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ABSTRACT

Coral reefs are one of the most diverse ecosystems on Earth. However, most coral reefs have never been assessed by scientists and factors such as global warming are threatening their existence. Therefore, it is imperative that researchers design tools, and collect data in an attempt to understand these ecosystems before it is too late. The objective, of this Portland State University Senior Capstone Project, is to design a tool that will aid the Nature Conservancy in collecting data in an aqueous environment. This tool must meet a few guidelines given by the Nature Conservancy. First, the device must record, save, and wirelessly send the recorded data. Second, the device must also have a long recording life, which requires a large sized battery, and memory space. Third, it would be desirable if the device had a recording time and a GPS locating feature, so that the researcher knows where and when the recording occurred. The objective of the Nature Conservancy is to find the relationship between underwater acoustic sound, and the impact it has on the overall health of the coral reef. It is important to collect as much data as possible, everything from the sounds of boats and snorkelers, to the sound produced by fish and coral itself. The study of coral reefs is an exciting, young, and growing field of research. It is crucial for researchers to build a large knowledge base about this ecosystem, so that coral reefs can be preserved and enjoyed by generations to come.

WORK BEING DONE WITH THE DEVICE TODAY

The Senior Electrical Engineering team has been able to test the device in the Willamette River. In this section the method the device is deployed, and the results it has given are shown. The short term goal of recording and recognizing the noise produced by a passing boat has been achieved and described here.

Location : Waterfront, Willamette River, Portland OR.


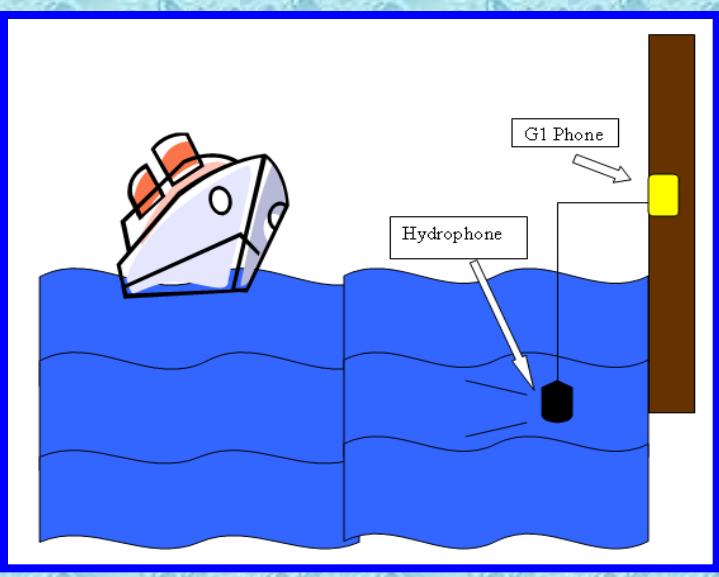






DIAGRAM: Shows a simple schematic of How the device works.



G1 Phone used to make recording.



This is the Hydrophone used by team to record audio from boats passing by on the river.



Pictures of team working on dock in Willamette River.

LITERATURE CITED

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2. RetoMeier,2009. Professional Android applications development
3. The Nature Conservancy. Facts about coral reefs. <http://www.nature.org/joinanddonate/rescuereef/explore/facts.htm>
4. Great Barrier Reef. Coral facts. <http://www.barrierreefaustralia.com/greatbarrierreef/coralfacts.htm>

CONCLUSION

Achievements to Date:

1. The device records in an underwater environment.
2. The device gives the date, time and location of each recording.
3. It will be low maintenance due to:
 - i. a long battery life.
 - ii. large storage space.
 - iii. robust, waterproof device casing.
4. It is environmentally friendly.

Research Purposes for this Device:

1. To study the impact of human interaction with marine ecosystems.
2. To study marine ecosystems such as, but not limited to, coral reefs.
3. To collect data instantaneously, or "in Real Time".

