Instrumenting Thailand's Coastline:
Cyber-Infrastructure for Environmental and Disaster Monitoring

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Introduction

- First year graduate student from University of California Santa Barbara
- Pursuing a PhD in Computer Science
- Currently on a Fulbright research scholarship at Walailak University
- 4 years experience working on sensor networks, with multiple projects in Taiwan and Thailand

Research Interests

- Mobile Devices as sensors for Environmental and Disaster Monitoring
- Bridge the gap between computer science and biological sciences
- Create technologies that are affordable and sustainable in developing regions

Current Projects in Thailand

- **Mosquito Crowd-Sensing**
- **Aquaculture Monitoring and Early Warning Flood Detection**
- **Coral Reef Monitoring**

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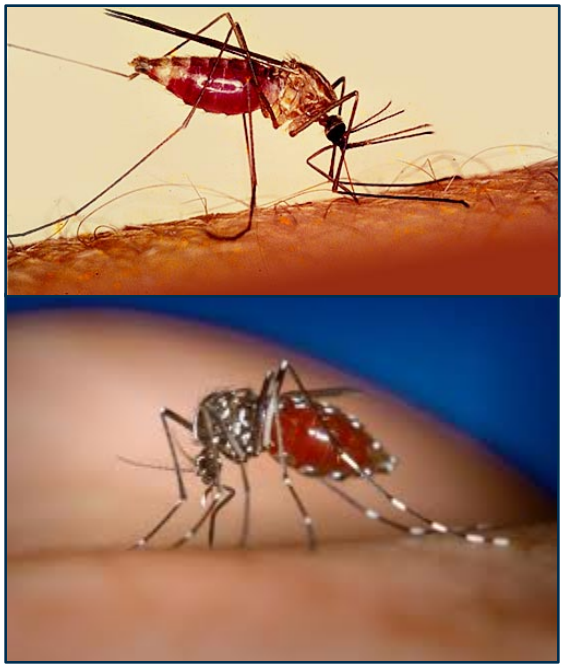
Mosquito Crowd-Sensing

In collaboration with Siriwan Wongkoon

- Walailak University has many outreach programs with local high schools.
- Part of an effort to integrate real-world science into local high school curriculum
- Students learn biology and field work, while contributing real scientific data



Mosquito Crowd-Sensing

In collaboration with Siriwan Wongkoon

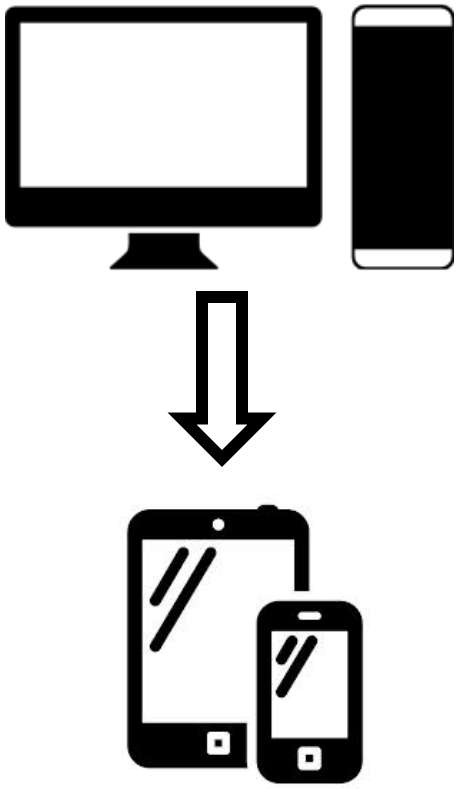
Students:

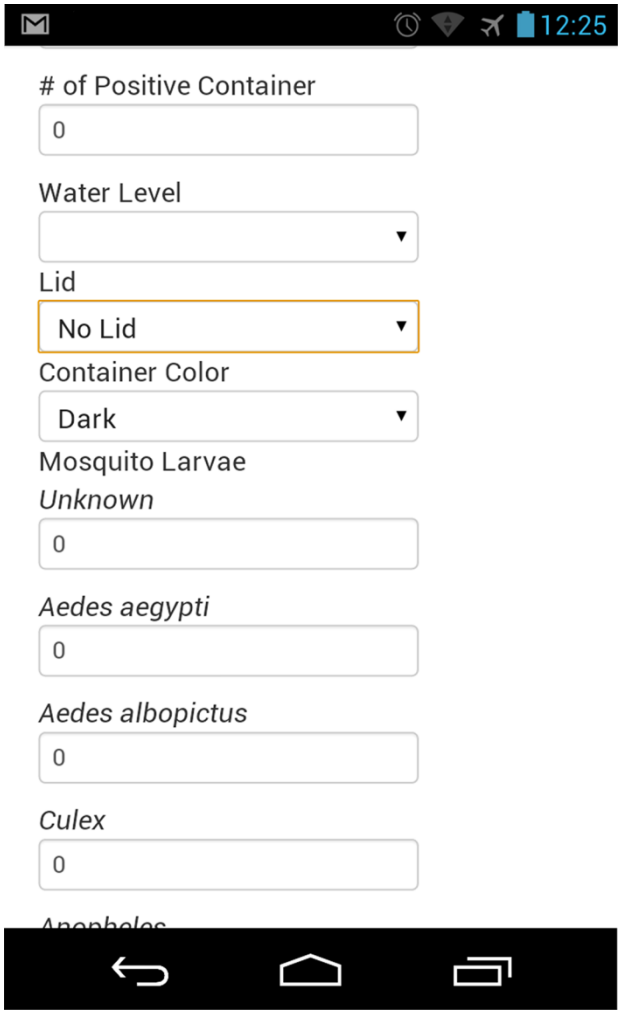
- Learn to identify mosquito species and how they reproduce and carry disease
- Go out and identify mosquitos, and water canisters that can facilitate mosquito reproduction
- Record this data into a central database for use by biologists

