



From stability sensors  
to video surveillance

# SMART BUILDING



# SMART BUILDING

System architecture for intelligent building control:

01



## SERVICES

Displaying information on a map, sending specific alerts, remote management of plant, smart actuators.

02



## BIG DATA ANALYTICS

Support on the management and use of connected services.

03



## DATA TRANSMISSION

LoRaWAN technology enables remote management of data recorded by sensors.

04



## SENSORS

Detectors and measurers, with reduced energy consumption.

# SMART BUILDING

The Smart Building model is fundamental within the IoT (Internet of Things) framework: digital services are built-in and integrated within buildings, making them safer and more efficient.



## Technology

Inside a smart building **electronics play a critical role**: from telecommunications systems to safety.



## Communications

All systems within buildings are **interconnected in automated mode**, through a supervision and control infrastructure (electric, hydraulic, HVAC, heating, ventilation and air conditioning).



## Green Buildings

**Smart buildings are also green**: energy and heat plants are more efficient, reducing energy loss and emission of harmful substances into the atmosphere.



## Security

Buildings are more secure, thanks to **more efficient systems**.



## Management and Monitoring

IoT systems, actuators, controllers, communication interfaces, connection buses, cloud solutions and software applications allow for an integrated approach to communications, management and **monitoring of all building systems**.



## Advantages

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Spaces can be monitored to understand and analyse space usage dynamics. The use of efficient networks, energy and security systems improves energy efficiency and resource management throughout the entire lifecycle of a building.

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**LOWER  
OPERATIONAL  
COSTS, MORE  
EFFICIENT  
MANAGEMENT**

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- **Improved quality of life** in buildings.
- Improved efficiency and **reduced environmental impact**.
- **Monitoring and management of energy related costs**.
- **Energy optimisation** and effective heat management.
- **Internal Smart mobility**.
- **Smart resource management**.
- **Improved security** and increased oversight of systems.
- **Targeted maintenance**.

# SMART ENERGY

The Smart Energy solution proposed by A2A Smart City applies to all energy plants (electric, hydraulic, Gas network, HVAC, heating, ventilation and air conditioning) based on the LoRaWAN network standard, comprised of:



## SENSORS

to detect the intensity of lighting or heat in any given area.



## SWITCH I/O

to monitor energy consumption of the entire building.



## METERS

that regulate the energy supply to installed systems (electrical, hydraulic etc.).



## GATEWAY

for data transmission to a Network Server that will provide storage and process data.



## MANAGEMENT SOFTWARE

available on Cloud and on Apps for Smartphones and mobile devices to display energy consumption and allow analysis (real-time or reporting), as well as remote management of energy plants.







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## ENERGY DIAGNOSIS, FIRST STEP TOWARDS EFFICIENCY.

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### **Diagnosis and targeted maintenance**

The use of energy sub-metering and diagnosis systems ensures maximum transparency on consumption and on available data, to identify main areas of energy improvement.

### **Improvement of energy production and consumption**

By using energy diagnosis tools it will be possible to: manage consumption, detect any anomalies and improve efficiency in energy plants.

This will create eco-efficient and eco-sustainable high performance buildings and systems: therefore reducing CO2 and greenhouse gas emissions, improving building performance and comply with legislation.

## Advantages

- Identification, using consumption data, of main areas of inefficiency and energy improvement.
- **Energy cost reductions** through an efficient energy management system.
- **Reduction of CO2 emissions** and other greenhouse gases, optimising building performance in compliance with legislation.
- **Scheduling predictive maintenance** on energy plants, based on energy consumption.
- **Automation** and remote management of energy plants.
- **Local energy management policies**, concentrating energy in specific areas of the building.
- **Improved security.**
- **Increased battery life for sensors** (up to 20 years) devices used by the LoRaWAN network operate on low power.
- **Constant and reliable radiofrequency transmissions** between sensors and the service infrastructure supported by LoRaWAN network.





# SMART SECURITY

Security is fundamental. LoRa network is an enabling technology platform for a wide range of smart solutions, which can be rolled out vertically and is responsive to customer needs.

## Intrusion prevention services



IoT technology provides **authentication solutions for operating building access points** and cutting-edge anti-intrusion solutions, easily integrated with traditional security systems. Security networks, based on sensors with long battery life and difficult to tamper with, are able to activate alerts, sirens, video cameras or alert the police.

**Information and alerts can be managed from mobile devices or from a centralised cloud software.**

The anti-intrusion sensors also make it possible to monitor at any time the building's access points, avoiding energy waste and heat loss.

## Advantages

- **Efficient network**  
The sensors connected to the LoRa network are independent of the local internet connection and powered by stand alone batteries.
- **Energy saving**  
Real-time monitoring on the status of all the access points within a building allows effective management of consumption and loss.
- **High security systems.**
- **Low technology costs.**





## CCTV and videoanalysis

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An **advanced video surveillance service ensures greater security**. Hi-tech sensors capture ultra-high-definition images and integrate video **analytics algorithms**, a fundamental feature of advanced IoT technology. The cameras are interconnected and converge on a **centralised operational platform**, where all the information acquired is processed.

Aggregation and data processing changes the management approach from reactive to proactive. The repressive model becomes a **preventive model**, which anticipates and intervenes promptly with specific types of events, such as abandoned objects.



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**PREVENTIVE  
SECURITY  
SYSTEM.**

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## Environmental Monitoring

Environmental sensors **monitor air quality**, both physical (temperature and humidity) and chemical (presence of polluting agents).

