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White Paper

Where Does IIoT fit in the ‘Industry 4.0’ Environment? (Part 2)

Ask the right questions for the IIoT Implementation

Once the decision is made to use IIoT to integrate the facility, several questions need to be answered to provide a uniform and robust infrastructure.

What Transmitters to Use

There is a wide range of IIoT transmitters to address any type of measurement. These range from direct measurements (flow, temperature, pressure, etc.) to voltage (0-10 VDC) and current (4-20 mA) transmitters to interface with more traditional transmitters. The IIoT suppliers typically offer an open communications protocol so you can integrate the wireless transmitters into the facility's infrastructure. This allows the integration of the IIoT sensors into any control system or gateway.

Communication and Programming

Send data to a PC, Mac, Linux computer, or a Raspberry Pi using modems. Send data to popular cloud platforms such as Microsoft® Azure® IoT, Losant, and MQTT using micro-Gateways. Data from wireless IIoT sensors can be sent to embedded platforms such as Arduino. Software platforms such as Microsoft® Visual Studio, Node-RED, LabVIEW®, and Python can be used. The IIoT vendors break down the packet structure, so integration into other languages is also possible.

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Transmitter Power

Power requirements for individual transmitters depend on how often the signal needs to be scanned, the signal's importance, and the availability of existing power.

Scan rate can be very important for this decision. Many transmitters have an option for internal battery power. Typically, IIoT sensors are rated for 300,000 to 500,000 transmissions until the batteries become so weak that they are unreliable. Looking at the upper end of this range, if the transmissions were spread over a 10-year period that would be 50,000 transmissions per year. This would allow up to 136 transmissions per day or about 5 transmissions per hour. If a 3-year life is acceptable, that would be 166,666 transmissions per year, or about 456 transmissions per day (about 19 transmissions per hour). For a higher transmission rate than this, batteries are not a good option. Also, a word of caution, putting a sensor in configuration mode will drain the batteries very quickly and reduce battery life. Each time a transmitter sends a data packet, the battery level is included in the packet so an alarm can be set to notify when the battery is getting low. Someone has to have the responsibility to check and change batteries as needed.

Many transmitters can be configured to not only transmit but also listen and if a broadcast from another transmitter is heard, that broadcast is immediately re-transmitted. The transmitter acts as a relay point. In this case, the transmitter must be powered continuously. This will be discussed in detail a little later.
In some cases, transmitters may be located thousands of feet from a power source and the cost of supplying power can be in the tens of thousands of dollars. A good solution for these situations is to install a solar power system that will supply continuous power. If multiple transmitters in the area can be powered from the common power source, it is even better.

In some cases, a transmitter (modem or gateway) must continue to operate even if power is disrupted. A UPS power supply can be used to power the device and maintain charge on a chargeable battery. For this type of application, the power consumption of the device (supplied by the manufacturer) and the desired length of emergency backup time are used to determine the proper backup battery rated in amp-hours.

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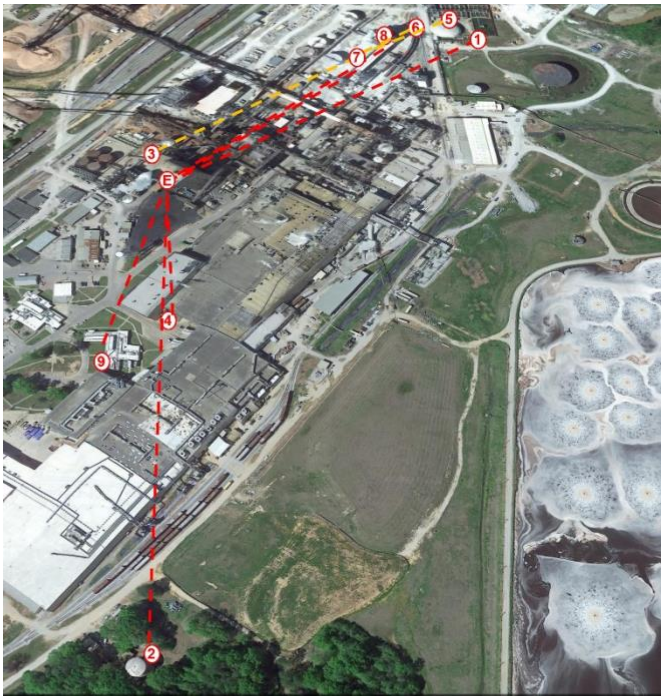
The Wireless Network

The long-range wireless IIoT sensors use digital mesh technology for secure wireless communications for industrial applications. The network automatically hops data from gateway to gateway until it arrives at the desired destination (Edge/modem to a control system, data historian, cloud, etc.).

Because the devices are line-of-sight transmissions, it can be important to perform a simple WIFI mapping exercise as a part of the initial project planning process.



This example utilizes an Edge Computer Gateway located on the roof of a boiler unit at the facility. There are nine IIoT devices. Devices 1, 2, 4, 7, and 9 have a line of sight to the gateway (red dashed lines). Device 3 is on the ground on the back side of the boiler and devices 5,6 and 8 have physical structures that block direct line of sight. However, all four devices have a line of sight to device 7 (yellow dashed lines), so, it is configured to be a relay point (always listening).

In this case, this is an environment application and data integrity must be maintained even if a network interruption occurs. By choosing the Edge Computer Gateway, a simple store, and forward protocol can be implemented so that if the network connection is temporarily interrupted, the Edge stores the data from the IIoT transmitters and broadcasts the time-synchronized data when the network connectivity returns.

For other non-critical applications, other modems/gateways can be used to provide connectivity to the facility control infrastructure.

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