algorab

Connecting the future

Company profile

www.algorab.com

Connecting the future

We live in a fascinating period in which the speed of change and technological progress is staggering. The Internet of Things (IoT) is finding application everywhere, it is real and is progressing with relentless growth and innovation. Each area is destined to be transformed, in a new era where widespread connectivity will be the new norm.

Innovation in IoT connectivity will continue: increasingly "smart" digital-ready customers are bringing the IoT to have an ample margin of growth toward a marked improvement in the daily lives of people and organizations and toward greater environmental sustainability. To date, the IoT has made giant strides, with its characteristic of being able to embrace an extremely broad range of subjects and sectors. From the environment to smart cities, from healthcare to biotechnology, from industrial production to logistics, the fields of application are more and more numerous. In the future, widespread connectivity and the IoT will enable us to apply new R&D paradigms to counter and resolve many of the issues that do not yet have a solution.

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About us

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Algorab is a leading company in the world of wireless remote control and IoT systems.

Born in 1992 out of the deep passion of its two founding partners for state-of-the-art technology, since its very first years of business it has believed in new technologies seeking unique and innovative solutions in the world of remote control. Starting from the field of industrial automation, it has subsequently diversified its applications into numerous other fields and sectors, allowing a transfer of unique knowledge and experience.

Today, Algorab is an innovative market-leading SME that, thanks to constant research and a strong drive for innovation, makes its know-how available to customers who want to look to the future.

Vision

We look to the future of remote control and the IoT to create new application scenarios with the aim of making information and knowledge increasingly more accessible.

Mission

We convey our passion for work with the quality of our products. We strive every day to find innovative solutions to create distributed connected environments and technological applications that increase business efficiency, improve quality of life, and foster environmental sustainability.

From Smart Lighting to Smart City

02

The public lighting system, thanks to its capillarity and geographical distribution throughout the city, can become an effective communication infrastructure that integrates different services for the benefit of the community in a Smart City perspective.

According to the United Nations World Urbanization Prospects 2018, in 2050 nearly 70% of the world's population will be living in urban areas. Although the recent pandemic has somewhat changed people's priorities and choices, significantly increasing work from distance, it is expected that urban areas will grow widely and be managed with a strategic vision.

In our opinion, a city is considered "smart" when it equips itself with modern human-scale infrastructure and widespread and flexible interconnection systems, which enable it to manage its economic and environmental resources, energy policies, transport, relations between persons and its administration in an innovative way.

The Smart City concept is based on advanced technological innovations to offer a new way of seeing urban reality, geared to environmental sustainability, energy efficiency and, ultimately, the well-being of city dwellers.

Why become Smart?

We have already experienced a similar technological evolution when the mobile phone changed from being a device that allows making phone calls and then sending messages to being a platform where you can install more and more apps for the most disparate services.

Our objective is to make the public lighting system evolve and turn it into a communication infrastructure that allows connectivity by third parties to offer additional services. These services, as with the mobile phone, will bring undeniable and manifold benefits.

For Administrations

- **Service Activation**
  The remote control infrastructure is designed to be able to connect different sensors to activate services to be managed independently or to be licensed to third parties, for example smart parking, smart metering, smart irrigation.
- **Territorial Management**
  The Algorab system allows managing both public lighting and other infrastructure-related services, thus giving administrations a useful and flexible tool for remote management of the territory.

For City Dwellers

- **Improved Liveability**
  An adequately lit city increases safety, and diversified additional services improve the quality of life.
- **Improved Efficiency**
  Services that can be activated on the intelligent lighting infrastructure save city dwellers time in order to be able to devote more energy to their interests.

For the Environment

- **Energy saving**
  Using a remote control system allows managing the lighting in an optimal way, designing profiles for switching on and off and dimming linked to actual needs. In addition, adaptive lighting sensors enable modulating the lighting independently according to the volume of motor car or pedestrian traffic.
- **Less Pollution**
  In addition to the effects of optimum lighting management, additional services also contribute to less pollution. Think for example of the reduced traffic resulting from a smart parking system or from punctual emptying of smart waste bins.


ONLY
Walgreens
DUANE reade
186 5th Avenue
West Side Highway
TRUCK ROUTE
LOCAL
EQUALIZER2
ONLY
BIKE LANE
LANE AHEAD

Smart Lighting

Algorab remote control systems, through the public lighting network, create a communication infrastructure that covers the city thoroughly. Thanks to this network it is possible to integrate several services for the benefit of city dwellers and the public administration.

Public luminaires will be able to communicate with motion, traffic or weather sensors, adjusting the lighting dynamically or adaptively as needed, as well as connecting with other sensors for additional services. This permits a better quality of life for city dwellers and consumption optimization.

Adaptive Road Lighting

Specific sensors can in real time communicate the road traffic conditions and the state of the road surface (for example dry or wet conditions) to the system, monitoring the pace of the vehicles and adjusting the lighting, maximizing energy savings while keeping the roads safe.

Fault Detection and Maintenance

The Algorab system turns out to be very useful for remote monitoring of single devices for maintenance purposes. Different types of network or single luminaire failure can be highlighted, without requiring on-site preventive inspections. In this way, it is possible to make an initial analysis and resolve issues from remote, intervening on site only when required.

Consumption Monitoring

The system records the operating states of each device, from counting the hours of operation, to energy consumption and to an accurate diagnosis of the power supply units. Abnormal consumption can also be detected.

Lighting Adjustment

The Algorab system enables managing lighting control flexibly and in relation to the most varied requirements of a Smart City. From simple adjustments to a calender that can be customized down to a single day in the year and the management of occasional events (concerts, rallies, etc.), the system guarantees perfect regulation of the systems with simplicity from a single luminaire to managing groups of streetlights.

Dynamic Lighting

Thanks to the integration of motion sensors it is possible to adjust the light intensity, adapting it to the number of people passing by. In the case of completely empty streets, it is possible, for example, to schedule significant dimming of the devices in order to minimize energy consumption. The illumination of a cycle path can also be dynamically adjusted according to the presence of people and cyclists.

Smart City

Algorab remote control system allows managing not only public lighting but also a diverse range of connected services.

Smart tracking

The system can, through various technologies, detect the presence and in some way the number of people or objects for both management and information purposes.

Smart bins

The bins located throughout the city, equipped with special sensors, can communicate their filling level to the central system. Data sent over the communication network can be processed to plan efficient and targeted collection routes.

Smart metering

It is possible to make remote readings of smart gas and water meters installed in the vicinity of public lighting systems. This reduces the cost of readings that, performed automatically and more frequently, no longer require the expensive intervention of an operator on site.

