Case study การประยุกต์ใช้ IoT และ NETPIE ในการสนับสนุนกระบวนการผลิต

By Mr. Ekasit Inthong
Asst. General Manager
Nidec Shibaura Electronics (Thailand) Co., Ltd.
228 Group Companies
With 96,602 employees
In 33 countries

Nidec Group Network

www.nidec.com
Nidec Products:

- **Spinning and Moving in Our Daily Lives**

- **Other products**
  - Industrial robots
  - Shutter for digital cameras

- **Small precision motors**
  - Vibration motors
  - HDD motors
  - Drive motors

- **Appliance, commercial, and industrial products**
  - Air conditioner motors
  - Wind power generator

- **Automotive products**
  - Millimeter wave radar units
  - Electric power steering (EPS) motors
  - Adjustable water pumps

**Consolidated net sales**: 1,178.3 billion yen (for FY2015)
Established: 1996  
Capacity: 1.2M.Pcs./Mth.  

Management:
Japan: 9 Persons
Thai: 16 Persons

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Resin-Packed Motors
Motors for Air Conditioners
Vision: to be Smart Factory in 2018

The Scope of Industry 4.0

MES & Production Profile including OEE
- Information between the front-end equipment & MES application
- Production Traceability

Production Testing Equipment
- Machine Vision
- Motion I/O Cards
- Computing Platform
- Controller

Factory Environmental Monitoring
- Electricity Monitoring
- Factory Waste Water
- Energy Management

Predictive Maintenance
- Production Performance Analysis
- Machine Status
- Abnormal Diagnosis
- Sensor Measurement

Machine Automation
- Industrial Robots
- Automated Guided Vehicle
- Industrial Machinery

MES: Manufacturing Execution System
OEE: Overall Equipment Effectiveness

Credit: Image from: http://www.advantech.com/
Change to be Smart Factory in 2018

**HOW TO DO:**

- **Step 1**  
  IoT to make “Speaking Machine”
  ใช้ IoT เพื่อทำให้เครื่องจักรและอุปกรณ์ “พูดได้”

- **Step 2**  
  MeS & Adv. Traceability System
  สำ异味ประสบการณ์ รับรู้ความซับซ้อน
  และขยันในการวิเคราะห์ข้อมูล

- **Step 3**  
  Machine to Machine (M2M)
  ทำให้เครื่องจักรเชื่อมโยงสั่งการได้ด้วยตัวเอง

MeS: Manufacturing Execution System of NSET
Hay guy, My oil Temp. 35°C and Pressure 12 Bar now. Ok?

Machine I have been working 12 Hours with 250 short/min. Microcontroller + WiFi

Hay! Man! This Die Over Stroke Running. It must recheck now!

Room Someone open Air Cond. 23°C and 4 lights

My Sensors found Step1 Slowly

Production Line I’m Expired! Don’t use me

Connector Oh no! NG. 4 pcs. No Good

NG. Box I have been working 12 Hours with 250 short/min.

Production Line Easy to See

Easy to Check

Easy to Solve
NSET@IoT® Step II (Overview Concept):

NODE-PIE* (Beta)

Smart Quality Control
- Smart In-Coming Inspection
- Smart Control Limit Alerting

Smart Quality Control

Production OEE

Predictive Maintenance

Image Processing
- Productivity & Quality
- Smart Working Manual

Smart Andon

Traceability Version 2.0

Ball insert
- Assy
- No load test
- Load test
- Inspection

Abnormal Alert Sensor

Smart Job Tag

BB Press

RFID

Packing Request

Packing

Smart NG Box Version 2

Smart AGV

Intelligent Production line

Smart Common Parts Box

Motion Sensor

Remark: * New Server Service from Net-Pie Platform: NSET test run from 25 September 17
NSET@IoT® Step III (Overview Concept):

Augmented Reality Technology

100% Intelligent Production Line

MES: Manufacturing Execution System
ERP: SAP HANA

RFID Gate (for F/G Warehouse)
RFID Gate (for Finish Goods)
AGV (for FG)
AGV (for Packaging)
RFID Gate (for Packaging)
Robot Arm For pick up motor

gBox1 Box2 Box3 Box4

Serial Barcode System
Converyer transfer System

100% IoT Device All Things

Big Data Management System

CUCarBot Copper wire Support
By reel robot car

Private Cloud System

100% IoT Device All Things

100% IoT Device All Things

100% IoT Device All Things

RFID Gate (for Materials)
AGV (for Materials)
IoT Gateway
AMOM (Automatic Manufacturing Ordering Machine)