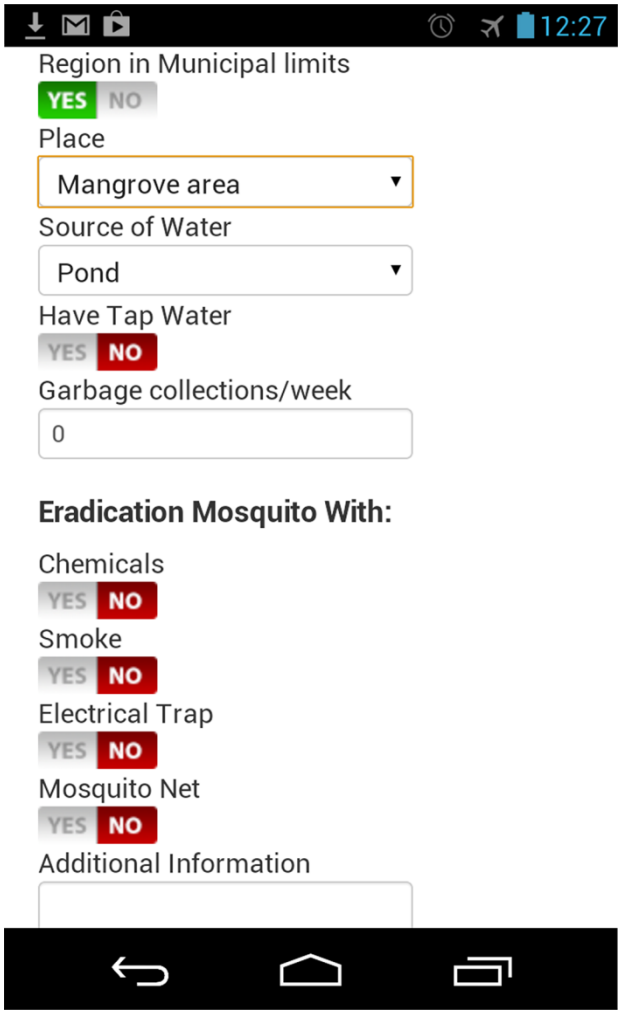
Mosquito Crowd-Sensing

In collaboration with Siriwan Wongkoon

- My work expanded on this system to create a mobile application for in field data entry
- The application simplified the data entry process and allows in field data entry (where internet is available)
- The application is available as both a mobile website (for any mobile OS) and as an Android application




12:25
# of Positive Container
0
Water Level
Lid
No Lid
Container Color
Dark
Mosquito Larvae
Unknown
0
Aedes aegypti
0
Aedes albopictus
0
Culex
0


12:27
Region in Municipal limits
YES NO
Place
Mangrove area
Source of Water
Pond
Have Tap Water
YES NO
Garbage collections/week
0
Eradication Mosquito With:
Chemicals
YES NO
Smoke
YES NO
Electrical Trap
YES NO
Mosquito Net
YES NO
Additional Information

Mosquito Crowd-Sensing

In collaboration with Siriwan Wongkoon

- This application is available and can be a part of any school curriculum
- The data is also made available and can be used for the study of diseases like Dengue Fever and Malaria which use mosquitos as vectors for infection