Smart environment

Sensors for monitoring air quality or noise pollution can provide detailed information on which to plan operational decisions regarding the city and its resources. The system also communicates with weather controllers that can provide information about weather conditions: temperature, humidity, wind speed and direction, and rainwater level.

Smart parking

Thanks to the connection with sensors connected to the lighting network, it is possible to check for the presence of free parking spaces. This information can be provided to the operator of a parking system, through web applications or apps, so to allow to reduce the time for searching for a parking place.

Smart irrigation

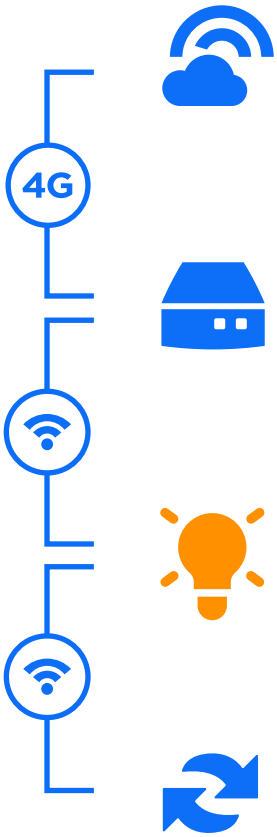
It is possible to improve water resource management in public irrigation systems by remotely controlling the opening and closing of sprinklers. Diversified irrigation scenarios can be automatically activated by controlling the systems based on time or also based on information from weather sensors.

Architecture

The architecture of a Wireless Sensor Network (WSN) with a mesh topology is structured in four layers. The first three are typical of a Smart Lighting system, while the fourth extends the functionality of a Smart City network.
Mesh, due to its speed and redundancy, is the most suitable for a WSN in a city.

Communication between these four layers is bidirectional:
- From the centre toward the periphery: when commands are sent both to the lighting devices (e.g. switching on, dimming, operating rules) and to any sensors (e.g. switching on an irrigation system)
- From the periphery toward the centre: when signals or messages are received both from the lighting devices (e.g. consumption detection, failure to switch on, malfunctioning of a luminaire) and from any sensors (e.g. parking space occupied, flooded underpass).

Communication between the various layers takes place
- Via a 4G cellular network or LAN between the SW platform and the gateways
- In narrow band wireless mode between the gateways and nodes and between the nodes and sensors



SW platform

The central management platform processes and stores the transmitted and received data. The SW can be installed on the managing company's servers or it can be in cloud, either with Algorab or third-party providers. The SW can interface via API with third-party systems and applications if necessary.

Gateways

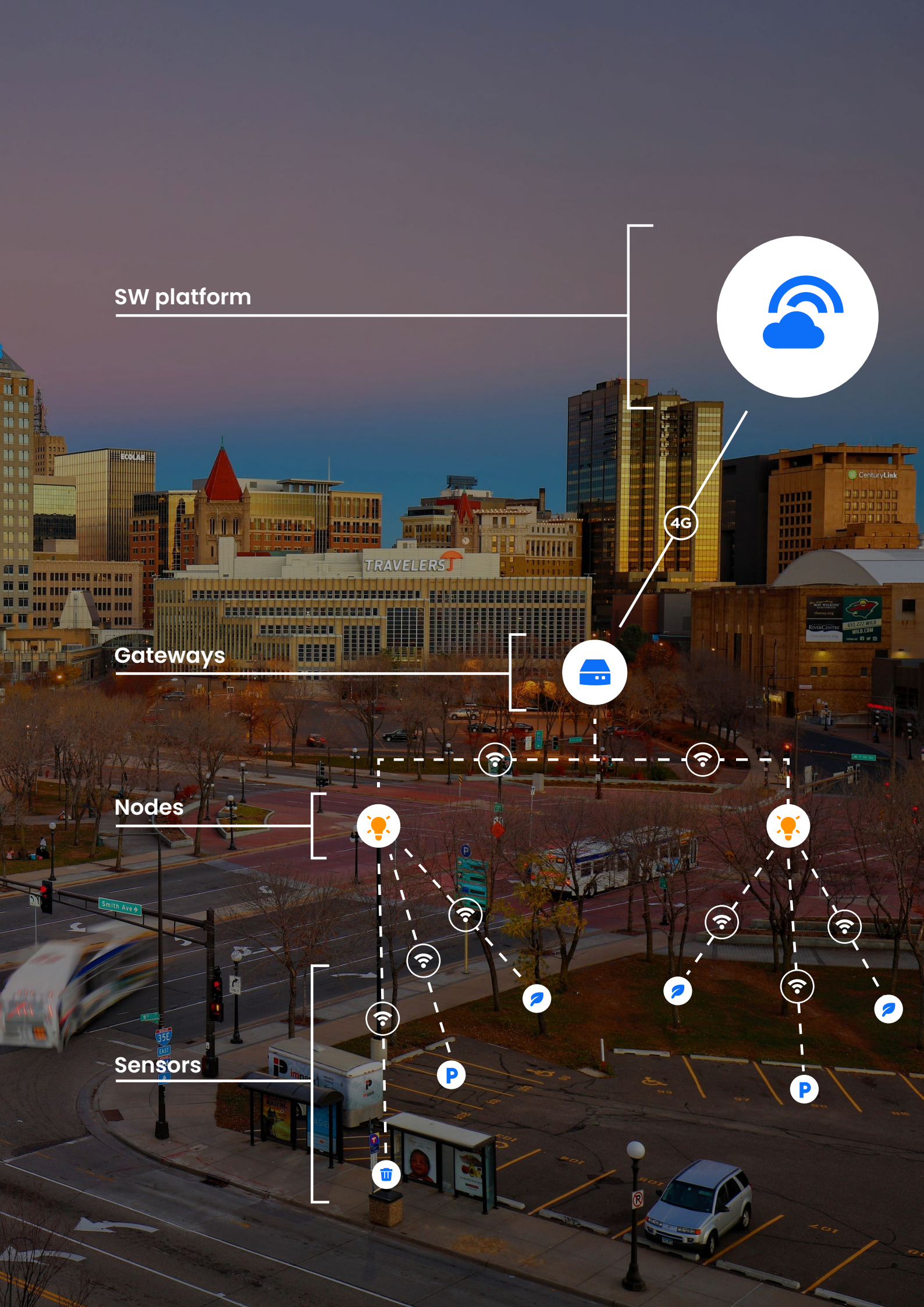
Gateways are generally installed in the electrical switchboards present on the territory to exploit the power supply line, even though they can be placed in external boxes, if powered. Moreover, components dedicated to controlling the switchboard can be installed for better management of the systems and electric lines.

