Power free
Wireless Temperature Diagnosis System

STANDARD ELECTRONICS CO.,LTD
Seoul office: #1706, Rosedale Bldg, 724 Suseo-Dong, Gangnam-Gu, Seoul, Korea
☎ +82 - 2 - 431 -3616 (FAX) +82-2-431 – 3617
Email : swpark94@gmail.com

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Background

Transformer fire accident

ESS fire accident

Status

- Recently, the main cause of electrical insulation fail in switch gear panel or power cable is overheating.

- To prevent electrical overheating faults, it is needed to monitor real-time temperature of conductors.

- For conventional temperature monitoring, there are wire thermal sensors(thermocouple, optical fiber), infrared radiation thermometer and built-in battery wireless temperature sensor.

Problems

- In case of wire thermal sensors, reduced production caused by long wiring work time and whole cable should be changed in fault.

- In case of infrared radiation thermometer, there is reliability problem because temperature values change according to the reflectivity of the bus bar.

- In case of built-in battery wireless temperature sensor, battery should be replaced every 1.5 years.

Compare to temperature sensors

| Thermocouple wire	thermal tape	RFID/SAW	IR Camera	optic sensor
contact	contact	non contact	non contact	contact
−75~250 ℃	50~70 ℃	−40 ~ 120℃	−20 ~ 350℃	−20 ~ 120℃
Eyes monitoring	Eyes monitoring	Display monitoring	Display monitoring	Display monitoring
Open door for monitoring	Open door for monitoring	Remote monitoring	Open door for monitoring	Remote monitoring
Long wiring work	No data recoding	Short communication distance (< 0.3m) Need for external power supply	Inaccurate data Blind area presence	Long wiring work Periodic temperature correction

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Energy harvesting is the process by which energy is derived from external sources (e.g., magnetic energy, thermal energy, kinetic energy, and natural energy), captured, and stored for small, wireless electronic devices. (WIKIPEDIA)
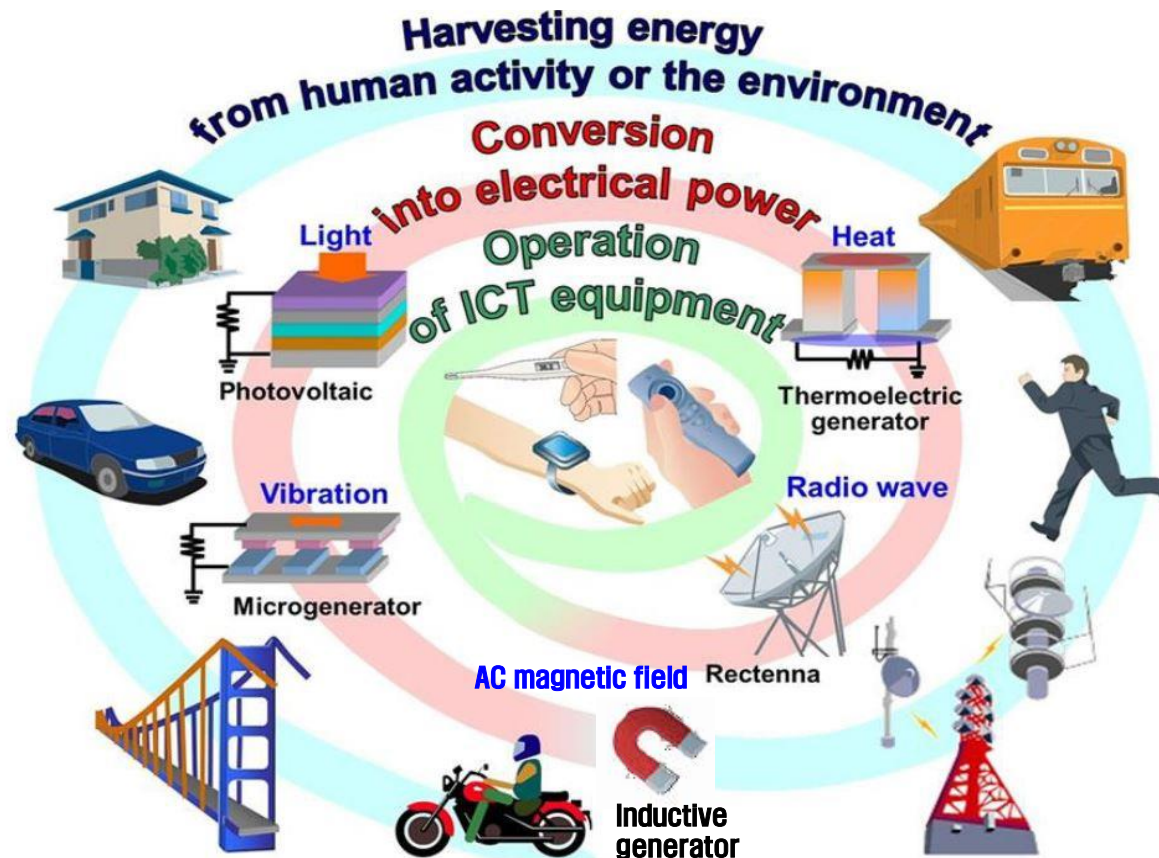
Power Free System Setup

