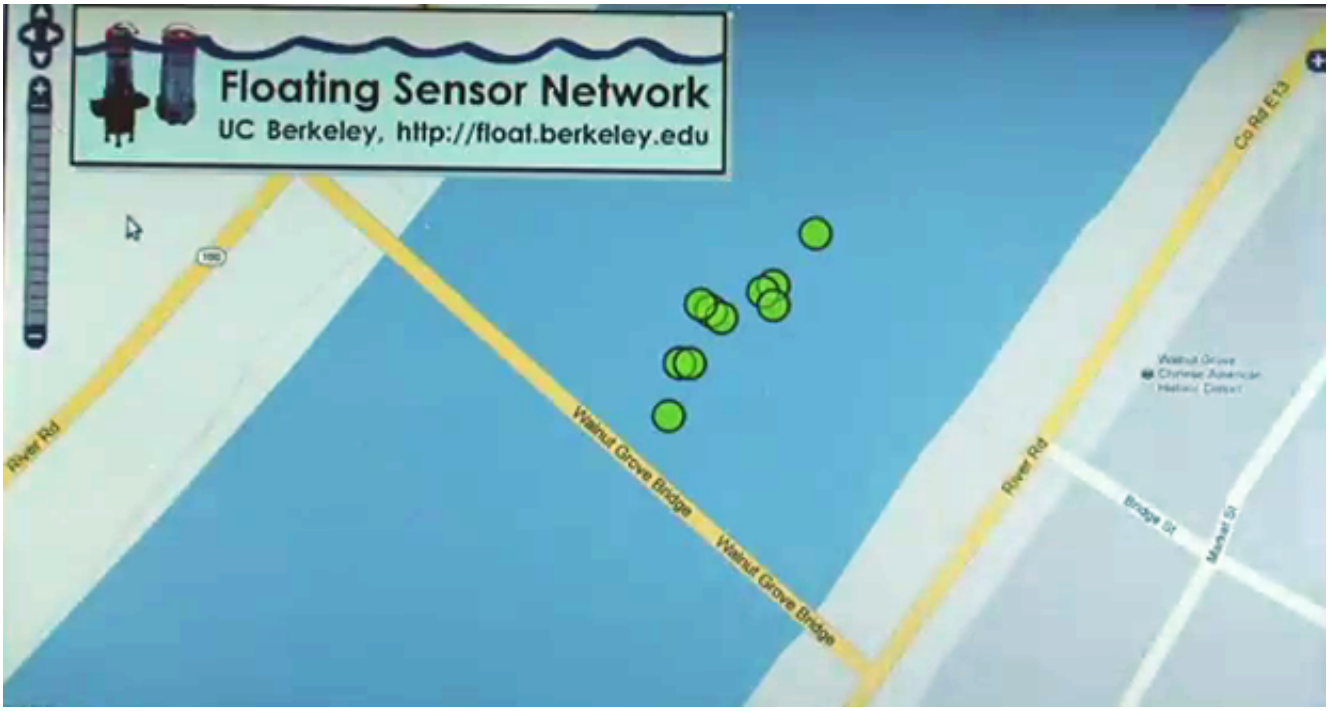
Floating, smartphone-equipped robots track water flow

By Charlie Osborne | May 10, 2012, 3:06 AM PDT

A swarm of 100 robots took a trip down the Sacramento River yesterday in a field test organized by engineers at the University of California, Berkeley.

Demonstrating the marriage of robotics and the next generation of water monitoring technology, the smartphone-equipped floating robots' aim was to assist in monitoring and mapping waterways.



UC Berkeley researchers have developed the robots as a method to learn about the quality, volume, speed, and direction of the flow of salt walter and freshwater through the river. Called the Floating Sensor Network project, the robots provide a network of sensors that "can be deployed rapidly to provide real-time, high-resolution data in hard-to-map waterways".

The project is led by associate professor Alexandre Bayen, a researcher at the Center for Information Technology Research in the Interest of Society (CITRIS).

A high volume of sensors moving through waterways can shed light on ecosystems, the spread of pollutants, the migration of fish including salmon and how different kinds of water merge in different water channels.

Using the Sacramento-San Joaquin River Delta as the trial for the robots, its complex network of channels that direct drinking water to two-thirds of California's population as well as providing irrigation for 3 million acres of agriculture can be monitored to insure safety — and to detect any changes to waterflow that may be detrimental to the population of California.

