Technologies for Environmental and Disaster Monitoring

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Mosquito Crowd-Sensing

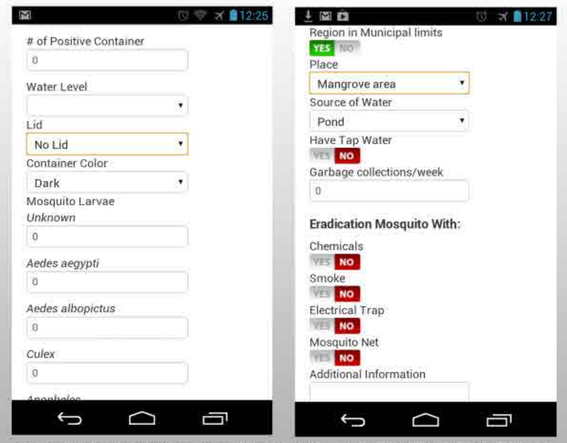
Center of Excellence for Ecoinformatics at Walailak is developing a curriculum for high schools to engage students in scientific study while accomplishing real world tasks.

Students learn to identify mosquito varieties, how they spread, and the types of diseases different types of mosquitos carry. Students go out and locate possible water containers that mosquitoes can utilize to breed and attempt to count and classify the mosquitos they find.

Data is aggregated in a central database where it is can be utilized for scientific research via web portal that provides access and visualization.

My part in the project is a mobile application to facilitate in-field data collection, using device GPS and easy-to-use data input.

We are currently working to expand this application to include visualization of mosquito population on the mobile device.

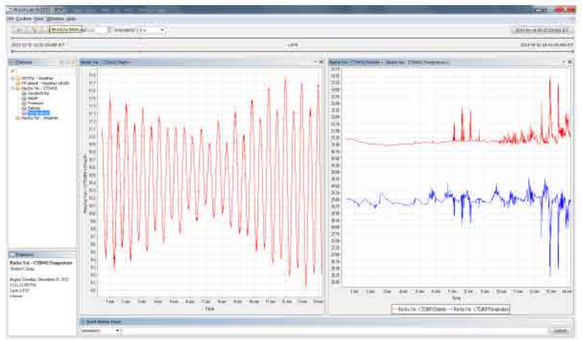


Screenshots from the Mosquito Reporting Application

Coral Reef Monitoring

Racha Yai is an island off the Coast of Phuket. It is home to many species of coral, but lately has been prone to coral bleaching and high rate of coral mortality.

To study the environmental factors leading to coral bleaching in fall of 2010 we deployed an observatory consisting of a weather station and CTD (underwater sensor that measures salinity, pressure, and temperature, to high degree of precision).



Visualization of the real-time pressure (left), salinity, and temperature values (right) at the Racha Yai observatory using NEES Real Time Data Viewer.

The deployment uses DataTurbine a real-time middleware application to facilitate real-time streaming to researchers here in Thailand, the Australian Institute for Marine Science, and UCSD.

Presently, I am working with Walailak to expand this deployment to include an additional site on the western side of the island.

Examining the CTD deployment (instrument on right)

Aquaculture Monitoring and Early Warning Flood Detection

Motivation

Bandon Bay, Surathani province is home to mussel, cockle, oyster, and shrimp farmers. In March 2011, severe rainfall in the southern region of Thailand caused an influx of freshwater and sediment into the bay. Cockle and oysters were suffocated by a thick layer of sediment. The surge of water forced the shrimp out into the open ocean. As a result, the aquaculture industry suffered immensely, with losses upwards of eight hundred million Baht.

Aquaculture in Bandon Bay

The goal of this project is to provide a valuable service to the region by giving farmers and locals a resource for assessing the water quality in Bandon Bay, as well as providing a warning system against possibly treacherous environmental patterns. The data collected will not simply be used for forecasting, it will be archived and made publically available. The data, techniques, and software used will be documented and shared with the international science community and can be applied in other research worldwide, facilitating further international collaboration.

Weather Station & Solar Panels

Recievers & Gateway

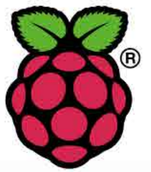
Method

Currently, we have deployed weather stations, solar panels, and a netbook for data collection and analysis in the bay.

The netbook, however, pulls too much power and is prone to power loss, especially after periods of cloudy weather. Likewise, the cellular connectivity is poor and causes frequent interruptions in data transmission.

We are evaluating two alternatives:

Rapberry Pi
(low cost, low power ARM system, runs Linux)
Android Sensor Pod - developed by UCSD
(low power, built in cellular, tested in field)



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Once we establish a stable system, we will move onto data analysis. The acquisition and transfer of data will be accomplished using **DataTurbine**, an open-source real-time data streaming middleware supported by the NSF-funded Open Source DataTurbine Initiative. For analysis, we are planning to use **ESPER**, an open source event-stream processing and event correlation engine.

We are currently working to acquire water quality sensors, including pH and dissolved oxygen, as those will provide crucial data for this project.

Oyster Growth, Monitored at Bandon Bay

FULBRIGHT UCSB UCSD it2 CREON Coral Reef Environmental Observatory Network NSF