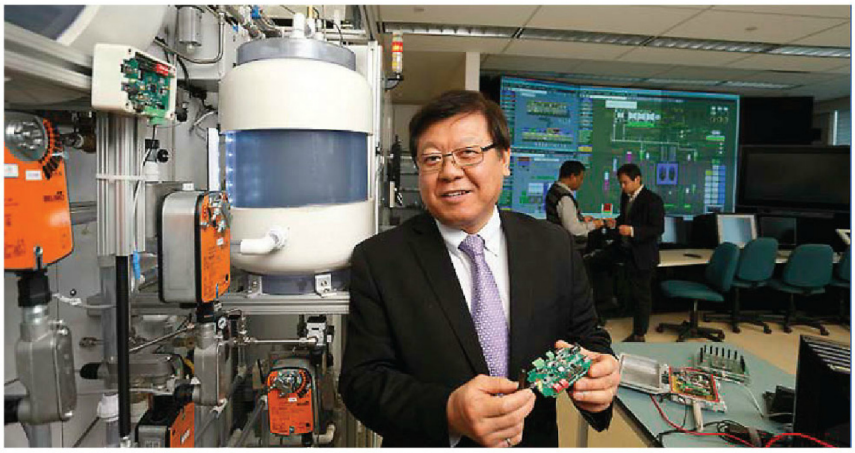
Managing risk in the nuclear industry

Exploring the potential of wireless information technologies



Professor Jin Jiang investigates the potential for industrial wireless technologies to improve the reliability and safety of nuclear power plants.

Due to strict, complicated, and expensive regulation processes, as well as the long service life of nuclear power plants, many instrumentation and control systems in existing nuclear power plants are lagging behind similar systems used in non-nuclear facilities, most notably, in how information technologies are being applied.

Western University engineering professor Jin Jiang appreciates the robustness of these legacy systems in the test of time, but he wants to explore the additional flexibilities and opportunities that new information and communication technologies can offer to improve the reliability of these legacy instrumentation and control systems, and hence enhance the safety of the plants in general.

Jiang is familiar with the unique needs of nuclear power plants. He is an Industrial Research Chair in Control, Instrumentation and Electrical Systems in Nuclear Power Plants, jointly supported by the Natural Sciences and Engineering Research Council (NSERC) and the University Network of Excellence in Nuclear Engineering (UNENE), and he works closely with both the Canadian nuclear industry and the International Atomic Energy Agency (IAEA).

"Designers and engineers of nuclear power plants like to use proven technologies, but newly developed wireless sensor network technologies can bring some clear advantages," Jiang said.

More specifically, he has been investigating several of the most widely adopted industrial wireless technologies for potential applications in nuclear power plants. A project with CMC Microsystems enabled Jiang to collaborate with Texas-based AwiaTech on developing and evaluating novel systems based on a wireless sensor technology, Highway Addressable Transducer Protocol (WirelessHART).

This technology is based on the widely used HART communication protocol, an application layer has been in use since the late 1980s.

Assisted by Dr. Peng Hu, an embedded software engineer with CMC, Jiang worked with AwiaTech to modify the source code of their specialized WirelessHART products to install the sensor nodes on to an instrumentation and control system test bed located in his state-of-the-art nuclear research and simulation lab at Western. The main objective was to evaluate the suitability of WirelessHART-based wireless systems in a nuclear power plant environment.

COLLABORATION WITH CMC MICROSYSTEMS AT WESTERN UNIVERSITY SHOWED PROMISING RESULTS

"We developed a test bed for industrial applications using the embedded platform as well as software," said Dr. Hu. "Even though this project uses a nuclear power plant as the background application, the developed technology and systems can be expanded to other industries as well."

This work was made possible through CMC Solutions, an innovative R&D collaboration initiative introduced by CMC Microsystems in 2013.

According to Jiang, WirelessHART devices provide good backward compatibility, making it possible to retrofit them onto much older instruments using standard interface protocols. Critical variables, such as water levels in the reactor, can be simulated on the test bed and the data can be acquired and transferred by wireless devices to receivers. "It's a real-time operation," observes Jiang.

This article was contributed by CMC Microsystems.

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