An Ecologically Curious Robot for Monitoring Coral Reef Biodiversity

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http://warp.whoi.edu

This project aims to develop a robotic system that can efficiently characterize the biodiversity of a complex ecosystem, such as a coral reef.

Challenges

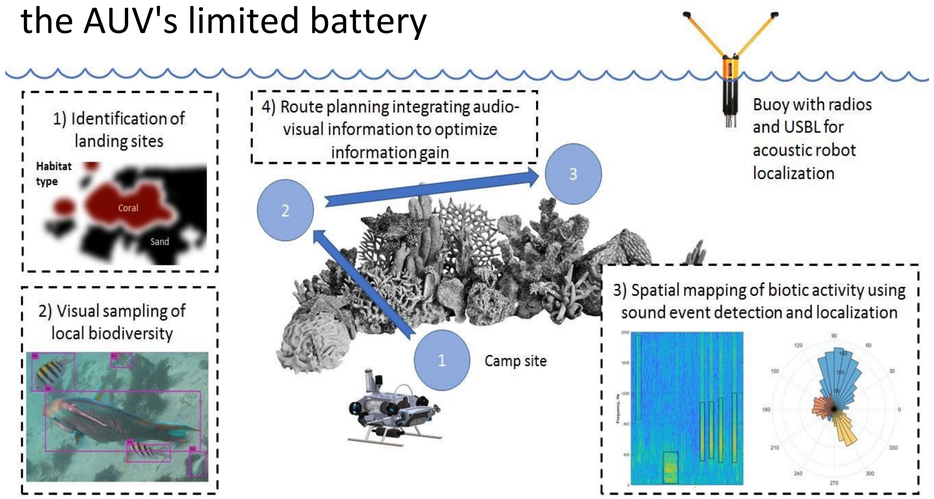
- High dimensional, sparsely distributed observations of biologically significant taxa
- Animal behavior biased in the presence of moving foreign objects (e.g. robots and divers)
- Visual observations have limited range and high specificity
- Acoustic observations have long range and low specificity

Scientific Impact

- Novel visual-acoustic sensor fusion to produce unified biological activity and biodiversity models of coral reefs without human supervision
- Informative path planning for long-term exploration combining autonomous sensing site selection and adaptive planning for power conservation
- Datasets for machine learning of visual-acoustic signatures of organisms

Approach

- Our AUV uses visual and acoustic observations in an Informative Path Planning algorithm
- Select sensing locations and times and resting periods to maximize biodiversity model accuracy while conserving the AUV's limited battery

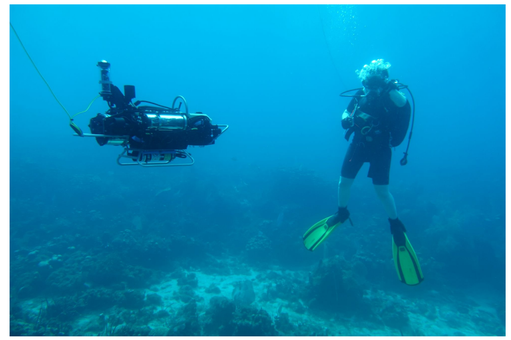


Educational Broader Impacts

- Training high school, undergraduate, and graduate students in STEM fields
- Developing collaborations with University of the Virgin Islands and Emerging Caribbean Scientists undergraduate program
- Provide video and audio for educational programs at Virgin Islands National Park

Societal Broader Impacts

- Coral reefs are under threat worldwide from climate change and disease
- Enables long-term evaluation of conservation and restoration efforts
- Applicable to monitoring of other complex ecosystems such as rainforests



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