

muRata SPEAKS

TECHNOLOGY | SOLUTIONS | INNOVATIONS

Murata Speaks - Monthly Webinar Series #23 [July 2022]



Industry 4.0

Accelerating Malaysia IR4.0 Pivoting Factory Operations



Our Speakers



Kazuya Kitahata

Deputy General Manager
Sales Department

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With over 15 years of Sales & Sales Engineering experience in Murata, Kitahata has worked with customers across the ASEAN region, mainly from Singapore, Indonesia, Thailand and Malaysia in recent years. Backed by a strong belief in contributing back to the society, he is dedicated to closely partner with customers to realize that.



Nicholas Hau

Product Engineer
RF Wireless
Connectivity Section

nicholas.hau@murata.com

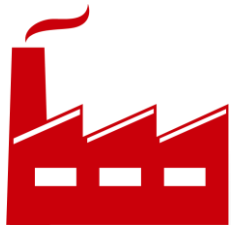
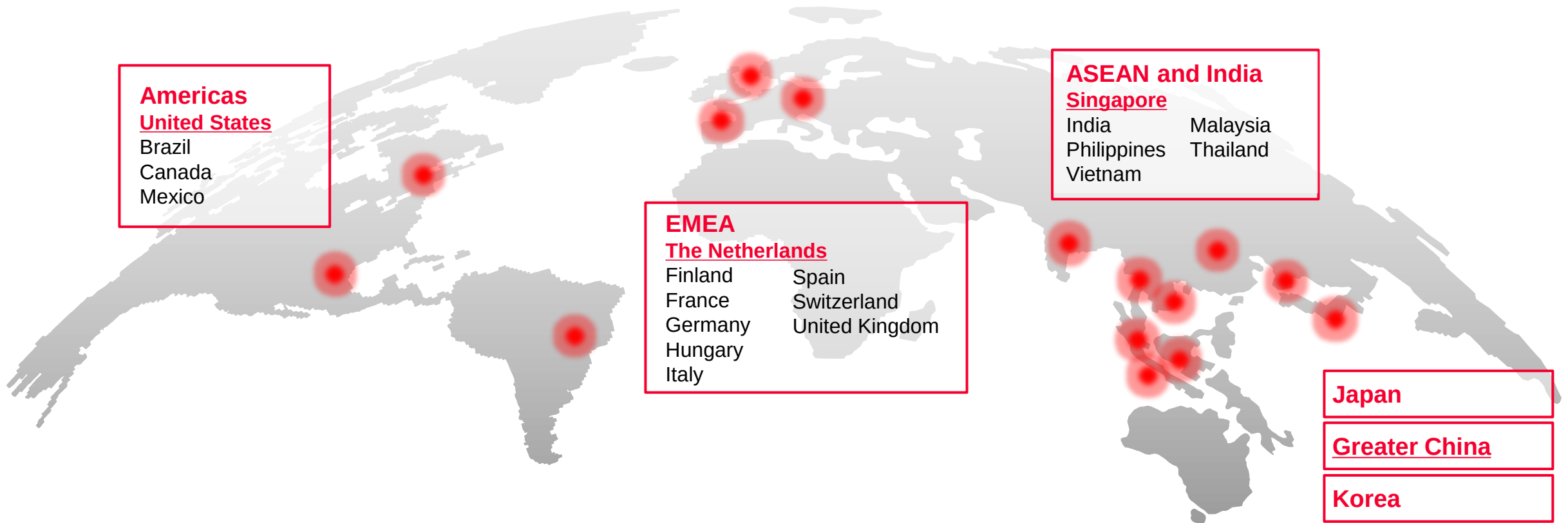
With a strong passion for IoT, Nicholas is skilled in both engineering and technical experience for wireless sensing systems. He is committed in providing support to ASEAN customers for Murata RF Wireless Connectivity, with coverage in both hardware and software applications.

Today's Agenda

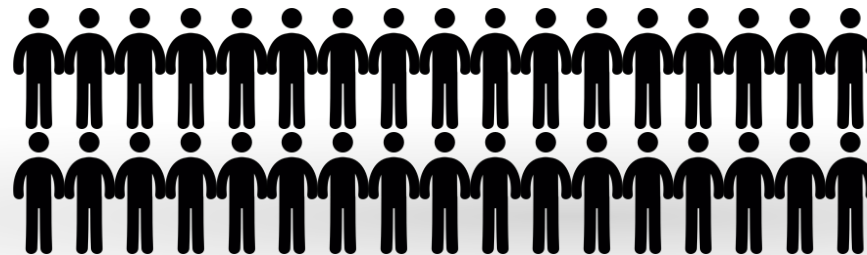
- Introduction to Murata
- Smart Factory & Condition Monitoring in Malaysia
- 3 Steps to Pivot Factory Operations
- Wireless Sensing Solution
Product Line-Up & Implementation Examples
- Q&A



Our Global Locations



A total of **43**
manufacturing
facilities around
the world



No. of Employees:

77,581

**as of 31 March 2022*

Murata Electronics (Malaysia) Sdn. Bhd. (MME)

muRata
INNOVATOR IN ELECTRONICS



Penang Sales Office (est. Oct 1994)

Unit 6.03, Menara Boustead, 39 Jalan Sultan Ahmad Shah, 10050 Penang, Malaysia



Kuala Lumpur Sales Office (est. Jun 1990)

Suite 13.01, Level 13, Menara IGB, No.1 The Boulevard, Mid Valley City, Lingkaran Syed Putra, 59200 Kuala Lumpur, Malaysia



Malaysia Plant (incorporated May 1993)

Plot 15, Bemban Industrial Park Jalan Bemban, 31000 Batu Gajah, Perak, Malaysia

- EMI Winding Factory & resales of Murata products through IPC



Malaysia Economic Policy

■ DEFINITION

Strengthening political stability, enhancing nation's prosperity, and ensuring unity while celebrating ethnic and cultural diversity as the foundation of nation state.

■ AIM

Providing a decent standard of living to all Malaysians by 2030.



Shared Prosperity Vision 2030

Source: <https://www.malaysia.gov.my/portal/content/30901>

■ 7 STRATEGIC THRUST

- Small and medium-sized enterprises (SMEs) and multinational corporation (MNCs) in manufacturing
- Drive for innovation, digitalisation and sustainability

