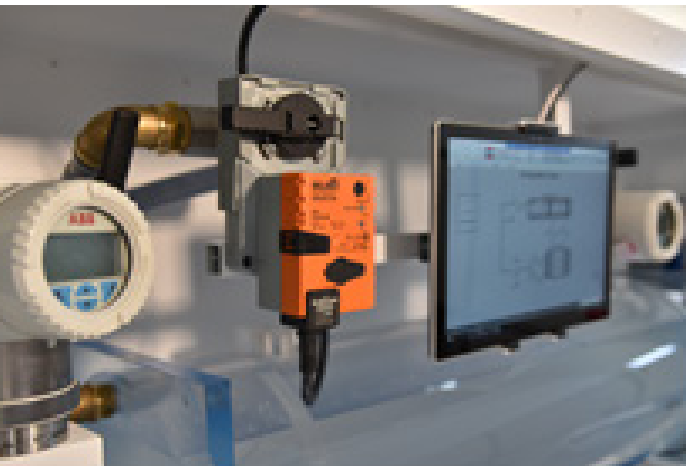
OIL, GAS AND CHEMICALS CASE STUDY

ABB AWIN GW100 WirelessHART Gateway

Demonstrating the value of wireless sensor networks in process control



Using a Two-Phase Gravity System test bed for research

Wireless Process Control Demonstrator with ABB AWIN GW100 WirelessHART Gateway creates a WirelessHART network.

Imperial College London

London, England

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01 ABB developed a test bed to investigate the value of wireless technology in applications, such as process control.

Situation and project background

There is a substantial gap in the scientific knowledge related to the adoption and use of wireless networks in process control applications. Most of the existing knowledge base for wireless sensor networks activity is centered around non-critical systems and non-critical applications (such as condition monitoring).

The aim of this project was to investigate the value and suitability of wireless technology in more critical applications, such as process control.

To advance the science surrounding smarter sensor-based systems, the Engineering and Physical Sciences Research Council (EPSRC)-funded project referred to as Science of Sensor Systems Software (S4) was launched. One work package was to investigate the performance of process control quality using wireless sensor networks in control loops. This created the need to build a test bed to carry out the investigation and offer research opportunities in wireless process control – exploring the relationship between wireless networks, sensors and controllers. As a project partner, ABB was tasked with the design and procurement of the test bed.

A two-phase gravity separator was chosen as the most appropriate test bed to enable research by the Adaptive Emergent Systems Engineering (AESE) group at Imperial College London.

Research objectives

The principle research objective of S4 was to develop the science of sensor systems which will enable the creation and operation of robust and reliable sensor systems that combine cyber and physical aspects.

The goal is to formalize the relationship between system components, enabling us to design and develop wireless control systems that are robust enough to eliminate the failure of sensors and communication links, ensuring plant stability. Arguably, the most reliability-sensitive applications for sensor systems are large control processes of the type used in industry and urban infrastructure.

The two-phase separator gave us a unique opportunity to evaluate proof-of-concept protocols and controllers on a test bed with a real physical phenomenon.

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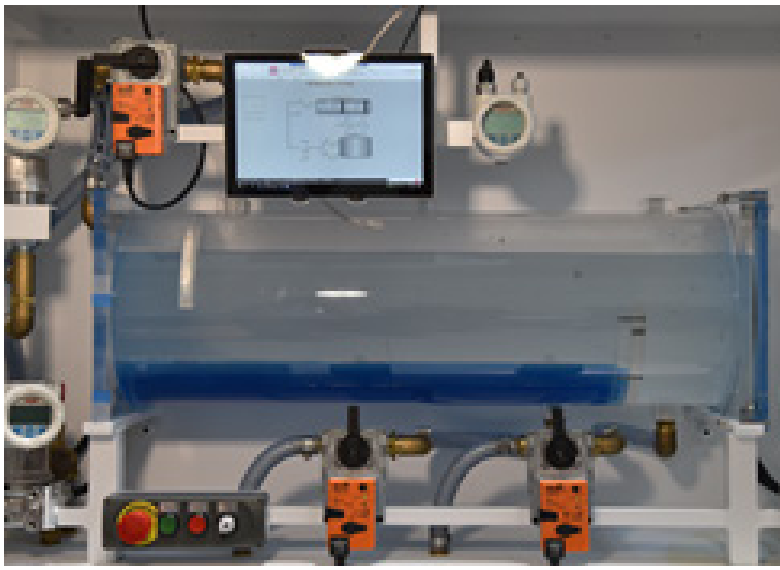

