

# **International Workshop on Wireless and Industrial Automation**

(March 7, 2005)

## **PROSPECT**

- According to ON World, more than one-half billion wireless sensors will ship by 2010, totaling at least \$7 billion.
- According to another more aggressive estimate on low data rate wireless, within 5 years it will be a \$10 - \$100 billion plus industry with \$10 - \$1 unit cost, versus currently \$1 - \$10 billion with \$100 - \$10 unit cost.
- There will be \$15 sensor nodes with 128k memory in 12 months.

## **OBERVATIONS**

- There are too many kinds of interferences. There is interference between adjacent bands; there is interference with broadband. Wireless signal could also go into the wire. Sometimes interference is unnoticed until it causes the failure. A node has to handle multi-path signals, but multi-path signals from other applications are interferences. For unlicensed bandwidth, as load increases, one application faces more interference by other applications. Capacity is hard to predict for a channel.
- In the automation industry, 1% change of productivity means millions of dollars difference. Wireless could improve the productivity, but could also decrease productivity. The dollar risk is high.
- For frequency hopping, if one hop fails, then there is extended latency for affected packages.
- 802.11 is not ideal for mesh network. ZigBee looks promising. Often mesh network falls apart because people assume a minimum link capacity which actually is not.
- Often simulation people and radio people do not talk to each other
- The cost is still high for wireless. The military is not limited, which has better wireless applications such as super filtering.
- There is low data rate within a plant unit, but a plant as a whole has huge data. How to transmit them wirelessly?

## **RECOMMENDATIONS**

- Industrial device has to be robust from the ground up. Early failure could slow wireless adoption.
- We should accept the fact that there is interference. We need to have redundancy and allow degradation. Just like wireline in industrial automation, wireless data flow has to be prioritized.
- For wireless installation, expert and site survey is needed. Reliable wireless applications need to understand other wireless applications in the same environment. Engineer should understand radio, be able to handle false alarms.

- Industry users need to say what the minimum requirement is, a common set of requirements. Industry and government should come together.
- We can get there, but need to pick carefully and go slowly, migrating incrementally from wire to wireless. First do not put wireless in critical control. Do sensor first.

## **CHALLENGES**

- We need real channel models that really work. Data could be fed into the model and simulation is done. It should be scalable to thousands of nodes.
- How to improve the quality/reliability of radios given so many interferences?
- Can we apply 3G CDMA for real time applications?
- National Research Council Identified Research Needs:
  - Interference Rejection – self interference from metal surfaces, lots of sparks and other sources
  - Integrated Intelligence – reduces need for host communication
  - Reliable Networks – ad hoc routing, security
  - Power – harvesting and new batteries
  - Standards – communication, interfaces, and protocols

## **ANECDOTES**

Recently the VHF heart monitors in a Dallas hospital stopped working when a local TV station near by tested HDTV broadcast for a short period. Fortunately no serious harms were done.