Case study

USING WIRELESS TECHNOLOGY FOR DATA CAPTURE

Bringing *life* to technology.

The problem

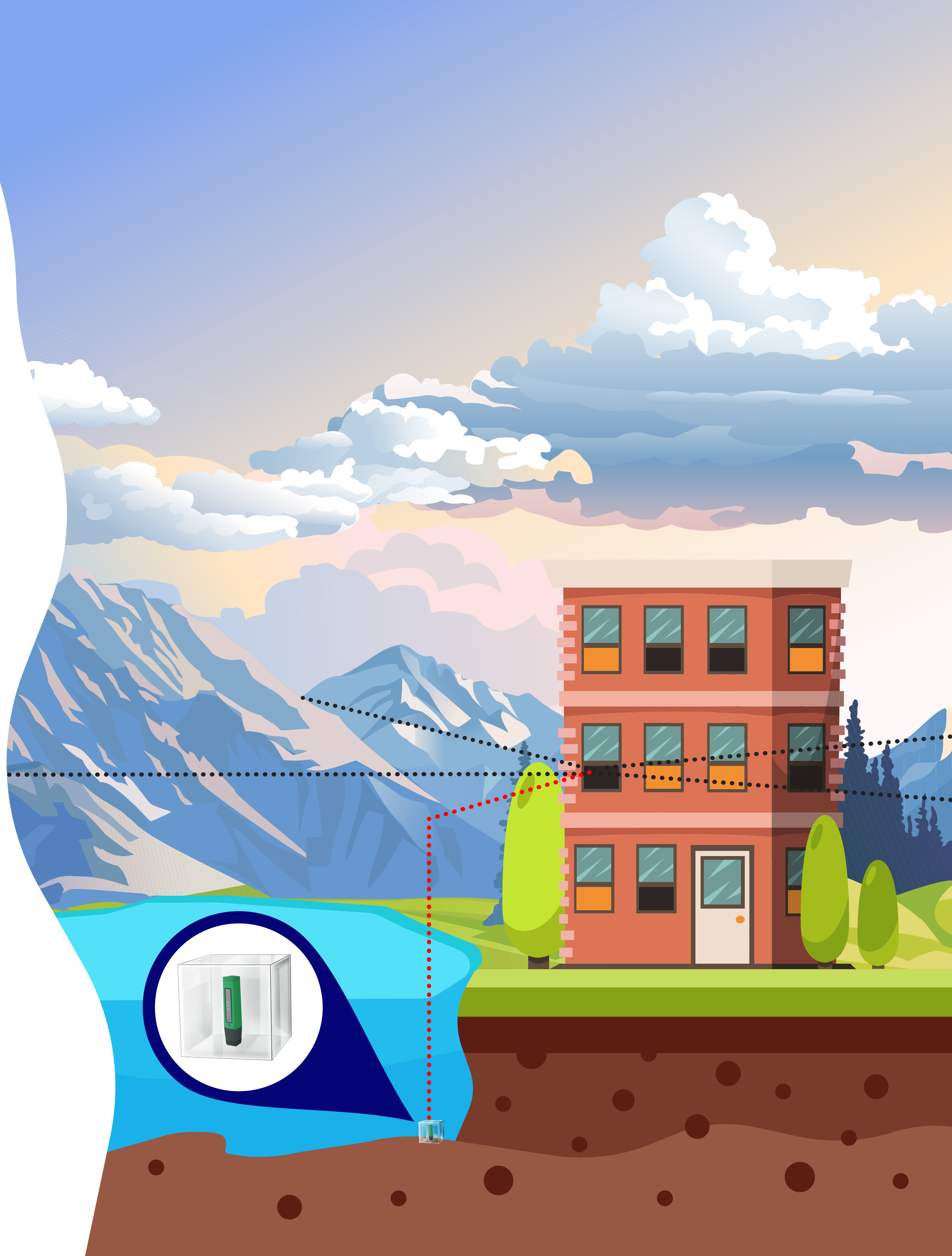
We meet people and have interesting conversations. One such conversation occurred at the Bristol and Bath Science Park, where we have our office. There was a small symposium being held, all about water quality. Not the dirty end of the water industry, but the clean water end, drinking water. A chance conversation with one of the exhibitors lead to a fascinating project.

The conversation started about the interesting hardware they had on display. They revealed that it was very effective at the designed job but there was an area they wanted to cover that was a concern at that time. They wanted to measure turbidity in a pool or pond, along with temperature.

The project undertaken was intended to look upwards from the bottom of a pond of clean water and monitor how much light was available, record this data along with temperature and upload the data at a fixed interval - such as hourly or daily. The data needed to be sent back to a central server for collation and analysis.

The prototype

Our approach involved a small computer board with its own clock on board, so we knew when it was daylight. It needed a battery to power it - no trailing leads possible! It needed sensors to measure light levels and sense the temperature. It needed a means to transmit this data back to a server, presumably using a wireless connection.



Wireless

We had two approaches initially - one directly connecting to an existing network and one whereby we would create the network locally and have a router connected to the Internet.

The first proposal was to use one of the lightweight networking options such as Sigfox or NB-IOT. Both have running costs but they are remarkably low, much cheaper than running a SIM card. The sensor would be able to establish its own link to the Sigfox or NB-IOT network to send infrequent and small messages.

An alternative approach was to connect the device to a local network, which had its own Internet connection. This was preferred because the plan was to use multiple sensors and it didn't make sense for each sensor to have its own path to the Internet - better to connect multiple devices locally and then upload. The sites planned to use the system all had existing Internet connections, so the only requirement was a link from the sensors to the centre.

The company Analog Devices offer a robust industrial wireless network, known as SmartMesh, so this was briefly considered. We evaluated the equipment to judge its suitability. However, SmartMesh proved to be too expensive, so in the end, we went for protocol-free 2.4GHz wireless module. These modules are from Nordic and can have protocols applied, such as Bluetooth or Zigbee. The appeal of Bluetooth or Zigbee is that devices support many modes of operation. Consider Bluetooth - your PC supports Bluetooth headsets for streaming music, and a Bluetooth mouse. Bluetooth is designed to handle multiple devices connecting to your PC so is immensely powerful, but also immensely complex.

We chose to use our own simple protocol over a 2.4GHZ connection. There was no need for the complexity of Bluetooth, we had no need to communicate with devices such as a PC, all we needed was a simple radio link and a system to send commands and receive data. This was simple to implement, we kept it very simple.

Testing

In order to test the device, we added the sensor and the wireless link into a small plastic box, made of clear plastic. It had its own battery supply. Being made of clear plastic meant that it had views all around to measure turbidity. We weighted it so that we had control over the orientation when we lowered it into the water. Next to our office is a small lake; it's visible from our office window. We mounted a transceiver in the office and we could easily communicate with the sensor.

We ran this system for a number of months as a proof of concept for our client. Part of the data sent back was the battery voltage so we could monitor the battery voltage and plan to retrieve the box and replace the battery every now and then. The aim was to replace the battery with a lithium-ion battery capable of supplying for around 5 years. We employed power saving techniques. The whole sensor was powered down and only powered up once an hour to take a set of readings and transmit the data.

XOR systems

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