ODOMETER

Sensors Today

by Tony Perry

The odometer is a type of sensor. It "senses" how far an object has traveled. The data generated by a sensor is used to make decisions. For example, knowing how far a car has traveled might help the car owner decide how many more miles to drive before taking it in for an oil change.

Sensors are a type of invention that you find everywhere. A smartphone has all sorts of sensors inside of it — as many as a dozen. One interesting example is a light sensor that measures the brightness of the surrounding environment. With this data, your phone can decide to increase the screen's brightness, allowing you to read a text message on a sunny day, or decrease the screen's brightness when you are in a dark room. Can you name other smartphone sensors?

GETTING INVOLVED LOCALLY

An electronic "smart" sensor has features that communicate and diagnose. Many **InvenTeam™** projects include smart sensors. The Pine School InvenTeam, located in Hobe Sound, Florida, invented one to measure wildlife activity in their local river. The goal was to help diagnose the water quality.

The members of the team live near the Indian River. Agricultural fertilizer runoff in the river basin has led to an excess of nitrogen and phosphorous in the river. The result is an increase in algae that sometimes "bloom," turning the water brown and creating what is known as "brown tides" (see example below). These algae blooms kill fish and destroy the habitat of local marine life, including that of dolphins and manatees.

THE DETAILS

To help protect the animals, the students decided that more data was necessary to make the community aware of the magnitude of the ecosystem's problem. They knew about an existing sensor called Kilroy that measures water quality. While data generated by Kilroy sensors describe how the water quality is changing, Kilroy had no way of directly monitoring the marine animals. The students on The Pine School InvenTeam™ decided to create a new sensor to monitor the marine life directly. The plan was to use underwater video and audio. But, to make their invention a reality, they knew they had to do more research.

First, they needed to learn how to design waterproof electronics. Second, they realized that the sensors needed to be far offshore. This meant

This photo shows the brown tide in water release from Lake Okeechobee in Florida.

InvenTeam™ projects are high school invention projects that receive grant funding from the Lemelson-MIT Program.

The Pine School InvenTeam showcase their solar-powered water quality sensing device invention at MIT.

The Lemelson-MIT Program

The Lemelson-MIT Program celebrates outstanding inventors and inspires young people to pursue creative lives and careers through invention. It also encourages youth to invent and develop their hands-on skills in Science, Technology, Engineering and Math (STEM) through two national initiatives for grades 6–12. One is the JV InvenTeams ™ that offers free curriculum. The other is a grants initiative (InvenTeams) for high school students. For more information, see: *lemelson.mit.edu/jv-inventeams*

—Leigh B. Estabrooks

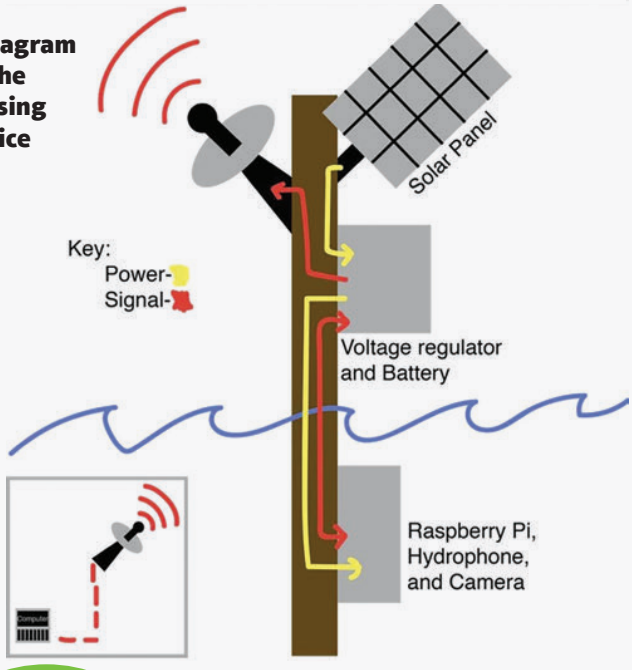
that the team needed to learn how to transmit the audio and video recordings wirelessly to the shore. Midway through the design process, the team decided to include a motion sensor. This would allow their device to record and transmit video only when movement is being detected nearby. Because there is no power outlet nearby and it is inconvenient to travel to the sensor to change a battery (see diagram below), the entire system is solar-powered.

AT WORK TODAY

The sensors are now installed on Indian River (see one at right). The students use the data generated by them to inform the public about how pollution is affecting the wildlife. The goal is to encourage changes in crop fertilization techniques on the farm land that borders the coastal region. Students at The Pine School continue to make improvements to their invention. Among these are offering better video quality and incorporating other sensors into their invention that will be able to monitor the marine environment in the future.

One of the water quality sensing devices installed in the Indian River near the school.

A diagram of the sensing device



The Pine School's student inventors are environmental stewards. They are helping to improve their world through the use of smart sensors and the data they are collecting. They are also increasing public awareness about a major local environmental problem. In 2018, the team received a local award for "Innovative Water Quality Technology."

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