1
RESTRUCTURING
BUSINESS AND
INDUSTRY ECOSYSTEM

2
KEY ECONOMIC GROWTH
ACTIVITIES
(KEGA)

3
TRANSFORMING
HUMAN CAPITAL

4
LABOUR MARKET
& COMPENSATION
OF EMPLOYEES

5
SOCIAL
WELLBEING

6
REGIONAL
INCLUSION

7
SOCIAL
CAPITAL

Murata contributing to Malaysia Vision 2030

Core fields

Communications



Mobility



Challenge fields

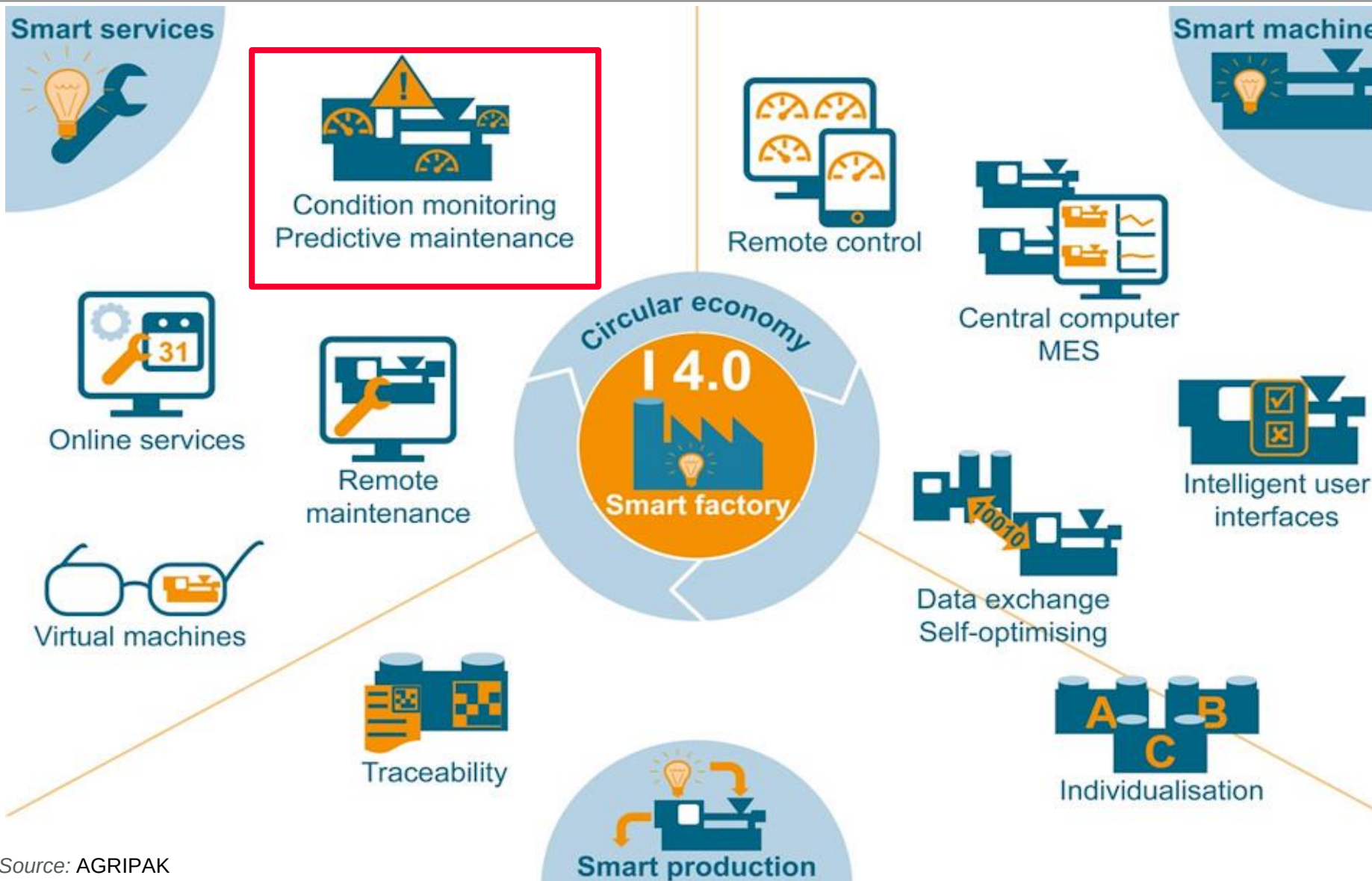
Environment



Wellness



Smart Factory Automation Overview



Source: AGRIPAK

Common Challenges



 **CRITICAL PROCESS BREAKDOWN!**
- Unexpected motor failure

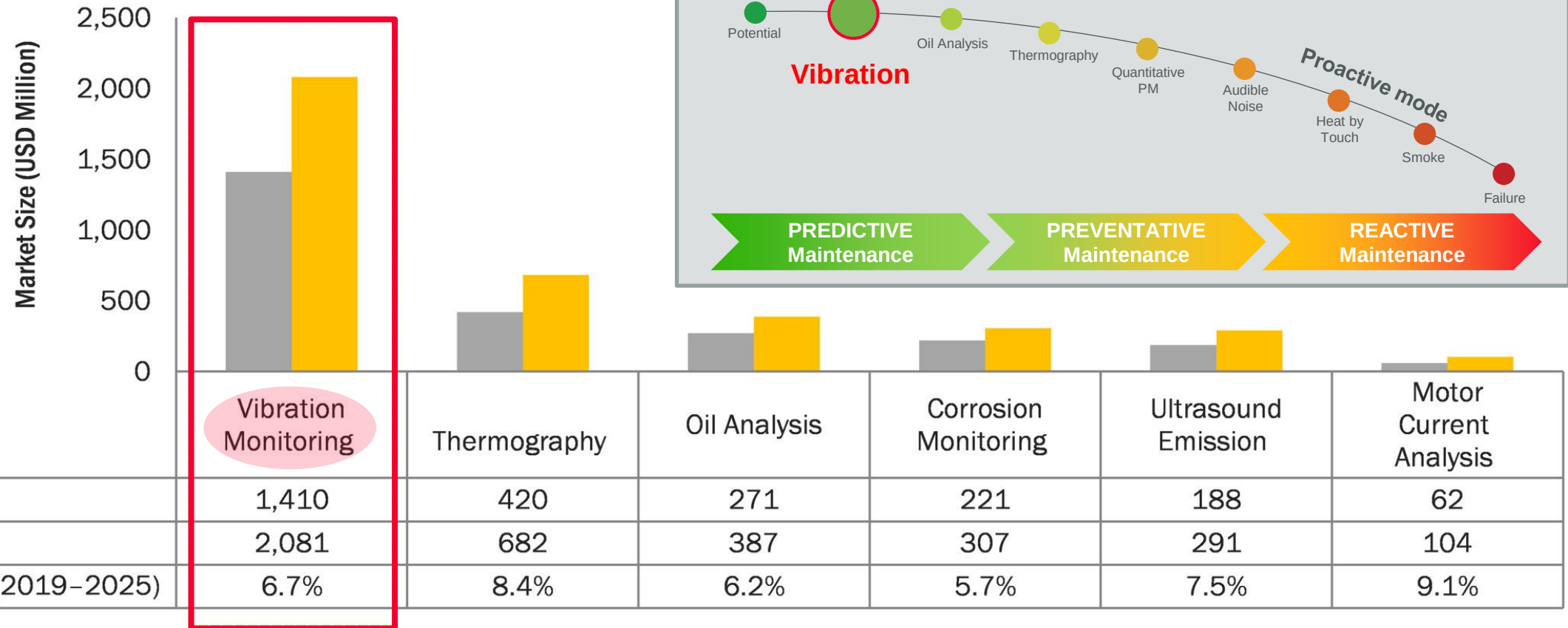
 **LONG DOWNTIME!**
- Production line stopped for days

 **HUGE FINANCIAL LOSS!**
- Estimated loss: USD 100K/ day per production line

Techniques for Machine Condition Monitoring

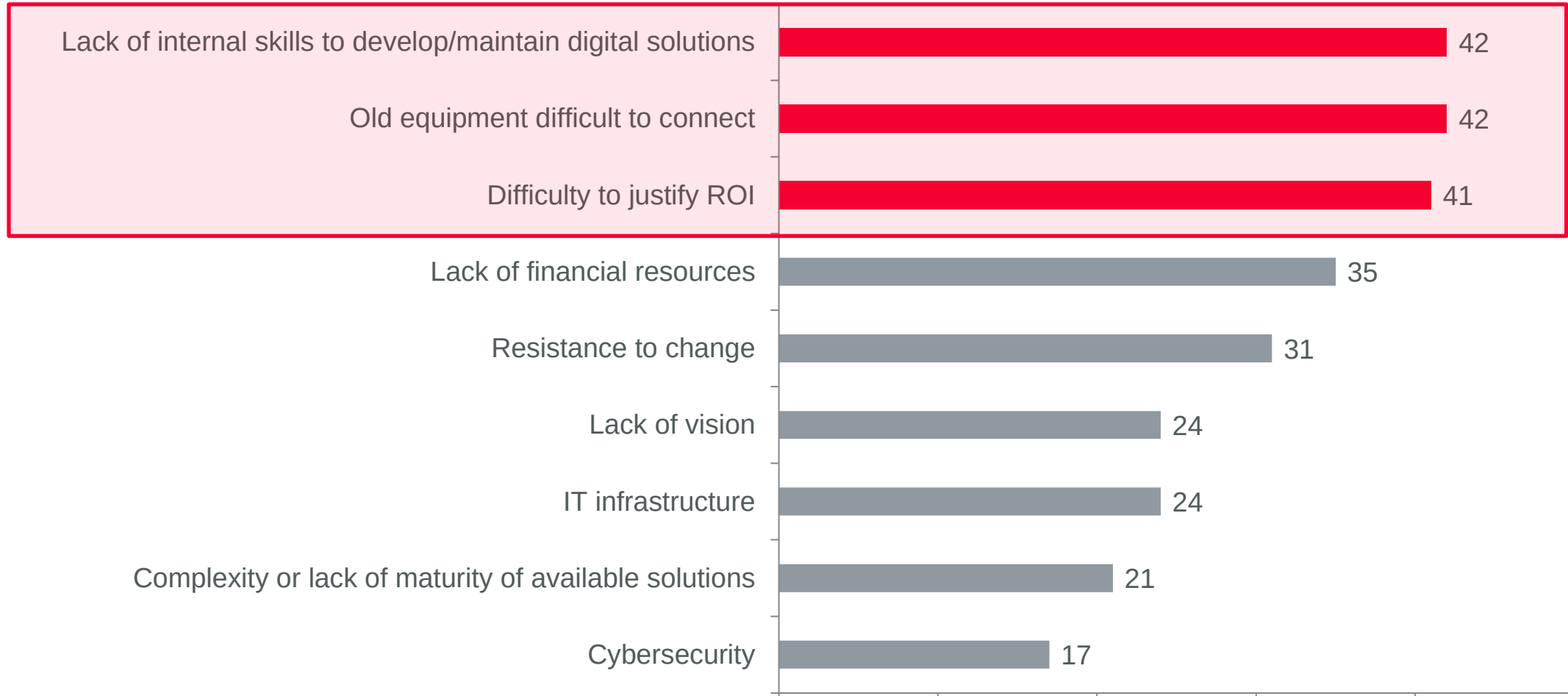
Vibration Monitoring

- to hold the largest share of machine condition monitoring market



Source: MarketsandMarkets

Main Challenges to Implement Smart Factory Automation



*Note: Results above are based on the Oliver Wyman and L'Usine Nouvelle online survey conducted between August and September 2017, with industrial firms
Source: Oliver Wyman, Frost & Sullivan Analysis

What kind of condition monitoring are you using?