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- **Energy Harvesting** : Using a magnetic induction coil, collecting the magnetic field around the busbar and generating inductive AC voltage.

- **A/D power conversion** : AC voltage is converted into DC voltage and supplied as the driving power of temperature sensors and a wireless transmission module.

- **Wireless temperature transmitter and receiver** : The measured busbar temperatures by each sensors is wirelessly transmitted to receiver and displayed on the digital temperature indicator.
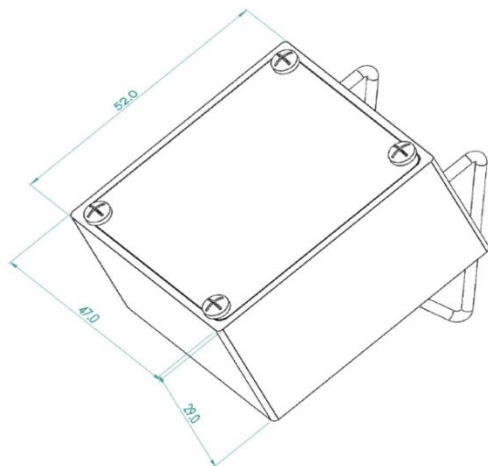
Energy Harvesting Wireless Temperature Diagnosis System

Energy Harvesting	A/D power conversion	Ultra low power wireless transmitter & receiver
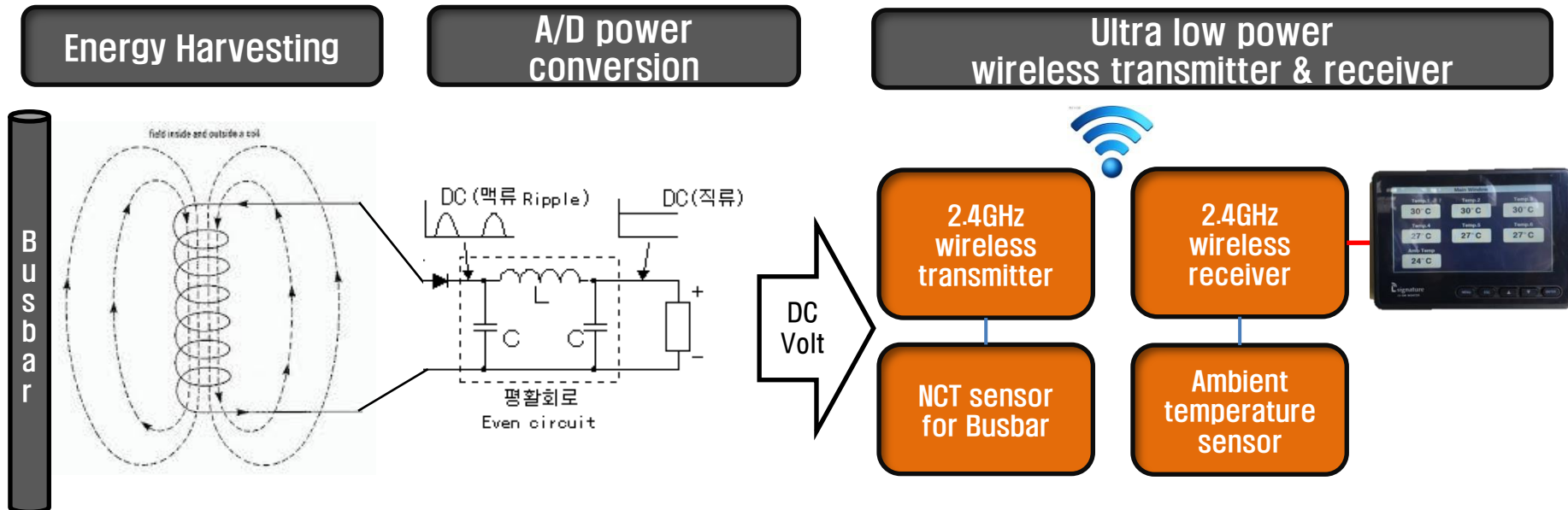
Product Specifications

