The Internet of Things: Standards & Testing, MEMS & Sensors Webinar

17 February 2015, 11:00 am EST via WebEx

Moderated by
Lloyd Green
Director, Engagement Marketing & Creative Community Services
IEEE Standards Association
Overview

• Welcome and Speaker Introductions
  Lloyd Green, IEEE-SA

• MEMS/Sensors and IoT – challenges, opportunities and success; MEMS Industry Group’s work in creating the IEEE 2700™ Standard and Accelerated Innovation Community
  Karen Lightman, Executive Director, MEMS Industry Group

• Test Lab Environments – why testing, specifications and interoperability are crucial to advancing IoT technologies
  Charles W.K. Gritton, Ph.D., Chief Technology Officer, Hillcrest Labs

• An Integrator’s Perspective – how standards promote scalability, which can help ensure IoT products are introduced to the market and benefit end-users
  Ken Foust, Platform Manager, Intel Corporation

• Why Standards are relevant, open and ensure the advancement of IoT technologies
  Ravi Subramaniam, Technical Director, IEEE Conformity Fostering

• Questions & Answers
  Attendee’s questions with panel discussions

*This event is being recorded
Questions may be submitted using the webinar “Chat” feature
Speakers

Karen Lightman: As the Executive Director of the MEMS Industry Group, Karen manages the operations of MIG; spearheads strategic growth; and oversees sales, public relations, marketing and outreach. Karen is active on the worldwide MEMS conference circuit as a keynote speaker and panelist promoting MIG’s role as the leading trade association advancing MEMS across global markets.

Ravi Subramaniam: Ravi is responsible for establishing and supporting conformity assessment activities based on IEEE's standards. Currently he is focused on developing multiple programs in telecommunications, power & energy, cybersecurity, and imaging and sensor technologies.

Chuck Gritton: Chuck has held senior management positions at some of the world's largest communications companies. He is currently Chief Technology Officer at Hillcrest Labs where he is responsible for Hillcrest Labs' technology development, including strategy, product architectures and research.

Ken Foust: Ken is a Sensor Technologist and Researcher at Intel Corporation, where he's active in sensor and sense making initiatives across Intel's product portfolio and R&D labs. In this capacity, he also works closely with the sensor industry and its consortiums, driving initiatives in sensor and I/O standardization.
MEMS/Sensors and IoT – challenges, opportunities and success; MEMS Industry Group’s work in creating the IEEE 2700™ Standard and Accelerated Innovation Community

Karen Lightman
Executive Director
MEMS Industry Group (MIG)
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MIG is the Supply Chain!

Connecting the MEMS & Sensors Supply Chain

- Designers
- Device Producers
- Materials & Equipment Suppliers
- Foundries
- End-Users/Integrators
For a complete list of members and partners, please visit www.memsindustrygroup.org
Upcoming MIG Events

MEMS Executive Congress Europe 2015
• 2015 March 9-10
• Copenhagen, Denmark
• Theme: Maximizing the Potential of MEMS and Sensors
  • Co-located with Smart Systems Integration

MEMS Technical Congress 2015
• 2015 May 6-7
• Cambridge, Massachusetts
• Focused on co-creation of the MEMS/sensors supply chain
  • Tour of Charles Stark Draper Labs
Join MEMS Industry Group!

*MIG is the trade association advancing MEMS and sensors across global markets*

Join MIG to:

- Navigate the MEMS and sensors supply chain
- Shape the future for MEMS and sensors needs for IoE/T markets
- Affect change with MEMS/sensors standards, security, power, energy…
MEMS and Sensors 101

- MEMS stands for MicroElectroMechanical Systems
- MEMS are miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) made using techniques of microfabrication
- MEMS is a $11B industry; adding more than $1B/year; forecast to grow to $22B by 2018
- MEMS and sensors are ubiquitous—in myriad of products and markets from cars to toasters to every wearable on the market
- MEMS and sensors are the bedrock of IoT
MEMS Growth by Application

MEMS market by application, 2006–2017

- Wired communications
- Military & Civil Aerospace
- Medical Electronics
- Industry
- Data processing
- Automotive
- Consumer and Mobile

Source: IHS
© 2013 IHS
MEMS Market Tracker, Q4 2013

12% CAGR
Challenges and Opportunities to Enable the IoT

• Challenges
  • Standards – the “s word”
  • Interoperability
  • POWER

• Opportunities
  • MIG’s creation of first ever performance standards for MEMS/sensors – IEEE 2700™
  • Sensor Fusion and MIG’s newly announced Accelerated Innovation Community (AIC)
  • Advancements in power management and energy harvesting
  • MIG’s working groups on standards, testing, healthcare; partnerships with IEEE SA, MIPI Alliance, HIMSS/Continua, SEMI and others
Test Lab Environments – why testing, specifications and interoperability are crucial to advancing IoT technologies

Charles W.K. Gritton, Ph.D.,
Chief Technology Officer
Hillcrest Labs
Different Companies, Different Spec Approaches

Accelerometer Offset (ZGO) Spec Differences

- Lists the offset when in 2G mode
- Lists data for all 3 axes independently
- Lists that this range is for the lifetime of the part
- Also specifies offset drift over temperature changes (but no temperature range where this spec is valid)
- Also specifies offset drift over voltage changes

- Only specifies the typical offset (and it uses 8G)

- Specifies offset pre-board mount and post-board mount
- Offset change over temperature includes range at which it is valid

Simplified Heading Error Example

Note that error in ZGO (0g offset) can cause pitch estimation errors
(1° ~ 17 mg uncompensated ZGO)
Accel ZGO One of Many Relevant Parameters

And the Accelerometer is one of Many Relevant Sensors

- Accuracy factors
  - Bias (offset)
  - Sensitivity
  - Sensitivity non-linearity
  - Cross-axis and package alignment
  - Resolution (includes noise and ADC quantization)
  - Dynamic range

- Precision factors
  - Over temperature
  - Over aging
  - Over supply voltage, supply ripple and power cycles

- Other factors
  - Latency
  - Bandwidth
  - Sampling frequency
  - Manufacturability
  - And many more...
Creates Need for Independent Testing

• Complete sensor qualification lab developed in our offices
• Proprietary testing procedure applied to all parts
• Creates standard criteria which allows fair comparison across parts
• Enables partners to make educated choices to match sensor choice with performance needs
But We Don’t Want to Do This!