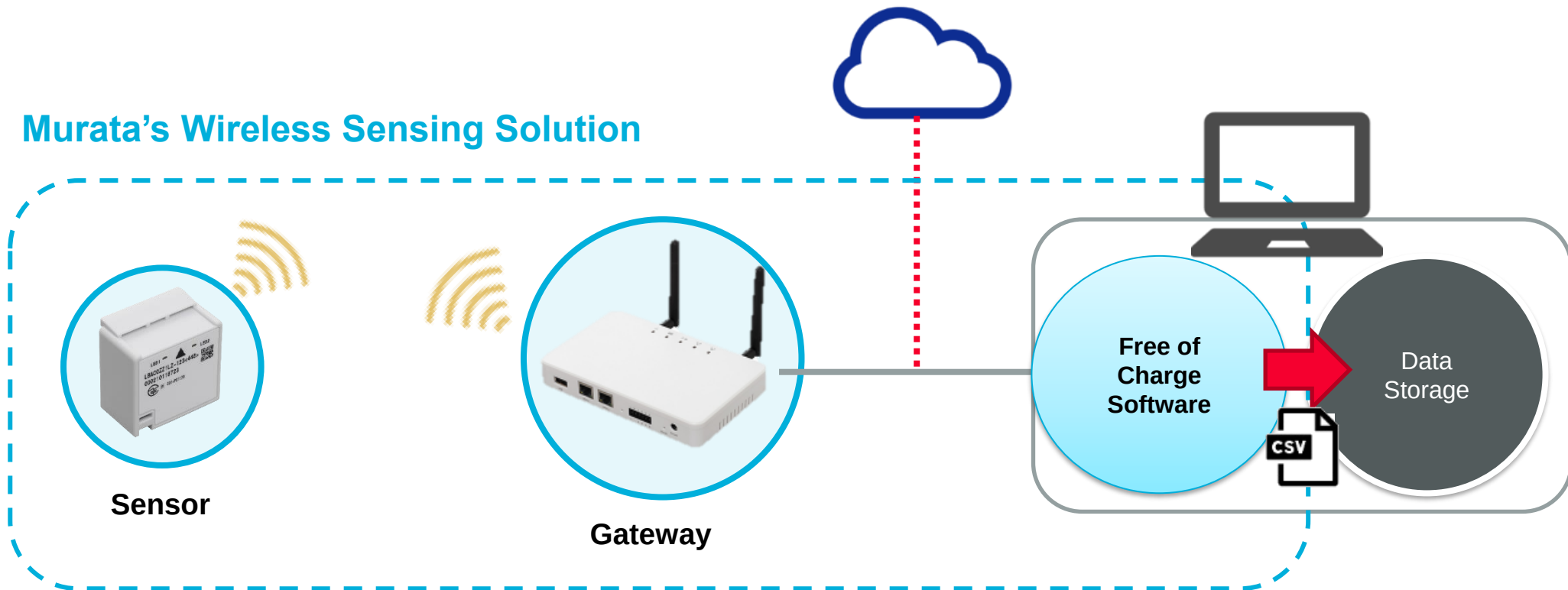
- 1 Yes - Real time condition monitoring
- 2 Yes - Time-based monitoring (TBM) using portable device
- 3 Yes - Conventional maintenance with regular service
- 4 No

How can Murata wireless sensing solution help to resolve these challenges?

3 Steps towards Condition Monitoring



Murata's Wireless Sensing Solution

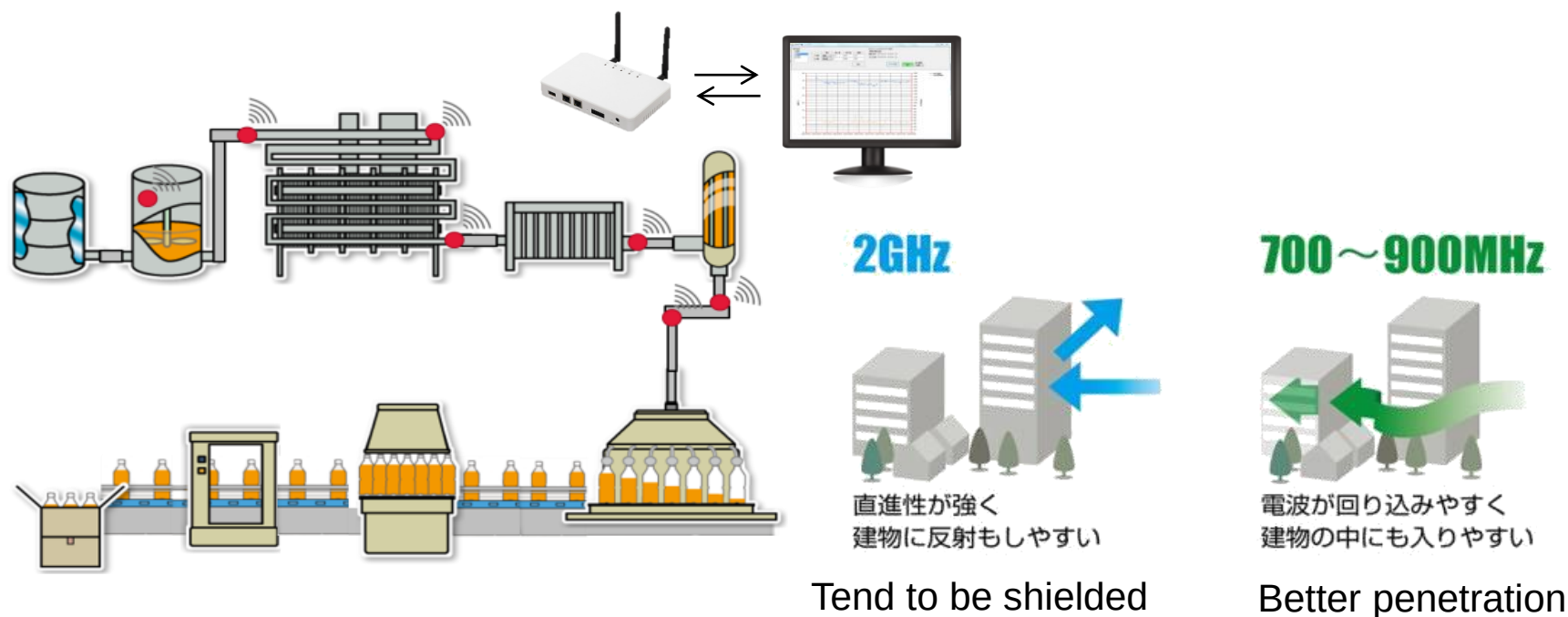


Start Immediately

Subscription Fee

Cloud Installation

- ☐ **Only with a Sensor and a Gateway**, start your evaluation immediately.
- ☐ **Free dashboard software** (sensor management, graphs, etc.)
- ☐ Data output in **csv format** is available



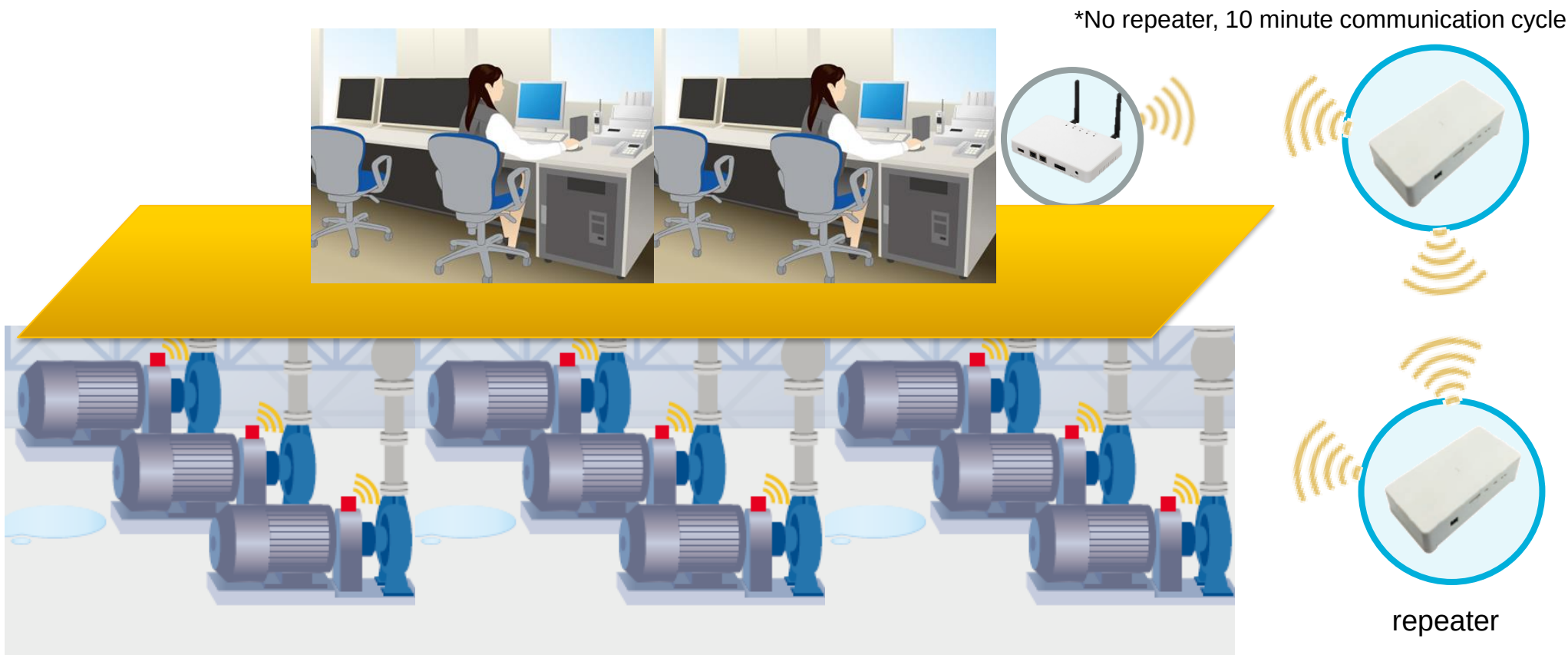
- **Sub-GHz** waves longer than **2.4 GHz**
- Major advantage: signals can better penetrate through walls, trees, buildings, other structures along propagation path

✓ **Easy Installation** ✓ **Good Connectivity** ✓ **Long Battery Life**

- ❑ **Easy installation** without large-scale construction or line stoppage
- ❑ **Good connectivity** even inside the factory using Sub-GHz radio frequency
- ❑ Low-power-consumption design enables **long battery life** (a few years)

