Safety and Efficiency in Mining: A Showcase of Real-Life LoRaWAN® Deployments

Webinar:
Safety and Efficiency in Mining:
A Showcase of Real-Life LoRaWAN® Deployments
Actility
STRACON Tech
Syook
एन सी एल NCL
tingz
Abeeway
Watch on YouTube

Agenda

- Introduction
- Enhanced Miner Safety in Peru: Integrating IoT and Private LoRaWAN Network Technology at Mina Justa – **StraconTech**
- NCL's 'Suraksha Kavach' for Enhanced Worker Safety in Indian Coal Mines – **Syook**
- Production Increase in an Open-Pit Mine in Turkey: A Case Study in Digital Mining with Machine learning, IoT and LoRaWAN – **Tingz**
- Asset tracking in hazardous environments with Abeeway trackers **- Abeeway**

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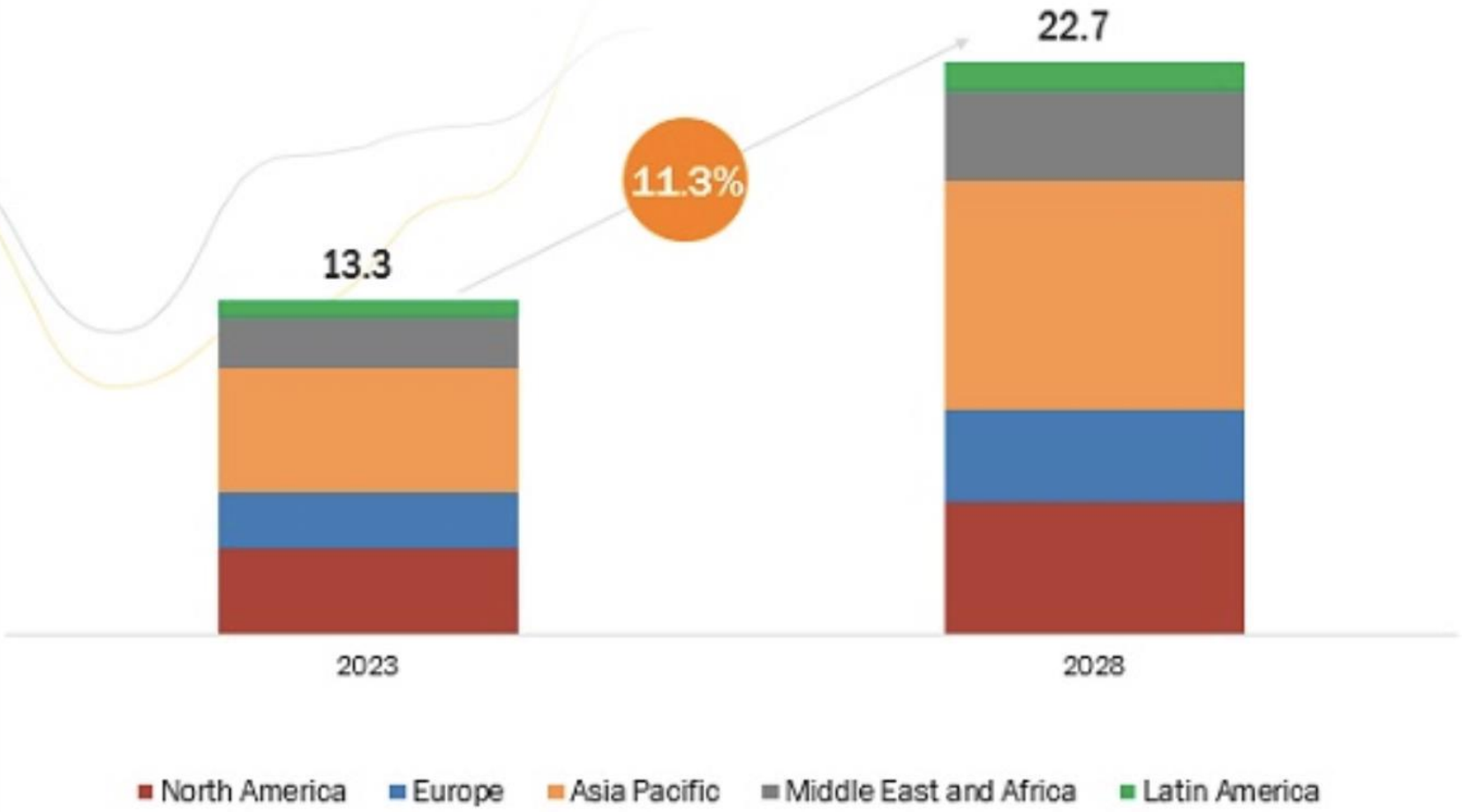
Introduction

Connected Mining IoT Global Forecast

CAGR OF

11.3%

The global connected mining market is expected to be worth USD 22.7 Billion by 2028, growing at a CAGR of 11.3% during the forecast period.



Source: Marketsandmarkets

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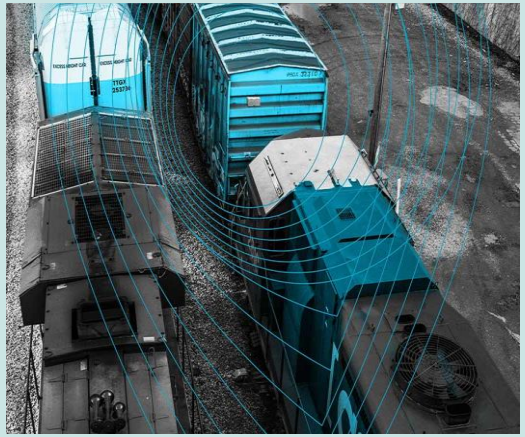
Key IoT uses cases for mining industry

Asset Tracking and Management



Safety Monitoring

Predictive Maintenance

Remote Operations and Automation

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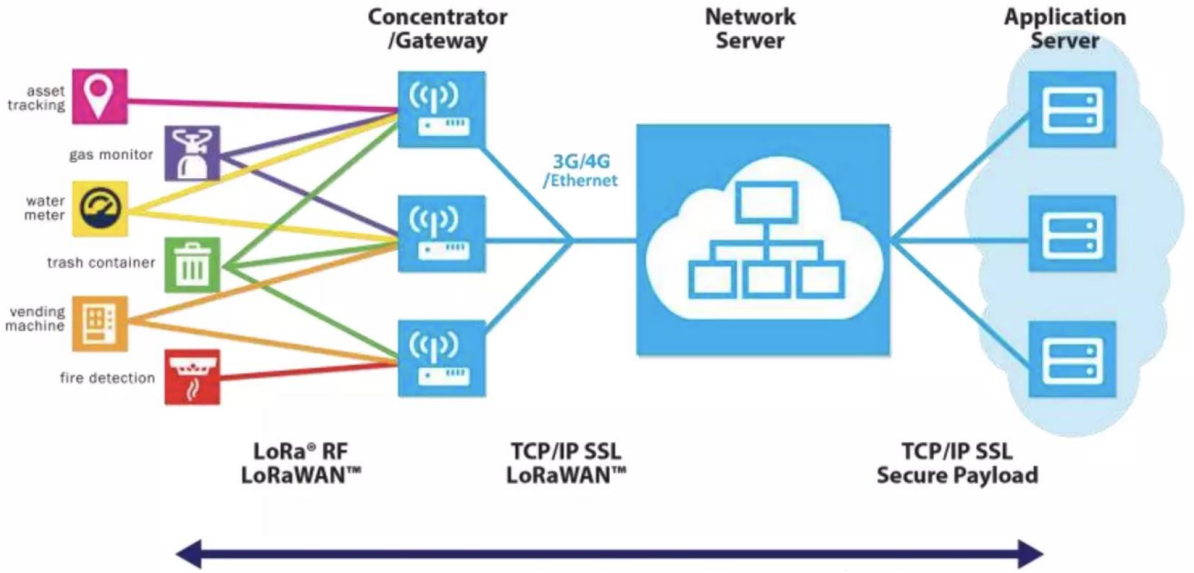
What is LoRaWAN?

- The LoRaWAN specification is a Low Power Wide Area (LPWA) network designed for:
  - Low power battery operated devices
  - End-to-end security
  - Private IoT network deployment in ISM bands
  - Roaming across public and private networks
  - localization



AES secured payload
Application Data

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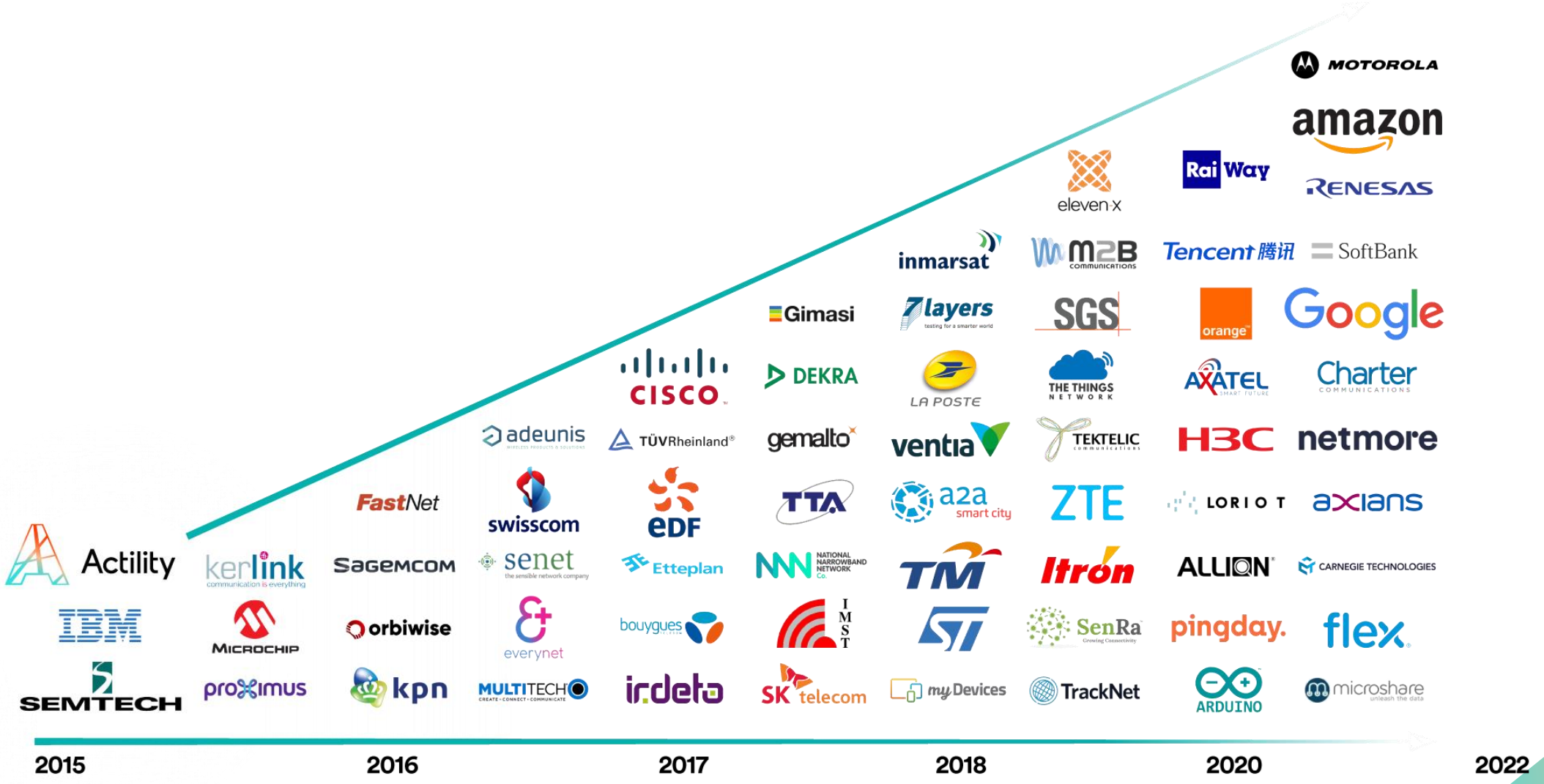
Actility is a founding member of the LoRa Alliance™



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Why LoRaWAN?