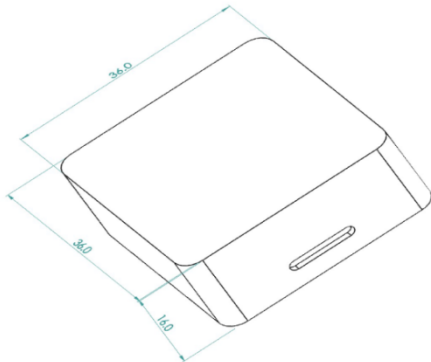## BTH250 (Clamp type)

Self-sufficient Power supply	Inductive energy harvesting from magnetic stray fields (AC)
Start current	50A
Dimensions	W52 × D47 × H29
Weight	144g
Housing	Plastic, non-conductive, flammability
Fastening	High elastic clamp for busbar 6mm ~ 12mm thickness
Available busbar width	50mm ~ 150mm
Temperature probes	1 x backside of housing with contact to bus bar 1 x ambient temperature in receiver
Frequency	2.4 GHz ISM band
Temperature measurement	−20 ~ 200℃ Data transmission distance in air 10m ~15m
Data output	RS−485/422(MODBUS−RTU),RS−232, Ethernet(MODBUS−TCP)

Product Specifications

CTH010 (Band type)

Self-sufficient Power supply	Inductive energy harvesting from magnetic stray fields (AC)
Start current	5A
Dimensions	W36 × D36 × H20
Weight	35g
Housing	Plastic, non-conductive, flammability
Fastening	bandage with removable stainless steel band
Available	Busbar Max 100mm / Cable Min 12∅
Temperature probes	1 x backside of housing with contact to bus bar 1 x ambient temperature in receiver
Frequency	2.4 GHz ISM band
Temperature measurement	−20 ~ 200℃ Data transmission distance in air 10m ~15m
Data output	RS-485/422(MODBUS-RTU),RS-232, Ethernet(MODBUS-TCP)

System Configuration
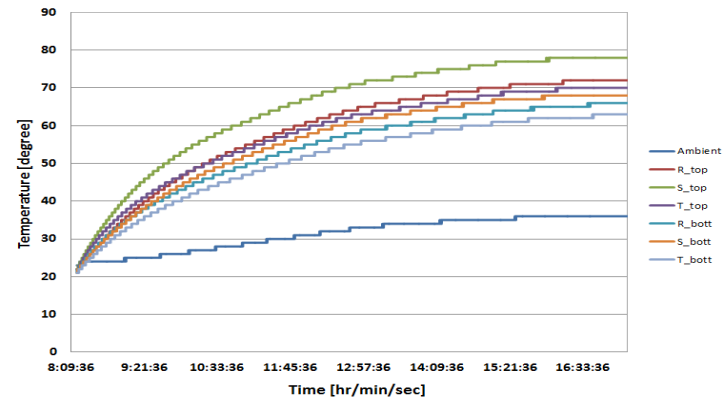

Receiver
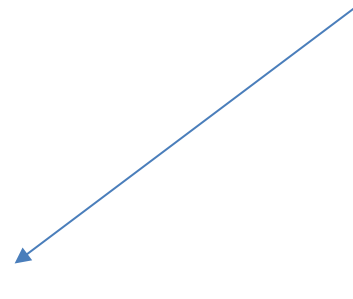
Display

Main Controller

Expected Benefits

Real-time temperature monitoring
and data recording

Maximize maintenance efficiency
through temperature analysis data

Prevention from electric shock by
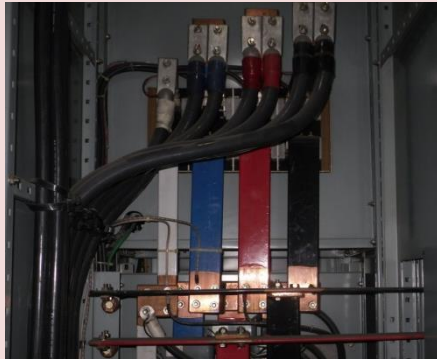remote monitoring without door open

