



Making it reliable

Now that we're all used to wirelessly connecting our voice and data, our car keys, remote controls, and probably some of our entertainment, it's natural to look at wireless – and particularly radio – links for yet more services that have traditionally needed wires.

The ZigBee Alliance is especially interested in commercial building automation as well as home systems, as it sees this as a key area for the technology. Examples include lighting in large office spaces, so that you don't have to walk to the nearest wall or pillar to turn a light on, but rather have a cordless light-switch by your desk. The same could be done for heating control, saving energy by putting thermostats where the users are.

Recently the industrial automation sector has started looking seriously at wireless. In a big industrial plant processing chemicals or oil, the cost of providing wiring can get as high as a hundred dollars per metre, especially if there are fire or explosion hazards. When you multiply this by the average wiring run of more than a kilometre in a large plant, and by the number of sensors and actuators, you reach very large sums indeed.

Whilst cost is an important issue in instrumentation, the single biggest issue facing the deployment of wireless within the industrial sector is reliability. We're used to occasional slow WiFi access or dropped phone calls, but in an industrial plant it's a very different story. Some controls and sensors are needed for emergency protection, whilst others are part of an intricate process control involving rapid chemical or nuclear reactions. The profession defines a number of classes of operation:

Safety	Class 0: Emergency action (<i>always critical</i>)
Control	Class 1: Closed loop regulatory control (<i>often critical</i>)
	Class 2: Closed loop supervisory control (<i>usually non-critical</i>)
	Class 3: Open loop control (<i>human in the loop</i>)
Monitoring	Class 4: Alerting (<i>short-term operational consequence, e.g. event-based maintenance</i>)
	Class 5: Logging & downloading/uploading (<i>no immediate operational consequence, e.g. history collection, SOE, preventive maintenance</i>)

Source: www.isa.org

How, then, do we make a wireless connection reliable enough to do all or part of this list of tasks?

The Wireless Industrial Networking Alliance started work in 2002, studying the problems and the capabilities of wireless systems to solve them. Now the ISA (Instrumentation, Systems and Automation Society), which has a long record of creating successful interoperability standards in industrial plants, has joined in with its committee, SP100 'Wireless Systems for Automation', and has become the agreed forum to standardise a wireless system.

In fact, it's likely that there will be a family of wireless systems, because a complex and robust system to achieve a low-numbered class of operation is very likely to be too expensive for scattered environmental monitors, for example. SP100 will take a close look at, and provide help to system specifiers in, areas such as reliability, robustness, latency, throughput, range, and failure modes and effects.

There are other issues in this industry too. First, there are many tens, possibly hundreds, of wired networking schemes which range from simple analogue levels corresponding to a distant sensor reading, all the way to Ethernet, the same as used by office computers. A wireless standard has to provide interoperability with at least some of these, which means that the way in which individual devices are addressed has to be compatible in both wireless and wired.

Once there are no wires, a source of power has to be provided for radio sensors, including: batteries (which have to be changed); solar cells; or standard AC mains. Plant personnel will have to follow a learning curve to become familiar with wireless systems and the different issues that they have. Finally, security – against eavesdropping, unauthorised attempts to operate a device, and corruption of data – needs to be at least as good as the wired system offered.

In our opinion ZigBee will be able to form a good basis for many industrial applications since chips and software have emerged with a good degree of reliability built in. In fact, the first issue of SP100 will be based on the same chips that ZigBee uses. It is anticipated that this adoption of the technology will contribute to the rapid expansion of sales of ZigBee devices, which is just what the market needs to get costs down to attractive levels.

Tim.Whittaker@CambridgeConsultants.com