- It provides an open standard for IoT networks
- Flexibility of network deployment
  - Deploy your own private LoRaWAN networks
  - Leverage existing public LoRaWAN network
- Battery lifetime of upto 15 years when communicating once per day
- Security: The LoRaWAN specification uses 128-bit AES algorithm for end-to-end encryption
- Rich ecosystem of devices, manufacturers and application providers
- Supported by both community and Tier-1 companies

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Why do we need ATEX/IECEx certification for mining (1/2)

1. **Safety Compliance**: ATEX (EU) and IECEx (International) certifications ensure that equipment used in mining operations meets stringent safety standards to prevent the risk of explosions and fires in hazardous environments.
2. **Legal Requirements**: Many countries have regulations mandating the use of ATEX/IECEx certified equipment in mining sites to comply with safety standards and regulations. Failure to comply can result in fines, legal liabilities, and operational disruptions.
3. **Risk Mitigation**: ATEX/IECEx certified equipment is specifically designed and tested to mitigate the risks associated with potentially explosive atmospheres commonly found in mining environments, such as flammable gases, vapors, and dust.
4. **Worker Safety**: Certification ensures that mining equipment is safe for use by personnel working in potentially hazardous conditions, reducing the risk of accidents, injuries, and fatalities.
5. **Product Reliability**: Certified equipment undergoes rigorous testing to ensure its reliability and performance in harsh mining environments, minimizing the risk of equipment failure and downtime.

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Why do we need ATEX/IECEx certification for mining (2/2)

6. **Global Acceptance:** IECEx certification provides global recognition and acceptance, allowing mining companies to deploy equipment across different regions without the need for additional certifications or approvals.
7. **Insurance Requirements**: Some insurance providers may require ATEX/IECEx certified equipment as a condition for coverage, recognizing the reduced risk associated with certified products.
8. **Customer Confidence**: Certification demonstrates a commitment to safety and quality, enhancing trust and confidence among stakeholders, including employees, customers, investors, and regulatory authorities.
9. **Cost Savings**: While initially, ATEX/IECEx certified equipment may involve higher upfront costs, it can lead to long-term cost savings by minimizing the risk of accidents, injuries, equipment damage, and regulatory non-compliance.
10. **Environmental Protection**: ATEX/IECEx certification not only ensures the safety of personnel but also helps protect the environment by reducing the risk of pollution and ecosystem damage resulting from accidents in mining operations

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TRACKING OF PEOPLE IN THE BLASTING AREA

Safety in the evacuation process

STRACON Tech

PROBLEMATIC +29%

Accidents in mines are caused by
BLASTINGS AND LANDSLIDES

STRACON Tech

OUR TRACKING SOLUTION

Our People Tracking solution will significantly improve worker safety by monitoring and alerting personnel entering the blasting area, **reducing the risk of accidents.**

In addition, this system allows r**eal-time monitoring of personnel**, generating alerts before entering rigid zones and making informed decisions by having historical information on the movement of workers, contractors and visitors.

- Increased workers safety
- **Real-time monitoring**
- **Increased efficiency and control**
- **Informed decisions**
- Reduction of accidents
- **Real-time monitoring**

STRACON Tech

LORAWAN CHARACTERISTICS

- **Secure bi-directional** connections through end-to-end encryption.
- **Low power consumption** (battery life up to 10 years)
- **Long communication** range (10 - 30 km).
- **Connection** of large amounts of sensors and equipment to public or private networks.
- **Low data rates.**
- **Low transmission frequency (ISM)**
- **Interoperability** of various LoRaWAN networks worldwide.

BASIC COMPONENTS

DEVICES

LoraWAN Gateway

- Large coverage per Antenna (10-30 Km typical)
- Cost effective per area covered, ideal for open pit mining
- Reduced bandwidth for greater tag battery savings
- Redundancy by design, all cells listen at the same time
- Network Server resolves duplicity of packets sent by cells
- High security standards with AES 128 encryption

BASIC COMPONENTS

DEVICES

Tags

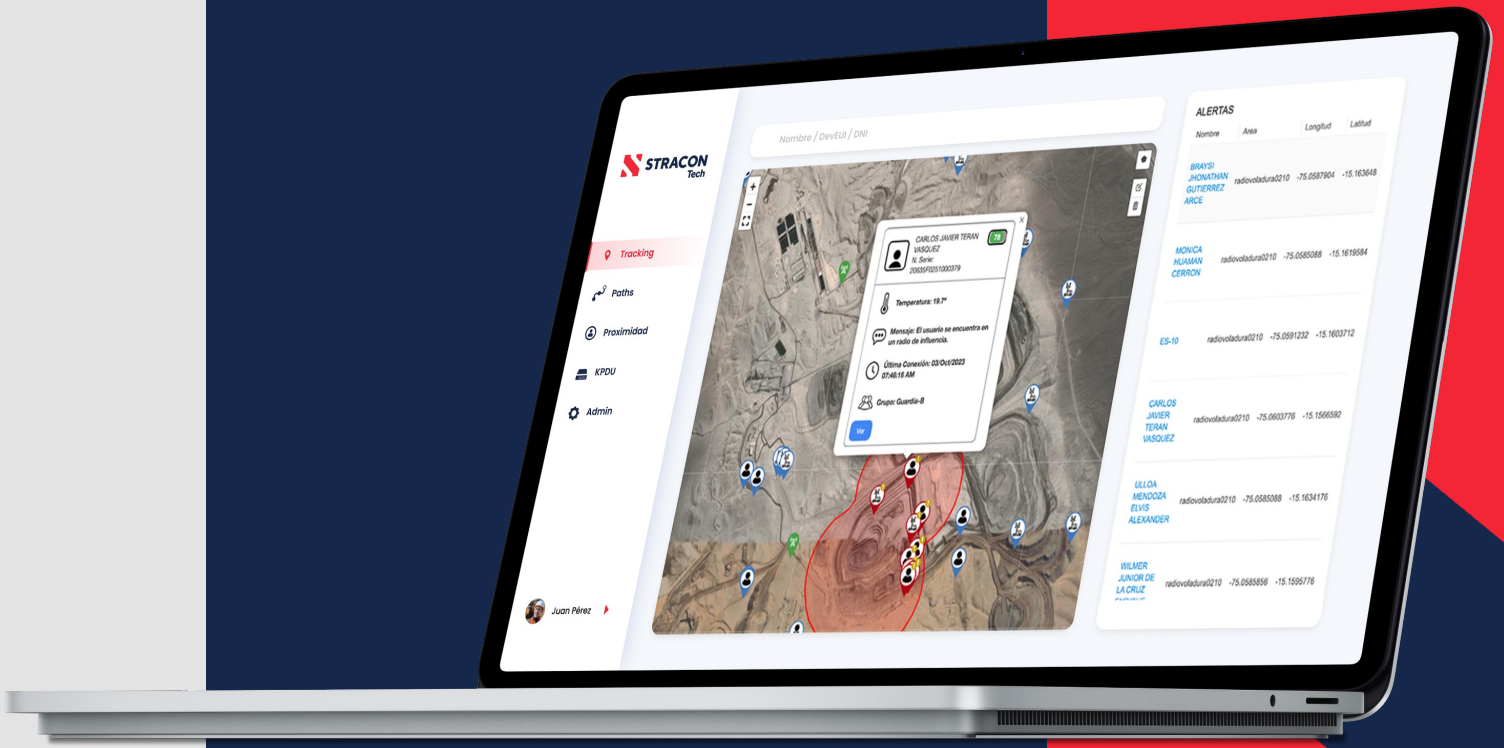
- Fully sealed equipment with IP67 degree of protection.
- Manufactured from high impact resistant polymer
- Electronic components with industrial specifications that allow work in an extended range of temperature (certifification for temperature and humidity).
- Reduced size and weight, facilitating transport, storage and daily use is not uncomfortable.
- Low power consumption guarantees long life of the rechargeable battery.
- Cost effective equipment that allows massive utilization in each mining company.

BASIC COMPONENTS

PLATAFORM

Software ST-Track

- Geographic Information System (GIS)
- Mine map display
- Real-time display on the map of tracker devices that are associated with each person.
- Definition of points of interest (POIs) such as entrances, exits, communication towers.
- Definition of Zones of Interest to count people for each defined zone and totalize.
- Association of devices per person.
- Definition of authorizations by Zone.
- Alarms for entry into unauthorized areas.
- Real-time counting by defined Zone and totalization within the coverage area.



BASIC COMPONENTS

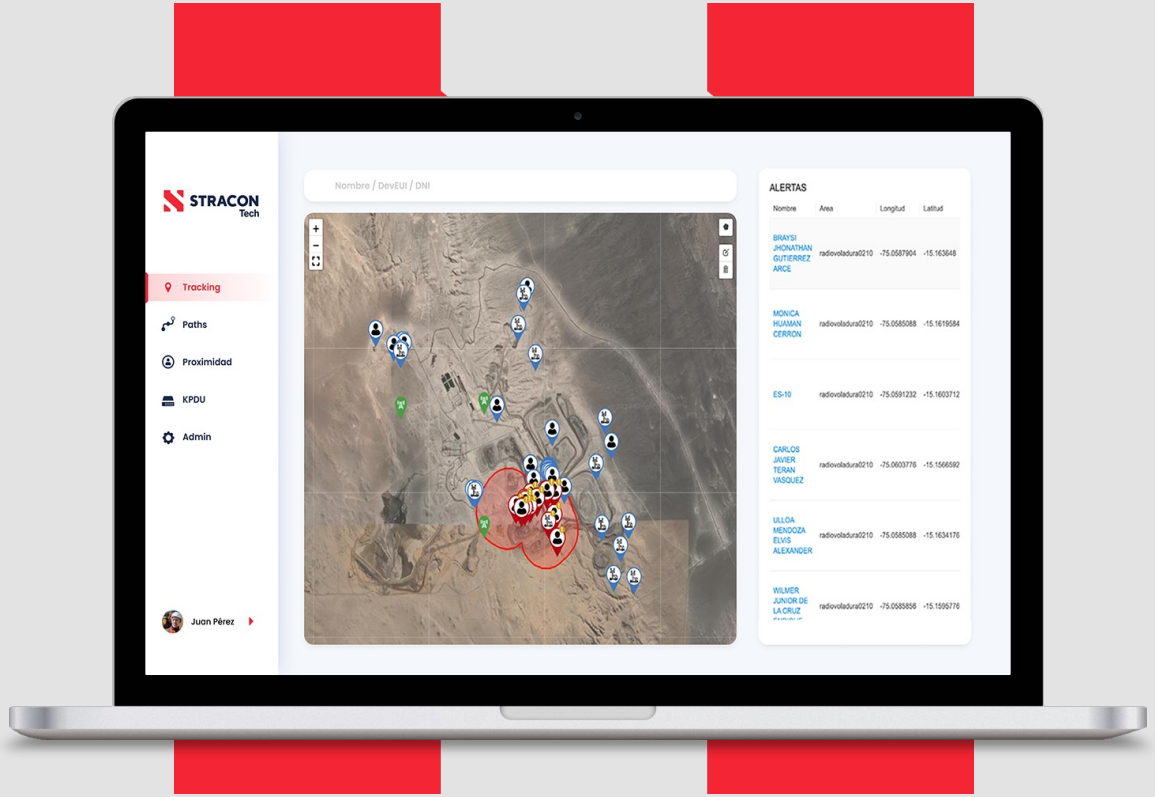
LNS
Thingpark SAAS

- Service 100% managed by Actility
- Virtually unlimited scaling possibilities
- Decoding of many devices in a very easy way thanks to the repository available.
- Compatibility with many Gateway manufacturers available in the market.
- Possibility of working in SAAS or OnPremise depending on the need.