Nodes

Nodes are installed on luminaires, internally or externally depending on the characteristics of the light fixtures and the design requirements. In special cases, for example high masts, they can be placed in special boxes which will then be provided with connections to the individual luminaires.

Sensors

Sensors are located on the territory according to their functions, paying attention that they have radio visibility with at least one node of the WSN.


SW platform
4G
Gateways
Nodes
Sensors
TRAVELERS
CenturyLink
Smith Ave

Nodes

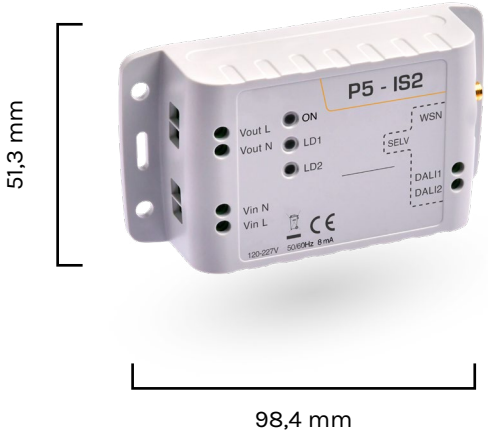
P5 series nodes are wireless point-to-point, multistandard and multiprotocol remote control devices, capable of implementing both mesh and "star" network architecture. These devices can be supplied either with a 2.4 GHz antenna or with a 868 MHz subgiga antenna (915 MHz where required). The devices support the major transmission standards and protocols, such as **IEEE 802.15.4, Bluetooth 5.0 and LoRaWAN**, and can also be equipped with a **Cat M1 LTE Modem**, with global certification. Using the powerful firmware installed, the devices can communicate even simultaneously over the two radio bands as well as implement a mesh and star topology at the same time.

The nodes have many other features:

- Stand-alone operation
- Astronomical clock
- Virtual midnight
- Over-the-Air (OTA) updating
- Compatibility with CAM profiles
- Data protection with AES 128bit encryption (can be extended to 256bit)
- Sensor option: luxmeter (except internal node) and accelerometer
- GPS option (except internal node)
- Power Meter option (except Zhaga node)

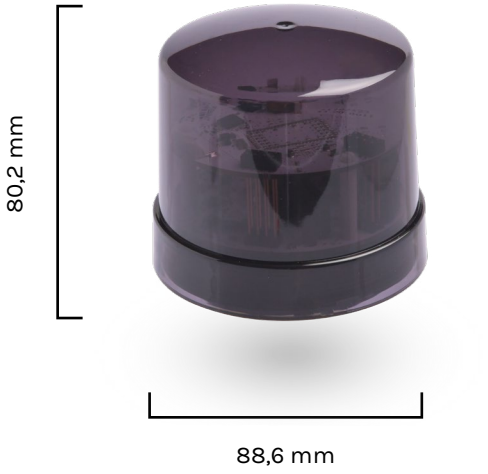
Zhaga

The P5-ZS2 device is located outside the luminaire, from which it receives a low voltage supply (24V DC) via a 4-pole connector (LUMAWISE Endurance S by Tyco Electronics). The P5ZS2 communicates with and controls the LED driver in the luminaire, through a bidirectional DALI connection. The P5-ZS2 device complies with the Zhaga standard ref. Book 18: "Outdoor connectivity interface for smart luminaires.



Internal

The P5-IS2 device is located inside the luminaire, in which it is physically inserted. The P5-IS2 communicates with and controls the LED driver in the luminaire, through a bidirectional DALI connection or with an analogue 1-10V signal, unidirectional in this case. The node has to be connected to an antenna, usually a low-profile antenna, which is mounted on the top or bottom of the luminaire for the best effectiveness.



NEMA

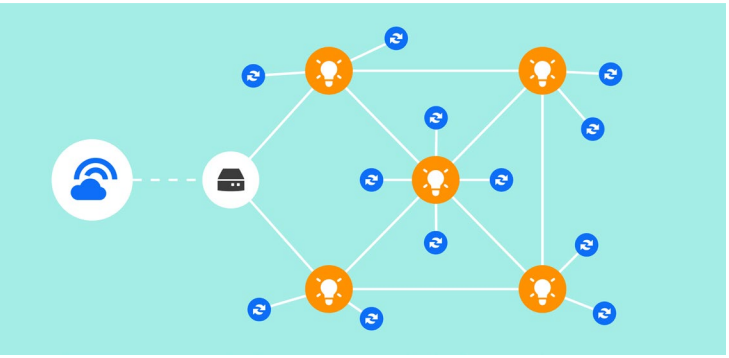
The P5-NS2 device is located outside the luminaire, from which it receives its power supply (220 V AC) via a 3+4-pole connector (NEMA SOCKET 7). The P5-NS2 communicates with and controls the LED driver in the luminaire, through a bidirectional DALI connection or with an analogue 1-10V signal, unidirectional in this case.

DualBand

The current wireless remote control systems operate, with different protocols, only on one of the free radio bands: usually 2.4GHz or 868 MHZ. Each of the two frequencies has advantages and disadvantages that must be evaluated according to the type of application.
Algorab, first among all manufacturers, is able to offer a remote control system that works simultaneously on both frequencies, thus making full use of all the advantages of both.

2.4 GHz

The 2.4 GHz connection, with mesh topology, is generally more suited to managing Smart Cities because it offers a capillary presence throughout the city and communications that allow the radio packets to take different routes to reach the nodes, gateways and SW platform.



+ PROS

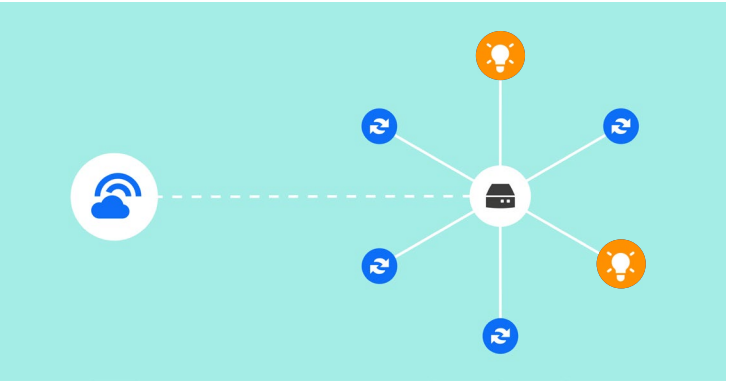
- High transmission rate (200 kbps)
- Wide bandwidth (5MHz)
- 16 channels that can be used, with channel switching capability from remote

— CONS

- Short coverage range (<80 m radio visibility)
- Possibility of interference

868 MHz

The 868 MHz connection is generally more suited to longer-range and less frequent communications, and is in fact privileged in star topology. In this case both the sensors and the nodes are considered end devices and communicate with the gateway, thus increasing the volume of data transmitted and the related traffic, reducing performance.