MATERIALS AND METHODS

Components of Device:

1. Google G1 cellular device.
2. MiniUSB connector.
3. HTC multifunction Audio adapter (USB splitter).
4. Portable hybrid solar charger for cellular.
5. Hydrophone.
6. A 9 Volt battery with battery holder.
7. Clear waterproof casing for cellular.
8. Buoy to keep device above surface of water.

Connect the devices accordingly:

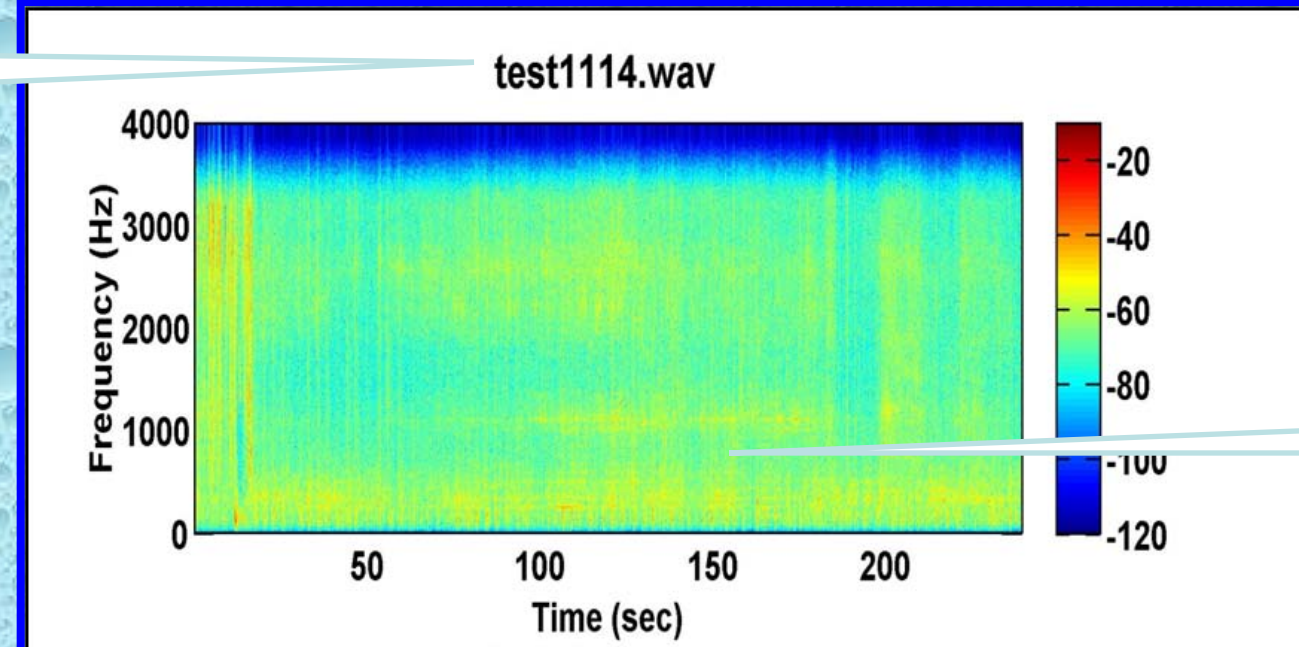
1. Secure the cellular & attached solar charger in the clear casing.
2. Place the casing on a floating buoy.
3. Lower the hydrophone in a controlled manner into the water.
 - i. Lowered about 3 meters down into the water.

