SDR ENGINEERING
FROM RADIO SIGNALS TO DECISIVE ACTION

TOWARDS AN ADAPTABLE CONNECTED & DISTRIBUTED INDUSTRIAL IOT INFRASTRUCTURE FOR INDUSTRIAL PLANTS

Concept note – Robust and adaptive communications for industrial IoT environments

INTRODUCTION

Description of general context: industrial plants need connected sensors to collect data & to steer the various devices of the plant. Sensors are becoming wireless, thus needing wireless communication. Communication needs to be bi-directional to retrieve data & to ask information to the sensor, as well as to change the sensor's configuration.

The total number of sensors as well as their variety require to transmit data at different rates, using different bandwidths. It also requires to properly manage the radio frequency spectrum in order to ensure an efficient & effective transmission of the data, both ways.

Data processing needs to be both edge & centralized. Edge processing allows to transmit only the needed data (the one for exploitation) while centralized processing allows to concatenate data from various sensors & to display the data under the exploitable form for the plant operators.

In this document, we present the joint view of SDR-Enginering to provide such a solution that must be adaptable to the variety of available sensors. In a nutshell, our solution will allow operators to:

- Use legacy & novel sensors, including through the variety of connections of our smart transmitter.
- Deploy the necessary processing, both edge & centralized, according to their needs, through the embedded processing on-board our smart transmitter.
- Make sure they have access to the right data at the right moment, through the availability of the data.

Detailed concept

In this setup, sensors are installed on the site and configured according to the manufacturer's specifications. Once deployed, the sensors need to transmit their data to a central command post. The specific data to be sent are defined by the operators, and the necessary processing is embedded within the transmitters.

Each sensor is connected to a radio transmitter, which handles data transmission. These transmitters can also include advanced algorithmic processing capabilities and artificial intelligence, enabling real-time data analysis, filtering, and decision-making directly at the edge. This reduces the volume of data sent and enhances the responsiveness of the system.

On the command post side, a radio receiver is installed to collect the incoming data. Radio parameters are configured semi-automatically to ensure reliable communication, and a transmission test is performed to validate proper operation.

Once the system is running, data is exchanged bidirectionally between the sensors and the central post, enabling continuous and interactive communication.

Finally, a system engineering study is carried out to identify potential adaptations of the solution based on the customer’s requirements and the realities of the installation.

Products & services

The system's communication relies on radio transmitters and receivers that ensure reliable data exchange between sensors and the central post. If specific conditions require it—such as long distances or signal obstructions—additional radio equipment can be supplied to maintain optimal performance.

A field study may be conducted before or during deployment to assess installation constraints, optimize sensor placement, and validate radio coverage, ensuring the solution is tailored to the site's real conditions.

Advanced data processing can be developed as needed, combining deep physical understanding of the monitored environment with real-time embedded software. This enables intelligent edge computing, such as anomaly detection, data filtering, or predictive analysis directly within the transmitters.

Ongoing maintenance of both hardware and software ensures long-term system reliability, including updates, calibrations, and technical support to adapt to operational evolution

Conclusions

The system is designed as an open and flexible architecture. It uses open radio protocols, allowing easy integration with existing infrastructure and third-party components. Its adaptability makes it suitable for a wide range of scenarios—it can be tailored in terms of radio setup, processing capabilities, and the number or type of sensors deployed.

Built to withstand real-world conditions, the solution is robust and reliable in diverse field environments. Its modular design also facilitates integration into existing networks, simplifying deployment and extension over time.