+ PROS

- Wide coverage range (even over 1 km without obstacles)
- Low network traffic
- Can be used in both star and mesh architecture

— CONS

- Only one usable channel, communication gets lost in the event of interference
- Low transmission speed
- Reduced bandwidth
- Duty cycle reduces the available transmission time

DualBand: Leader in Versatility

Algorab is the first, and so far the only, manufacturer to offer to the market a highly innovative product that allows effectively and efficiently implementing a communication infrastructure for the benefit of Smart Lighting and Smart City.

DualBand nodes have been developed with the aim of exploiting the benefits of each of the two frequencies to offer a product capable of giving excellent performance under all conditions of use. Algorab's unique DualBand technology is positioned at the top of the range in terms of reliability, flexibility and compatibility.

This innovation is part of the Algorab philosophy of offering flexible and open systems, so that the investments made today, also thanks to the possibility of Over-the-Air (OTA) updating, can be highly performing throughout the life of the systems.

Connectivity is the key to making Smart City real, and the DualBand node allows to significantly extend the capabilities of creating a connected city.

+ PROS

— Can use different standards and protocols both on the frequency of 2.4
— GHz (IEEE 802.15.4 and Bluetooth 5.0) and on the frequency of 868 MHz (IEEE 802.15.4 and LoRaWAN)
— Flexibility to implement a mesh and star topology in parallel, to meet the needs and requirements of the moment
— Eliminates the risk of external interference, being able to choose to route the communication over the free band
— Optimizes overall system performance by using the 2.4 GHz band for more frequent communications, typical of public lighting management, and the 868 MHz band for communications that are rarer, typical of widespread sensors
— Ability to interface and work in synergy with existing LoRaWAN networks

Gateway kit

The modules that make up our Gateways are identified under the abbreviation RIO (Remote Input Output). The various modules can be added, removed or replaced with great ease thanks to their special DIN bar coupling system. The terminals where the electrical signals are connected are extractable, so replacing a module does not involve re-wiring the connecting cables.

A gateway can be configured to perform 3 main functions:

- **Gateway function:** communicating on the one hand with the nodes of a point-to-point remote control and on the other hand with the SW platform.
- **Electrical panel control function**: acquiring useful information on the state of the panel, such as consumption, switches, and transmitting it to the SW platform.
- **Electrical panel automation function**: performing even complex automations such as controlling the contactors of the electric lines or resetting the switches.

Basic modules

RIO-ETH

The RIO-ETH device is the essential gateway module and has the main function of connecting the system to the SW platform via 4G, Ethernet or fibre-optic networks. RIO-ETH is a small, powerful Linux-based computer that can handle complex automations, and is designed to support applications of any kind and to work even in environments with very severe physical conditions. It has an antenna connector, a Mini USB connector, a USB connector, an Ethernet port, and a SIM card slot.

RIO-485

The RIO-485 module is used as an alternative to the RIO-ETH module to implement a simple remote control of an electrical panel. It has a 2G modem for connecting to the SW platform and an RS-485 interface for connecting a power meter.

Additional modules

RIO-CRD

The RIO-CRDS2 coordinator is the module that communicates with the nodes of a Wireless Sensor Network (WSN). The module has its own firmware that governs its operation, mainly data coding, encryption/de-encryption of the information transmitted/received by the nodes, node FW updating and of course physically transmitting data through the radio transceiver.
The coordinator communicates with the gateway via an RS-485 fieldbus, also remotely controlled.
For dual-band systems, a specific option is offered which allows communication over both frequencies.

RIO-IOA

The RIO-IOA mixed interface module allows connecting/acquiring up to 5 digital inputs (on/off), connecting/controlling up to 3 digital outputs (by relay) and connecting/acquiring a 0-4/20 mA current analogue input. This module allows many functions to be carried out in a single structure, such as simultaneously remotely controlling the reading of a temperature or brightness sensor, thanks to the analogue input, reading the state of a panel thanks to the digital input and switching a line on or off thanks to the relay output. For this reason, although it is an add-on module, it is recommended in all the configurations.

RIO-8IN and RIO-5OUT

The RIO-8IN device enables connecting/acquiring up to 8 digital inputs (on/off). It is used if basic control functions are required, such as reading or monitoring the state of a panel.
The RIO-5OUT device allows connecting/controlling up to 5 digital outputs (on/off) via relay contacts. It is used if basic control functions defined as 0-1 (on, off) are required, such as switching a line on and off.
These modules are generally used to integrate an RIO-IOA if additional inputs or outputs are required.

Gateway kit

In a Smart City system, it is preferred to have nodes on all city streetlights. In this case, approximately one gateway is installed every 100 nodes. A more in-depth evaluation is recommended, however, as this number may vary depending on the characteristics of the system, such as the location of the nodes on the territory, whether it is SingleBand or DualBand, whether the topology is mesh or star. The gateway kit should be defined according to the specific needs of each individual customer/system. However, the basic kits for the three main applications are described here, should they be implemented separately. Devices are not to be duplicated if they are deployed jointly. Specific types of system may require special options or additional elements, in this case intervention by Algorab is recommended.

