

Researchers Develop Wireless Bridge Sensors Without Batteries

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Clarkson University Assistant Professor Edward S. Sazonov and graduate students Darrell Curry and Haodong Li check data from a wireless bridge sensor on the Route 11 bridge in Potsdam, N.Y. Clarkson researchers have developed technology that uses the vibrations caused by passing traffic to power wireless bridge monitoring sensors.

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Wireless battery-powered sensors that monitor bridges and report changes that may lead to failure are easy to install, but it is unwieldy to provide power for the sensors.

Each bridge needs at least several sensors, many installed in hard-to-

access locations. Replacing millions of batteries could become a problem, adding to the expense of maintaining the bridges. The Clarkson researchers have found a way around this problem.

"We have completely eliminated the battery from the equation," says Assistant Professor Edward S. Sazonov, who developed the technology along with Professor Pragasen Pillay. "Hermetically sealed wireless sensors powered by bridge vibration can remain on the bridge without need of maintenance for decades, providing continuous monitoring of such parameters as ice conditions, traffic flows and health status."

The two electrical and computer engineering professors, along with graduate students Darrell Curry and Haodong Li, used the New York State Route 11 bridge, a steel girder structure, which runs over the Raquette River in Potsdam, N.Y., as a case study.

Energy was harvested by locating an electromagnetic generator on a girder. The harvester responded to one of the natural vibration frequencies of the bridge. Each time a car or a truck passed over the bridge, even in a different lane from the sensor installation, the whole structure vibrated and excited the mover in the generator, producing electrical energy. Harvested electrical energy powered unique wireless sensors that increased energy output of the harvester and consumed only microwatts of power while performing useful tasks.

Sazonov and Pillay have been invited to present their work at the Transportation Research Board of the National Academies Meeting in Washington, D.C., in January. The board provides support for their research.

They are also working on using the energy harvesting technology to power the various sensors in passenger cars.

Wireless monitoring of bridges and overpasses has gained much attention in the past few years. Bridge collapses happen suddenly and unpredictably, often leading to tragic loss of human life. In 2006, the Federal Highway Administration listed 25.8 percent of the nation's 596,842 bridges as either structurally deficient or functionally obsolete. While many of these bridges will remain in service for years, they need monitoring and rehabilitation. Currently, bridge monitoring is performed through periodic visual inspections. In the tragic example of I-35W Mississippi River bridge collapse, the bridge passed a visual inspection a year prior to failure.

Read more about this research at www.intelligent-systems.info/bridge.htm

Source: Clarkson University

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