http://twibl.org/mosquito/

Current Projects in Thailand

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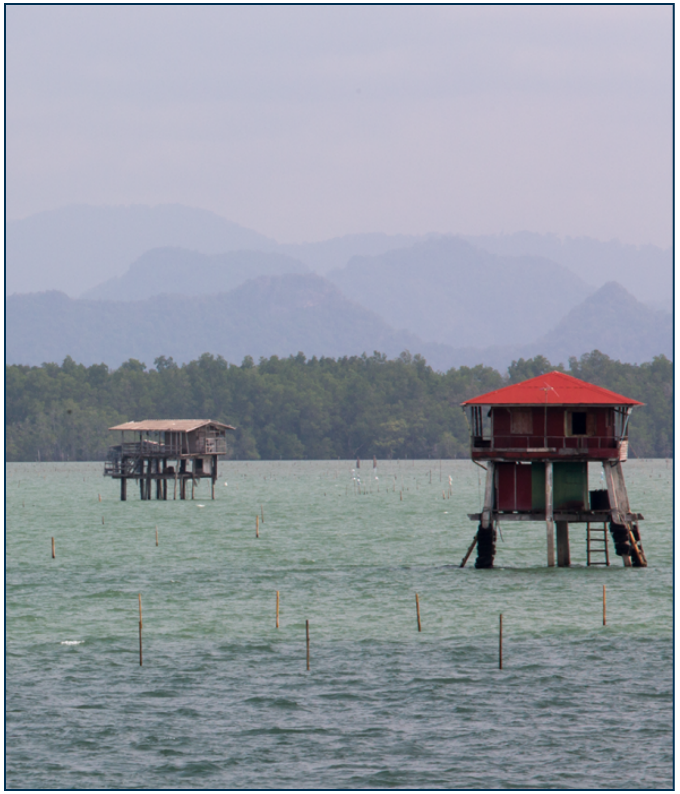
- Coral Reef Monitoring

Aquaculture Monitoring & Early Warning Flood Detection

In collaboration with Sirilak Chumkiew

- Bandon Bay, Surathani province is home to mussel, cockle, oyster, and shrimp farmers.
- Severe rainfall causes an influx of freshwater and sediment into the bay.
- This causes massive damage to the aquaculture industry.



Aquaculture Monitoring & Early Warning Flood Detection

In collaboration with Sirilak Chumkiew

Goal: Monitor water quality in the bay and detect potential flooding events

- Use a series of weather stations and underwater sensors monitoring
  - Salinity
  - Temperature
  - Pressure
  - Turbidity
  - Dissolved oxygen.
- Analyze this data in real-time at the site

Aquaculture Monitoring & Early Warning Flood Detection

In collaboration with Sirilak Chumkiew

Progress so far

- Weather station deployed at the bay
- Solar Panels for power
- Cellular for data
- Netbook for computing
- Still waiting on water sensors
- Currently performing monthly water quality sampling

Aquaculture Monitoring & Early Warning Flood Detection

In collaboration with Sirilak Chumkiew

Current work

- Solar cells not providing sufficient power for stable system
- Planning on deploying Raspberry Pi for computation & communication
- Interested in also looking at UCSD Android sensor pod as alternative

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Coral Reef Monitoring

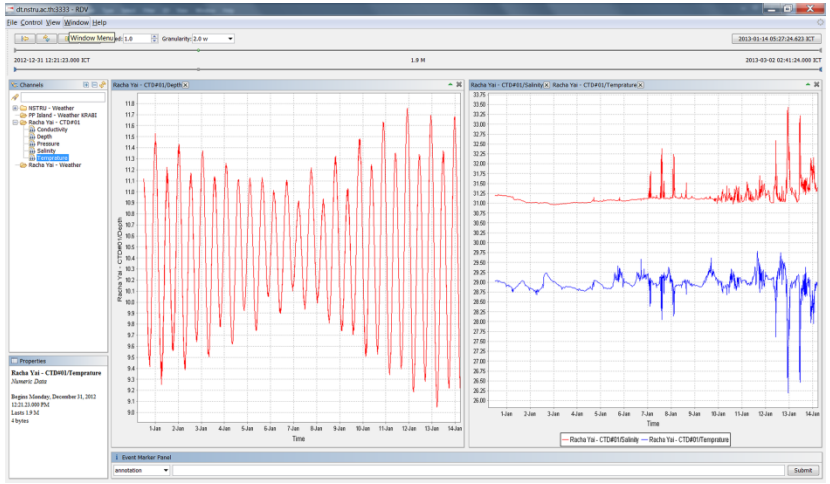
In collaboration with Walailak COE

- Coral reef observatory at Racha Yai, Phuket
- Original deployment was a product of the **PRAGMA 18** workshop
- Collaboration between:
  - Australian Institute of Marine Science
  - COE at Walailak
  - University of California, San Diego

Coral Reef Monitoring

In collaboration with Walailak COE

- The observatory has been streaming real-time data since 2010
- Utilized for a variety of research projects at Walailak
- Data and results publicized and used in some secondary school curriculums
- Original collaboration has helped provide the start for further funding and expansion



Coral Reef Monitoring

In collaboration with Walailak COE

- System has been operational for 2.5 years in spite of power failure, network disruptions, and storms.
- But in February we did need to replace cable after a shipwreck tore the existing one.

Coral Reef Monitoring

In collaboration with Walailak COE

New Project:

- Expand coral reef observatory at Racha Yai, Phuket to include an additional site on far side of the island
- Will require wireless communication and independent power.
- Finished initial survey in February, now in logistical planning stages

Common Elements

- Environmental and disaster monitoring can utilize parts of the same infrastructure
- Environmental monitoring, especially in developing regions requires systems that are affordable and can recover in spite of harsh environmental factors.
- ‘Online’ sensors provide a great asset not just for research but for education and public engagement

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Questions/ Comments/ Idea?