Gateway kit for point-to-point remote control

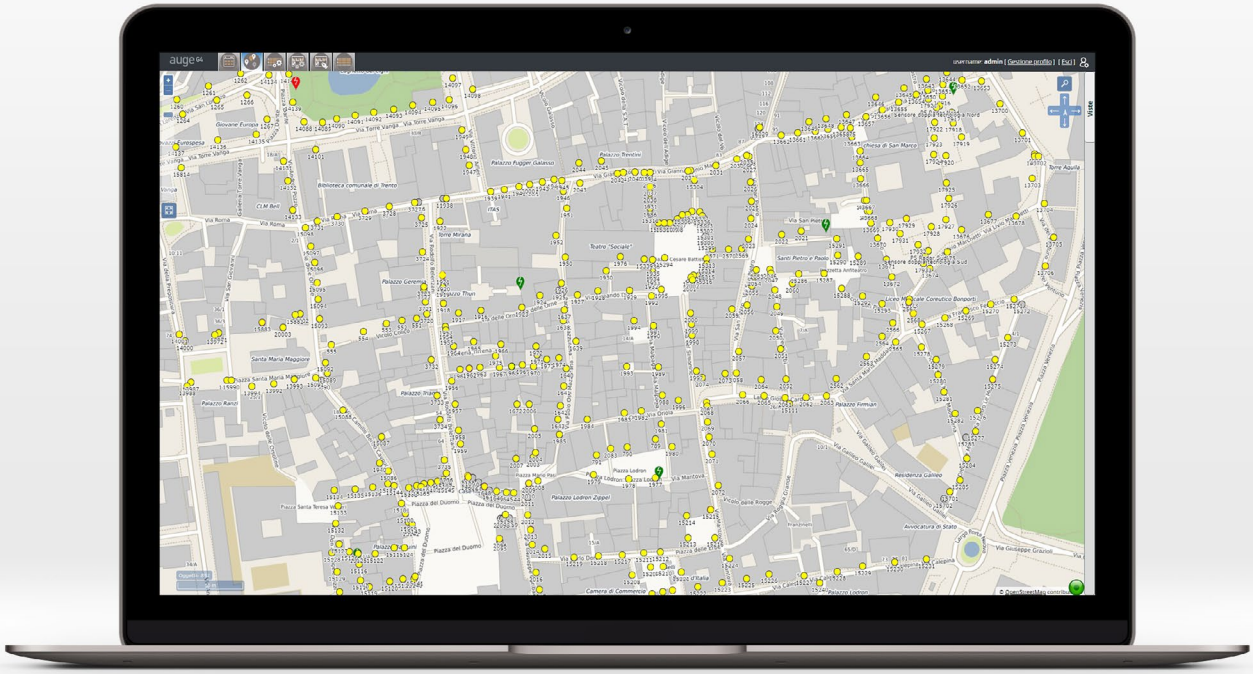
- **RIO-ETH:** to communicate with the SW platform
- **RIO-CRDS2:** to communicate with the nodes
- **Power supply unit:** to transform the power supply at 220 V AC into 24 V DC
- **Antennas:** 1 for the gateway and 1 for the coordinator (2 if DualBand), each with its own bracket and cable

Gateway kit for electrical panel remote control

- **RIO-ETH/RIO-485:** to communicate with the SW platform and to manage panel control
- **Power supply unit:** to transform the power supply at 220 V AC into 24 V DC
- **Antennas:** 1 for the gateway, with its bracket and cable
- **RIO-IOA:** for panel readings and checks
- **Power meter:** for reading the network's main electrical parameters
- **RIO-8IN:** *(optional)* for additional panel checks
- **Homopolar toroid:** *(optional)* for network electrical leakage detection

Gateway kit for electrical panel automation

- **RIO-ETH:** to communicate with the SW platform and to manage the automation of the panel
- **Power supply unit:** to transform the power supply at 220 V AC into 24 V DC
- **Antennas:** 1 for the gateway, with its bracket and cable
- **RIO-IOA:** to manage panel automation
- **RIO-5OUT:** *(optional)* for additional panel automations



Auge-G4

Auge-G4 is the central SW platform that allows to manage the Smart Lighting and Smart City system, with numerous features and functions.

Groups setting and dimming profiles

Luminaires can be assigned to groups depending on their application. Luminaires on a main road can have a different dimming profile to those on secondary roads. Profiles can be programmed according to daily, weekly, monthly, yearly or even customized schedules. For example, in the case of occasional events, the adjustment levels can be changed quickly according to the needs of the moment. Switching on the system can follow the logic of the built-in astronomical clock or an external control.

System Data Management

The software allows storing specific information and documents for each managed system resource, comprising product characteristics, technical manuals, electrical diagrams, and certificates of conformity.

PELL Compatibility

Public Energy Living Lab (PELL) is an Italian management system developed by ENEA to monitor and make public lighting consumption transparent. The objective is to ensure the standardized collection of strategic information on the Public Lighting infrastructure with a view to the interoperability of operating systems and data sharing between the parties concerned.
The Auge-G4 SW has fully implemented the PELL specifications and is therefore fully compliant with the exchange of information.

Alerts and maintenance

The system allows managing the maintenance of the equipment and scheduling periodic interventions. Alerts can be sent via email to specific recipients. An interactive calendar also allows organizing the activities of multiple maintenance teams at the same time and keeping a log of the work carried out by compiling reports.

Georeferenced Graphic Display

The various system components (nodes, gateways, sensors) are represented on the map thanks to their precise geolocalization, which allows to overview the system for a better operation. The view is graphed with specific colours and icons to identify different products and states of activity.

Ticketing Module

The platform provides a module dedicated to managing support tickets and work in the field. This module allows describing the type of work required, defining its level of urgency, scheduling it, keeping track of its progress and viewing both a single ticket and a set of jobs carried out.