Packaging Stock
Intelligent Packaging Support System
NSET@IoT® System Configuration:

- **Machines Or Tools**
  - PLC
  - Sensors/Actuators
  - Wi-Fi Shield
  - Power Supply

- **Hardware**
  - Arduino

- **Input**

- **Output**

- **Applications (end users)**

- **Storage and Database**
  - Local Database
  - IoT Gateway
  - Edge/Fog Computing
  - SQL Server

- **Communication**
  - TCP
  - MQTT
  - REST API
  - HTML
  - HTTP

- **System Components**
  - Microcontroller
  - Wi-Fi Shield
  - MQTT
  - NETPIE
  - IoT Gateway Lite
  - KitWai
  - Microsoft SQL Server
### Our Status of NSET@IoT® Activities:

<table>
<thead>
<tr>
<th>Solution</th>
<th>Target (Thing)</th>
<th>Actual (Thing)</th>
<th>Status</th>
<th>Benefit by Month (Baht)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Labor</td>
</tr>
<tr>
<td>Smart Machine</td>
<td>800</td>
<td>220</td>
<td>27%</td>
<td>50,000</td>
</tr>
<tr>
<td>Smart Line</td>
<td>200</td>
<td>100</td>
<td>50%</td>
<td>35,000</td>
</tr>
<tr>
<td>Smart Energy</td>
<td>300</td>
<td>80</td>
<td>27%</td>
<td>20,000</td>
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<tr>
<td>Smart Operation</td>
<td>200</td>
<td>120</td>
<td>60%</td>
<td>55,000</td>
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<tr>
<td><strong>Totally</strong></td>
<td><strong>1,500</strong></td>
<td><strong>520</strong></td>
<td><strong>35%</strong></td>
<td><strong>160,000</strong></td>
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</tbody>
</table>

# Investment cost from Aug.16 – Aug.17 → 1.33 MB.

- Reduced In-Direct Labor: 0.85 MB. → 9.7%
- Reduced Expense: 0.20 MB. → 7.4%
ตัวอย่างกิจกรรม
Smart Energy Management:

- Temperature Humidity Sensor
- Relay Switch
- Light Sensor
- Motion Sensor
- Smart Air-Cond.
- Smart Light
- Temperature Control Monitor
- Check Sheet
- MDB (RS485)
- Smart MDB
- Overview Energy Consumption Monitor
- Mobile App.
Smart Machines:

- Lubricant Temperature Sensor
- Cooling Water Flow Rate Sensor
- Pressures Sensor

Smart TPSM of Machine

Maintenance Real Time Monitor

Omron PLC

Smart Machine Condition

Injection Machine Condition Control Monitor
Smart Production Line:

- Production Efficiency Monitor
- MTBF and MTTR Recording
- Smart Shot Die Counting
- Production Quantity of India Factory

MTBF and MTTR Recording

Smart Shot Die Counting

Production Quantity of India Factory

Production Efficiency Monitor

<table>
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<tr>
<th>LINE</th>
<th>MTBF (hr)</th>
<th>MTTR (min)</th>
<th>STOP (hr)</th>
<th>LOSS (hr)</th>
<th>STATUS</th>
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<tbody>
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<td>A</td>
<td>48</td>
<td>3</td>
<td>12</td>
<td>42</td>
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<tr>
<td>B</td>
<td>70</td>
<td>4</td>
<td>9</td>
<td>36</td>
<td>On</td>
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<td>42</td>
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<td>15</td>
<td>67</td>
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<td>6</td>
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<td>54</td>
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</tr>
</tbody>
</table>

Shot Die Injection Mold Control Monitor

NIDEC (NIND) Production Quantity

NEEMRANA: 08:21:42

Production Quantity of India Factory
Smart Warehouse:

- Smart Shelves
- Space Utilization
- Stock Searching
- RFID
- Inv. Real-time Monitor
- Smart Forklift
- Smart Weight
Smart Quality Control:

- e-Check Sheet

- Traceability System

Nidec

All for dreams
Real-time Monitor:
Always start from “Can do It” mindset, Just start taking action!
Many small Success can lead to a big Achievement!