SUMMARY OF THE SOLUTION

The solution include:

- LoraWAN Network design
- ST-Track Platform
- TAGs: AbeeWay Smart Badges
- Field installation, start-up and configuration.
- Change Management: Post Implementation Support.



NEXT STEPS

PROXIMITY DETECTION

- Battery Reports of the Tags.
- Historical record of incidents between vehicles.
- Historical record of incidents between vehicles and people.

TESTIMONIES

"I would like to attest that STRACON Technologies has been awarded the People Tracking project in September 2022.

The scope of the solution is a LoRA communication network where smart Tags/Fotocheck transmit location and movement signals. The solution has an intelligent SaaS platform where several functionalities are embedded, among them polygons or exclusion areas for the blasting zone where only authorized people can be.The solution was successfully delivered and is in white run with expected results, once confirmed we would be expanding the coverage and usage, besides adding the connection of different Lora WAN sensors to perform Telemetry measurements."

Marco Yacarini
IT Superintendent - **Marcobre**

MINA JUSTA
Marcona, Perú

HOMOLOGATION

Our product complies with all regulations and requirements and is approved by the MTC.

MTC
Ministerio de Transportes y Comunicaciones

Jonathan Prieto

CTO

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STRACON Tech

STRACON Tech

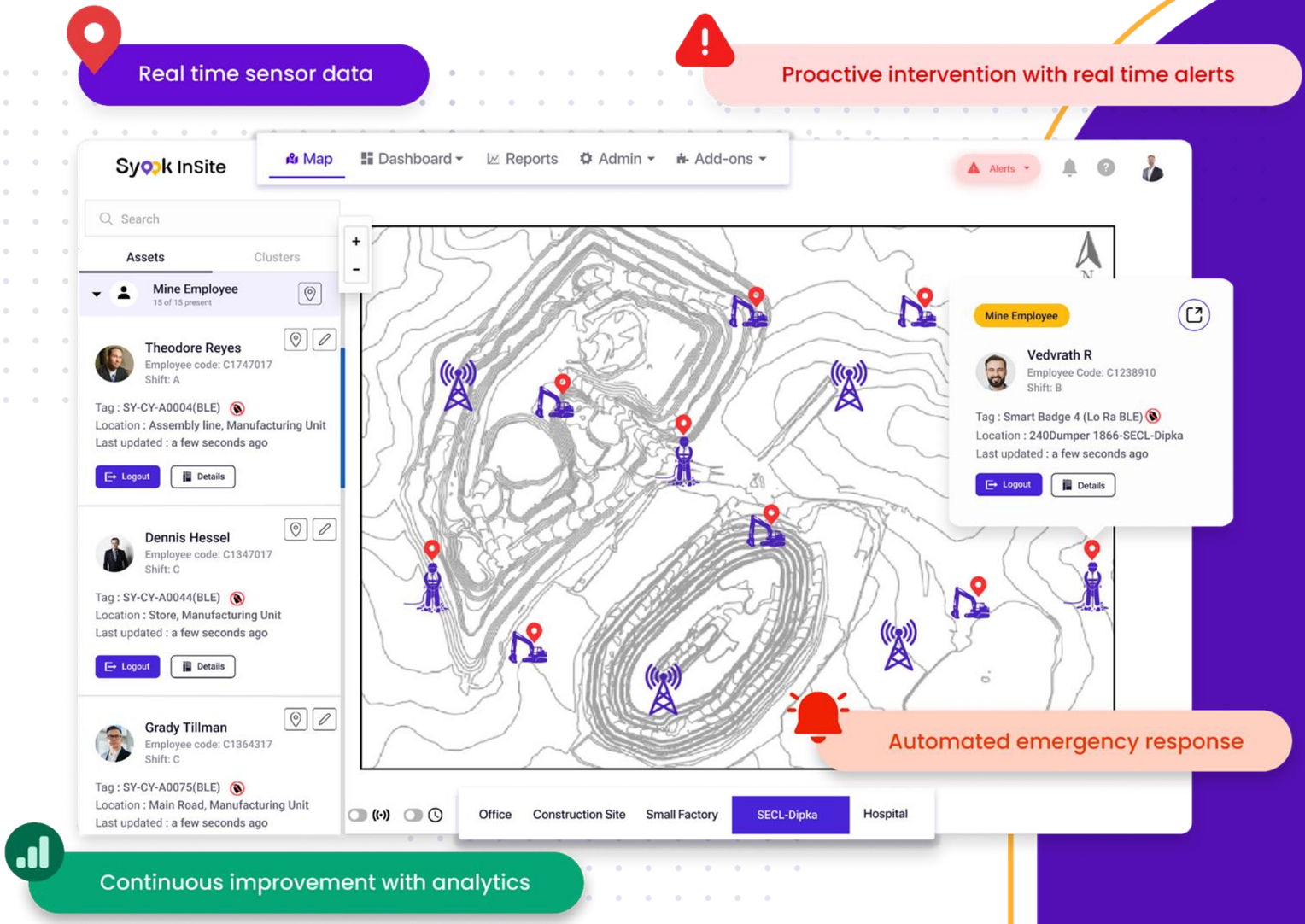
More tons, less cost, safely and sustainably

Visítanos en:

/Stracon Tech

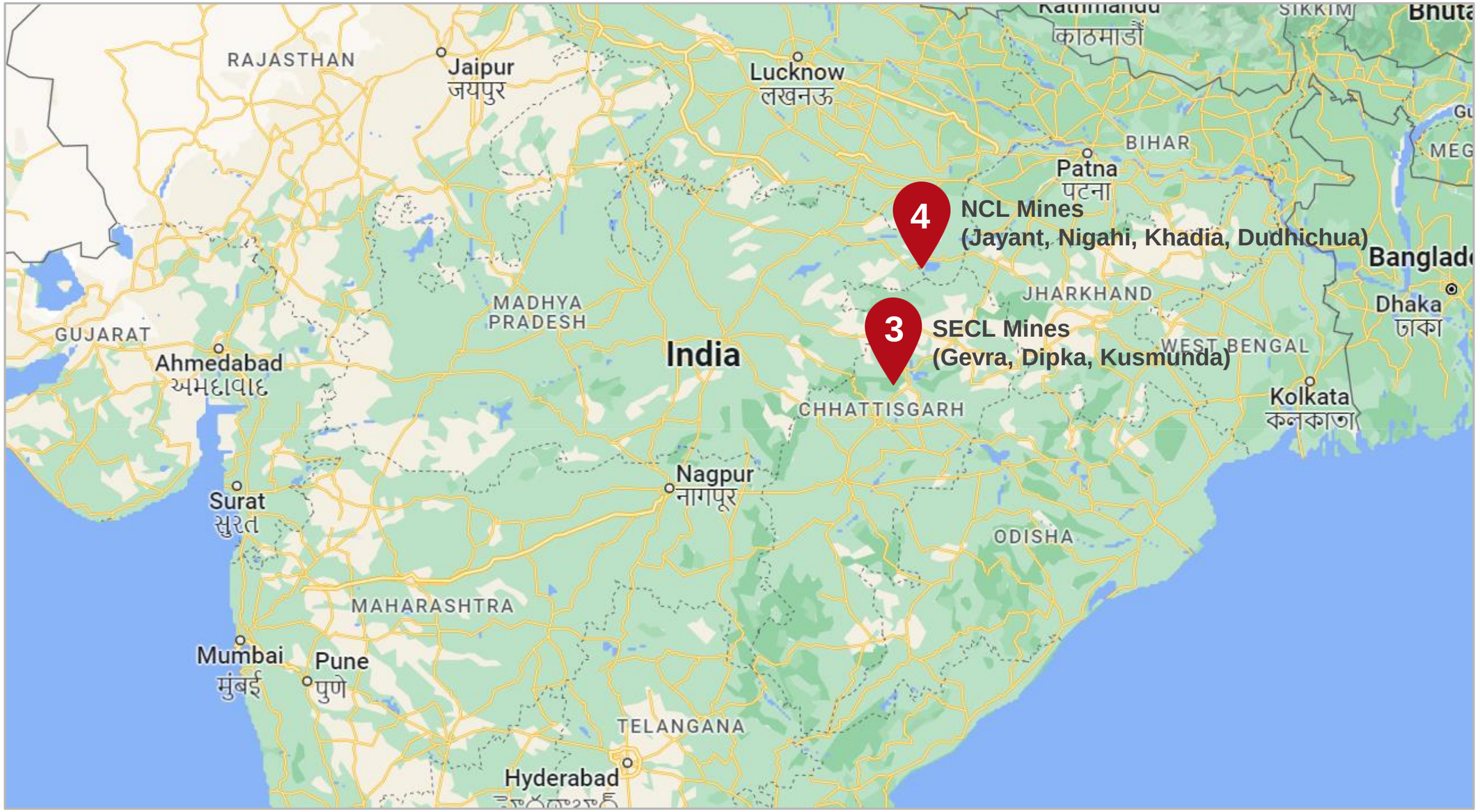
NCL's 'Suraksha Kavach' for Enhanced Worker Safety in Indian Coal Mines

Syook Actility Abeeway



Improve Safety — Enhance Productivity — Supercharge Compliance

Coal Mine Sites- NCL & SECL



Coal Mine Sites- NCL & SECL

Business Challenges

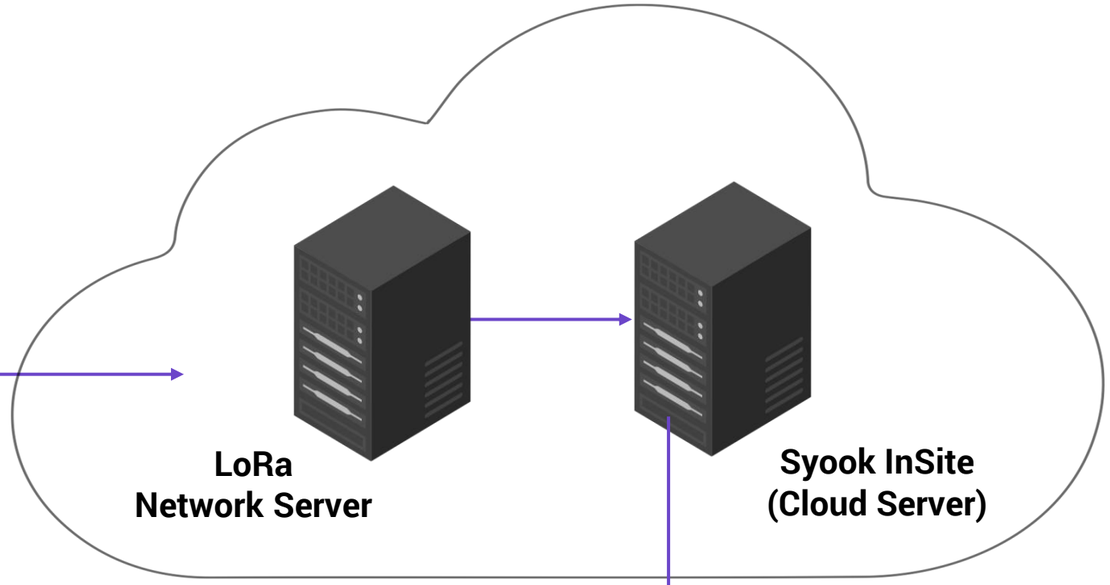
- No real-time visibility of workers & HEMMs
- Lack of effective system to ensure worker safety
- Prolonged man-machine allocation at the start of every shift
- No location data to reduce response time of emergency incidents
- No real-time alerts on blasting zone/hazardous zone at the worker level