Remote and integrated management
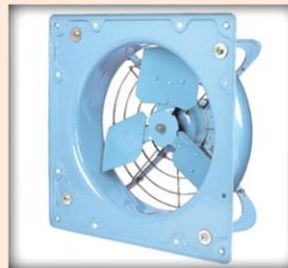through various communication service

Application

Switch gear panel
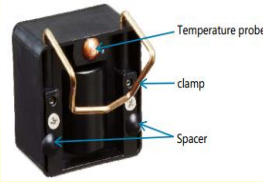
Transformer

Motor

Under ground cable

Transmission cable

Fan

Competitive product comparison

Company	Performance	Cost
L– signature 	• **Data communication cycle : every 4 seconds** • **Start current : over 5A** • **Clamp or band type**	**30% or more cheaper than competitor products**
USA (E∗) 	• **Data communication cycle : every 10 minutes** • **Start current : over 50A** • **Only clamp type**	
France (S∗) 	• **Data communication cycle : every 60 seconds** • **Start current : over 5A** • **Only band type**	

Market Strategy

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* Developed wireless diagnostic device for AI electric fire process

* Development of underground and distribution cable temperature diagnosis device

* Development of buried cable location remote detection device

* Subway power line temperature diagnosis device

Distribution strategy

Product Strategy

Marketing Strategy

Cost Strategy

* Active sales using technology sales network

* Established domestic distributors and overseas sales networks, maximizing customer satisfaction

* Supplied domestic power plants, substations, power equipment manufacturers, etc.

* Overseas advance through international standard certification
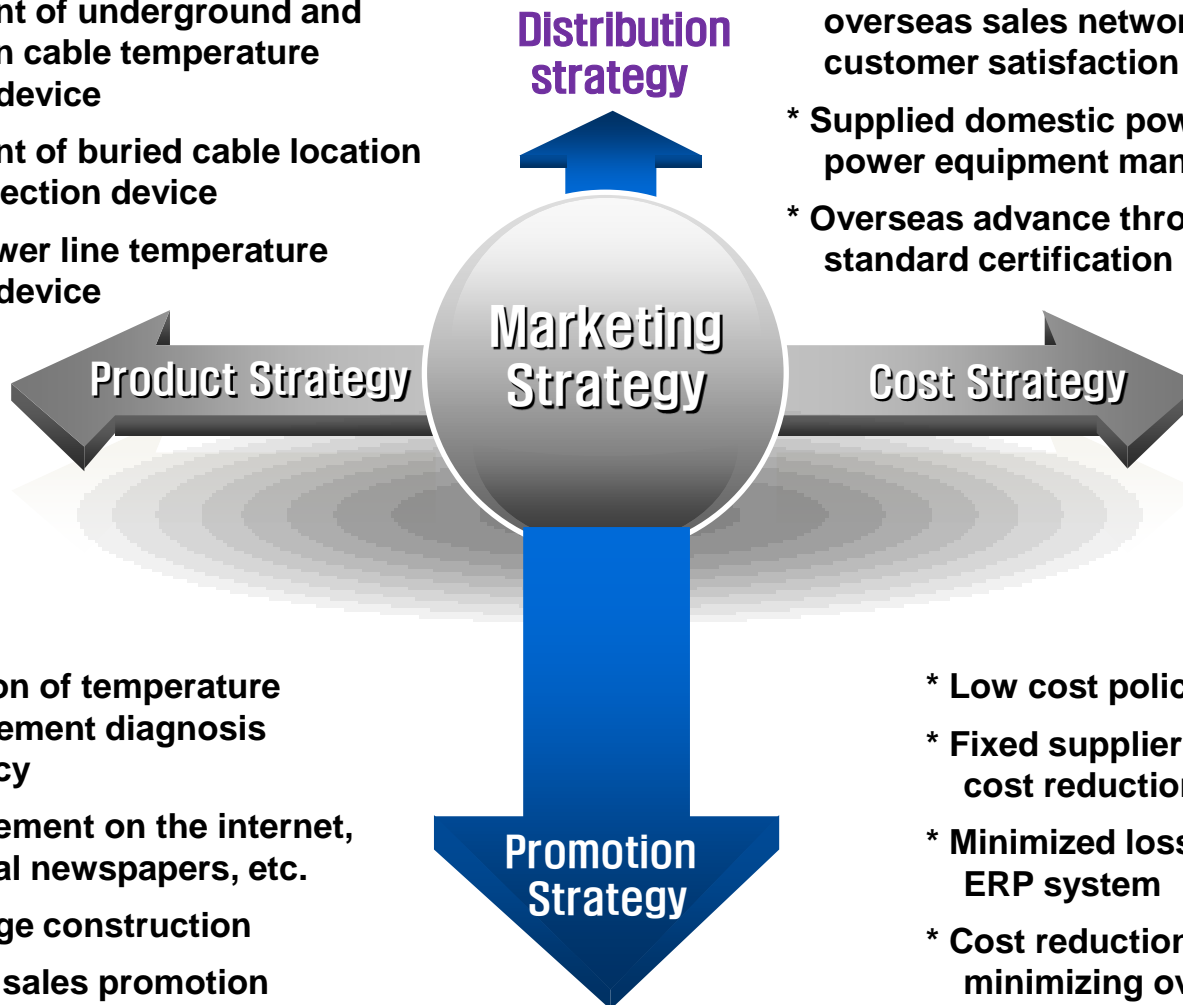
* Promotion of temperature measurement diagnosis efficiency

