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Intelligent sensors watch for impending floods

18:10 23 October 2006
NewScientist.com news service
Tom Simonite

A "grid" of smart river sensors that monitor water depth and flow and can predict impending flooding is to be installed in a UK river.

By producing more accurate and concise data than existing monitoring systems, the network could give locals and government decision-makers earlier warning of rising trouble.

Two of thirteen sensor nodes have so far been installed along a kilometre stretch of the River Ribble, in the Yorkshire Dales, and the rest of the network should be in place by the end of the year. "The river floods regularly after Christmas every year," says Danny Hughes, a computer and environmental scientist at Lancaster University, UK, who is working on the project.

The final network will contain three kinds of sensor node. Eleven will measure pressure from below the waterline in order to determine depth. The other two will monitor the speed of river flow – one using ultrasound underwater, and the other using webcams to track objects and ripples moving along the surface, from the riverbank.

Grid computing

Each node is smaller than a human fist and powered by batteries and solar panels. Each is also accompanied by a computer unit about the size of a packet of chewing gum, which contains a processor about as powerful those found in a modern cellphone.

The sensors are positioned within tens of metres of each other and communicate through Wi-Fi and Bluetooth antennas. This enables them to collaborate for data collection and processing tasks, creating a larger community computer. The same "grid computing" approach is used to connect computers at different locations for distributed research projects.

If the river's behaviour starts to change, the network uses the data collected to run models and predict what will happen next. If a flood seems likely – because it is rapidly rising and moving quickly – the network can send a wireless warning containing the details.

Immediate vicinity

Currently, the network only reports to a lab in Lancaster through one node equipped with a GPRS wireless transmitter. In the future, however, it should be possible for the system to alert those people in the immediate at-risk vicinity, says Hughes.

Electronic billboards could be used to issue a warning, and more detailed information could be displayed online. "SMS messages could also be used," says Hughes. "They could be sent to a list of subscribers affected by floods."

"One end goal would be that people living in areas that flood can install these themselves," Hughes adds, "they are simple and robust enough to make that possible."

Something to report

Hughes says other types of sensor could be used to monitor the water inside a levee, or inner city pollution levels, for example.

Such networks could speed up responses to environmental events, says Craig Hutton, who is working with river sensors at the University of Southampton in the UK.

"They can send only the information relevant to the decision that needs to be made, thanks to their ability to pre-process the data," he notes. This means the network should only get in touch when there's something to report, which also conserves power.

By contrast, systems currently in use constantly stream data back to control centres. "If you are dealing with a flood or air pollution incident and have to make a decision in two hours, you don't want to be inundated with huge amounts of data," says Hutton. In future, smart sensor networks might even suggest potential courses of action along with warnings, he says.

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Each sensor contains a small embedded computer, shown (Image: Danny Hughes, University of Lancaster)

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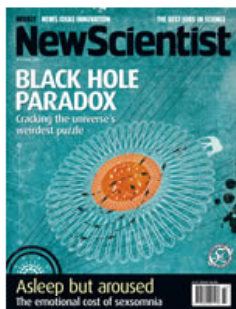
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