Data Security

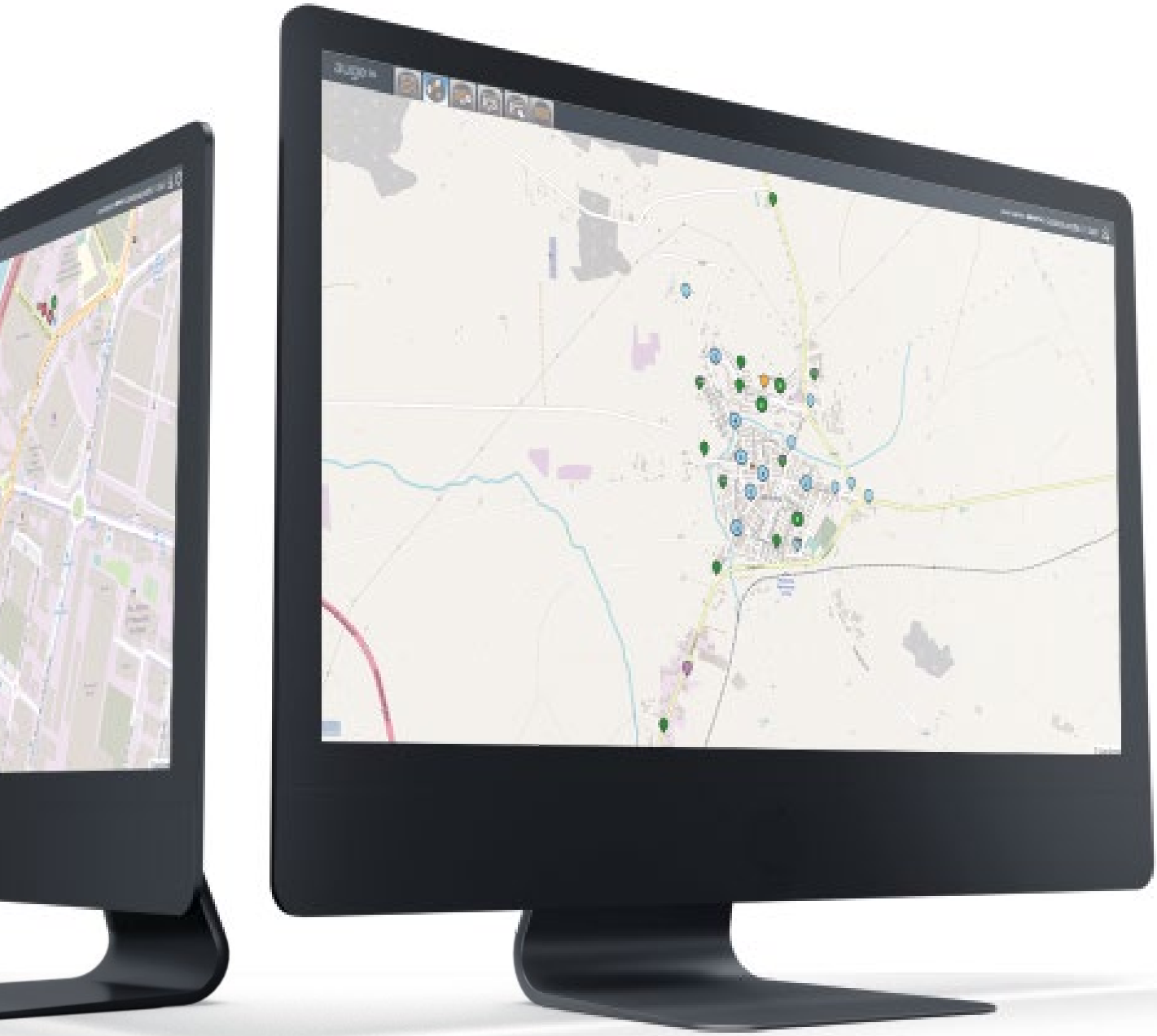
Data transmission between the Wireless Sensor Network and the control software is protected at multiple levels by means of message encryption and secure virtual networks establishment. In case of cloud installation, data is regularly saved via incremental backup copies as required by the customer.

Software Installation Flexibility

The Auge-G4 software is available in two options: cloud or server. With cloud installation, the customer connects to an external server, without requiring any particular initial investment. Installation on the customer's server, instead, enables keeping all the data in the company's database.

Data Analysis and Reporting

All data stored by the software can be analysed on multiple levels, with time level and geo-localized filters. The selected data can be displayed in graphical form or exported to excel or pdf for different uses.



Sensoristics

Adaptive lighting is an important element in a modern public lighting system, since it allows switching on, switching off and dimming the luminaires to be adjusted according to the needs of the moment, automatically or scheduled.

PIR Motion Sensor

TE Connectivity's LUMAwise Motion sensor is designed for street lighting. It has an extensive area of detection for better dimming management, with greater energy savings and safety.
The sensor is part of the Zhaga-D4i System, the new standard for Smart Cities. Easily installed under the luminaire body by means of a Zhaga Book 18 connector, it can be connected to the Algorab nodes for remote control and for managing groups of luminaires or, alternatively, it can work independently and control a single luminaire.

TAI/ FAI

A single camera allows traffic counting and luminance measurement according to the UNI 11248 standard. In particular, with TAI the lighting is regulated solely on the basis of the road traffic, while with FAI the luminance of the road surface and weather conditions are also considered.
The CPU is equipped with a processing unit and a WSN radio coordinator module capable of wirelessly transmitting the dimming levels to the paired streetlights. Through the WSN the data arrives at the Algorab gateways and from here, via mobile IP/ LAN, to the SW platform.
The camera also features a built-in WiFi radio unit to enable on-site configuration of video processing and an LTE modem with a SIM slot to enable direct connection with the control centre to send video frames over dedicated broadband.

The Algorab system has been developed in a flexible and open way, in order to be able to communicate with its own and third-party sensors, as long as these follow the numerous standards that the system itself is able to handle. Here are some examples of the sensors offered.

P5-Flooding

This sensor allows to measure the water level to prevent the consequences of flooding (e.g. in underpasses). The information is conveyed through the mesh network.

P5-PM10

The P5-PM10 device is capable of measuring the amount of particulate particles in the air and can be an indicator of pollution. Other measurements such as NO2, NO CO2 are also available as an alternative.

P5-Noise

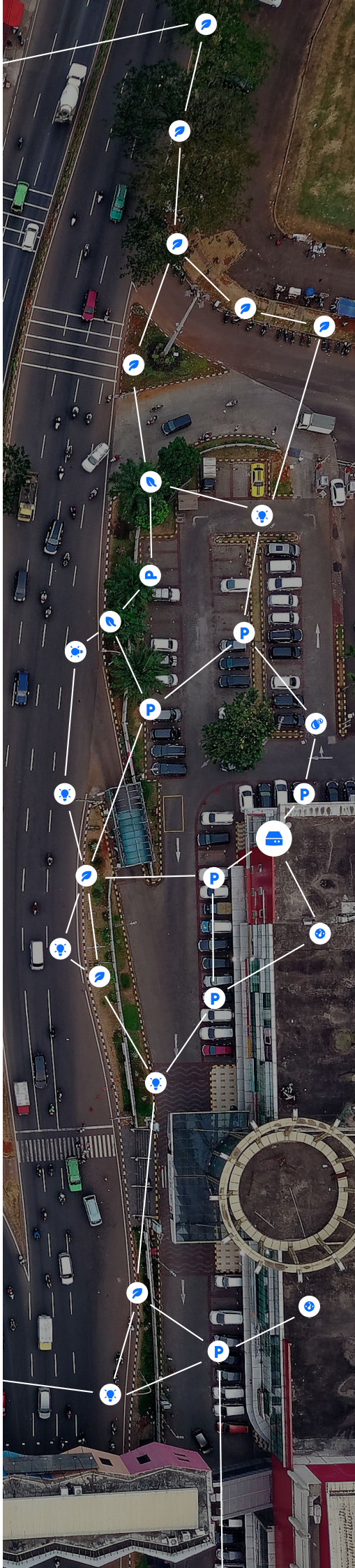
P5-Noise can measure noise levels in order to control noise pollution in a given area. It interfaces directly with the public lighting mesh network.

P5-TAG

P5-TAG enables locating a person or a vehicle by indicating the streetlight nearest to the tag.