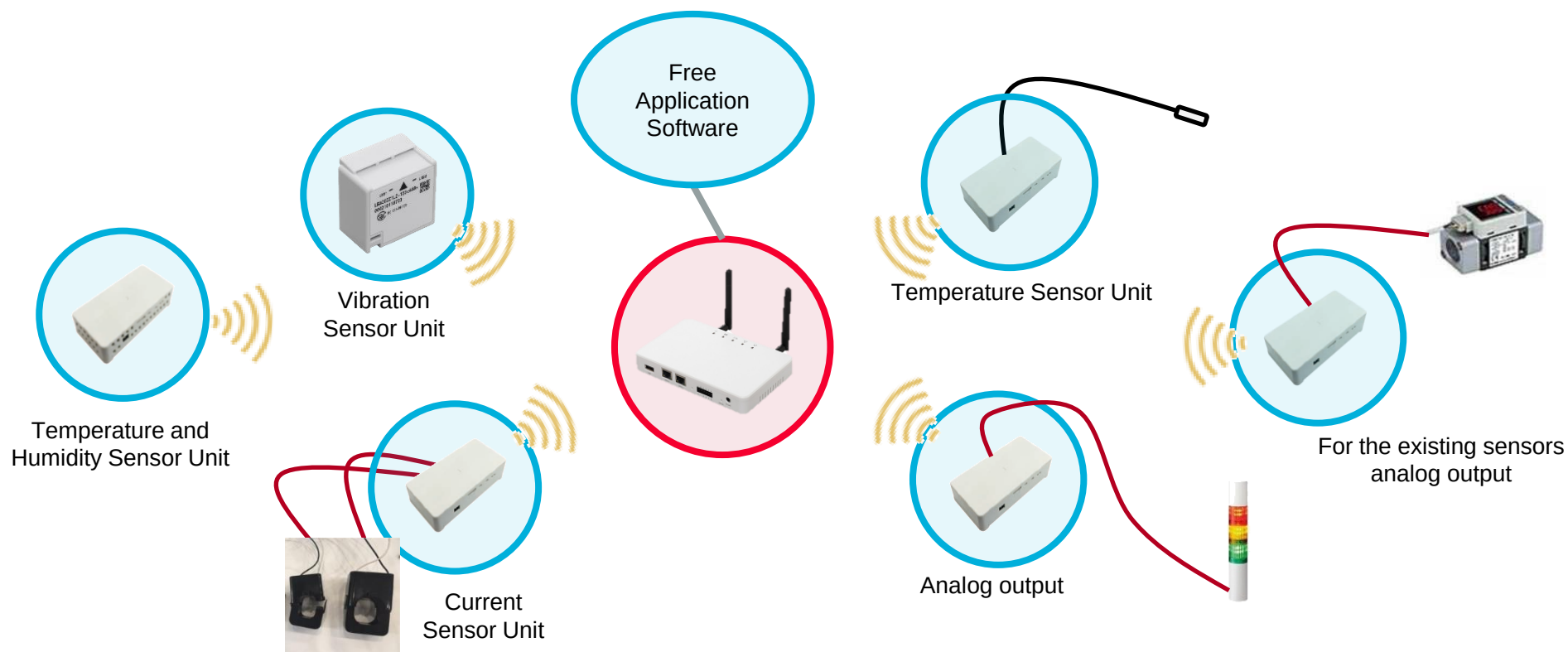
*Gateway and repeater require external power supply

Verify Effectiveness: Wireless Network



Communication distance for line-of-sight: 200m max.

More than 200m communication across floors can be realized using a repeater.



Wide range of Wireless Sensor Nodes

- ❑ **One gateway** to support wide range of sensors.
- ❑ **Not necessary** to install a separate system for different measurement targets.

Ease of Implementation and Installation

Murata Wireless Sensing Solution

- Easy to Install
- Easy to Use
- Easy to Expand





What are the machine/s that you would like to monitor?

*(*multiple selection allowed)*

1 Exhaust Fan

2 Water Pump Motor

3 Blower Motor

4 Vacuum Pump Motor

5 Water Chiller Pump Motor

6 Air Handling Units (AHU) Motor

7 Motor Conveyor

8 Cooling Fan Motor

Implementation Examples

Vibration Sensor Implementation Example – Exhaust Fan



- Conduct **regular inspection** of exhaust fan
- Exhaust fans are in **high, hard-to-access** places
- Concerned on **workers safety** and risk of injury

Solution

Wireless vibration sensor nodes can be installed on the exhaust fan motors.

Detects the vibration caused by exhaust fan and enables remote monitoring that prevents any risk of injury to workers.

Murata's Wireless Vibration Sensor



To improve maintenance efficiency and increase worker's safety

Vibration Sensor Implementation Example – Rotating Motors

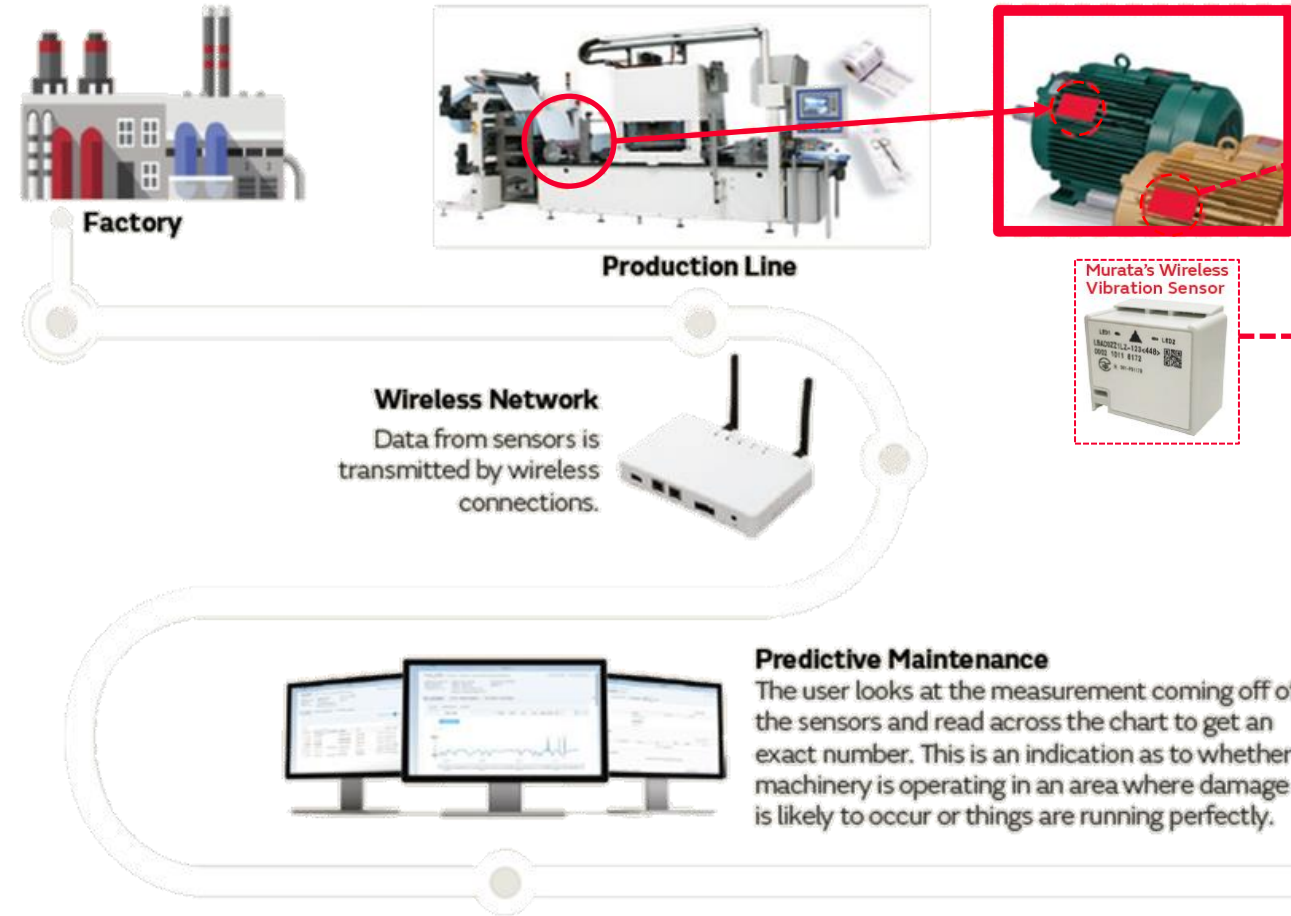


Problem

- Vacuum facilities are connected in manufacturing line.
- When the **machines overheat**, it will automatically shutdown and stop
- If any one of the motors in the vacuum process stops, several lines will be affected and line down

Solution

Wireless vibration sensor nodes can monitor the motors and bearings remotely, reduce time on on-site visit check, filling, organizing and searching for paper documents.



To arrange maintenance schedule in advance, increase production stability, productivity and cost saving.

Current Sensor Implementation Example – Suction Fan



Problem

Failure occurred due to an **abnormality** in the **suction fan** of the exhaust gas treatment device.

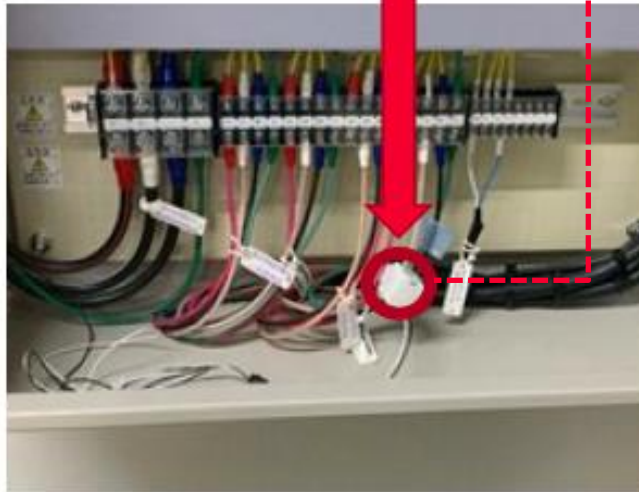
Huge loss of costs due to one **batch failure**.