• With standards around data sheet naming, definitions, testing procedure, and reporting we wouldn’t have to do this

• Could focus more of our time and resources on creating value-adding software for a range of applications

• Would be able to add extra value to the sensor ecosystem!
An Integrator’s Perspective – how standards promote scalability, which can help ensure IoT products are introduced to the market and benefit end-users

Ken Foust
Sensor Technologist
Intel Corporation
The Sensor Standardization Problem

- Given explosive adoption of sensor technologies in the consumer electronics industry, and the variety of sensor types, vendors, and integration considerations, it is acknowledged that OEM's, ISVs and other platform providers are faced with a non-scalable integration challenge.

- **14+ Sensor types**
- **18+ Sensor vendors**
- **26+ Sensor product lines**
- **5+ Third-party software libraries**
- **2 HLOS requirements sets**
- **Algorithm tuning for each sensor model**
- **Sensor mechanical design and placement considerations**
- **Sensor calibration requirements**

**Scalable**
Taking Action!

Solution
• Unite key industry leaders, from platform and OS providers to leading sensor vendors and MIG/MIPI members, to drive CE-focused industry standards.
• Through swift and targeted action, ratify the new standards among leading sensor vendors.
• Diffuse the ratified standards into the industry quickly and broadly
• Transfer collateral to formal standards bodies (IEEE-SA P2700, MIPI Sensor WG)

Memorandum
• Adoption burden should be minimized and distributed
• Product differentiation and innovation must not be stifled

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<th>Industry Forum</th>
<th>Deliverable</th>
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<td>Datasheet Parameters</td>
<td><img src="logo" alt="MEMS Industry Group" /> <img src="logo" alt="IEEE" /></td>
<td>Standardized Sensor Performance Parameter Definitions</td>
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<td>Digital IO</td>
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How can we close standardization gaps for IOT?
MIPI Alliance System Diagram

- MIPI I3C SenseWire
- An exciting new addition to the MIPI catalog in 2015!

- Goal: Develop an I2C compatible interface with sensor-focused differentiating features
  - Reduce power, pin-count and cost
  - Adoptable, flexible and convenient
Development Timeline – A Model for the Future

Conception to Release in 10 Months!
Summary

• Technology integrators are facing scalability challenges
• Industry groups are taking action!
  o MIG, IEEE, MIPI Alliance, iNEMI…
  o New standards, collateral, interfaces, methods…
  o Leveraging aggressive timelines
• How can we close standardization gaps for IOT?
Testing & Certification – Value Proposition

Ravi Subramaniam
Technical Director
IEEE Conformity Assessment
Benefits of Implementing a Conformity Assessment Program

• Benefits of conformance test before deployment implementation
  o Early identification of non-conformances
  o Exact functionality of the protocol is identified
  o Multi-vendor solutions will have interoperability issues – helps identify such issues
  o New offerings will have bugs – helps to catch them
• Reduces the vendor’s cost / need for re-tests for different end-users
• Establishes a baseline for performance expectation
• Eases interoperability
• Transparency based on common implementation / Test Authority
Successful Certification Program will deliver value and benefits to MEMS Industry:

**Systems Integrator (Certification Driver) Benefits**
- Ability to leverage a common, shared resource for certification and testing
- Expanded base of compliant suppliers
- Interoperability to minimize risks of deployment choices

**Vendors**
- Expanded potential national and global market
- Reduced burden for buyer specific testing
- Test Tools development to be standards based
  - Additional testing features to be offered based on SI specific requirements
Pillars to a Successful Program

- Demand Driver
- Standard
- Test Specification
- Test Labs/Tools
- Vendors/Products
- Education/Outreach
Conformity Assessment Certification Scheme – Single Scheme

Accreditor(s)

ISO/IEC 17011 + Competency requirements
ISO/IEC 17065 + competency requirements
ISO/IEC 17025 + competency requirements
Performance/Design Requirements

Certification Body(ies)

Laboratory(ies)

Products

Oversight & Communication

Scheme Owner

Agreement

Harmonizes technical requirements

Courtesy of G. Gillerman @ NIST
Alternatives

Each company/SI currently creates their own competing way of evaluating sensor performance

- Conflicting definitions
- Confusion and lack of understanding makes selling points difficult to see
- Slow adoption of new features
The Market Challenge of Standards

**Benefits**
- Establishes Developer Community
- Eliminates Customer Concerns with Sole-Sourcing
- Broadens Market Reach
  - Sole-source sales restricted to “must have”
- Reduces Production Costs
- Reduces R&D Costs
- Improves Interoperability
  - Affiliated Market Potential

**Challenges**
- IP Protection Issues
  - What do you protect/what do you expose
- Competition
  - Must compete on:
    - Efficiency
    - Differentiation
- Cost/Resources
  - R&D Support
  - Standards delegate(s)
Thank You
Questions and Answers