INDU-EYE

The battery-less and least environmentally impact autonomous iloT platform



Introduction to the energy harvesting technology principle \rightarrow Heat conversion to energy



Indu-eye Battery-less wireless heat powered IoT

Link to animation

Main advantages:

- Multi-sensor: vibration & temperature & 4/20mA sensors
- Communication: very long-range wireless NB-IOT (5G) / LoRaWAN
- No battery: no maintenance & minimal environmental impact
- Edge computing & A AEInnova DAEVIS[™] IoT Dashboard
- CE Mark / FCC ongoing / ATEX-IECEX ongoing



AEInnova Indu-eye Vibro LoRaWAN \rightarrow 3 components

The wireless iloT device:

- \circ $\;$ Wireless long range:
 - LoRaWAN (up to 14Km)
 - NB-IOT / LTE-M (up to 22km)
- Analog/digital sensor interface
 - 4/20mA bus (Q2-2021)
- Edge computing (FFT, Filters...)



Sensors:

- \circ 3 Axis vibration
 - Up to ±4g / 0.01g sensibility
- Temperature (PT100 & PT1000)
 - Up to 650°C
- Any industrial 4/20mA sensor (Q2-2021)

The thermoelectric generator:

Working from 50°C to 150°C (Min 30°C Δ T)









Use case for Vibration monitoring Oil & Gas



Gas compressor monitoring to prevent failures

Savings:

- 92% compared to **wired solutions** (GE bently Nevada)
- o 65% compared to wireless solutions (Yokogawa, Emerson)

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN Gateway \rightarrow DAEVIS
- Long range coverage: 900m
- Parameters:
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
- Heat source: 60°C









Pump monitoring to prevent failures

<u>Savings</u>:

- o 92% compared to wired solutions (GE bently Nevada)
- o 65% compared to wireless solutions (Yokogawa, Emerson)

- Low infrastructure: INDU-EYE \rightarrow NB-IOT Network \rightarrow DAEVIS
- Long range coverage: Unlimited
- Parameters:
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
- Heat source: 98°C
- Edge computing:
 - FFT spectral analysis (1,000 frequencies per every axis).





Use case for steam trap monitor Food processing plant

BÊNGE

Steam leaks detection on steam traps

<u>Savings</u>:

60% compared to wireless solutions (SmartWatch Bitherm)

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN \rightarrow DAEVIS
- Long range coverage: 1.2Km
- Parameters:
 - Temperature
 - Ultrasound (Q3-2021)
- Heat source: 90°C





Ash level meters Power generation sector

Guel

Measurements on electrostatic filters

<u>Savings</u>:

- 40% compared to **wireless solutions**
- 1,200€/year due to it was a manual measurement process

- Low infrastructure: INDU-EYE → LoRaWAN → Modbus TCP/IP →Profibus → Siemens PLC
- Long range coverage: 0.9Km
- Heat source: 70°C
- Parameters:
 - Temperature (up to 650°C)





Use case for vibration & temperature monitor Power generation sector

ferrovial

Vibration and temperature measurements on biogas plant

Savings:

- o 65% compared to **wireless solutions**
- 1,400€/year/device due to it was a manual measurement process)

<u>Main features:</u>

- Low infrastructure: INDU-EYE → LoRaWAN Gateway → DAEVIS
- Long range coverage: 400m
- Parameters:
 - Two vibration devices for motors and pumps:
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
 - One temperature device:
 - Temperature (up to 650°C)
- Heat source: 60°C 120°C





Use case for vibration monitor Aluminum sector



Vibration measurements on combustion fans

<u>Savings</u>:

o 65% compared to **wireless solutions**

<u>Main features:</u>

- Low infrastructure: INDU-EYE \rightarrow NB-IOT \rightarrow DAEVIS
- Long range coverage: Up to 22Km without wireless infrastructure
- Parameters:
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
- Heat source: $70^{\circ}C 140^{\circ}C$





Use case for vibration monitor Iron & steel sector



Vibration measurements on combustion fans

Savings:

• 65% compared to **wireless solutions**

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN Gateway \rightarrow DAEVIS
- Long range coverage: 140m
- Parameters:
 - One vibration device for :
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
 - One temperature device:
 - Temperature (up to 650°C)
- Heat source: 90°C (Furnace wall).







Use case for vibration monitor Rubber sector



Vibration measurements on a reactor

Savings:

• 65% compared to **wireless solutions**

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN Gateway \rightarrow DAEVIS
- Long range coverage: 200m
- Parameters:
 - \circ 1 vibration device for :
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
 - 1 temperature device for :
 - Temperature: up to 650°C
 - Heat source: 120°C (Furnace mounting).