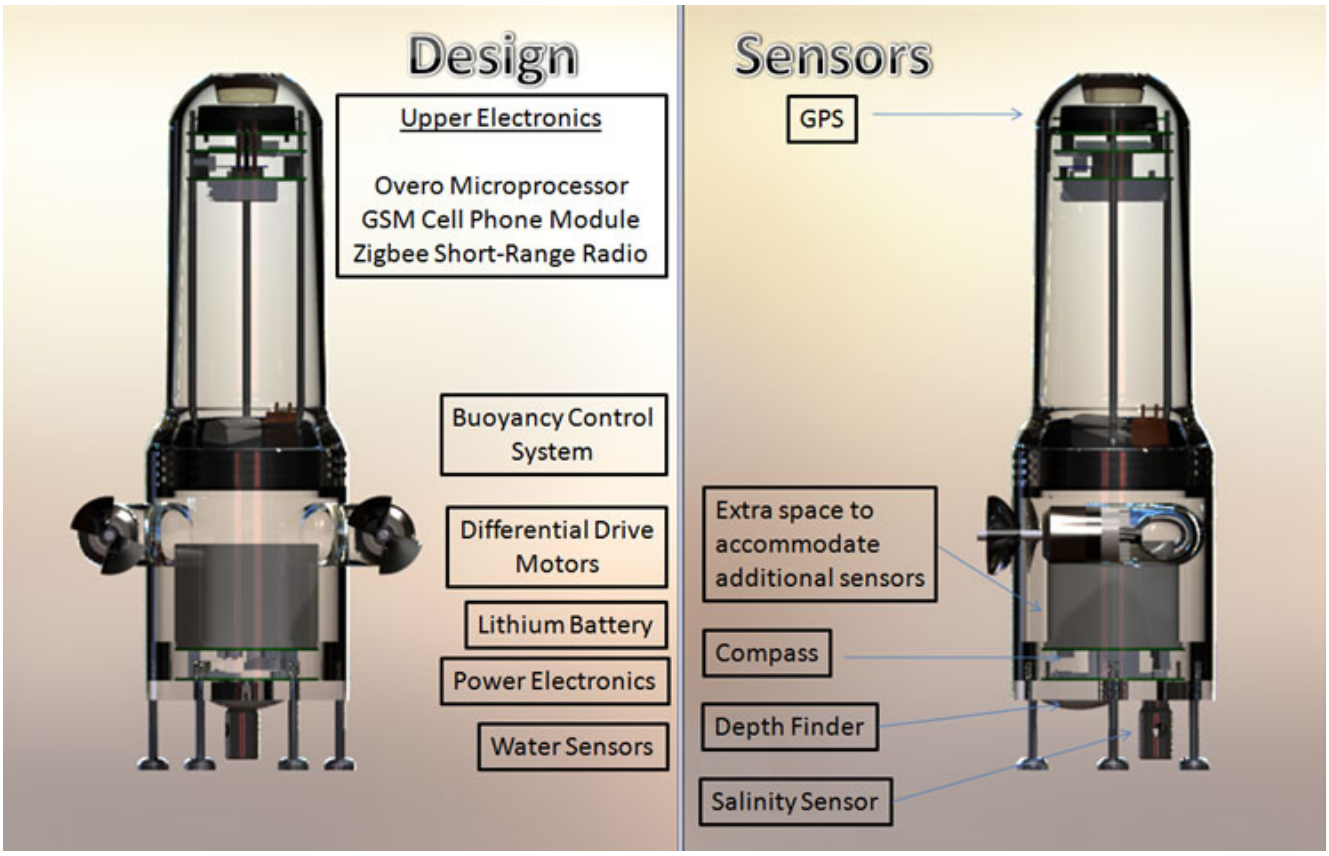
Bayen said:

> "We are putting water online. Monitoring the state's water supply is critical for the general public, water researchers and government agencies, which now rely upon costly fixed water sensor stations that don't always generate sufficient data for modeling and prediction.
>
> The mobile probes we are using could potentially expand coverage in the Delta — on demand — to hundreds of miles of natural and manmade channels that are currently under-monitored, and help agencies responsible for managing the state's limited water supply."

Each 'drifter' is equipped with GPS-enabled mobile phones encased in 12-inch-long watertight capsules. The researchers used bespoke programs to run on open source platforms in the smartphones, and as a result, the devices transmit location and water data back to servers at the Berkeley Lab every few seconds. Information is then processed and added to an interactive map to track the robots, data collected and the sensor's progress.

The robotic hardware has gone through a series of evolutions, and the 4th-generation 'drifter' devices include these capabilities:

- The use of GPS technology to track surface water flow;
- Drive motors to move to a desired GPS point at approximately 0.5 m/s;
- Flow and quality data sent in real-time using the GSM network.
- Buoyancy control systems to "dive" to 5m depth.
- The capability to measure salinity in real time;
- A 72-hour operational lifetime.



The sensors can be thrown without damage, and the researchers believe that this kind of flexible system could be paramount in the event of an emergency – such as contaminants unexpectedly entering a waterway. Using the devices, water flow and contaminant spread could be monitored at a level not often found in current water-tracking technology. Shane Canon, head of the Technology Integration Group at NERSC said:

> "Not only is this project interesting from a data collection perspective, but it also presents a new challenge for us on the data processing side. While the total amount of data is not unusual, the streaming rate is higher than we usually see, and the researchers are looking to access the data in near real-time."

Although the robots released in the delta were focused on monitoring the speed of water currents, the researchers said that additional sensors could be equipped in order to collect a variety of measurements including contaminant detection and temperature.

The sensor network has been tested in partnership with the U.S. Department of Homeland Security and the U.S. Army Corps of Engineers to assess water discharge downstream from damaged levees, and later this year a deployment is planned to monitor the ecosystem found at Lake Tahoe.

For more information, view the video below:

Image credit: UC Berkeley

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