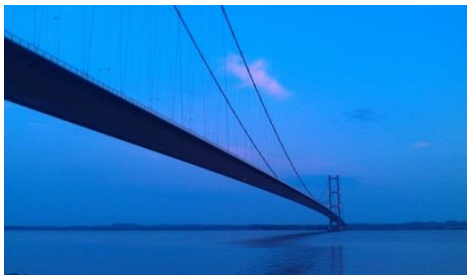
Wi-Health - An active wireless network with autonomously powered long range acoustic nodes for total structural health monitoring of bridges

Maintaining the structural integrity of safety critical constructions, such as bridges, becomes increasingly difficult as they age. A vital part is the periodic inspection for detecting degradation, such as fatigue cracks and corrosion, that are not always visible to the typical manual and visual inspections alone, but may eventually lead to catastrophic failure. There are several aspects that need to be considered in periodic inspections using conventional techniques only; flaws may grow to failure between inspections, access to conduct the inspection may be poor and it may be difficult to determine the significance of any flaw that has been detected and decide whether failure is imminent or if it can be left until a more propitious time for repair.



There is therefore strong interest in replacing periodic inspections with full-time, continuous Structural Health Monitoring (SHM), with networks of sensors that are permanently installed on the structure and are sensitive to defect development. Where these structures are very large, wireless sensor networks offer significant benefits. Although there are many promising SHM technologies applicable to a variety of civil and defence infrastructure, most of them use expensive components, bulky equipment and have prohibitive power requirements, which prevent permanent, large-scale, installations of networked sensors across remote locations.

Project objective

Wi-Health was a collaborative effort between European SMEs and research organisations with the objective to develop and produce a structural health monitoring (SHM) solution for the assessment of bridges in order to improve structural defect detection at an early stage before the defects have caused serious damage.

It has developed a technology for multi-purpose wireless networks that combine the Long Range Ultrasonic (LRU) and Acoustic Emission (AE) monitoring techniques in autonomously powered nodes for the detection of defect growth at damage-prone areas of bridges, such as welded plate structures. As the unprocessed data streams produced by these monitoring techniques require a high bandwidth, data processing at the node devices has been used to greatly reduce the bandwidth requirement of each node, which makes large numbers of wirelessly networked monitoring devices possible. Software for managing the sensor network and the database of monitoring data was developed. This was designed to allow control and oversight of the monitoring whilst it was on-going on. It was also designed to enable integration with other information systems.

These developments mean that for the first time a very large scale wirelessly integrated network of devices could be used to ultrasonically monitor for structural flaws (and make use of other parametric inputs such as temperature) whilst being managed in real-time from a single computer in a centrally organised way with the potential to be more cost effective than existing, more limited alternatives.

Wi-Health is collaboration between the following organisations: TWI Ltd, Vermon S.A., Polkom Bodania, Tangent Technologies Ltd, Humber Bridge Board, Kingston Computer Consultancy Ltd, Feldman Enterpise Ltd, I.D.E.A.S. Ltd.

For further information, please visit the project website at **www.wi-health.eu**.

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under Grant agreement number 283283.

Copyright © 2014 TWI Ltd. All rights reserved