Solution

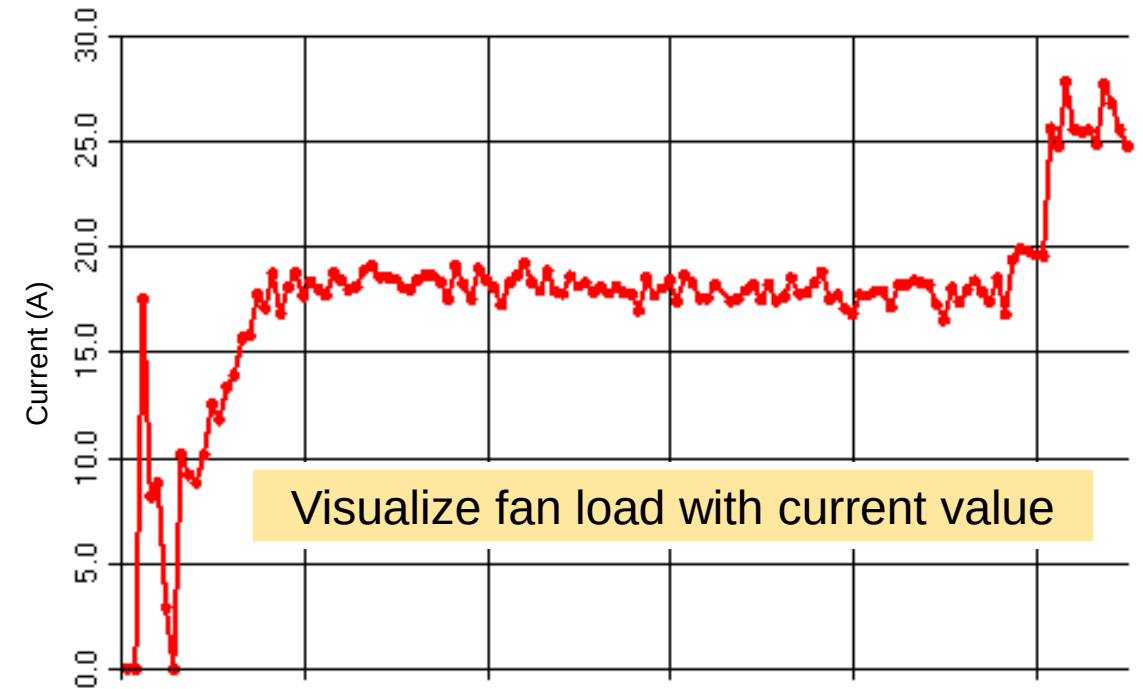
Wireless current sensor was installed to measure the current value of each fan

Load of fan can be visualized and enables maintenance before abnormality becomes apparent

Current Sensor



Murata's Wireless Current Sensor



To arrange maintenance schedule plan in advance, improve maintenance efficiency and reduce loss

Temperature & Humidity Sensor Implementation Example



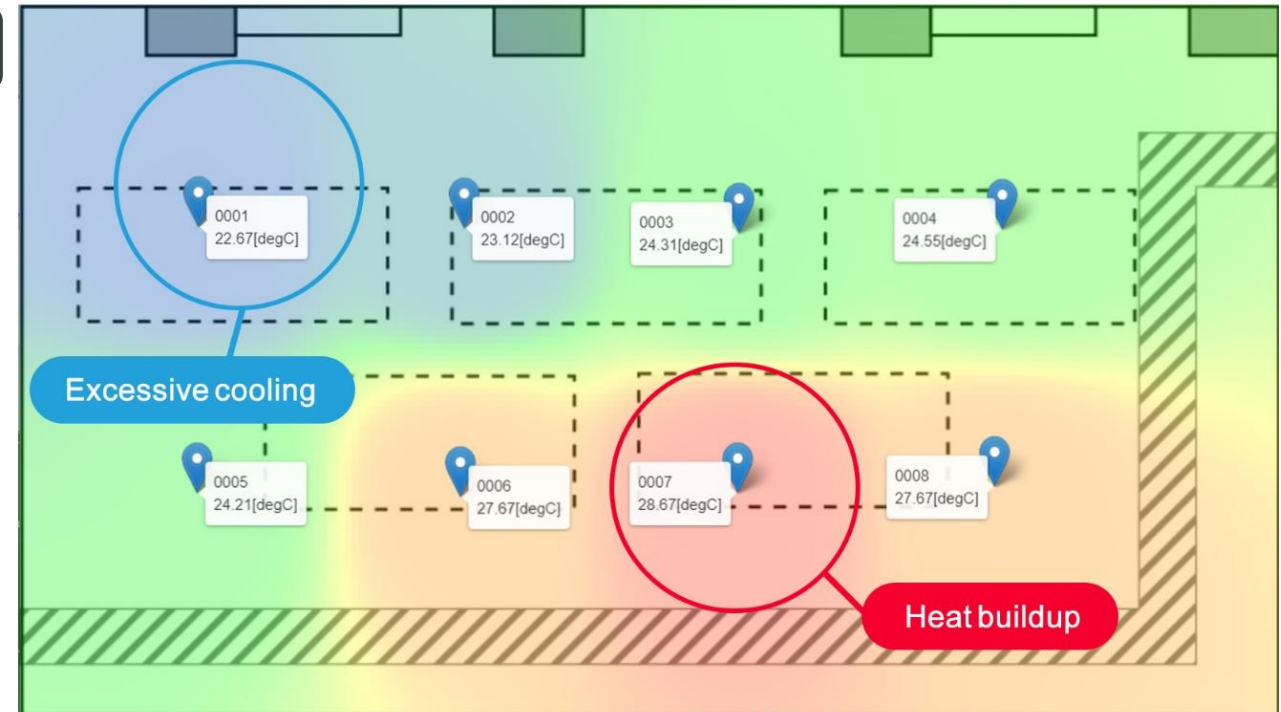
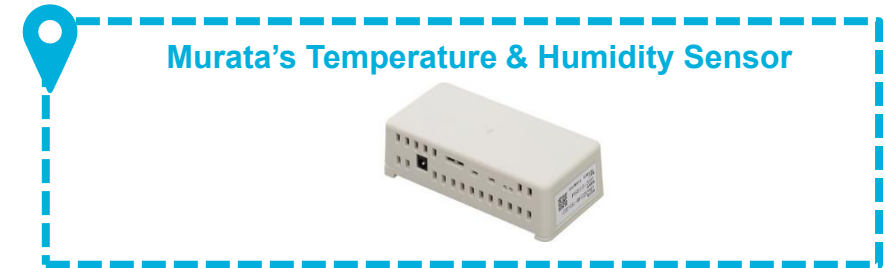
Problem

Unable to visualize **electricity wastage** being used on **air conditioning**

Solution

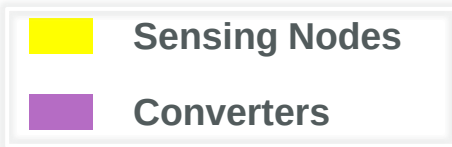
Wireless temperature and humidity sensor installed to optimize power used for air conditioning

Temperature unevenness detected in the area and reduced heat leakage by 10°C.



To visualize temperature unevenness and reduce heat leakage, reducing costs

Wireless Sensing Solution Lineup



Wireless Vibration Sensor Acceleration only (1LZ)

Predictive maintenance of rotating machines such as motors and pumps for more efficient equipment maintenance



Wireless Vibration Sensor Acceleration & Velocity (1TF)

Predictive maintenance of rotating machines such as motors and pumps for more efficient equipment maintenance



Temperature Humidity Sensor Unit

Temperature and humidity monitoring inside factories and buildings



CT Sensor Unit

Monitoring current consumption of equipment



4-20mA and Pulse Signal Unit

Collecting data wirelessly from existing 4-20mA sensors



0-5V and Pulse Signal Unit

Collecting data wirelessly from existing 0-5V sensors



Relay Unit (Repeater)

Wireless communication range extender for installations in large facilities



Gateway

Receiving data from sensor units and transfer them to customer's system by suitable interfaces and protocols