### Advantages

- **Alerts** when exceeding dangerous pollution thresholds.
- **Collection of information** for managing heating/air conditioning systems
- Collection of information on manufacturing spaces, to **increase efficiency**.
- Scheduling of preventive maintenance to **safeguard environmental quality**.

## Radioactive Monitoring

**Monitoring levels of radioactivity** is essential to safeguard health and safety in industrial buildings and prevent the dispersal of harmful substances and constantly monitor the presence of radioactive elements such as Radon.



### Advantages

- **Alerts** when exceeding dangerous radioactive thresholds.
- **Rapid response for radioactive related emergencies**.

# Fire prevention and detection solutions gas and fumes



An efficient IoT sensor network enables the constant monitoring of spaces, reducing to a minimum the timeframe of **detection of an emergency and understand its gravity**: it is possible to quickly identify flames, heat, fumes, gas leaks, speeding up responses and minimising the impact and risks for individuals and companies.

## Advantages

- Sensors **detect flames**, smoke or gas leaks.
- **Identify temperature variations** associated with fires.
- Periodically send measurements on the status of the building (temperatures, detection of gas ...) with reliable and secure communications, enabled by the LoRa network.
- Works on **very low power thresholds**, batteries can last over 20 years.





# Flooding prevention solution



The solution proposed by A2A Smart City includes IoT sensors on the LoRaWAN network to constantly monitor **pipes and hydraulic systems, liquid and gas leaks**. The sensors can be installed both internally and externally to the liquid and gas piping. Quickly detect every issue (pressure variations, losses, flooding ...) and provide **real-time monitoring, rapid alerts** and execution support for services and emergencies management.

## Advantages

- **Reduced loss**, immediate flooding or gas leak response.
- **Increased safety**.
- **Quick detection of issues**.
- **Long battery life**, up to 20 years, thanks to the low power thresholds of the LoRaWAN network.
- **Maximum coverage across the building** and the piping network, with minimal infrastructure and low cost.



## Head counting services

Monitoring numbers of people in a given space or in transit to optimise energy resources and the security of buildings.

Monitoring also **improves maintenance and cleaning activities** based on patterns of space usage.



## Acoustic monitoring services

LoRa technology offers a wide range of speakers and microphones for **real-time bi-directional communications** (for informative or deterrent purposes). The system also provides **audio analysis**, with automatic recognition of unusual sounds such as screams, gun-shots, explosions.

The IoT sensors, which constantly monitor audio and audio levels in the environment, detect potential dangers or exceeding noise standards, are a useful tool for managing services and emergencies.

## Advantages

- Study the **best transit route**.
- **Optimise energy management** in the building.
- **Optimise security systems** for users inside the building enabled by low-consumption sensors.
- **Optimise maintenance activities** based on access to premises.

## Electronic nose

The “electronic nose” is a device that **continually analyses air quality in rooms**, to improve health and safety.

This tool allows to perform air quality detection and analysis at low cost and in real time.





# SMART RISK

The A2A Smart City proposal includes the installation of a network of sensors using LoRaWAN that constantly monitors the status of the structures by using:

## Measures

to measure the displacement between two points on both sides of a fracture.

## Tape extensometer

to measure changes in distance between two fixed points.

## Joint measurers

to measure small fractures.

## Inclinometers

to monitor ground micro-displacements with precise measurements of the subsoil.

Sensors constantly collect data and transmit it to a cloud server. Big Data Analytics allow to:

- monitor **conditions of structures**
- produce **periodic reports**
- **activate alerts** to prevent any risk to citizens and limit social/economic damages.



## Advantages

- Security for the local population.
- Improved maintenance.
- Full coverage across the entire building.

The LoRa™ Alliance is a non-profit association for the support, development and standardisation of the LoRaWAN communication protocol. The LoRa Alliance members include companies from all over the world.

A2A Smart City has been a member of the LoRa Alliance since December 2015: as a member of the LoRa Alliance, A2A can develop LoRaWAN points across Europe in agreement with other members of the organisation. A2A Smart City recommends the use of a 1.0.2. standard LoRaWAN network, the latest version available exclusively to members of the LoRa Alliance, already in use in Lombardy and with the potential to be extended to other countries.

All technological solutions proposed are implemented following the LoRaWAN™ standard, a technology that operates in radio frequency on an electromagnetic spectrum between 867 and 869 MHz.



## LoRaWAN NETWORK



- **Long Range:** wide coverage, throughout the urban area, one gateway has a coverage range of 5km in urban areas and 10km in suburban areas.
- **Low Power:** the sensor batteries can last for up to 10 years without requiring connection to the electricity grid;
- **High Capacity:** supports millions of messages for every monitoring station/sensor;
- **Geolocation:** enables the support of the geo-location service without GPS and without additional battery consumption
- **Standardized:** the LoRaWAN network ensures interoperability between applications, IoT service providers, and telecommunications service providers;
- **Security:** the LoRa standard ensures privacy and data protection via a data encryption system (Embedded end-to-end AES-128 encryption);
- **Low Cost:** the infrastructure and nodes have low maintenance costs and are low in energy consumption.

Smart building optimises energy efficiency in buildings, through plant management, monitoring and supervision.

The operation and management of all assets in a smart building is highly efficient in terms of costs while guaranteeing optimal levels of service. Main objectives are to reduce the environmental impact, allow easy management, improve remote control systems and increase security.



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