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01 A two-phase gravity separator demonstration system using wireless instrumentation was created for student research.
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02 The system allows oil and water to be mixed in a feed tank and later successfully separated in a transparent separation tank.

Challenges

- Build a test bed that is compact and mobile, yet safe for the students to use
- Make the gravity separation process visible
- Use real-world wireless instrumentation for process monitoring (in this case, level, temperature and pressure monitoring)
- Ensure all instruments are battery powered
- Create a wireless system that is reliable, simple, secure and easy to use
- Make the system extensible so that researchers can make configuration changes
- Ensure simplicity, so that no special training is required to operate the system

Note: WirelessHART was shortlisted as a protocol of choice for connecting wireless instrumentation to control systems.

Solutions applied

- ABB AWIN GW100 Gateway was selected to create a WirelessHART network
- ABB AC800M controller was selected to run control logic
- ABB ACS355 drive was selected for controlling the ABB motor
- ABB Ability™ System 800xA was used with library support for WirelessHART protocol
- ABB WirelessHART 266 series differential pressure instrument was used for level monitoring
- ABB WirelessHART 266 series gauge pressure instrument was used for pressure monitoring
- ABB WirelessHART TTF300-W was used for temperature monitoring

Outcomes

Using the ABB wireless control solutions listed in the previous section, a two-phase gravity separator demonstration system was built in which oil and water were mixed in a feed tank and later successfully separated in a transparent separation tank.

For a better visualization, a soluble color (blue) was added to the water to give it a distinctive look compared to the transparent oil. The system was designed to operate via both the System 800xA operator workplace HMI and the physical operation buttons on the front panel. The separation process was calibrated and finetuned by ABB process performance personnel. The water and oil level setpoints were precisely tuned to demonstrate the separation of the oil from the water, yet the system was left unlocked so that students could experiment with those levels to study the effects they have on the process.

The two-phase gravity separator is currently located at the South Kensington Campus of Imperial College London. It is used by members of the S4 project to confirm the reliability of sensor systems that blend cyber and physical components and to demonstrate the viability of wireless sensors in control systems. It also enables researchers from the Alan Turing Institute to evaluate a data-centric engineering approach to control systems.

Benefits

- WirelessHART setup is made easy with the ABB AWIN GW100 WirelessHART Gateway
- ABB WirelessHART devices connect with AWIN GW100 effortlessly
- Wireless process measuring readings are available in System 800xA, along with support of standard faceplates and graphic elements
- Bulk configuration of WirelessHART devices is made possible using import/export of configuration functionality, which reduces engineering effort and time
- From an application point of view, there is no difference between reading data from a wired or wireless signal
- No special training is required to operate the process

Endorsements and acknowledgments

On behalf of the S4 project team, Dr. Michael Breza (Imperial College London) would like to thank ABB IAOG Norway for its help and guidance in this project. This test bed, and the research that it enables, would not have been possible without ABB IAOG Norway expertise and knowledge.

We would also like to thank ABB Education, ABB Technology and Innovation and ABB Process Performance departments for their contribution to the project. Moreover, we would also like to thank UK Engineering and Physical Sciences Research Council (EPSRC) for their support of the project.

Wireless Process Control Demonstrator for Imperial College London

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