* Advertisement on the internet, technical newspapers, etc.

* Homepage construction

* Creative sales promotion

Promotion Strategy

* Low cost policy

* Fixed supplier -> Raw material cost reduction

* Minimized loss by introducing ERP system

* Cost reduction through minimizing overhead

Delivery Performance

Customers	Applications	Delivery	Phase
KEPCO substation	• **154kV TR bushing installed and in operation.** • 22.9kV cable in digital substation	**2019.3**	**Commercialized**
KOENERGY thermal power plant	• **6.6kV HV panel installed and in operation.**	**2019.5**	**Commercialized**
Hyundai Electric	• **6000A LV panel field test finished.** • **Exclusive contract for Hyundai Electric smart switchboard**	**2019.4** **2020.1**	**Commercialized**
LS cable	• **LV busduct field test finished.**	**2019.8**	**Commercialized**
KT communication	• **LV panel installed and in operation.**	**2020.1** **2020.3**	**Commercialized**
Samsung Electronics	• **FAB LV panel in test bed**	**2020.4**	**Test bed**
POSCO	• **Export contract with POSCO in China**	**2020.1**	**Commercialized**
Shinchang Electric	• **Installation and operation at Hyundai Steel Switchgear**	**2019.10**	**Test bed**
KMEC	• **Exclusive contract for smart switchboard and diagnostic sensor**	**2019.11**	**Test bed**
SG Innovation	• **Exclusive contract for switchboard diagnostic sensor**	**2019.10**	**Test bed**

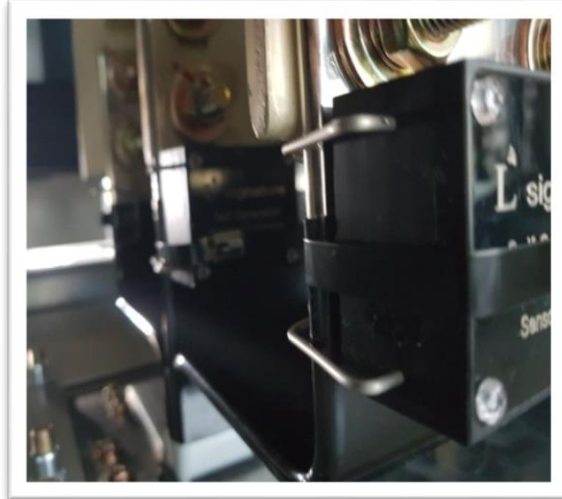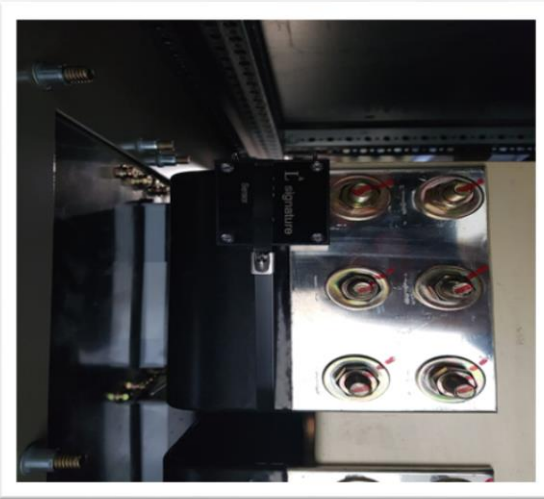# Delivery Performance