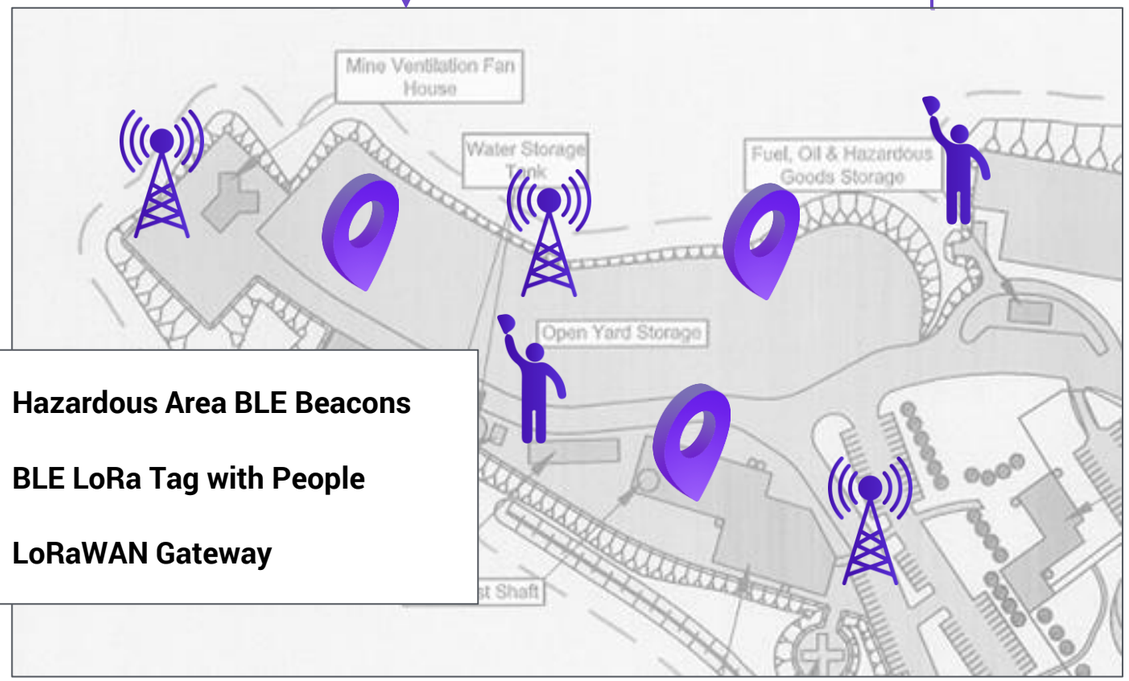
Solution Overview

BLE Beacons

Worker LoRa Tag

4G/Internet



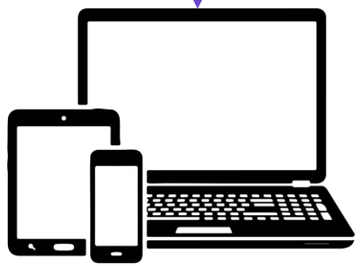


Hazardous Area BLE Beacons

BLE LoRa Tag with People

LoRaWAN Gateway

Internet



Syook InSite Dashboard

Solution Hardware

LoRaWAN Gateways

- **Carrier grade casing (IP67)**
- Easy installation mounting
- Backhaul connectivity: 4G Worldwide module with 3G/2G fallback and ethernet (RJ45)

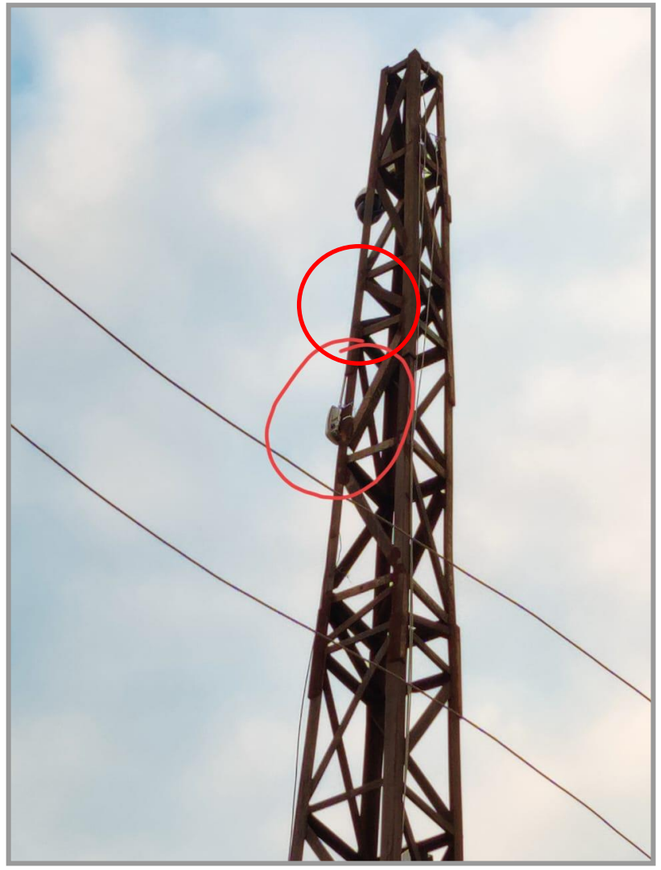
Suraksha Kavach for operators

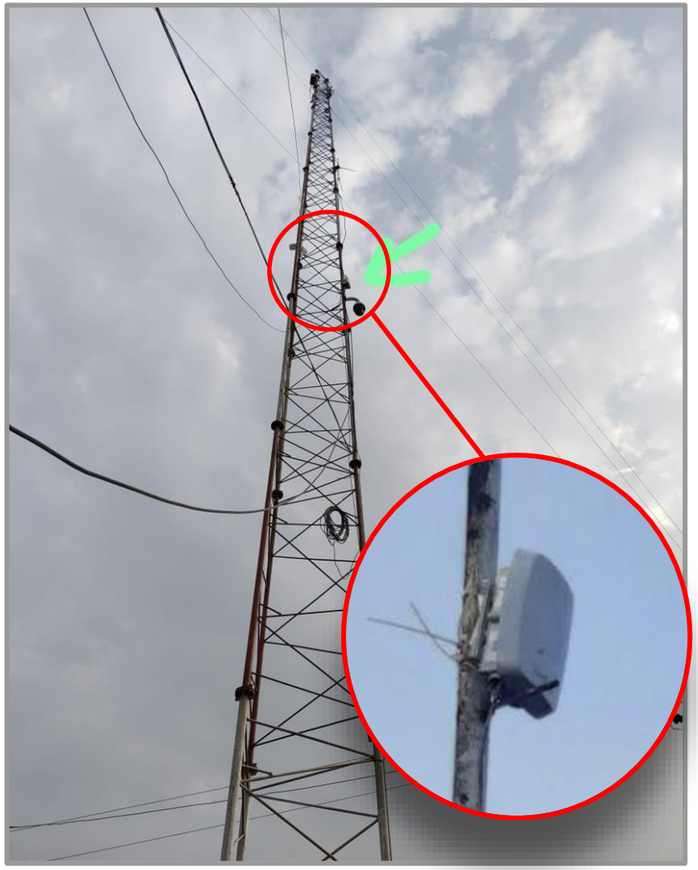
- **High-Pressure water-spray resistant enclosure (IP65)**
- Magnetic USB connector for Rechargeable battery
- 96 dBa buzzer, bicolor LEDs, SoS button
- Battery life: upto 3 weeks

BLE Location beacons

- **IP65 Waterproof & Dustproof**
- Replaceable coin battery 1000mAh
- Up to 18 months battery life, 6 years overall lifecycle
- 50 meters detection range

Deployed Hardware

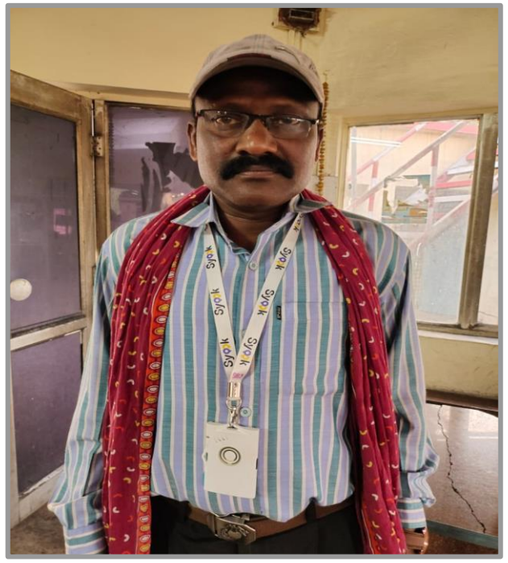




LoRaWAN gateways strategically installed across coal mines.

BLE Beacon inside HEMM

Tag Distribution



Tag Distribution Awareness

Syook

NIVESHAN

Coal India

Syook

आओ, **सुरक्षा कवच** पहने और खुद को और अपने सहकारीयों का जीवन सुरक्षित करे ।

मोबाईल नेटवर्कना होने पर आपातकालीन स्थिती में अपने सुपरवाइजर को संकेत दीजिए ।

ड्युटी पर सुरक्षा कवच पहनिए, खुद को और अपने सहकारीयों को प्रतीबंधित जगह जाने से बचाइये।

SOS आपातकालीन बटन का उपयोग करके लोगों को सहायता मांगने के लिए सूचति करके त्वरित सहायता प्राप्त कर

यह आपातकालीन स्थिती में लोगों को तेज़ी से सुरक्षा तक पहुँचने में मदत कर सकता ह

सुरक्षा कवच बता सकता है कि क्था कोई कुछ मनिटों के लिए बिल्कुल भी नहीं चल रहा है, और फिर अपने सुपरवाइजर और आस-पास के लोगों को अलर्ट भेजता है

सभी की सुरक्षा के लिए यह बहुत जरूरी है कि कोई भी उस क्षेत्र में प्रवेश न करे जहां विस्फोट हो रहा हो, लेकनि अगर कोई इस क्षेत्र में प्रवेश करता है, तो पर्यव क्षक को तुरंत सतर्क कर दयिा जाता है