Weather Station

The weather station enables measuring the main atmospheric parameters. The sensor is powered at 230 V AC and is detected by the mesh network created by the public lighting luminaires.



Tools

QR-CENSUS

QR-CENSUS is an App developed to scan, or possibly manually enter, QR codes relating to nodes installed in the field. Additional information about the luminaire body can be added to this data.

The main purpose of the application is to survey the devices and detect their installation point, saving their GPS coordinates: the archive of the data collected in this way will be sent to the Auge-G4 platform for their configuration.

P5-TOOL

P5-TOOL is a PC Windows application that enables testing, configuring and parametrizing the P5 nodes installed in the field. The tool consists of software and a USB stick with a built-in antenna that can communicate via the 2.4GHz network directly with the nodes.

This tool is extremely useful for installers and maintenance engineers as it allows for example checking the operation of a node, changing the dimming profiles, sending commands locally to single nodes or groups of nodes, setting a default operation, adjusting the behaviour of the nodes in the presence of a device with motion detection, changing the transmission channel in the case of interference and much more besides.

The P5-TOOL is also a valid support for communicating with nodes in the field in the case, for various reasons, a gateway is not working or even the Auge-G4 platform is temporarily out of operation.

APP-SCENARI

The new APP-Scenari is designed for Android smartphones and enables to use the Bluetooth 5.0 connection on all S2-series P5 nodes to implement some of the P5-TOOL features in a much more compact and user-friendly format. This is the ideal tool for installers to perform on-site functional tests, or for system managers to set rules or scenarios quickly.

APP-Scenari is ideal for installations with just a few nodes (e.g. a car park, a small park) where it is sufficient to set simple on/off and dimming scenarios and reporting is not necessary. In these cases, having APP-Scenari, it is possible to avoid installing a gateway and using the Auge-G4 platform.

Services

Customizing Auge-G4 Software

The Auge-G4 SW platform is already complete with commands, rules, reporting, graphical and geographical representations and everything else needed for routine system management. However, there can be cases where customers may still need specific features. This is why Algorab offers the ability to customize the SW to meet customer needs.

In particular, Auge-G4 can be interfaced with other customer platforms via API, thus ensuring complete operation with any legacy systems.

Training

Algorab provides training courses both to support the HW installation phase and to explain the features and use of the Auge-G4 SW platform. It is also possible to define specific training modules for customer needs. The courses can be carried out both on-line and in attendance, at Algorab or on the customer's premises. Supporting documentation is provided with the course.

The courses, although not mandatory, are strongly recommended to avoid any issues that may arise during installation and to allow fully exploiting the potential of the Auge-G4 SW.

Service and Support

Algorab technicians are at disposal of customers for support both in the installation and set-up phase and during the life of the system. The interventions can be carried out both remotely and with assistance on site.

Service and support agreements can be defined with varying duration and different levels of SLA depending on the customer's needs.

Case study

Livorno

Livorno is the third largest city in Tuscany, by population, and is one of the most important Italian ports both as a commercial port and as a tourist port. It has been one of the first Italian cities that, thanks to the support of Enea, the National Agency for New Technologies and Energy and Sustainable Development, embarked on the road to Smart modernization of public lighting. With this aim, in addition to replacing existing lamps with new LED lamps, it decided to equip all the luminaires with a remote control node so that they would become smart poles. The whole project was led by a major ESCO.

Briefing

Replace all city lamps with LED lamps, install remote control and remote management systems on each luminaire, implement the equipment with sensors capable of capturing data on traffic flows, parking availability and polluting emissions into the atmosphere. Create a network of the entire system using the new PELL (Public Energy Living Lab) platform, developed by Enea. This was the objective of the municipality of Livorno.

Solution

To meet the objective of having a Smart City that communicates throughout the whole city, a mesh topology was structured using the frequency at 2.4 GHz, ideal for such a large number of luminaires and for the paired sensors.
To control the luminaires it has been used the P5-IS2 internal node, placed in the lighting fixtures directly by their manufacturer, with a low profile antenna, which allowed to install a node also in the artistic lamps that have been kept.
The gateway kit consists of the RIO-ETH module, connected via 4G to the SW platform, and RIO-CRD for communication with the luminaires. To meet the customer's requirements, an RIO-IOA for remote panel automation, a 3-phase power meter to measure the line power/energy and 3 amperometric transformers to detect the line current were also added.
As far as sensoristics is concerned, sensors for adaptive lighting were installed, with FAI cameras for managing the lighting of specific sections of street and sensors for detecting people in the vicinity of pedestrian crossings. The Auge-G4 SW was offered to manage the remote control system.
At the specific request of the ESCO, the SW was interfaced via API to the management platform already in use.

57 Sensors

193 Gateways

16.075 Light points

For the installation phase, two useful tools were offered, the QR-Census App and the P5-Tool SW, which enable the correct identification of the installed nodes and the maintenance on site by the operator. Lastly, adequate training was provided, both on site and remotely, for the installation and use of the Auge SW. Throughout this phase our Technical Office Department offered qualified support to the customer for the correct installation of the system.

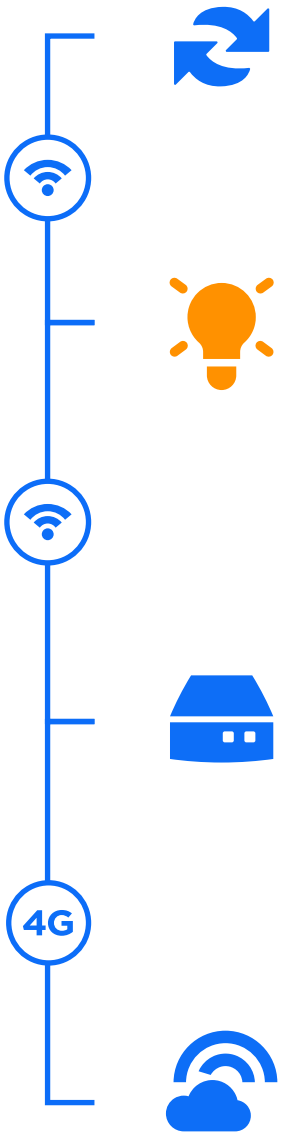

Smart
Tunnel
03

IoT technologies can be applied effectively even in particular environments where maximum safety is required.

Tunnels are very specific environments since constant use of the lighting makes them primary objectives of energy efficiency, difficult access requires constant control for verifying the correct functioning of the luminaires and related maintenance, and their operational criticality makes them subject to stringent safety regulations.
In particular, the main objective is to avoid the light "shock" that is created with the difference in brightness between the outside and inside of the tunnel, both when entering and when exiting.
The Smart Tunnel system is therefore born as a result of these strict requirements to allow effective management and maintenance of such a complex environment.