Use case for vibration monitor Rubber sector



Vibration measurements on a reactor

<u>Savings</u>:

• 65% compared to **wireless solutions**

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN Gateway \rightarrow DAEVIS
- Long range coverage: 200m
- Parameters:
 - 1 vibration device for :
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
 - 1 temperature device for :
 - Temperature: up to 650°C
 - Heat source: 120°C (Furnace wall).







Use case for vibration monitor Rubber sector



Vibration & Temp measurements on raspers

<u>Savings</u>:

• 65% compared to **wireless solutions**

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN Gateway \rightarrow DAEVIS
- Long range coverage: 120-160 m
- Parameters:
 - One vibration device for :
 - Monitor: 3-axis vibration
 - Precision: 0.008g
 - Max vibration: ±4g
 - One temperature device:
 - Temperature (up to 650°C)
- Heat source: 90°C -140°C (Furnace wall).





Use case for vibration monitor Chemical sector



Vibration measurements on recirculation turbine

Savings:

• 65% compared to **wireless solutions**

- Low infrastructure: INDU-EYE \rightarrow LoRaWAN Gateway \rightarrow DAEVIS
- Long range coverage: 30m
- Parameters:
 - \circ One vibration device for :
 - Monitor: 3-axis vibration
 - Precision: 0.008g
 - Max vibration: $\pm 4g$
- Heat source: 120°c.



Other uses cases powered by renewable energies

New projects using micro wind turbines





Use case for vibration monitor railways sector



Vibration monitor in ventilation fans for tunnels (railways, highways...) to avoid accidents

Savings:

80% compared to wired solutions

- <u>Main features:</u>
 - Low infrastructure: INDU-EYE → LoRaWAN Gateway → DAEVIS
 - Long range coverage: 750m in this project
 - Parameters:
 - Monitor: 3-axis vibration
 - Precision: 0.01g
 - Max vibration: ±4g
 - Wind source from 10Km/h
 - Ready in Q3-2021.



New projects using solar PV







Use case for silos Cement / Sand / Grain - cereals



Volume measurement for route planning

<u>Main features:</u>

- Low infrastructure: INDU-EYE \rightarrow NB-IOT \rightarrow DAEVIS
- Long range coverage: > 20Km
- Parameters:
 - Monitor: Distance / Lidar
- Fully powered by sun.
- Ready in Q4-2021.



Use cases summary

Industry	Application	Sensor	Communication	Savings
Oil & Gas	Gas compressor	Vibration	LoRaWAN	65% to 92%
Oil & Gas	Pump	Vibration	NB-IOT	65% to 92%
Chemical	Ventilation turbine	Vibration	LoRaWAN	70%
Railways	Ventilator fans	Vibration	NB-IOT	80%
Aluminium	Combustion fans	Vibration	NB-IOT	65%
Iron & steel	Combustion fans	Vibration	LoRaWAN	65%
Food Processing	Steam trap leaks	Temperature	LoRaWAN	60%
Power Generation	Electrostatic filters	Temperature	LoRaWAN	40%
Rubber	Reactor and rasper	Vibration & Temperature	LoRaWAN	65-72%
Cement	Volume in silos	Volume	NB-IOT	>70%
Power Generation	Motors & Pumps	Vibration & Temperature	LoRaWAN	65%







DAEVIS – Dynamic Aeinnova Visualizer Cloud based on AWS

Savings:

• Up to 80% compared to other platforms

- Software as a Service platform for sensor management
- O Powerful graph engine and fully customizable
- Dynamic Report and historical data
- O Hierarchy management
- Alarms via pop-up, SMS, Telegram, Email...
- O Predictive maintenance (Q2-2021)
- \bigcirc Integration with Scada or other platforms
- Edge-computing remote management & optimization



Environmental impact & claims

-

Environmental Impact reduction > 98%



10,000 Wireless industrial sensors Battery-powered



10,000 AEInnova's Wireless industrial sensors self-powered by Heat / Wind





Certifications

CE MARK for INDU-EYE LORA BY APPLUS

LGAI Technological Center, S.A. (APPLUS) Campus UAB - Ronda de la Font del Carme s/n 08193 Bellaterra (Barcelona) T +34 93 567 20 00 F +34 93 567 20 01 www.applus.com

Aplus[⊕]