सुरक्षा कवच

आपकी सुरक्षा, हमारी ज़िम्मेदारी

1

जरूरत पड़ने पर SOS से सहायता

2

मदद मांगने वाले व्यक्ति का स्थान पता लगाना

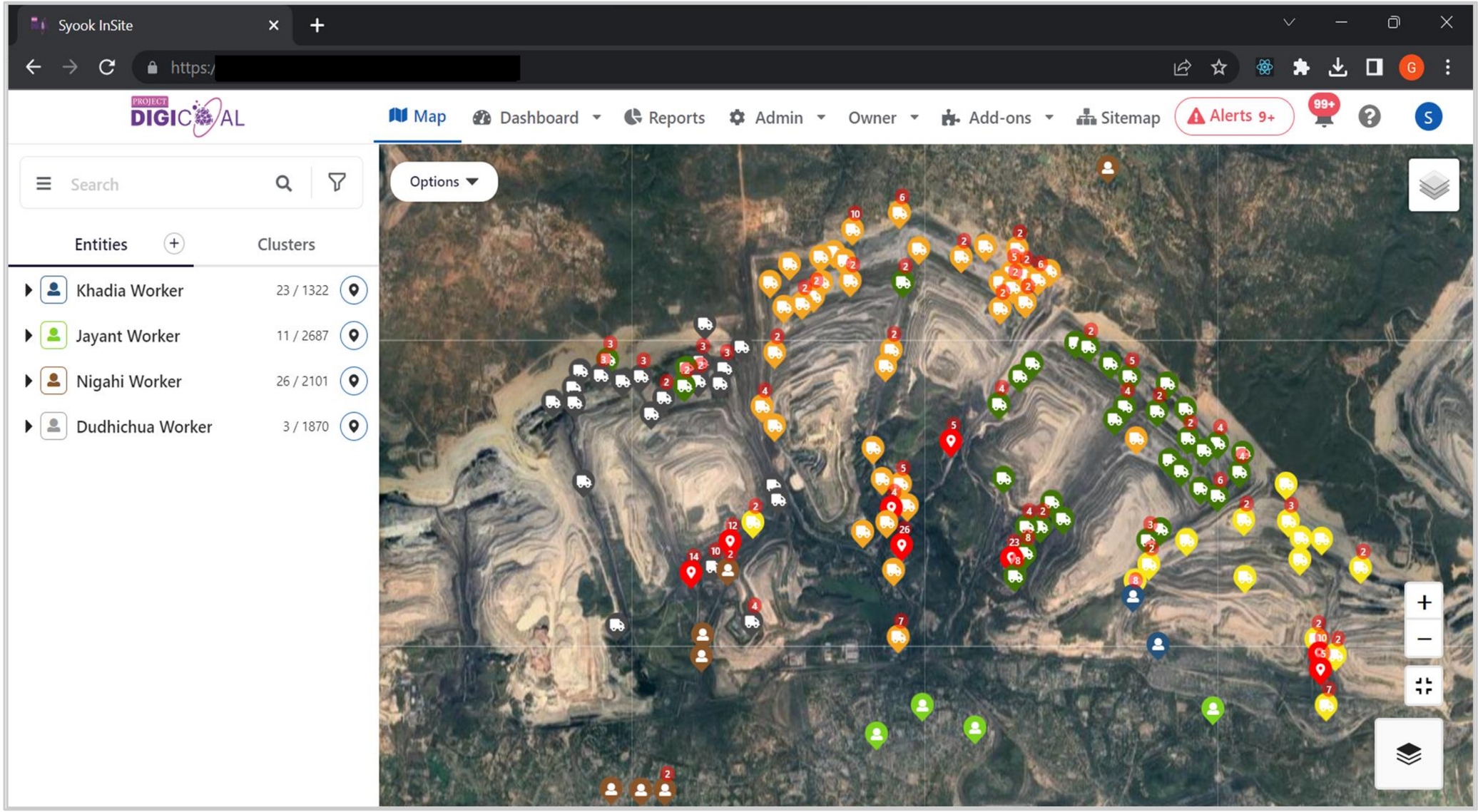
3

स्थिरता का पता लगाना

4

विस्फोट के दौरान सुरक्षा

Digital Map


Syook InSite
https:/
PROJECT DIGICOAL
Map
Dashboard
Reports
Admin
Owner
Add-ons
Sitemap
Alerts 9+
99+
Search
Options
Entities
Clusters
Khadia Worker 23 / 1322
Jayant Worker 11 / 2687
Nigahi Worker 26 / 2101
Dudhichua Worker 3 / 1870

Connected Worker Safety

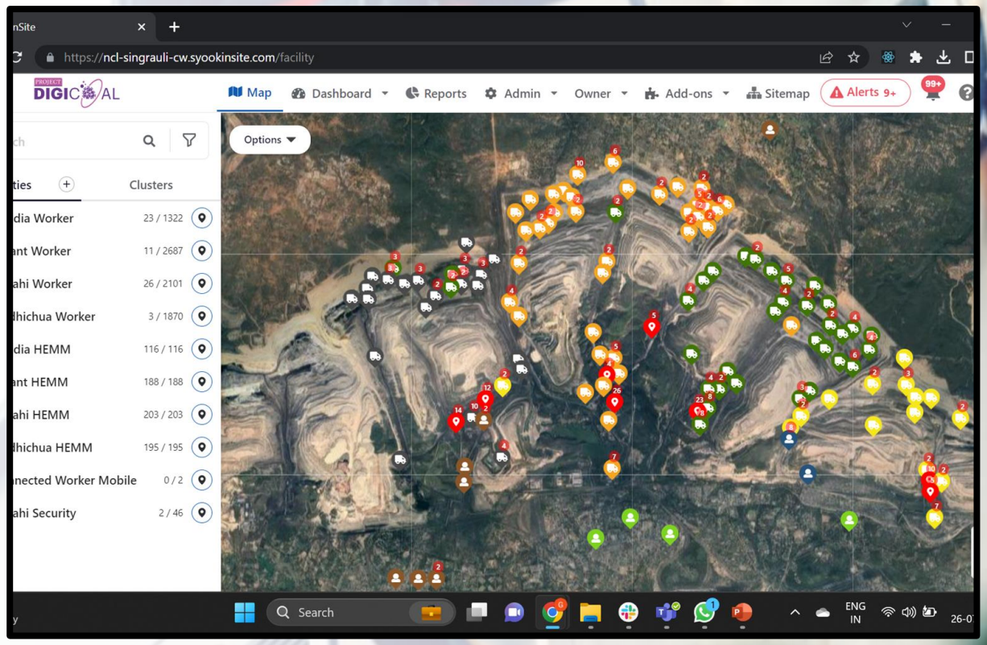
Real-time location: Faster search of personnel within the campus

Work-hour monitoring: Productive and unproductive area monitoring

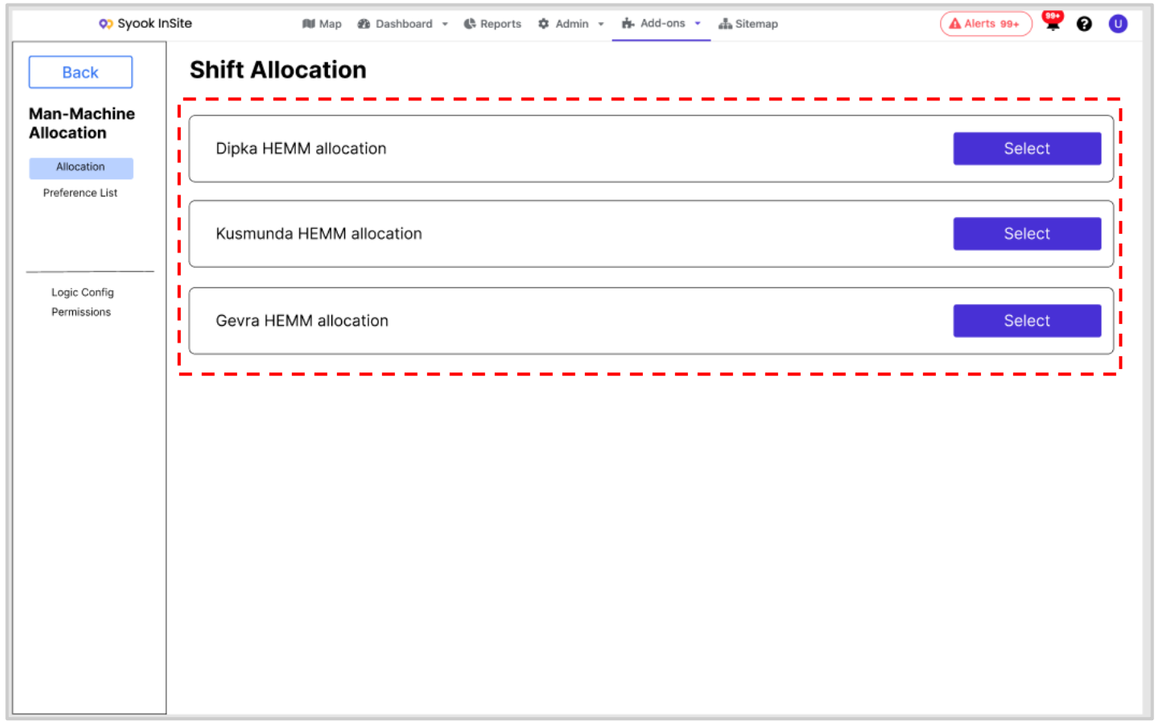
Security monitoring: Authorised areas are uniquely marked for every worker and alarm raised when violated

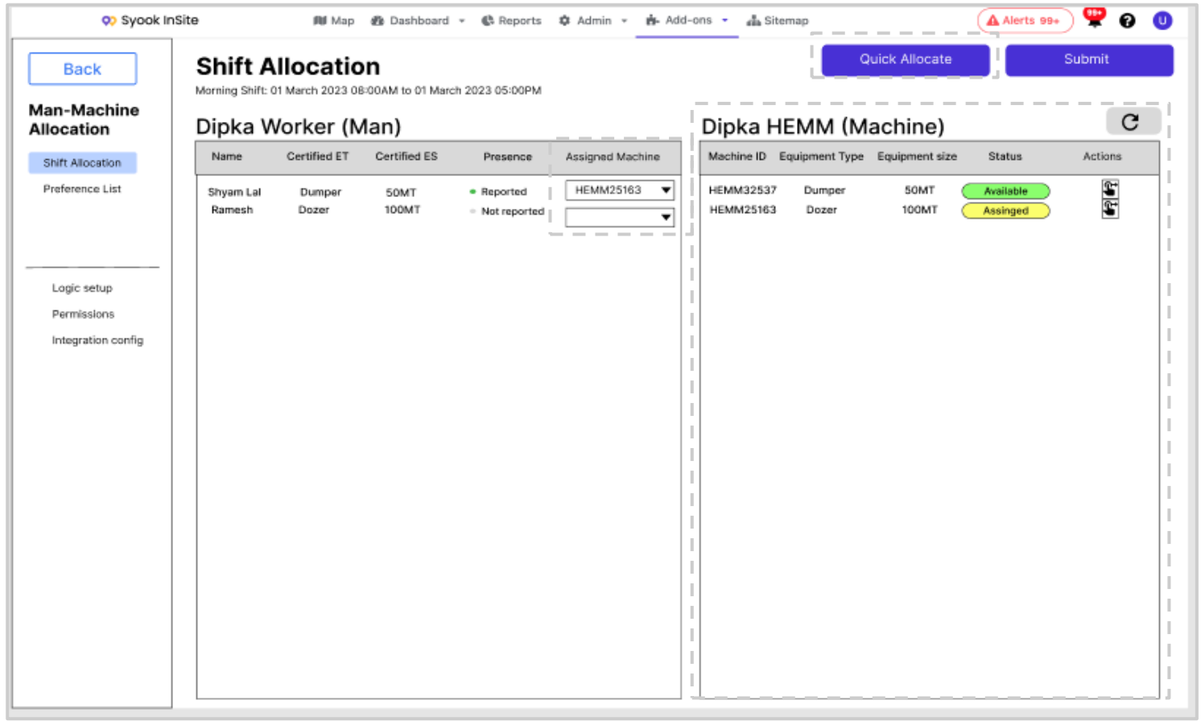
Smart Attendance: Generate automated attendance reports based on detection of workers in the facility

Worker safety: SoS can be raised by worker through tags. Fall can be detected automatically by the platform



Auto Man-Machine Allocation





Faster allocations: Significant time reduction in the allocation of the available machines to present workers at the start of the shift, from 45 mins to under 15 mins

Integrations

HEMM GPS Location & Availability:

We have integrated with SAP for the GPS Locations & machine availability through APIs

Emergency & Compliance alerts:

Our platform is sending real-time alerts to Third Party SW (Centralised War Room) for quick action

CIL Achievements

Syook

Built in Bengaluru for the World

Thank You!

