Intelligent sensors gear up for real-time flood monitoring

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An intelligent flood monitoring system that could give advance warning of the type of rapid flood that engulfed the UK Cornish village of Boscastle in 2004, is under test in the Yorkshire Dales. Danny Hughes, Phil Greenwood and colleagues from Lancaster University won an award for their paper describing the system at the UK e-Science All Hands Meeting in Nottingham last month.

The system, which makes use of grid computing, could reduce the cost of flood damage by providing warnings of local flooding in time for people to take pre-emptive action. Most current systems issue general warnings over large areas because they rely on sparsely-distributed sensors which send information to a central point for analysis. The new system, which is based on a network of intelligent sensors that can be placed in flood-prone sites, promises rapid, low-cost warnings specific to these sites.

Professor Paul Watson, from Newcastle University who chaired the AHM programme committee said: "we were impressed with the way in which the UK e-Science Programme has encouraged the formation of a multi-disciplinary team to address an interesting problem of great practical importance to the population as a whole; flooding is a major concern in the UK and many other countries. By making advances in a set of scientific fields and then combining the results, the team has built a novel and interesting new system".

The system now undergoing trial in Yorkshire consists of 13 depth

sensors fixed in locations across a flood plain and a digital camera which rather like a traffic speed camera, monitors flow rate from the speed of flotsam between two points. Each sensor incorporates a powerful computer, no bigger than a packet of gum, which communicates wirelessly with other sensors in the network to form a computing grid. The software that enables the sensors to operate as a grid has been developed under the UK e-Science Core Programme (Open Overlays project). The North-West Development Agency is funding the flood monitoring work.

When flood waters are rising, the sensors can change how they operate together so that the network can continue to monitor the situation even if some sensors are submerged or swept away. The sensors are also able to adjust their power consumption so batteries are conserved during dry times and power is available for increased activity during flood. "As soon as the sensors detect water coming down the valley, the network gears up," says Danny Hughes.

In order to provide flood warnings, the system makes use of flood forecasting models which were developed at Lancaster by Professor Peter Young and colleagues. The models can be run on the sensor computing grid and adjusted so that their predictions stay in line with what the sensors are recording. "An interesting possibility is to use such a local warning system to give advanced warning, even in catchments where the response to rainfall is very fast, making flood forecasting very difficult," suggests Professor Keith Beven of Lancaster who is also involved in the project. "An example was the Boscastle flood in 2004, where a general forecast of heavy rain was issued, but the event was too localised to be able to give a warning to Boscastle residents. Fortunately, nobody was killed in that event," he says.

Source: Research Councils UK