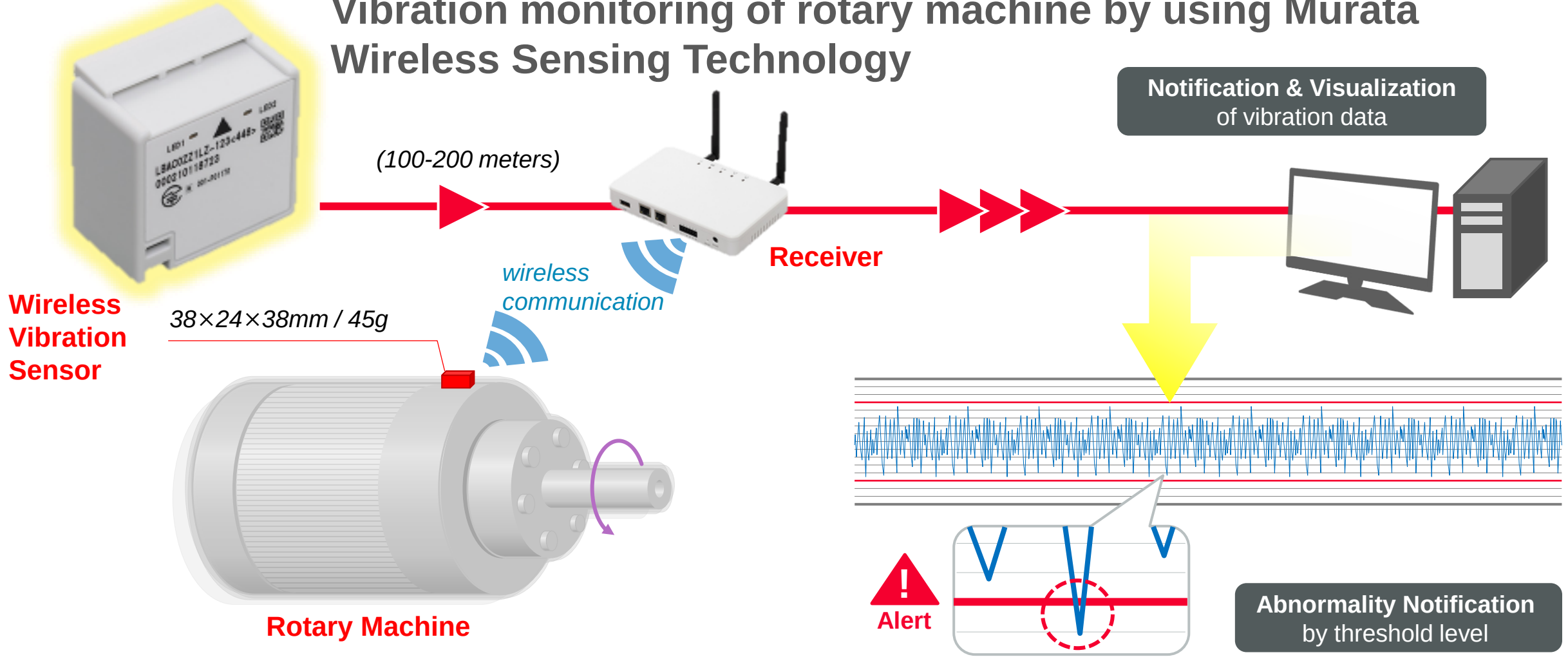


Thermocouple

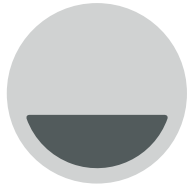
Temperature monitoring inside high temperature machineries up to 200° C

Wireless Vibration Sensor for Condition Monitoring

Vibration monitoring of rotary machine by using Murata Wireless Sensing Technology

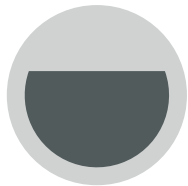


Wireless Vibration Sensor – Overview



Sensor Elements

- **Piezoelectric Ceramic Technology** → Vibration Detection
- **Thermistor** → Temperature Sensing



Measurement Parameters

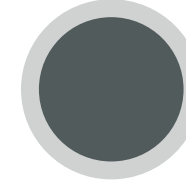
- Top 2 peak **acceleration** and its frequencies
- Top 3 peak **velocity** and its frequencies
- Acceleration RMS
- Velocity RMS
- Kurtosis
- Temperature

Completely
Wireless

Wide
Coverage

Small &
Light

Early
Abnormality
Detection



Features

Dimensions: ~38 x 24 x 38 mm

Vibration Frequency:

- Acceleration: 12.5Hz~10kHz
- Velocity: 10Hz~1kHz

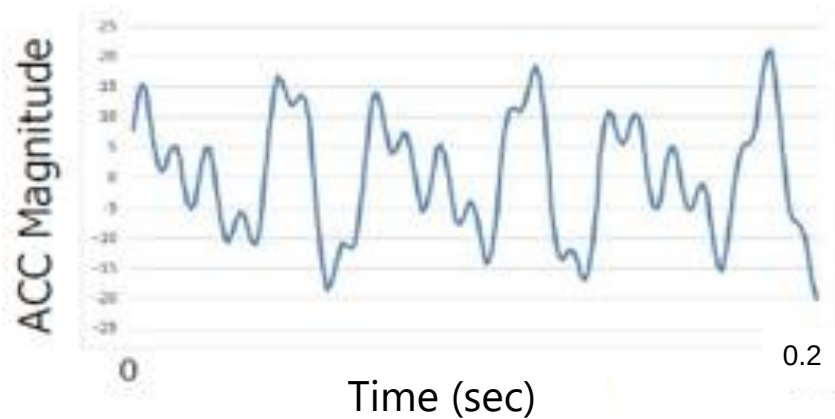
Vibration Acceleration:

- ±30G Resolution: 28mG

FFT calculation function is installed in the sensor unit.

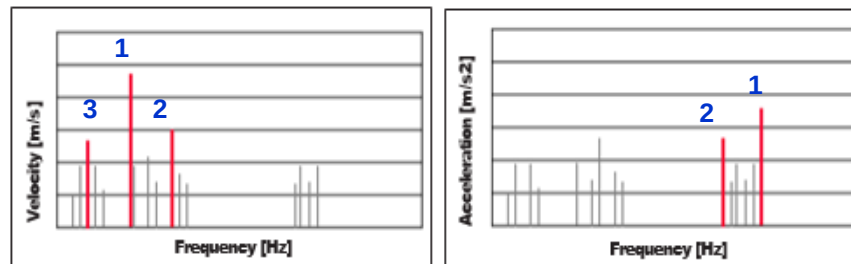
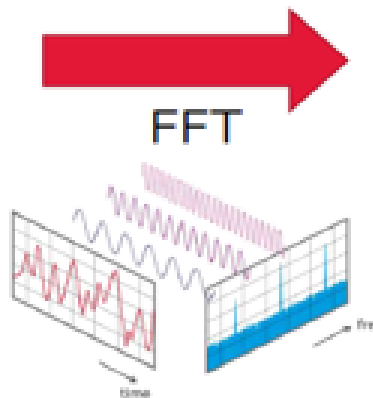
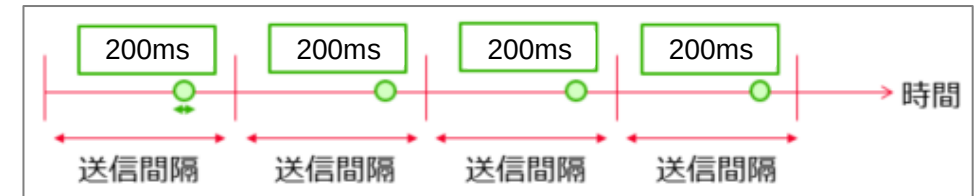
Wireless Vibration Sensor – FFT Feature

Acceleration Raw Data



Capture trend by collecting data

- Top 2 acceleration points and its frequencies
- Top 3 velocity points and its frequencies



* Recommendation: Refer to Vibration Monitoring (ISO10816) as a guide with the velocity value obtained from the Wireless Vibration Sensor

- ✓ Simplify data processing
- ✓ Save battery consumption

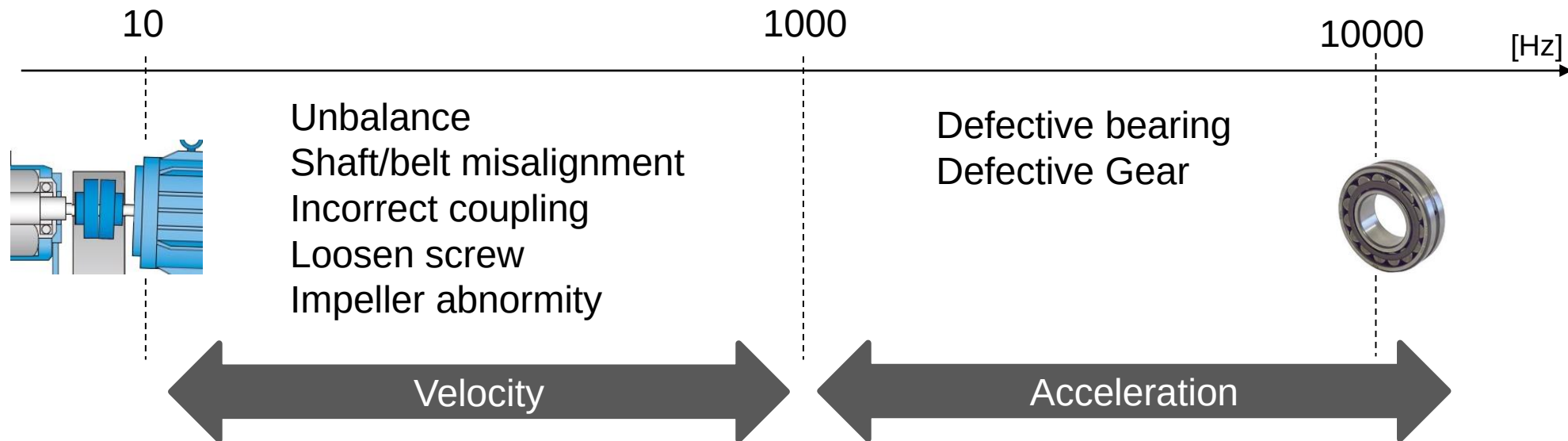
Wireless Vibration Sensor – Frequency Band Feature



The vibration derived from each failure mode has a different frequency range.

⇒ Based on target modes, it's important to monitor **velocity** and/or **acceleration**, since the sensitivity differs by frequency.

<Vibration frequency and failure modes>



Murata Vibration Sensor provides both indicators; velocity and acceleration.