EMITIDO POR / ISSUED BY	LGAI TECHNOLOGICAL CENTER - No. 0370 (APPLUS)					
SOLICITANTE / APPLICANT	ALTERNATIVE ENERGY INNOVATIONS S.L.					
FABRICANTE (Nombre, Dirección) MANUFACTURER (Name, Address)	ALTERNATIVE ENERGY INNOVATIONS S.L. (7 TELERS 5 - B, 2ND FLOOR, OFFICE 11 08221TERRASSA (BARCELONA - ESPAÑA)					
COMERCIALIZADO POR (marca) COMMERCIALISED BY (Brand)	AEInnova (ALTERNATIVE ENERGY INNOVATIONS S.L.)					
PRODUCTO PRODUCT	Heat-powered IoT vibration monitoring device using LoRa at 868 MHz protocol					
TIPOS TYPES	Indu-Eye LoRa Vibro					
Versión HW / SW HW / SW version	SW: v1.y.z HW: v1.y.z					
DIRECTIVA APLICABLE APPLICABLE DIRECTIVE	DIRECTIVA 2014/53/UE DEL PARLAMENTO EUROPEO Y DEL CONSEJO, DE 16 DE ABRIL DE 2014, RELATIVA A LA ARMONIZACIÓN DE LAS LEGISLACIONES DE LOS ESTADOS MIEMBROS SOBRE LA COMERCIALIZACIÓN DE EQUIPOR SALDOLECTRICOS DIRECTIVE 2014/53/EU OF THE EUROPEAN PAULAMENT AND OF THE CONNCIL OF 16 APREL 2014 OF THE EUROPEAN PAULAMENT AND OF THE CONNCIL OF 16 APREL 2014 OF THE EUROPEAN PAULAMENT AND OF THE CONNCIL OF 16 APREL 2014 OF THE EUROPEAN PAULAMENT AND OF THE CONNCIL OF 16 APREL 2014 OF THE EUROPEAN PAULAMENT AND OF THE CONNCIL OF 16 APREL 2014 OF THE EUROPEAN THE LAUS OF THE MEMBER STATES RELATING TO THE MAKING AVULABLE ON THE MARKET OF RADIO EQUIPMENT					
DESCRIPCIÓN DESCRIPTION	Sistema de monitorización IoT de vibraciones alimentado por calor, utilizando protocolo LoRa a 868MHz. Heat-powered IoT vibration monitoring device using LoRa at 868 MHz protocol.					
CUMPLE CON LOS REQUISITOS	Art.3.1a Salud y Seguridad / R Art.3.1a Health & Safety	8	Art. 3.2 Uso eficiente del espectro radioeléctrico / Art.3.2 Efficient use of Radio spectrum	×		
MEET ESSENTIAL REQUIREMENTS	Art.3.1b EMC / R Art.3.1b EMC	0	Art 3.3 Características especiales / Art.3.3 Special characterístics			
to designate space de validas de su anave, suns númers colorida con el del seconte catilizado. Il This das mant is not unid utilizad its technical annos union						

Esh number coincides with the number of the certificate.

La evaluación de la documentación técnica entregada se encuentran recogidos en el expediente técnico número: 19/31702715 The evaluation of the technical documentation delivered is included in the technical file number: 19/31702715

Restricciones (si aplican) / Restrictions (if apply):

Bellaterra, 19 de Noviembre 2019 // 19th November 2019

Applus®

José Luis Medina Director Electrical & Electronics – Spain

Este Certificado es vilido mientros no se producton cambios en el estado de la técnica que indiquen que el equipo nadostáctrico aprobado ya no puede compler los requisitos esenciaises de la Directiva 30/453/UE yno haya antificaciones en el tipo aprobado que puedan afectar a la comformidad com los requisitos esenciaises de la Directiva 30/453/UE Timo Centrícan la valua la long a teme are o obranga in tim per una indicaling tela despreter año de agromer at una este una esenciai en que entre te esenciai requiementen di Directiva 2014/53/UE nents of Directive 2014/53/EU and there are no notifications of the approved type that may affect the Accordance with the essential requirements of Directive 2014/S3/EU Pigina 1 de 4

LGAI TECHNOLOGICAL CENTER, S.A. CIF: A-68207

CERTIFIED QUALITY MANAGEMENT SYSTEM BASED ON ISO 9001:2015 BY SGS



Thanks for your attention

David Comellas - CEO

Raul Aragones – Business Developer

Click on banners for EU granted projects ongoing