Funded By:

ओएनजीसी ONGC

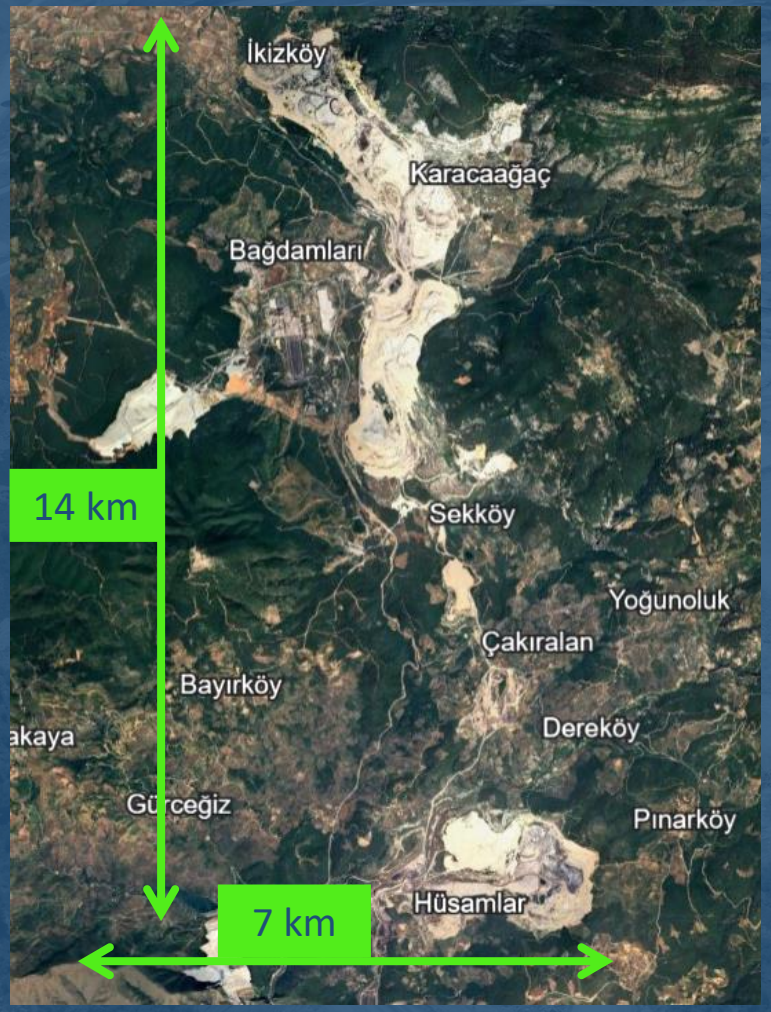
INFLECTION POINT VENTURES

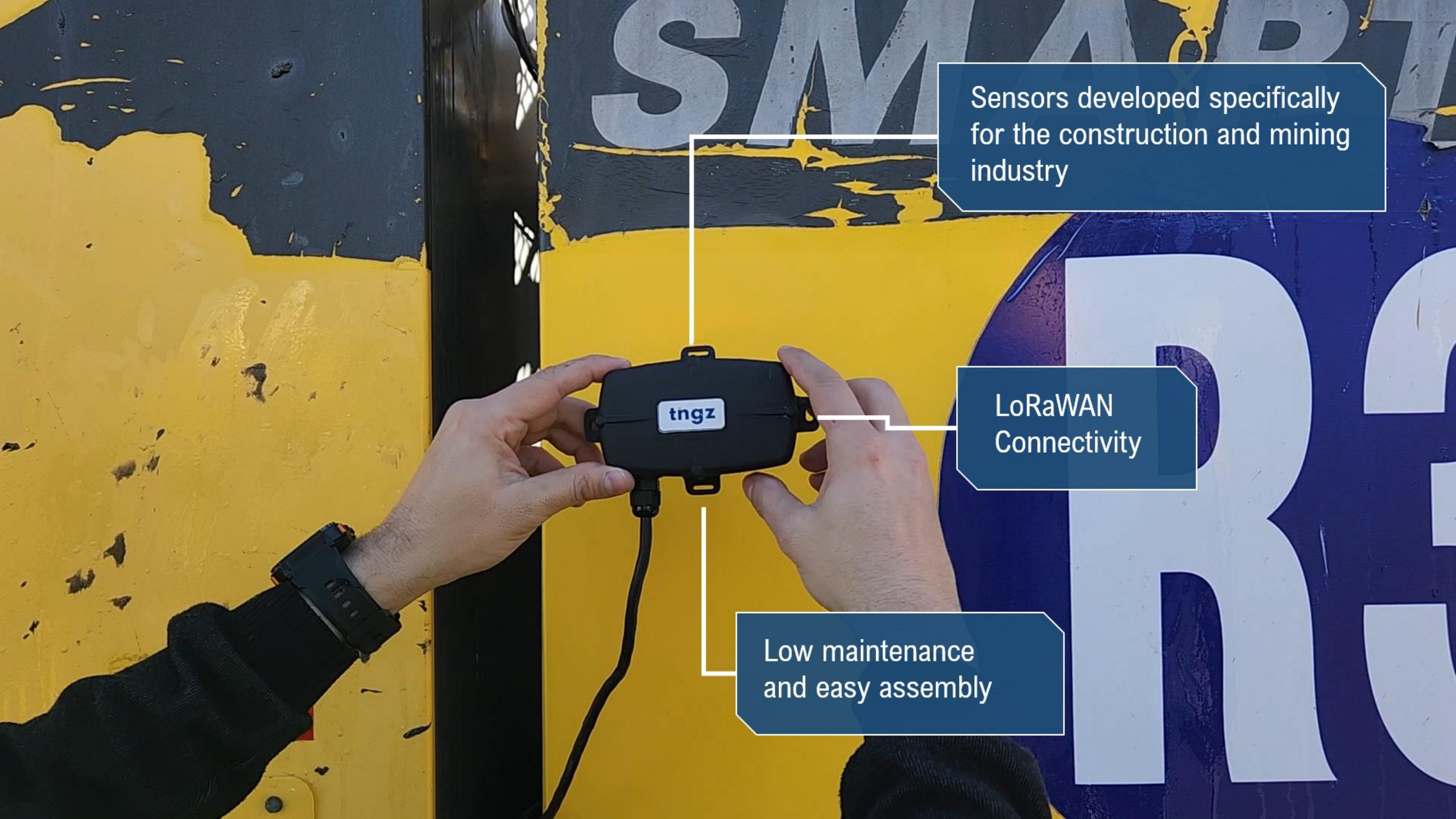
tngz

Kemerköy Lignite Mine
Digital Transformation Project

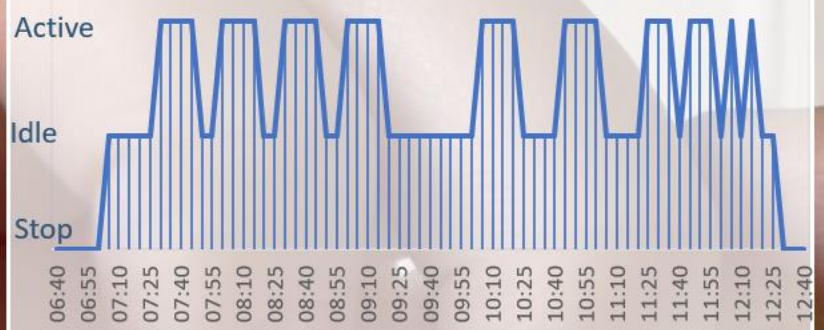
tngz
✓ 320+ Heavy Equipment
✓ Tracking the number of mining trips
✓ Monitoring total production
✓ Work hour reporting
✓ Performance tracking
Alarm | Scania G400CB
Long Stop: 14 mins
İdle | CAT 395M
Performance
% 14
% 86
Workshop Visits | HITACHI 890 LCH
Exit : 22/12/2023 09:08
Enter: 06/12/2023 10:11
Active | Scania G400CB
Route : Excavation Site A4
Number of trips: 12
Volume: 216 m3

tngz

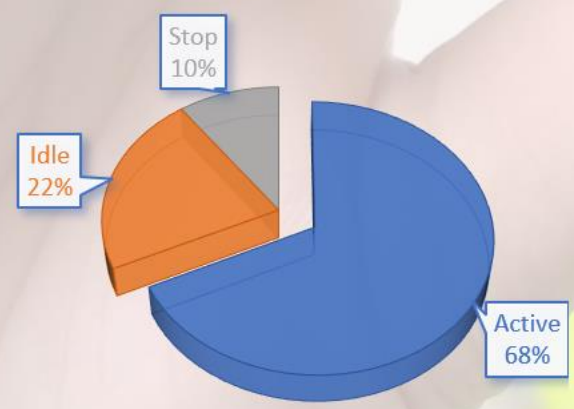

İkizköy
Karacaağaç
Bağdamları
14 km
Sekköy
Yoğunoluk
Çakıralan
Bayırköy
Dereköy
Pınarköy
Hüsamlar
7 km


Sensors developed specifically for the construction and mining industry
LoRaWAN Connectivity
Low maintenance and easy assembly
tngz

Real-Time Activity Analysis

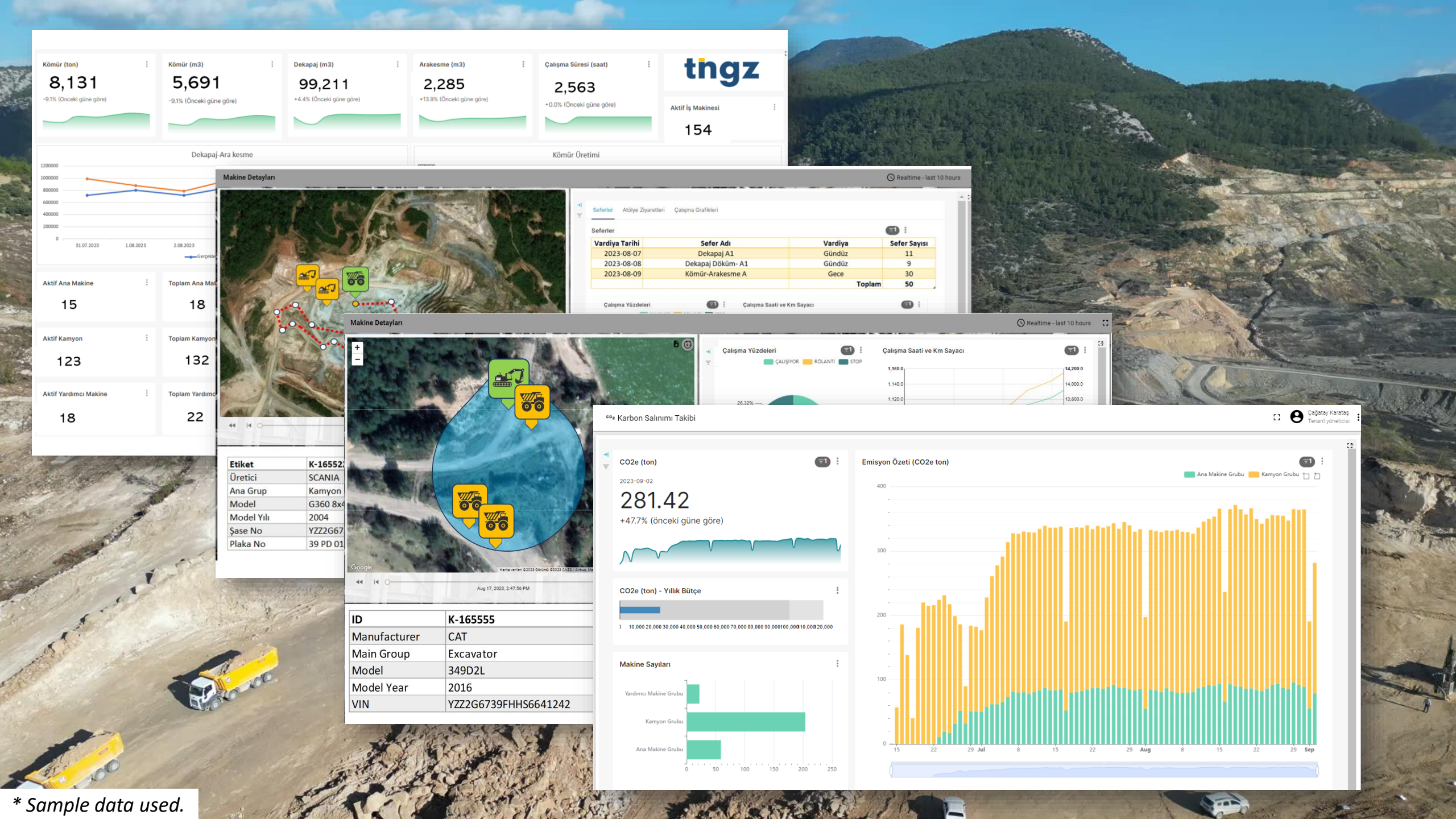


Transported Volume	179 m3
Alarms	High Speed - 73km/h
Number of Trips	9
Workshop Visits	09:32 - 11:22
Total working hours	270 mins

