Industrial Wireless Systems Workshop

March 13, 2017

NIST/IEEE IMS/IEEE IES

Rowan University, Glassboro, NJ

Workshop Background and Purpose

Background: Wireless technology has great appeals to many manufacturers, in this case industrial automation systems, which include process control, discrete manufacturing, safety systems, and building automation. Applying wireless sensing and control technologies in new or existing systems for monitoring and controlling equipment and processes eliminates costly cabling and enables configuration flexibility. In addition, using wireless technologies can improve plant-floor operating conditions, performance, and efficiency. But before applying these technologies, companies need to determine what wireless technology will be suitable and reliably operate to communicate measurement and control data in challenging industrial environments with many potential physical obstructions and sources of interference.

Purpose: To explore latest and future wireless technologies for establishing best practice guidelines to help manufacturers and users make confident decisions in selecting and applying appropriate wireless technologies for their plants or factories based on their operating requirements and environments.

Workshop Summary

Morning:

- Panelists gave short presentations

Afternoon:

- Panelist Q&A, Breakout/Brainstorming Sessions
- Breakout sessions were originally divided into guidelines and use cases groups. The groups were then combined because many attendees want to attend both group discussions.

Results:

- Consensus was Guidelines will be produced as a NIST document with standardization to be considered later.
- Participation by industry and academia is highly encouraged.
- Ad-hoc working group was recommended. Consensus was NIST to take the lead on forming the working group. The working group will be established within two months of the workshop and will convene monthly.
- A group photo was taken

NIST Disclaimer

Certain commercial equipment, instruments, or materials are identified in this paper in order to specify the experimental procedure adequately. Such identification is not intended to imply recommendation or endorsement by the National Institute of Standards and Technology, nor is it intended to imply that the materials or equipment identified are necessarily the best available for the purpose.

Organizers and Panelists

ABB

- Zhibo Pang

Boeing

- Al Salour
- Bala Chidambaram
- Mark Vanhorne

Phoenix Contact

- Justin Shade

X8, LLC and ISA

- Sterling Rooke

IEEE

- Allen C. Chen
- Kim Fung Tsang
- Victor Huang
- John Schmalzel

NIST

- Rick Candell (Engineering Lab)
- Kang Lee (Engineering Lab)

Considerations when reading the notes

For the Breakout/Brainstorming Session

- In most cases, the wording is taken verbatim from the notes written on the whiteboards
- Text in brackets “[ ]” was added for clarity. Original point may be underlined to add emphasis on what was actually recorded.

Breakout/Brainstorming Sessions

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Use Cases and Issues

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Breakout Session Discussions
Issues for Using Industrial Wireless in Factories

- Power/battery
- Multipath
- Noise
- Latency
- ~~Security~~ NIST 800-82 & CSF
- Life cycle costs
- Bandwidth
- Throughput
- Scalability
- Device cost
- Ease of use
- Interoperability
- Co-existence
- Size
- Integrability
- Environmental reliability
- MTBF [monitoring machine health]
- Safety
- Intrinsic safety
- Maintainability
- Legacy Interfaces (analog)

Breakout Session Discussions

Critical Success Factors

- [Does it improve] product quality?
- [Does it improve] product cost?
- [Does it improve human] safety?
- [Does it increase] production system reliability?
- [Does it improve evidence of] Regulatory compliance?
- [Does it enhance] Environmental stewardship (waste, pollution, radiation, clean air)?

Breakout Session Discussions
Types of Wireless Systems and Uses

- Monitoring, alarm, safety monitoring
- Supervisory
- Feedback
- Operational
- Materials/inventory management
- Identification
- Localization
- SIS (Safety Integrated systems)
- RF Channel diagnostics (channel sounding)

- *Hand-held detector of emergency equipment within the cabin of aircraft.*
- *Automated paint stackers*
- *Identify unauthorized staff in safety zones*
- *Taxonomy of types of industrial systems could be helpful*

Breakout Session Discussions

Factory Floor Example Use Cases

- Gas detection for confined spaces
- Scheduling of machines
- “In-situ” monitoring
- Human safety (Fall protection-heights, slips)
- Machine health monitoring
- Wireless dimensional probes (quality)
- Wing positioning for fuselage joining (quality)

- *Hand-held detector of emergency equipment within the cabin of aircraft.*
- *Automated paint stackers*
- *Identify unauthorized staff in safety zones*
- *Taxonomy of types of industrial systems could be helpful*

Guidelines

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Breakout Session Discussions

Suggested Document Sections #1

- Existing & Future Wireless Technologies
- Technology categories
- Technology Selection
- Spectrum selection
- RF concerns
  - Environment
  - Site surveys
  - Spectrum selection
- Policy/Procedures for BYOD [Bring your own devices]
- Future capabilities & concerns
- Spectrum monitoring/forecasting

Breakout Session Discussions

Suggested Document Sections #2

- Validation of new systems
- Tools/methods for testing
- Calibration of wireless sensors (analog)
- Acceptance plan for deployment
- Human Health & Safety
- Medical Device compatibility

Breakout Session Discussions

Suggested Document Sections #3

- Control [i.e. supervisory control]
- Monitoring [for accurate and timely observation of the process]
- Feedback [for machine control]
- Operations [to improve quality and productivity; refer to value prop.]

Breakout Session Discussions

Use of [Guidelines]Documents

- Used for education internally [within companies]
- Used to give to a supplier [for informational, requirements, and supplier conformance purposes]
- Best Practices [for selection and deployment of wireless systems]
- Spur Innovation [within the industrial wireless sector]
- Version Control [of the document assuming that this becomes a living document to be maintained over time.]

INTENDED DUE DATE 9/30/2018

Next Steps

Industrial Wireless Workshop

Working Group and Guidelines Preparation

- The consensus was that an ad-hoc working group is to be formed and led by NIST to develop NIST Guidelines on Industrial Wireless Systems
- Action items:
  - Victor Huang (IEEE IES) will email the raw notes taken at the workshop to Rick
  - Rick Candell (NIST) will prepare the notes for release
  - Rick Candell (NIST) will prepare a public announcement that a working group is be formed to develop best practices for selection and deployment of wireless technologies for industrial environments.
  - Monthly working group meetings was agreed upon to make steady progress.
  - A mailing list will be created for interested parties.

Group Photograph

The photo was taken after the workshop was adjourned; some participants left early.