FYI: ISO 10816-3

ISO Velocity Severity Chart (Guideline)

Indicator: Velocity RMS

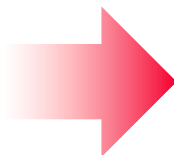
ISO 10816-3		Medium-sized machines		Large machines	
Advisor		Group 2		Group 1	
Velocity		Rated Power			
in/sec eq. Peak	mm/sec RMS	15 kW - 300 kW		300 kW - up	
0.61	11.0	DAMAGE OCCURS			
0.39	7.1				
0.25	4.5	RESTRICTED OPERATION			
0.19	3.5				
0.16	2.8	UNRESTRICTED OPERATION			
0.13	2.3				
0.08	1.4	NEWLY COMMISSIONED MACHINERY			
0.04	0.7				
0.00	0.0	NEWLY COMMISSIONED MACHINERY		NEWLY COMMISSIONED MACHINERY	
Foundation		Rigid	Flexible	Rigid	Flexible

CT & Temperature & Humidity Sensor



Temperature Humidity Sensor Unit

Temperature and humidity monitoring
inside factories and buildings

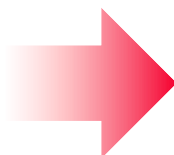


Measurement Parameter: Temperature, Relative Humidity
Temperature Measurement Range: -10°C~60°C
Humidity Measurement Range: 10%RH~90%RH
Size: ~45 x 90 x 25mm



CT Sensor Unit

Monitoring current
consumption of equipment



Sensor Element: Clamp type Current pickup (External
Connections)
Measurement Parameter: Current (AC 50/60Hz)
Current Measurement Range: 0.1A~500A
Size: ~45 x 90 x 25mm

Software Demonstration – WsnManager

WsnManager

Disconnect Gateway **Wireless** Route Sync Archive SD Read View Setting Alert App Setting Clear

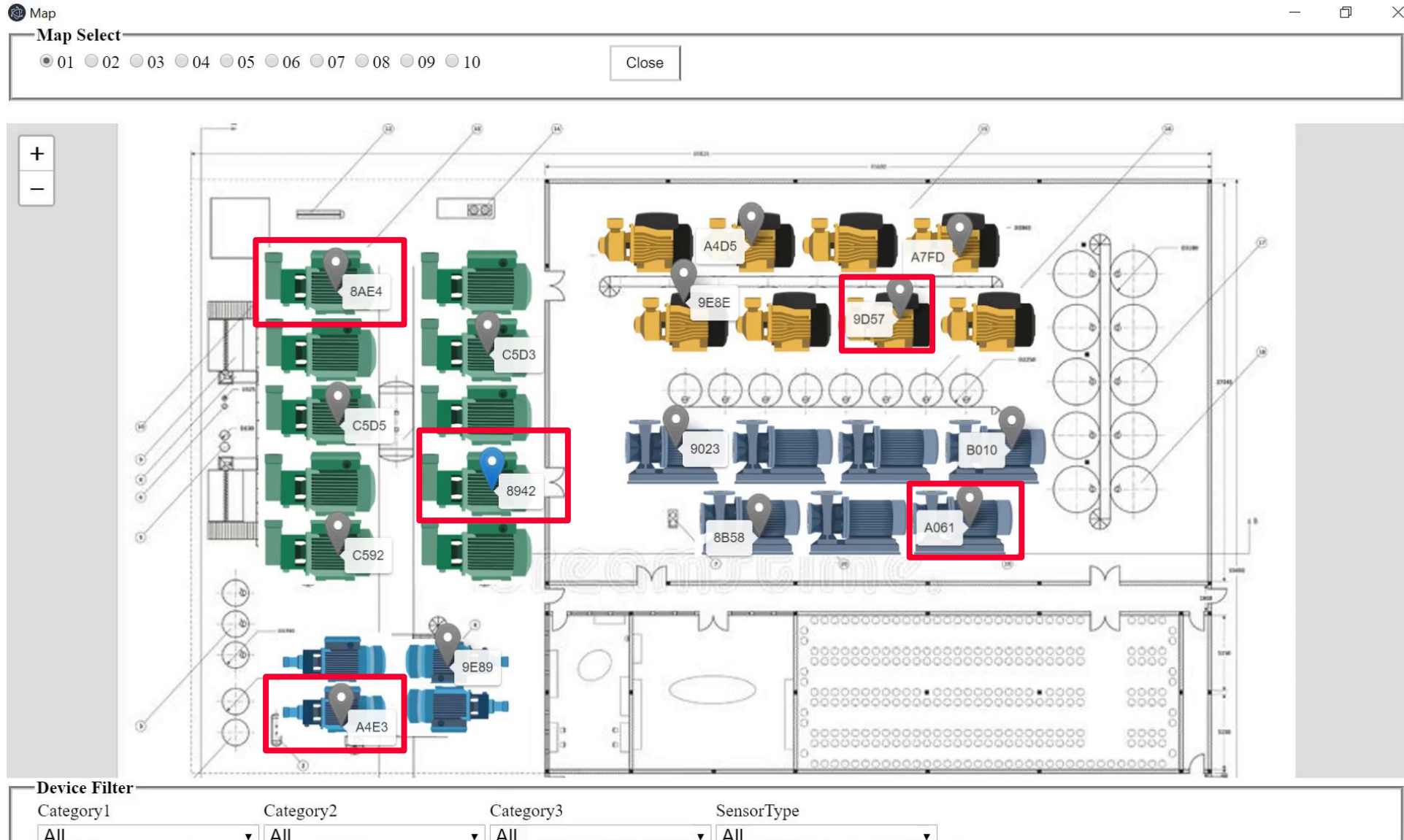
Close

	Category1	Category2	Unit ID	SensorType	Receive time	Count	RSSI	Battery	Data2	Data5	Data7	Data12
	Boiler Room	Motor 1	8942	09:Vibration[1LZ]	2022/05/31 12:50:33	0m15s	-75	Vbat:3.36[V]	P-Acc1:1.29[m/s2]	P-Frq3:9175[Hz]	P-Frq4:12[Hz]	Kurt:2.8[-]
	Current		A7FD	12:CT[1NT/1MT]	2022/05/31 12:50:30	0m3s	-76	Vbat:2.76[V]	I1:0.18[A]	Pre-I1:0.19[A]	Pre-State:0[-]	
	Production	---	---		2022/05/31 12:50:24	0m9s						
	Production	Blower Motor	8B58	09:Vibration[1LZ]	2022/05/31 12:50:24	0m9s	-46	Vbat:3.42[V]	P-Acc1:0.68[m/s2]	P-Frq3:37[Hz]	P-Frq4:62[Hz]	Kurt:7.23[-]
	Production	Conveyor	C592	18:Vibration(Ve...	2022/05/31 12:50:09	0m24s	-52	Vbat:3.37[V]	P-Acc1:0.01[m/s2]	A-RMS:0.1[m/s2]	P-Vel1:0.15[mm/s]	V-RMS:0.13[mm/s]
	Production	Motor Pump	C5D3	18:Vibration(Ve...	2022/05/31 12:50:06	0m27s	-48	Vbat:3.42[V]	P-Acc1:0.01[m/s2]	A-RMS:0.12[m/s2]	P-Vel1:0.11[mm/s]	V-RMS:0.1[mm/s]
	Production	Water Pump	C5D5	18:Vibration(Ve...	2022/05/31 12:50:02	0m31s	-46	Vbat:3.42[V]	P-Acc1:0.02[m/s2]	A-RMS:0.18[m/s2]	P-Vel1:0.14[mm/s]	V-RMS:0.14[mm/s]
	Repeater		B010	FE:Repeater[1...	2022/05/31 12:48:49	1m44s	-29					
	Rooftop	---	---		2022/05/31 12:50:31	0m2s						
▶	Rooftop	Cooling Fan	9E8E	09:Vibration[1LZ]	2022/05/31 12:50:29	0m4s	-85	Vbat:3.25[V]	P-Acc1:1.29[m/s2]	P-Frq3:287[Hz]	P-Frq4:12[Hz]	Kurt:3.12[-]
	Rooftop	Exhaust Fan	9E89	09:Vibration[1LZ]	2022/05/31 12:50:30	0m3s	-86	Vbat:3.35[V]	P-Acc1:0.45[m/s2]	P-Frq3:37[Hz]	P-Frq4:237[Hz]	Kurt:3.52[-]
	Rooftop	Exhaust Fan 2	9023	09:Vibration[1LZ]	2022/05/31 12:50:31	0m2s	-92	Vbat:3.42[V]	P-Acc1:0.6[m/s2]	P-Frq3:350[Hz]	P-Frq4:375[Hz]	Kurt:2.28[-]

Software Demonstration – Chart



Software Demonstration – Map



Software Demonstration – Alert

(1) Alert in S/W Application

Alert Display

Delete Sound ON Close

	Alert Time	Unit ID	Category1	Category2	Category3	Alert
▶	5/11/2021 1:34:01 PM	C71A	Area A			Battery.VbatWarning 3.43(*<4)
	5/11/2021 1:35:01 PM	C71A	Area A			Battery.VbatWarning 3.28(*<4)

WsnManager

Disconnect Gateway Wireless Route Sync Archive SD Read View Setting Alert App Setting Clear Close

	Category1	Category2	Category3	State	Caution ID/Type	Warning ID/Type	Unit ID	Serial No	SensorType	Receive time	Count	Route	RSSI
▶				Normal			901D	00021011901D	09:Vibration[1LZ]	2021/05/11 13:...	4m4s	901D->Gatewa...	-50
	Area A			Warning			C71A	00051011C71A	18:Vibration(Ve...	2021/05/11 13:...	0m30s	C71A->Gatewa...	-27

(2) Email Alert

Alert e-mail
[E-mail function Enabled]