Set Recording for the Device:

1. For Autonomous Recording:
 - i. Enter a valid start and end date to record.
2. For Manual Recording:
 - i. Click'start' button to begin recording.
 - ii. Click'stop' to end recording

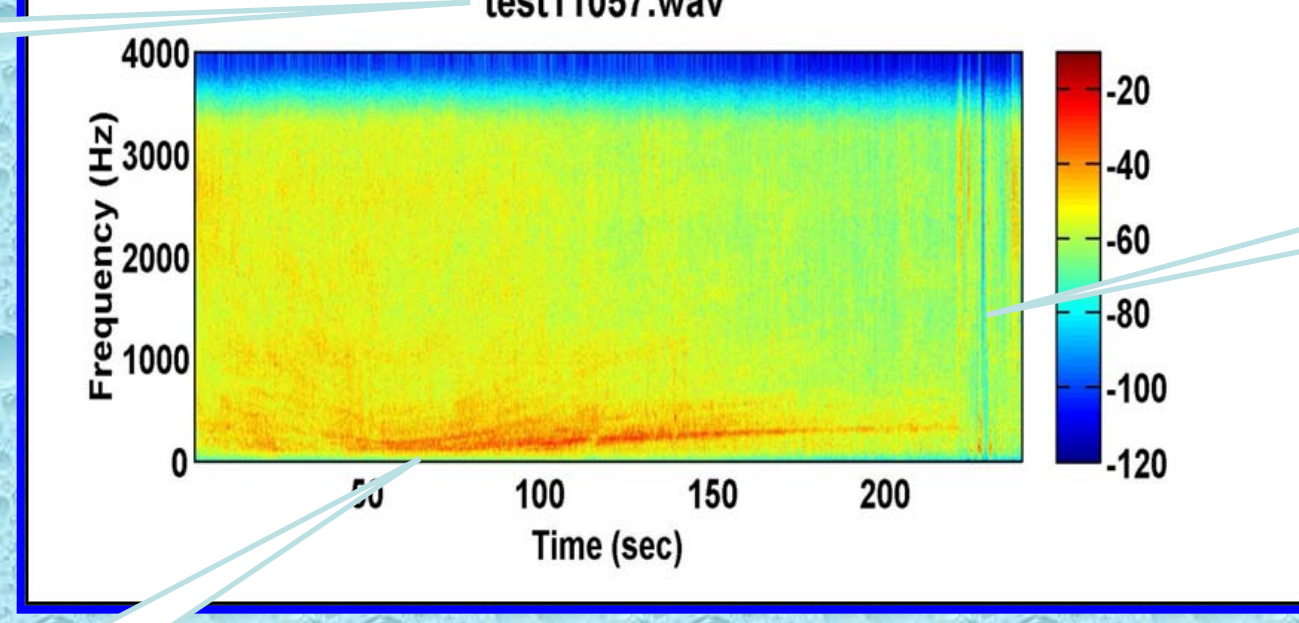
Retrieve the device when desired recording has been done.

Motor Boat: Spectrogram file *test1114.wav*






Noise from Small Motor Boat.


Barge: Spectrogram file: *test11057.wav*




Noise from "Surface waves" reflecting from the pier.

Heavy concentration of noise (red color) indicates the "Closest Point of Approach" of large barge.



Above picture shows the "Surface Waves" reflecting off of the pier. This occurred after the barge had passed by the Hydrophone.



Picture of a Coral Reef

Questions this Device will Answer:

1. What does a healthy coral reef sound like?
2. What effect does boat noise have on the health of coral reefs?
3. What does a Spectrogram of boat noise look like?

Summary:

This device will give marine researchers a tool that they can use to study and gain knowledge of a region in our planet that has been dubbed by some as, *The Last Frontier*. As global warming, pollution and human contact increasingly effect the ocean and it's inhabitants, it is imperative that scientists gain as much understanding as they can of our marine ecosystems. Coral reefs are known to be one of the more sensitive marine environments. It is therefore believed that by learning about what effects these ecosystems researchers will get a better idea of what effects the larger system, that being the ocean.

As of today, April 2009 there are more unknowns than knowns about this vast environment. However, it will be devices like the one described in this poster that will help collect the data, that will formulate the theories, and eventually help us understand this unique environment that covers over 70% of planet earth.