KEPCO substation
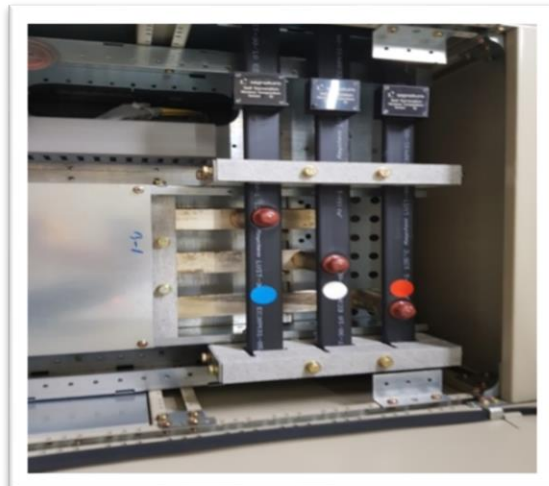
KOENERGY thermal power plant
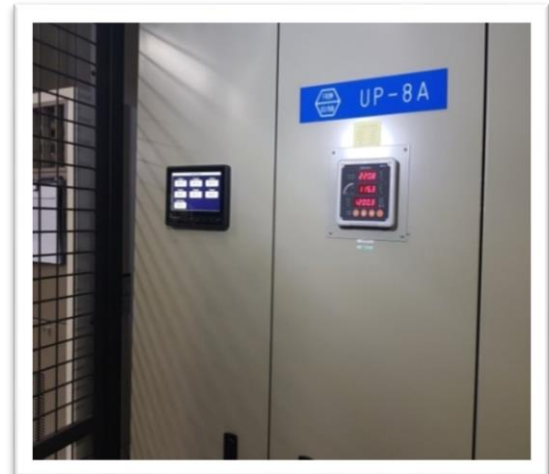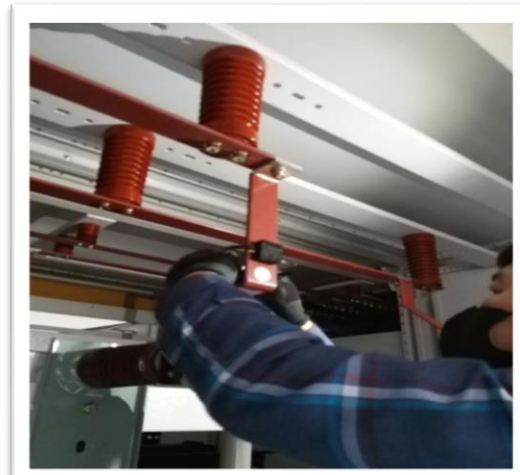
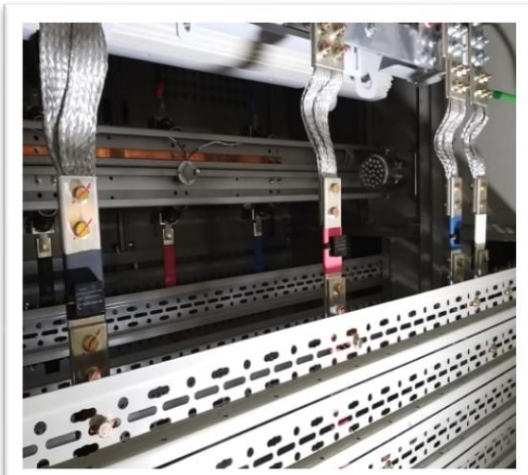# Delivery Performance

