



Oxford Flood Network

<http://oxfloodnet.co.uk>

Building a citizen-led flood detection network using the Internet of Things.



Figure 1 - Typical Oxford Flooding

A Complex Problem

Oxford is prone to flooding. Although the Environment Agency provide blanket warnings they have limited resources and a small number of expensive, professional sensor. To help understand flooding at a street level we need data on the streams, groundwater and complex basin of the Thames & Cherwell. What we need is higher resolution data.

The Oxford Flood Network project aims to show how to monitor water levels in your own community using the Internet of Things and wireless sensors.

The Smart City Built by Citizens

In the floodplain of Oxford members of the local community are installing their own water-level monitoring sensors. Inspired by the crowdsourced [Japan Radiation Map^{\[1\]}](http://jciiv.iidj.net/map/) they are sharing local knowledge about rivers, streams and groundwater to build a better, hyper-local picture of the situation on the ground.

Some properties have boreholes which can be used to determine groundwater levels. Some have water sloshing about under their living room in their floor void. And those who live by swollen streams have intimate knowledge of the conditions that lead to floods. These are all great indicators of imminent flooding but are often passed around by word of mouth in a local community.



Figure 2 –An Installed OxFloodNet Sensor

This working demonstrator and reference design forms the basis of a blueprint for communities to build their own sensor networks to highlight their own issues – air quality, radiation, noise, whatever they can find a sensor for.

¹ Japan Radiation Map <http://jciiv.iidj.net/map/>

The Internet of Things, Applied

With low-cost sensors feeding data to the Internet, citizens who have local knowledge of the areas likely to flood can install monitors in their own area and contribute to a community map.

Crowdsourced environmental sensor data can be collected to inform communities of conditions - even down to which streets are currently flooded.

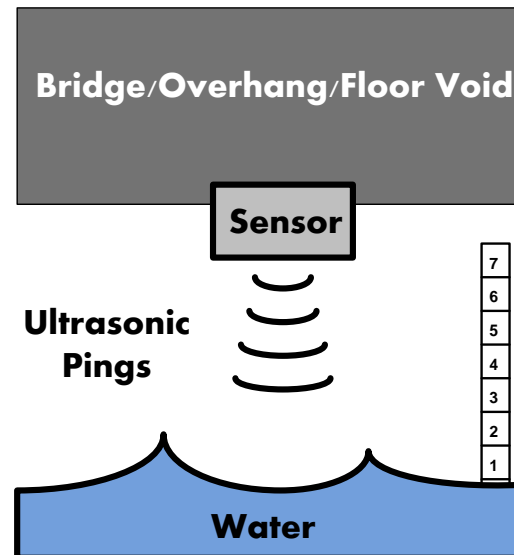
Tweet My Flood

The data will be published with an open licence & API so it can be turned into an application by anyone. For example, while the basic output is a heat-map of flooding around Oxford, an app could be written to tweet when water levels threaten your particular property, or to warn of heavy rainfall in the catchment area and when it's likely to reach you.

How it Works

Ultrasonic rangefinders periodically ping the surface of the water, calculating the distance to the sensor. This data is sent to the gateway where it is uploaded to the Internet.

The small, battery powered, wireless devices can be attached to bridges or overhangs at participating locations, or even under floor voids.



The data is analysed by a central system which has been told about typical levels and flooding thresholds. Based on these values a map can be produced with warnings of abnormally high levels or sudden changes in depth.

TV Whitespace

To enable the Oxford Flood Network local organisations **Love Hz** (<http://love-hz.com>) and **Nominet UK** (<http://nominet.co.uk>), along with telecoms operator **MLL Telecom** (<http://mltelecom.com>) are running a pilot of a cutting-edge technology called TV Whitespace (TVWS).

Ofcom, the UK telecoms regulator, is opening the airwaves for this experiment. TVWS is a technology which uses gaps between TV channels for wireless communication and is particularly suited to machine-to-machine (M2M) communication and the Internet of Things whilst also suiting applications in rural broadband and disaster communications.

Citizen Science

In a time when the Smart City is a buzzword in local authorities and technology companies, it's important that the citizens themselves are empowered by the technology. Asymmetric infrastructure projects lead to mistrust. Instead, communities can take control of their destinies and provide their own evidence for their own issues.

Funding

The Flood Network side of the project is currently self-funded by Love Hz. The TV Whitespace pilot consists of Whitespace equipment owned by Nominet and network build effort by MLL Telecom.

The project is seeking further funding to improve sensor technology beyond initial prototypes and to develop a social technology blueprint to allowing communities to reproduce this in other areas whilst self-funding infrastructure costs.

Our experience in building this Oxford demonstrator will allow us to offer consultancy services, training and provision of network equipment and services to communities and organisations. We will make devices, kits and parts which will make deployment simpler, and offer community engagement workshops allowing the right people in the community to lead their own flood network forward.

Contact

The project is led by **Ben Ward**, founder of Love Hz. Hardware & software is developed with **Andrew Lindsay** of ADL Software Consulting.

We are also collaborating with Nominet and MLL Telecom for the TV Whitespace elements of the project.



About Love Hz – Love Hz is an Oxford-based startup specialising in the Internet of Things and wireless sensor networks. It operates one of a handful of networks in the UK's TV Whitespace pilot, organised by Ofcom to explore the technology, and is using it to deploy sensor networks in remote locations.

For further information or to discuss applications of wireless sensor networks please contact Ben Ward:

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