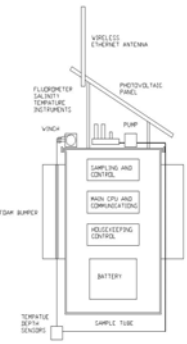


Robotic Boat Operation

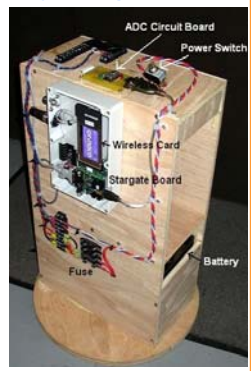
- Autonomous sensor guided and/or network guided near-surface sampling system for field operation
- Wireless 802.11b based network communication
- Outfitted with basic sensor suite for pertinent environmental parameters - thermistor, fluorometer and water sampler
- Autonomous navigation to GPS waypoints using on-board GPS and compass (PID based control)
- Network guided and sensor directed navigation and sampling

Buoy Operation

- Continuous real time data acquisition and logging of pertinent environmental parameters
- Wireless 802.11b based communication
- Sensor suite: Array of thermistors (for temperature vs. depth profiling) and fluorometer (chlorophyll)
- Data transmission to the shore



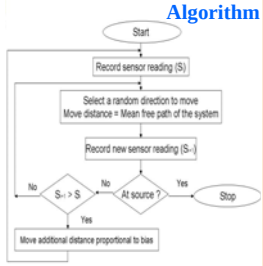
Buoy Design



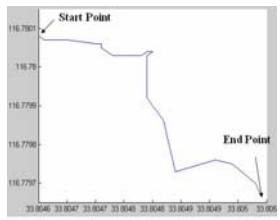
Network (Robotic Boat + Buoy) Operation

- Network of 10 static nodes and 1 robotic boat
- AODV based ad-hoc 802.11b wireless network for communication between all the mobile and static nodes
- Transmission of data to base station
- In-network data processing and network guided direction for robotic-boat
- Sensor directed boat navigation and sampling

Algorithm



Field Deployment at James Reserve



Path of robotic boat during an autonomous run