Hyundai Heavy Industry

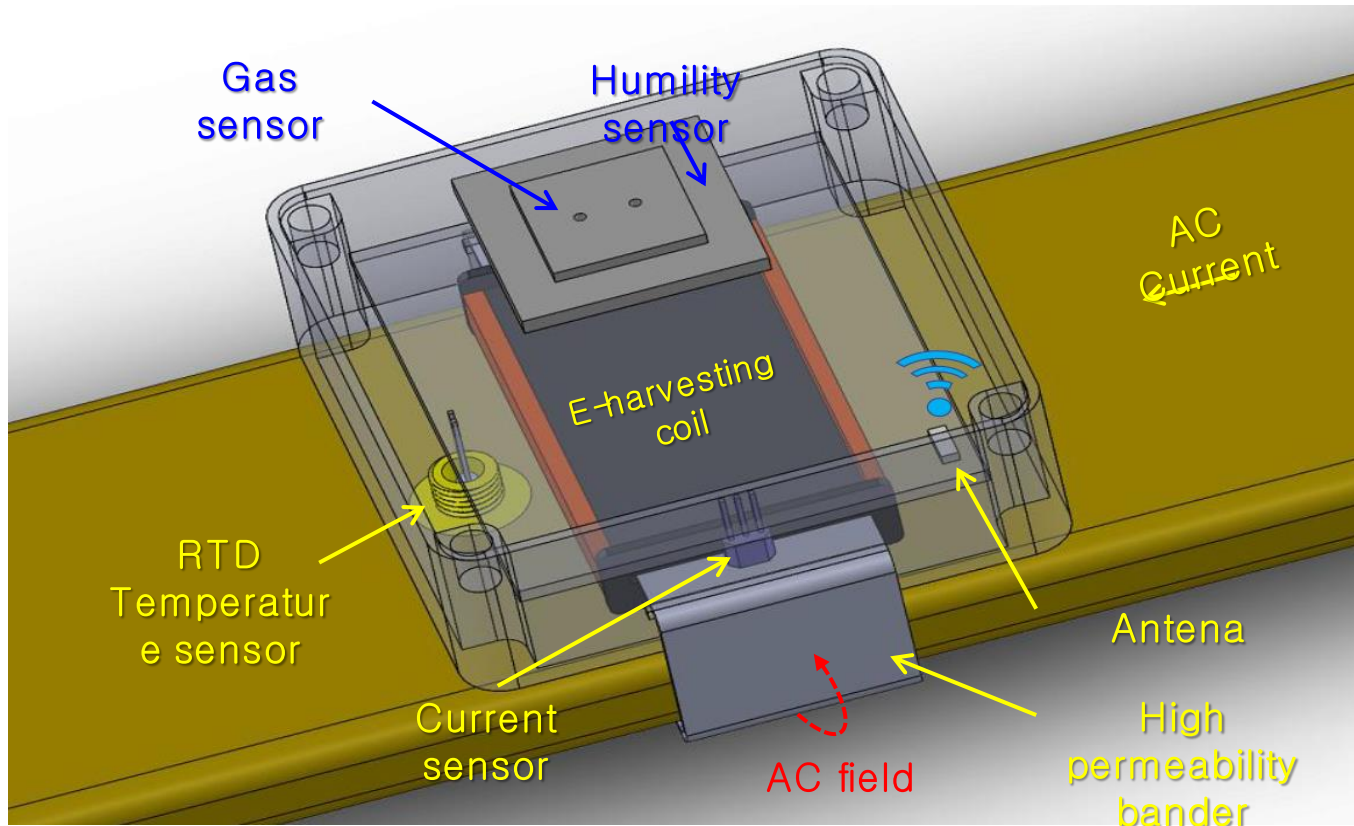LS cable

Delivery Performance

KT Communication

Busan city water purification plant

Next Generation Product Concept

AI Wireless Diagnostic Device for Monitoring Electric Fire Progressing Steps

[Overcurrent (Current Sensor)-> Overheat (Temperature Sensor) -> Moisture (Humidity Sensor)-> Flame Carbonization (Gas Sensor)]