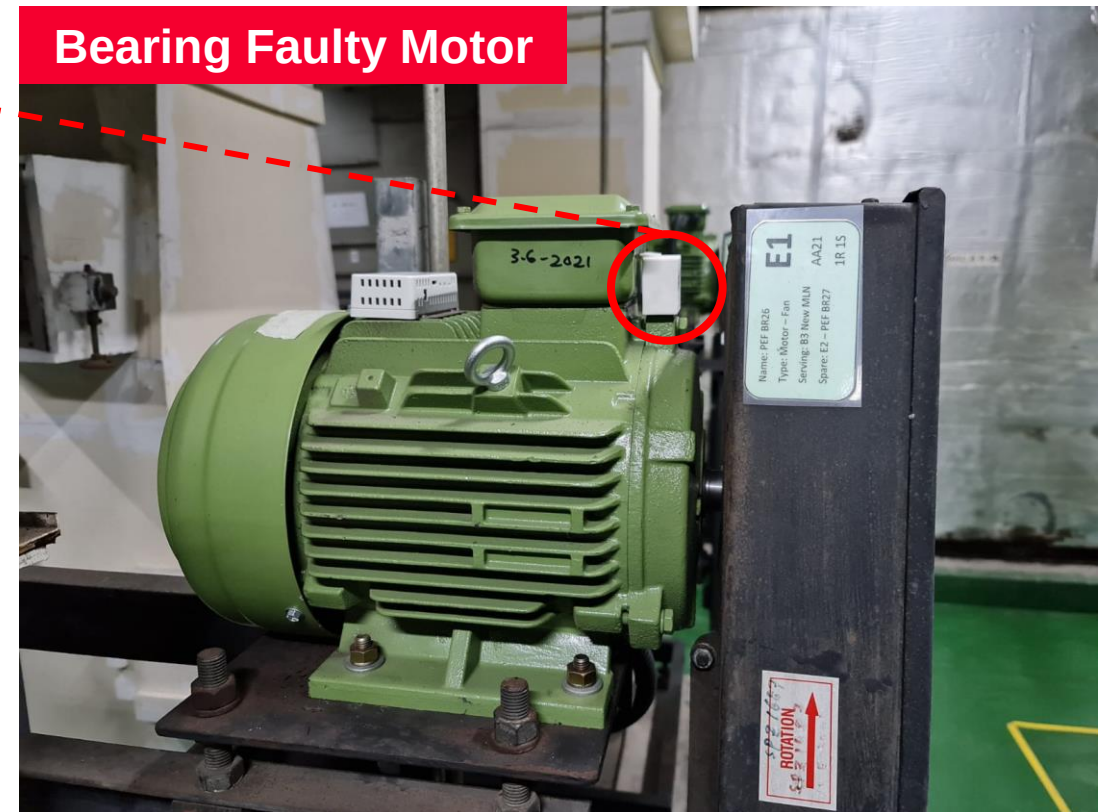
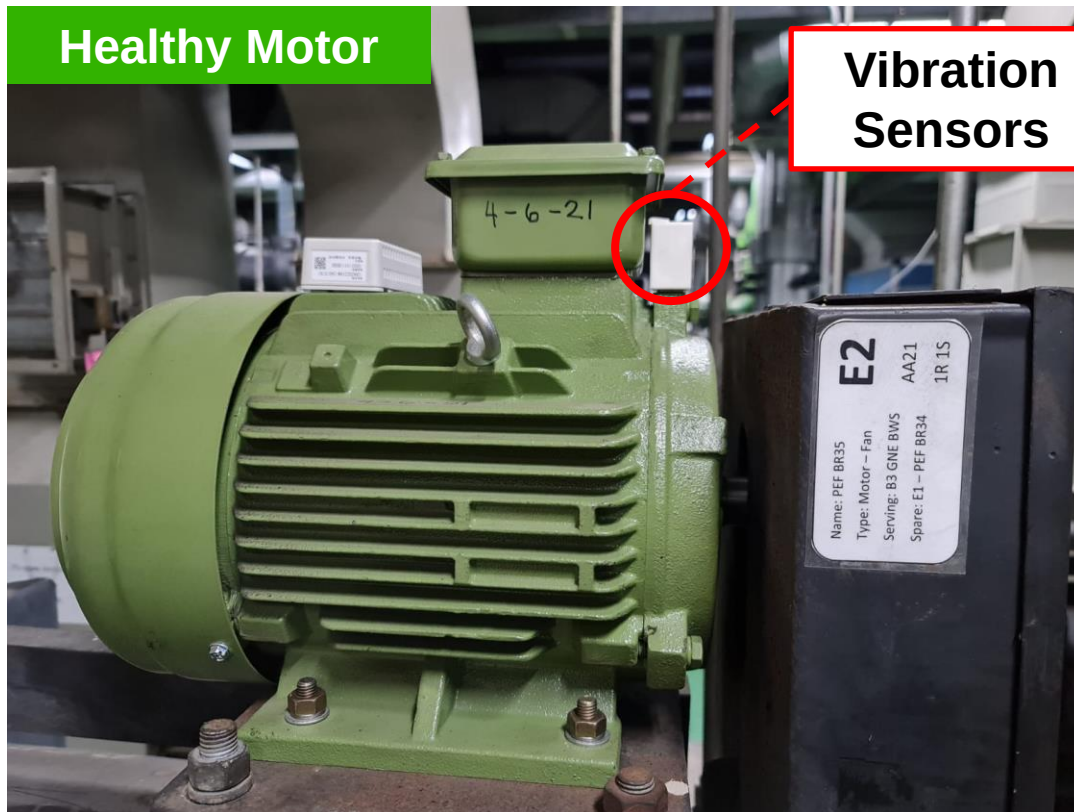
WSN Alert!! Inbox ☆

 muratames009@gmail.com 10:18 am
to me ▾

2021/10/04 10:17:55,8667,...Condition1:RMSWarning 5.35(*>3)

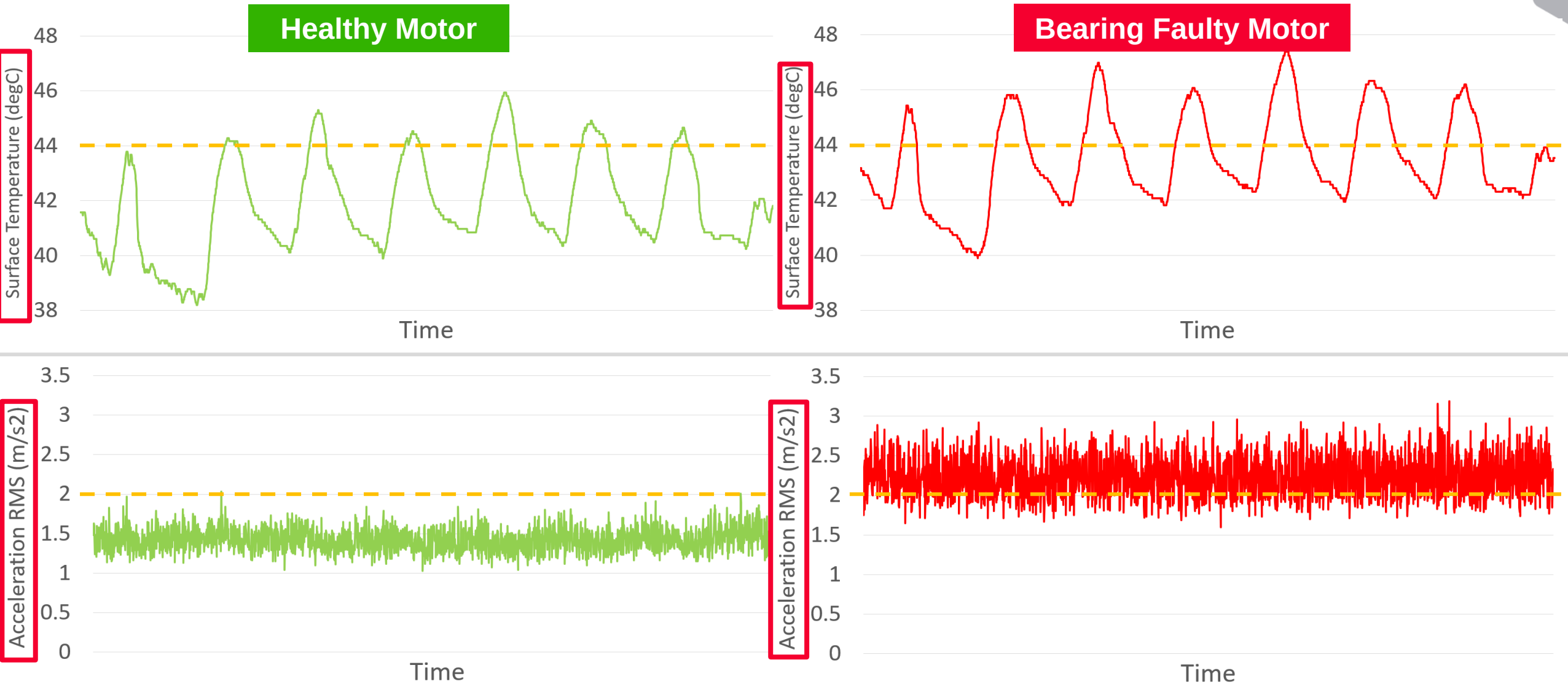
⏪ Reply ⏩ Reply all ➡ Forward

Actual Use Case in Maintenance Room



Vibration Sensors were placed at same placement on 2 similar Exhaust Fan Motor

Actual Use Case in Maintenance Room



Wireless Sensing Solution

Monitoring System for Factories and Buildings

Predictive maintenance and condition monitoring solution
utilizing Murata's wireless and sensor technologies.



**Easy
Installation**



**Wide Frequency
Range**



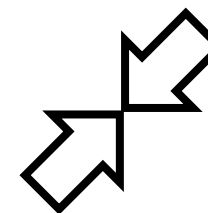
**Long Wireless
Communication**



**Murata's
Competency**



Price & Size



Battery Life
(last for 10 years)



Industry 4.0

**TAKE CONTROL
AND TRANSFORM
YOUR DIGITAL
FACTORY**



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Questions & Answers

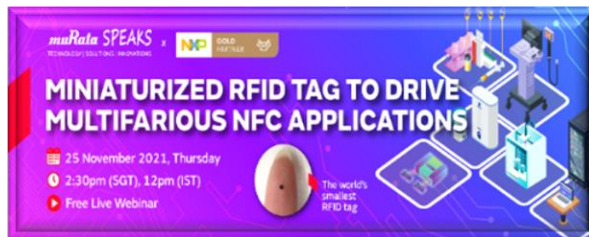
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December 2021
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February 2022



March 2022
*Thai Language



April 2022



May 2022



June 2022
*Thai Language

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