



# Sensor Networking Case Study

How a sensor networking company migrated to ZigBee wireless with FlexiPanel products

## Soil Instruments Ltd

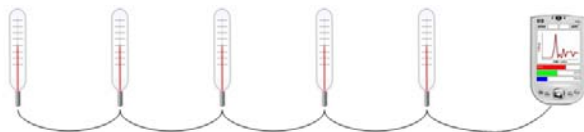
Soil Instruments Ltd is a long-established company that manufactures and installs geotechnical and structural instrumentation for civil infrastructures such as dams, tunnels and bridges worldwide – many very well known.

Typically their sensors measure inclination, pressure, strain and vibration over long periods of time. The sensors are networked in installations often spanning over a kilometer.

According to the Sunday Times / Microsoft Tech Track 100, they are the fastest growing technology company in South-East England, with sales expanding 250% to US\$9m from 2003 to 2005.

## Going Wireless with ZigBee

In the existing system, many sensors are connected together by a cable. Data is logged at one gateway node.

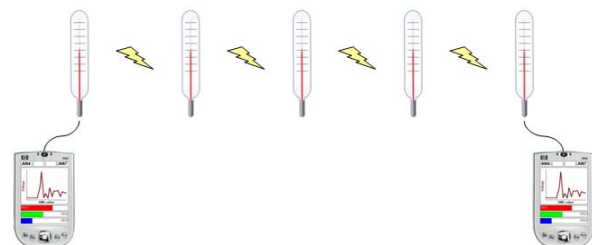


With such large networks, a substantial part of the installation time and expense is in the industrial-standard cabling between sensors. Cabling is also obtrusive, obstructive and prone to damage from machinery, workmen and vermin. So the decision to go wireless was not difficult.

Neither was the choice of ZigBee, and in particular FlexiPanel's pre-certified EasyBee and Pixie modules. The MailBox profile provided an off-the-shelf ZigBee development environment without the need to develop and register sensor-specific profiles with the ZigBee Alliance. All that was needed was to migrate the existing sensor-specific circuitry and firmware.

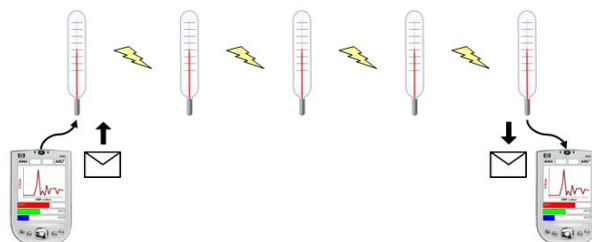


In the new wireless system, every sensor is a ZigBee router. This allows large spans to be networked flexibly. Engineers can plug in to any sensor and download data from any of the other sensors in the network.



In order to maximize battery deployment, the sensors used MailBox's network-wide sleep features. This allows the entire network to power down simultaneously.

As with many ZigBee implementations, new thinking brought about unexpected benefits. In Soil Instruments' case, it was possible to implement a messaging service so engineers could send text messages to each other over the sensor backbone.

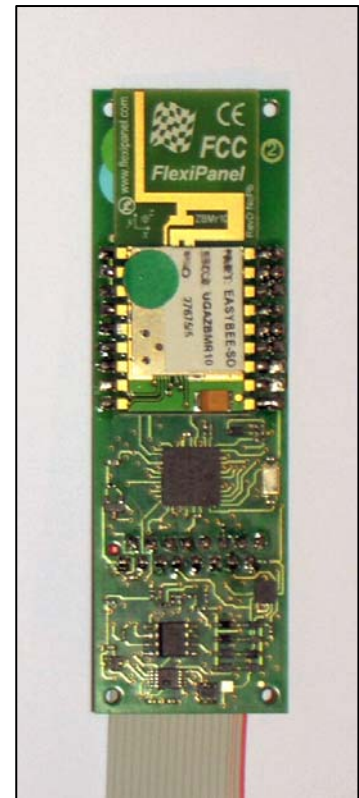


## Inside a Sensor Node

The Soil Instruments sensors are based on the Pixie module from FlexiPanel. However, in order to extract every last possible I/O pin from the PIC18LF4620 microcontroller, parts of the design were licensed and integrated directly onto the main sensor board, and the EasyBee module was used as an FCC/CE compliant PHY/MAC layer. The resulting sensor unit is housed in a weather-proof and vandal-proof puck antenna casing with connections via a 16-wire flat cable. It features:

- Full Microchip ZigBee stack & MailBox profile
- AT-command style communications via serial port
- Up to 8Mbyte data logging memory
- Up to 1K random access nonvolatile EEPROM
- 18-bit vibrating wire driver and sensor circuitry for stress monitoring
- Pulse counter for utility metering, operates during sleep
- 19-bit potentiometer input for extension measurement
- 19 bit 4-20mA input for current-loop sensors
- 19 bit differential voltage input for resistance bridge sensors
- Sensor excitation outputs including non-electrolyzing waved mode for electrolevel tilt sensors
- 10-bit battery and regulated voltage sensors
- Internal and external 10-bit temperature sensors
- Power switching to activate external equipment
- 3.3V, 5V and -5V power management from single battery source

The sensor node has been designed to service limitless applications. If this specification fits your needs, why try to re-invent it? Contact Soil Instruments today.



### Jon Scott, Managing Director Soil Instruments Ltd



*“Competing at the leading edge in a technology company involves relentless innovation. Moving to ZigBee has been a giant leap for us.*”

*“If your business involves using wires to deliver data, you have to go cable-free. If you don’t, you’ll watch your market melt away before the decade is out. Wires will just be something we tell our grandkids about.”*



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