OCN418 Project Summary
Kirstin Thompson

The objective of the course was to fuse technological innovation with environmental science and give students an opportunity to develop and deploy environmental monitoring sensors and systems. Students were able to experiment with physical computing and electrical engineering tools and techniques, become familiar with low-cost ways to create environmental sensor packages, and build prototype instruments to deploy for field-based research. Throughout the second half of the semester I began creating a water-quality sensor package that would collect conductivity, pH, temperature, and pressure measurements of a water column. I plan to use this sensor package in He'eia fishpond and Kaneohe Bay for water quality measurements during the course of my master's thesis project.

Sensor Development

During the course of the semester students became familiar with the functionality of the Raspberry Pi and its Linux operating system, as well as the programming language, Python. This knowledge base allowed us to begin the coding, packaging, and deployment of our own sensor package. The main components used for my project include the i) Atlas Scientific EZO pH circuit ii) Atlas Scientific pH probe iii) Atlas Scientific conductivity probe iv) Atlas Scientific EZO conductivity circuit v) TSYS01 temperature sensor vi) MS5803-14BA pressure gauge vii) and a circuit board with a built-in conductivity voltage isolator (built by Stanley Lio). All sensors use the I^2C data protocol. The script I created runs code from four driver files, one for each sensor, and stores the recorded data into a csv file on a SD card. Two of the driver files can be used for calibration of both the pH and conductivity probes (while connected to a monitor). Using the "Supervisor" command, the script will run whenever the sensor is powered on, which means that out in the field, data will always be recorded as long as the battery is connected and charged. Since the package was designed for mounting onto a drone (Phantom 4 Pro), the weight of the sensor package was taken into consideration. Components that minimized weight, such as the Raspberry Pi Zero and a small rechargeable battery, were used in the final package. The Pi Zero, battery, and circuit boards were mounted onto a small fiberglass board that was then attached to the drone via zipties, with the sensor cables funneled through a hole in the fiberglass to hang below.

Sensor Deployment

The sensor package will be deployed periodically at He'eia fishpond and Kaneohe Bay, on the windward side of Oahu. Profiles taken in locations inside and outside the pond can serve to expand the data currently available from the robust network of in-situ instrumentation deployed in He'eia Ahupua'a. Deployed in conjunction with SeapHOX instruments (proposed to be deployed in Kaneohe Bay), the sensor package can contribute to the mapping of pH, temperature, and salinity gradients to better understand biogeochemical processes in the pond and surrounding fringing reefs. Ongoing changes such as the re-establishment of taro fields and removal of invasive species in He'eia, as well as the changing local climate, create an interesting and exciting opportunity to better understand the changing environmental conditions and parameters impacting successful aquaculture production.