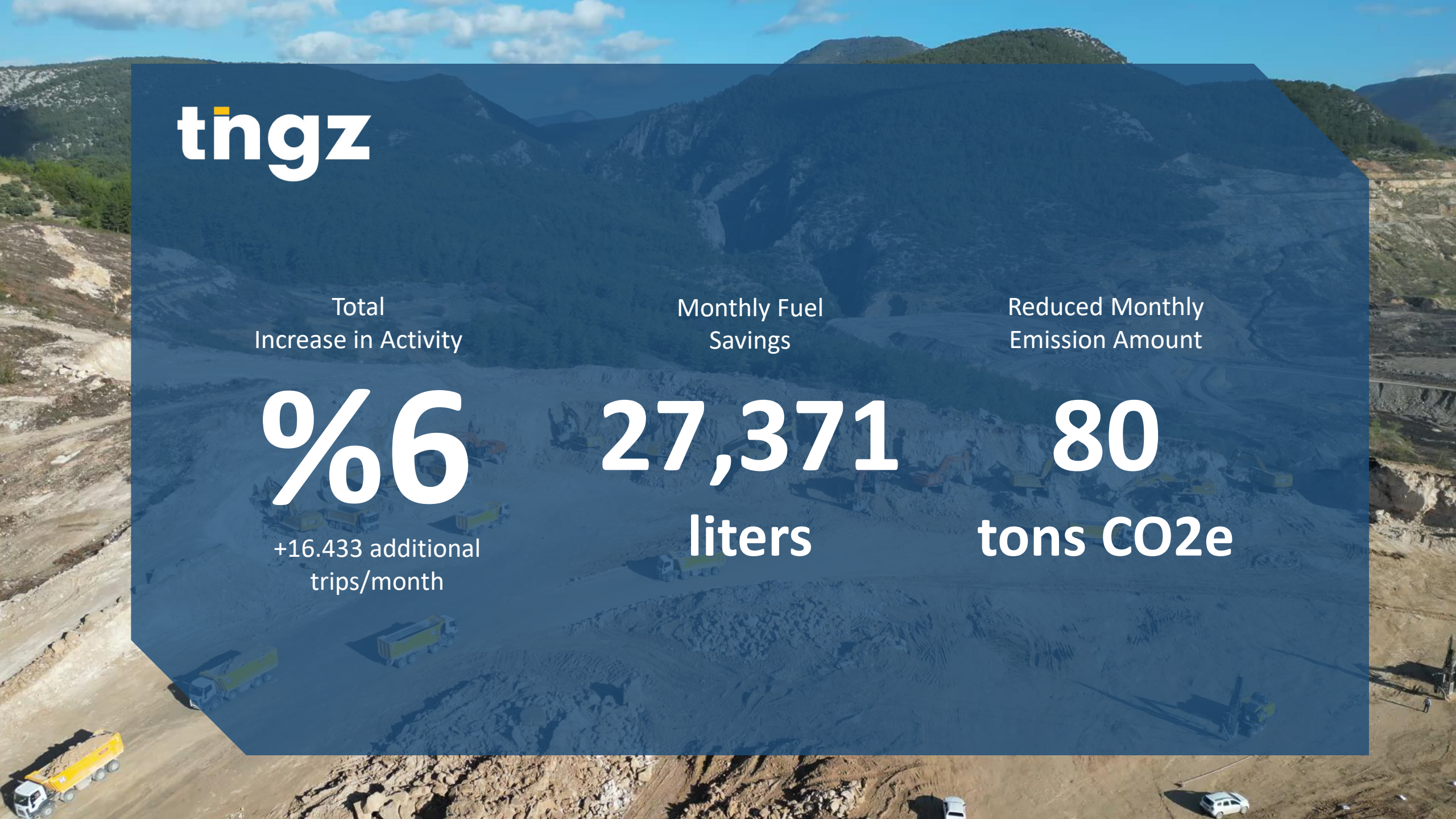


Activity analysis module

Algorithms specific to business machines



** Sample data used.*


tngz
Total
Increase in Activity
%6
+16.433 additional
trips/month
Monthly Fuel
Savings
27,371
liters
Reduced Monthly
Emission Amount
80
tons CO2e

tngz

Asset Tracking in Hazardous Environments with Abeeway's ATEX/IECEx-Certified Trackers

Rohit Gupta

A versatile catalogue of trackers to match a wide variety of vertical applications

Industrial tracker

Large battery, hardened casing, high-precision tracking : designed to last
IP65, 19Ah type D battery.
Up to 3 years battery life in motion tracking mode at 120 position per day.

Micro tracker

Light, handy, yet powerful. Enables you to track and protect things (or people and pets) of value.
IP65, 450mAh rechargeable battery
Buzzer, multimode button.

Battery life :

- *Proximity mode : 5 days to 2 weeks depending on data precision*
- *Location mode : 90 days battery life at 40 fix per day with indoor/outdoor positioning.*

Compact tracker

Solid and lightweight, built for heavy-duty tracking.
Asset tracking and management, even in the harshest environments.
3xAA 2.7Ah replaceable batteries, IP 68, ATEX/IECEx Zone 0/2 certified, temperature & motion sensors
Up to 4 years battery life in LP GPS at 24 fix per day.

Smart Badge

Sleek, smart, and multi-functional.
ideal for worker protection and zone alerts
IP65, ATEX Zone 2 certified, Zone 1 certification (in progress) Buzzer with 70dB high volume, industrialized magnetic connector, 1300mAh rechargeable battery, multimode button.

Battery life :

- *Proximity mode : 1 to 2 months depending on data precision*
- *Location mode :120 days battery life at 60 fix per day with indoor/outdoor positioning.*

All our trackers are LoRa Alliance certified and ready to be deployed worldwide - EU868, US915, AS923

COMPACT TRACKER

Geolocation technology

GPS | A-GPS | Wifi sniffer | BLE

LoRaWan Specifications

LoRa class A; 16 dBm for EU; 21.5dBm EIRP max; CE;

HW configuration

Size : 112mm x 66mm x 33mm, very modular fixation
Waterproof enclosure (IP68); IK08, tropicalised PCB.
Functional temperature range -20°C à + 65°C
Temperature sensor, 3D Motion sensor ; Magnetic switch (option)

Power management

Designed for long Battery life time 8Ah Battery (Type AA/3.6V Li-$SOCl_2$)
Low stand-by current
Supports high peak current For high output power (20dBm mode)

Programmable Functionalities

Motion Tracking / Permanent track/ Start & Stop / Activity Tracking / Standby
Geofencing: Send notification when leaving/entering a specified zone
Activity rate: Monitor operating period with on board sensors

ATEX/IECEx

ATEX/IECEx Zone 0-20 and ATEX/IECEx Zone 2-22 certified for use in hazardous/explosive environments

ATEX/IECEx Zone 0-20
ATEX Zone 2-22

Marketplace Ordering link: here

A tracker designed for asset tracking/management in industrial environment

NEW
Low power ATEX/IECEx BLE beacon manageable over LoRaWAN

Industrial Manageable ATEX Beacon

Availability: NOW

Microsoft Azure Certified Device

LoRa Alliance Certified

ATEX/IECEx Zone 0-20
ATEX Zone 2-22

Marketplace Ordering link: here

Beaconing Formats

Eddystone	iBeacon	AltBeacon	Quuppa

LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE; FCC

HW specification

Size : 112mm x 66mm x 33mm, very modular fixation
Waterproof enclosure (IP68); IK08, tropicalised PCB.
Functional temperature range -20°C to + 65°C
Temperature sensor, Magnetic switch (option)

RoHS

Power management

Designed for long Battery life 8Ah battery (Type AA/3.6V Li-$SOCl_2$)
Supercapacitor to protect against battery passivation
Low stand-by current
Supports high peak current for high LoRaWAN Tx power (20dBm mode)

Programmable Functionalities

Programmable using Abeeway app or over LoRaWAN

ATEX/IECEx

ATEX/IECEx Zone 0 and ATEX/IECEx Zone 2 certified for use in hazardous/explosive environments

A BLE beacon designed for asset tracking in industrial environment

NEW
Low power ATEX/IECEx BLE beacon manageable over LoRaWAN

Abeeway Smart Badge

Availability: NOW

Microsoft Azure Certified Device

LoRa Alliance Certified

ATEX Zone 1-21 (Expected Q1'
ATEX Zone 2-22 (Available)

Marketplace Ordering link: here

Beaconing Formats

Eddystone | **iBeacon** | **AltBeacon** | **Quuppa**

LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE; FCC

HW specification

Size : 104mm x 68 mm x 11 mm
Waterproof enclosure (IP65);
Functional temperature range -10°C to + 55°C
Temperature sensor,

RoHS

Power management

Rechargeable 1.3Ah battery (Rechargeable Li-Po)

Programmable Functionalities

Programmable using Abeeway app or over LoRaWAN

ATEX/IECEx

ATEX/IECEx Zone 1 (In progress) and ATEX/IECEx Zone 2 (certified) for use in hazardous/explosive environments

A BLE beacon designed for asset tracking in industrial environment

Combo LPWAN Compact Tracker

Availability: NOW

NEW
Compact Tracker combining
LoRaWAN, LTE-M & NB-IOT

Leverages Sequans GM02S module and Abeeway-Murata 1WL Geolocation module

ATEX Certification: In progress

For more information: here

Geolocation technology

GPS | A-GPS | Wifi sniffer | BLE

LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE

LoRa Alliance Certified

Cellular Specifications

LTE-M and NB-IOT
Supported bands: 1, 2, 3, 4, 5, 8, 12, 13, 14, 17, 18, 19, 20, 25, 26, 28, 66, 70,71, 85);
Total Radiated Power (TRP) = 18dBm

HW specification

Size : 112mm x 66mm x 33mm, very modular fixation
Waterproof enclosure (IP68); IK08, tropicalised PCB.
Functional temperature range -20°C to + 65°C
Temperature sensor, 3D motion sensor, Magnetic switch (option)

RoHS

Power management

Designed for long Battery life 8Ah battery (Type AA/3.6V Li-$SOCl_2$)
Supercapacitor to protect against battery passivation
Low stand-by current

Programmable Functionalities

Motion Tracking / Permanent track/ Start & Stop / Activity Tracking / Standby
Geofencing: Send notification when leaving/entering a specified zone
Activity rate: Monitor operating period with on board sensors

A tracker designed for asset tracking/management in industrial environment

LoRaWAN Relay

Availability: NOW

NEW
Compact Tracker configurable as LoRaWAN Relay

Leverages Abeeway-Murata 1WL Geolocation module

LoRa Alliance Certified

Use Case

Reduce infrastructure CAPEX to ensure target coverage at the edge

LoRaWAN® Specifications

LoRaWAN class A; 16 dBm for EU; 21.5dBm EIRP max; CE
LoRa Alliance Relay specification (**TS011-1.0.0 Relay**)

HW configuration

Size : 112mm x 66mm x 33mm, very modular fixation
Waterproof enclosure (IP68); IK08, tropicalised PCB.
Functional temperature range -20°C to + 65°C
Temperature sensor, Magnetic switch (option)

RoHS

Power management

Designed for long Battery life 8Ah battery (Type AA/3.6V Li-$SOCl_2$)
Supercapacitor to protect against battery passivation
Low stand-by current
Supports high peak current for high output power (20dBm mode)

ATEX Certification: In progress

A Relay designed for asset tracking/management in industrial environment

ThingPark X Location Engine

Because there is no single-size-fits all geolocation technology

Multi-technology geolocation algorithm to the optimal location information.

