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Industrial telemetry

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"If you can't measure it, you can't control it."
Since the beginning of civilisation we have been measuring physical properties and features such as distances, speed, temperature, pressure etc... starting with simple instruments that became more sophisticated and more complicated as time went by. Because whatever we were eager to measure was not always located nearby or at accessible locations, engineers designed various ways of 'measuring there while displaying the results here'. Telemetry was born.

The range of applications for this technology is so wide that we barely find a field or an industry in the world where there isn't some form of telemetry. Major applications include medicine, environment, wildlife, defence, aviation, space, meteorology, process and manufacturing to name a few.

Remote telemetry units

Remote telemetry units (RTU), also called remote terminal units, are well known in process automation and control as parts of supervisory control and data acquisition (SCADA) systems.

The RTU is a small computer which provides intelligence in the field, and allows the central master to communicate with the field instruments. Its function is to control process equipment at the remote site, acquire data from the equipment, and transfer the data back to the central system.

Modern RTUs are usually capable of executing simple programs autonomously without involving the host computers of the central system. Today, the difference between RTUs and programmable logic controllers (PLC) is fading away. Many automation vendors are selling RTUs with PLC features and vice versa. The industry has standardised on the IEC 61131-3 functional block language for creating programs to run on RTUs and PLCs, although most vendors also offer proprietary alternatives and associated development environments.

Communications

The communication media used to transmit and receive data is the most important part of a telemetry system as it has an impact on cost, reliability, functionality and security. The choices are multiple depending on the application and environment:

Cables: We are used to cables, and they make us feel comfortable because we trust them and understand them. Cables, however, are expensive to install, get chewed by rodents and are simply not practical in some locations. Cables are usually implemented in a factory. They are not suitable for systems covering large geographical areas because of the high cost of the cable itself, the conduits and the extensive labour in installing them.

Telephone lines: The use of telephone lines is a more economical solution for systems with large coverage. A leased line can be used for systems requiring online connection with the remote stations. Dial-up lines can be used for systems requiring updates at regular intervals (eg, hourly updates). The host can dial a particular number of a remote site to get the readings and send commands.

Radio link: The radio link is suitable for a point-to-point communication. For multi-point applications special protocol, timing, interfacing and other issues might make it too difficult to implement, too expensive or simply not practicable. Depending on the frequency and output power, a radio licence may be needed, which can be hard to get in some areas.

Licence-free bands: The availability of licence-free industrial, scientific and medical (ISM) radio bands in the 915 to 928 MHz and 2.4 to 2.483.5 GHz ranges can be most advantageous. Vendors are offering systems using spread spectrum and frequency hopping technologies working on those frequencies. However, it should be recognised that those radio bands are also used by many other applications and may eventually become saturated.

Satellite communications: The use of satellites for telemetry has been around for a number of years. For the layman, this technology seems to be ideal for sites located in the 'middle of nowhere', too far for traditional radio links and with no telephone lines or mobile service available; to be used only as a last resource. In reality, satellite communications can be a cost-effective way of transmitting data and

should be considered when making a decision on data communication. Advantages are a very wide area coverage and cost independent to distance. Disadvantages are transmission delays and a continuous leasing cost.

Power lines: Frequency shift key (FSK) technology supports data transmission on existing AC/DC power lines, instrument loop wires or any other two-conductor wire for a wide variety of applications. The major applications include office/business communication, process control, data acquisition, monitoring, energy management and access control.

GSM/GPRS network: The global system for mobile communications (GSM) is the most popular standard for mobile phones in the world. GSM service is used by over two billion people across more than 200 countries and territories. GSM differs significantly from its predecessors in that both signalling and speech channels are digital. This means that data communication was built into the system.

General packet radio service (GPRS) is a mobile data service available to users of GSM mobile phones. GPRS data transfer is charged per megabyte of transferred data, while data communication via traditional circuit switching is billed per minute of connection time. GPRS can also be utilised for internet communication services such as email and web access.

Implementing telemetry

Implementing telemetry, just like any other automation system component, is challenging and implies the help of specialists. Equipment vendors offer a wide range of solutions supporting various communication mediums. Careful consideration should be given to cost, installation cost, as well as running cost, viability, reliability, latency, compatibility, security and upgradeability.

It is important to clearly identify the parameters to be monitored and how to monitor them. If an RTU is going to be used, one should clearly define what it is going to do. Is it requested to log data? How much data and how often? Do we need alarms? If so, how do we want to receive them - mobile phone, email, SMS? Do we want the RTU to filter the alarms and only send them if certain conditions are met or if the alarm is active for a preset period of time?

Telemetry may bring economic benefits to unexpected

areas of the business, for example, the supply chain Monitoring a tank level at a remote location, for example, would result in thousands of dollars saved because bigger and less frequent refill deliveries will be done.

Well planned and implemented, telemetry is another technology that brings enormous advantages to process and manufacturing industries.

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