Driving power efficiency one step further with our **Patented LP-GPS algorithm**

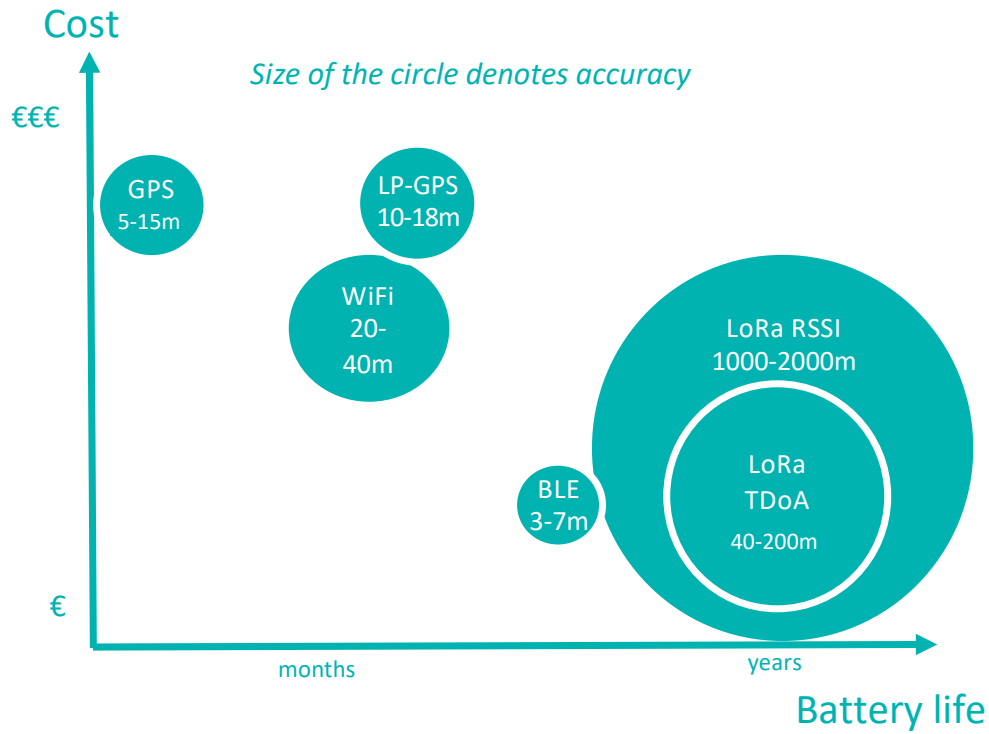
Not only a point on a map : Value-added capabilities like geofencing , DA-GPS, or alerting capabilities.

Abeeway Device Management, to administor efficiently your fleet of trackers

API Driven framework to smoothly integrate with any application

Integrated with major **location database** Google here

Finding continuously the optimal balance between power efficiency, accuracy, costs



Actility

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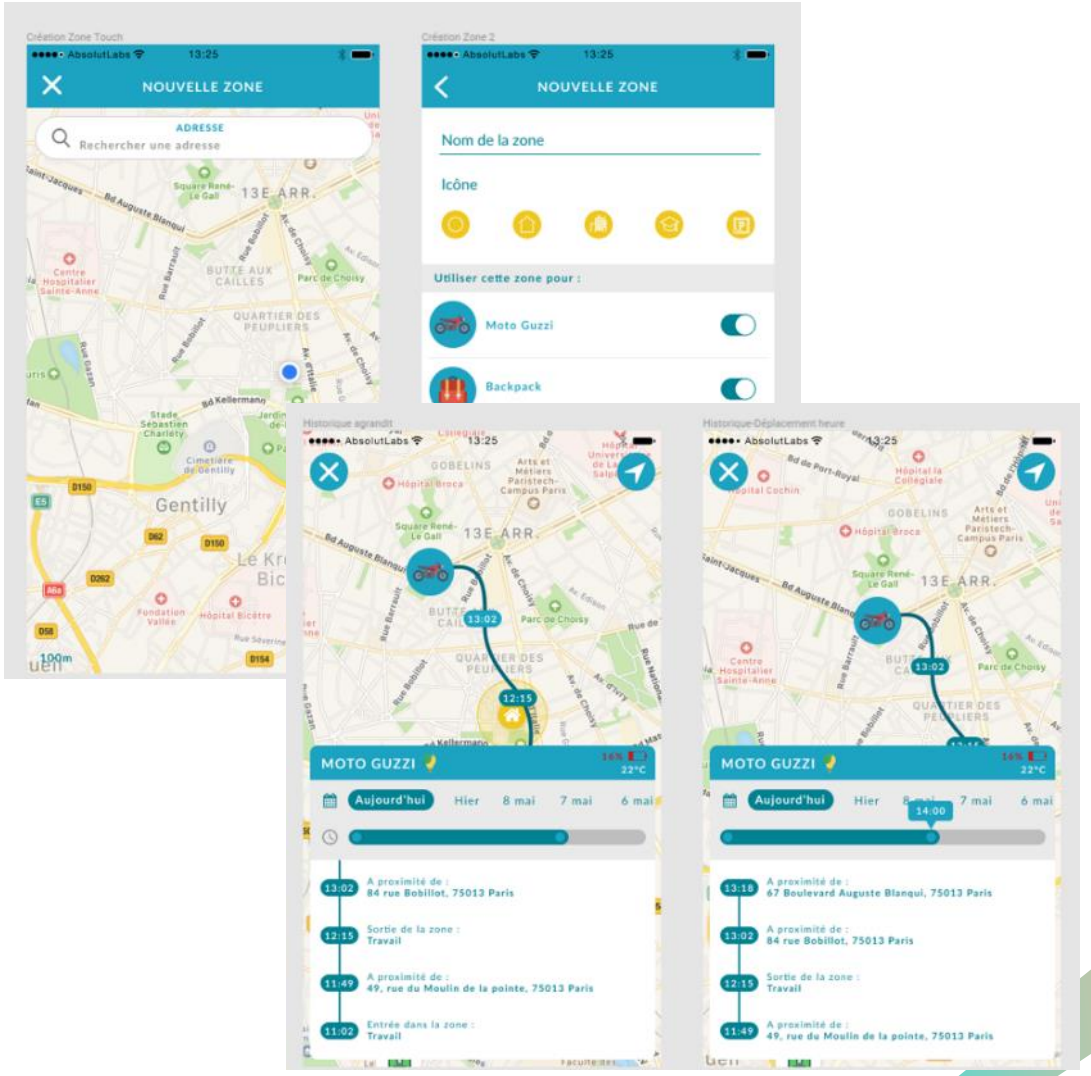
Helping our customers to address the consumer market with the **Abeeway Mobile Application**

User-friendly mobile app enabling multi-purpose consumer tracking

- Feature set : manage and customize your tracker, locate it on demand anywhere anytime, view its detailed motion history, set up alerts, change modes, share it with our users, update your tracker's firmware....
- Native apps on iOS and Android

Designed to be easily customizable to fit any brand identity and particular needs under white label scenario



For more information: here

Actility

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ATEX/IECEx certification for Abeeway devices

- ATEX/IECEx certification for Abeeway trackers for use in hazardous environments
- Typical Use case: Fixed offshore platforms, petrochemical plants, mines, flour mills, etc.
- Note:
  - Zone 0 includes certification for Zone 1/Zone 2 (Gas)
  - Zone 20 includes certification for Zone 21/Zone 22 (Dust)

	Supported tracker models
ATEX Zone 0-20 IECEx Zone 0	Compact tracker, Industrial Manageable ATEX Beacon
ATEX Zone 2-22	Micro Tracker V2, Smart Badge, Compact tracker, Industrial Manageable ATEX Beacon
ATEX Zone 1-21	Smart Badge

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ATEX/IECEx certification for Abeeway device

- For more information on ATEX/IECEx markings, see here.

Compact Tracker Industrial Manageable ATEX beacon	**ATEX Zone 0**: II 1G Ex ia IIC T4 Ga Ta -20 °C ... +40 °C II 1D Ex ia IIIC T135°C Da Ta -20 °C ... +40 °C **ATEX Zone 2**: II 3G Ex ic nA IIC T4 Gc Ta -20 °C ... +40 °C II 3D Ex ic tc IIIB T135°C Dc Ta -20 °C ... +40 °C **IECEx**: Ex ia IIC T4 Ga Ex ia IIIC T135°C Da
Smart Badge	**ATEX Zone 1:** Ex II 2G Ex ib IIC T4 Gc Ex II 2D Ex ib IIIC T135°C Db **ATEX Zone 2:** Ex II 3G Ex ic IIB T4 Gc Ex II 3D Ex ic IIIB T135°C Dc
Micro Tracker V2	**ATEX Zone 2**: II 3 G Ex ic IIB T4 Gc (-20 °C ≤ Tamb ≤ +40 °C) II 3 D Ex ic IIIB T135 °C Dc (-20 °C ≤ Tamb ≤ +40 °C)

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Backup

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ATEX Zone 0-20 Marking (Gas) for Compact Tracker (1/2)

CE Mark
(conforms to EU standards)

Ex logo
(approval for use in explosive atmospheres, as specified)

Explosion Protection
(This will always precede the protection category)

Gas Group
IIC Hydrogen

Equipment Protection Level
Ga – Rare failures

Ambient Temperature
range of -20°C – 40 °C

II 1 G Ex ia IIC T4 Ga Ta -20 °C ... +40 °C

Equipment Group

II Non-mining

Safety Category

1

Atmosphere

G Gas

Protection

ia – intrinsic safety

Temperature

T4 corresponds to max surface temp of 135 °C

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ATEX Zone 0-20 Marking (Dust) for Compact Tracker (2/2)

CE Mark (EU standards)

Ex logo (use in explosive atmospheres)

Explosion Protection

Dust Group IIIC Conductive dust

Equipment Protection Level Suitable for zones 20, 21, 22

Ambient Temperature range of -20°C – 40 °C

II 1 D Ex ia IIIC T135°C Da Ta -20 °C ... +40 °C

Equipment Group

II Non-mining

Safety Category

1

Atmosphere

D Dust

Protection

ia – intrinsic safety

Temperature

Max surface temp of 135 °C

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