Architecture

The architecture of a Smart Tunnel system is always based on the 4 components already presented, although in this case the sensors communicate directly with the gateway. The management logic of the luminaires installed in the tunnel is determined by default and loaded on the gateway, or it can alternatively reside on the tunnel managing company's PLC. The SW platform, when required, collects data from the sensors and luminaires via gateways.
For the distances involved and for the types of sensors used, the coordinators can be remotely controlled and/or some communication can take place via cable.



Sensors

The luminance sensors are connected via RS-485 to a dedicated box that contains a coordinator with the function of a converter, which communicates with the gateway wirelessly. Any other sensors, such as a weather station, can be connected to the remote control network wirelessly (WSN) or by wireline (4-20 mA or RS-485).

Nodes

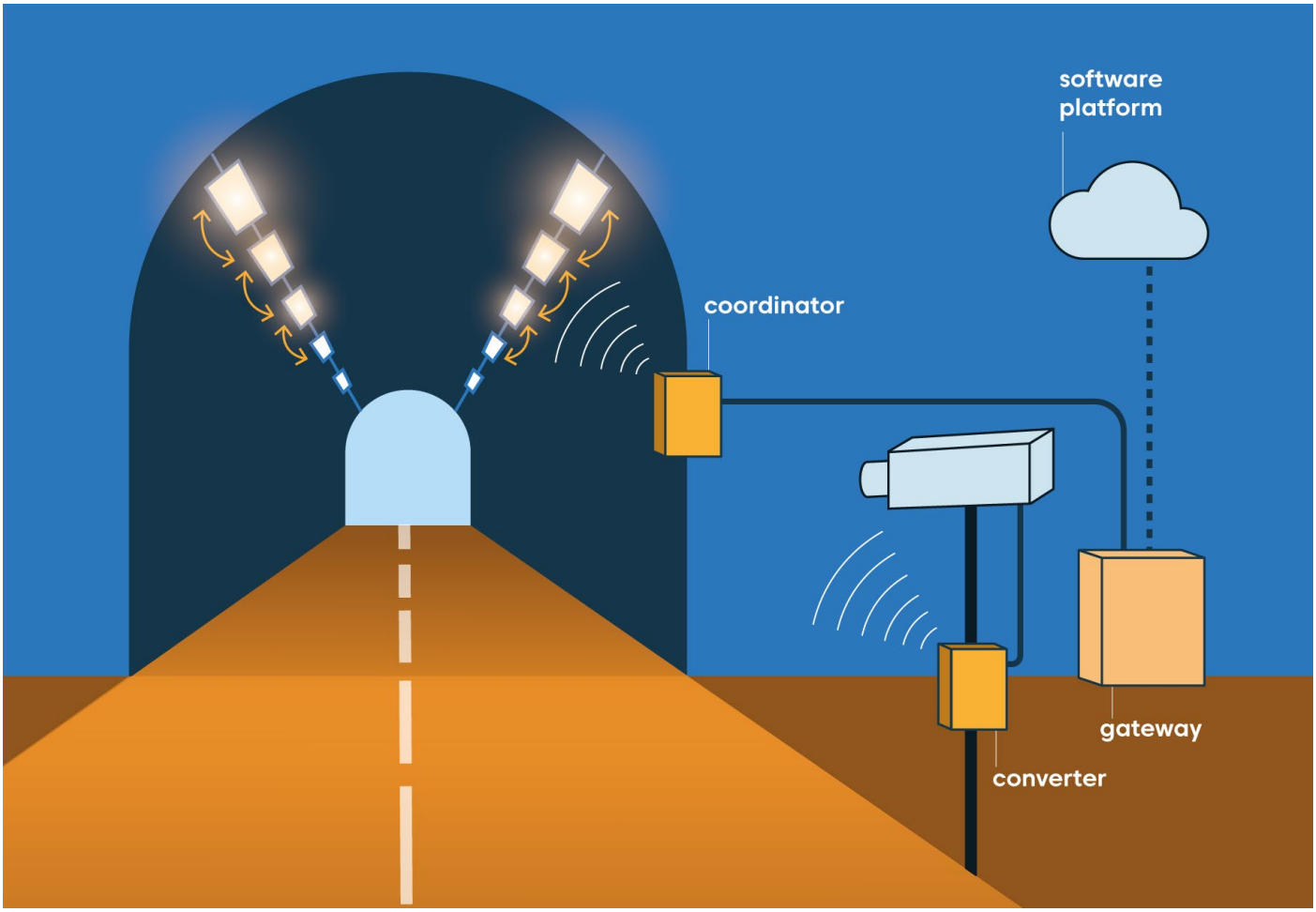
The remote control nodes are mainly located on the supporting lights, whose brightness is regulated according to the ambient conditions detected by the luminance probe. Internal nodes are often used in tunnels with an adhesive antenna always placed inside the luminaire body. In recent cases, nodes with a Zhaga connector with a diameter of 40mm have also been used, thanks to their small size, which greatly facilitate maintenance.

Gateways

The gateway is usually housed in control panels near the tunnel entrance and can communicate with the SW platform by connecting to the Internet via an Ethernet connection or in 4G mode.
The coordinator is usually remote in a box at the tunnel entrance, so that it can have radio visibility both with nodes inside the tunnel and with the luminance probe.

SW platform

The Auge-G4 management platform receives, processes and displays the operating data of the luminaires in the tunnel, indicating any malfunctioning of the luminaires themselves. The data are displayed on specific synoptic displays and in a historical perspective.



Luminance probe

The probe is designed for the specific application in road and motorway tunnels. The technology is based on using a photodiode and its filter, specially designed for reading luminance (Cd/m2) as per the requirements of the UNI 11095 standard. According to current regulations, the probe must be positioned at a well-defined reference distance, so that it is not affected by the vehicles and points toward the centre of the tunnel entrance section.

Case study

Mecca

Mecca is the quintessential holy city of the Muslim creed. It contains the largest Mosque in the world and is an extremely important destination for religious tourism. The project in question was aimed at modernizing the lighting systems in tunnels in order to ensure an effective service and safety for a large number of pilgrims.
The project was realized in cooperation with a leading Italian producer of lighting fixtures.

Briefing

The customer's request was to install remote-controlled lighting systems in 36 arches (18 tunnels). 15 tunnels are for vehicle transit and the other 3 are for pedestrian traffic.

Solution

The internal node P5-IS2 with a 2.4 GHz connection was used to control the luminaires. Approximately 10,000 internal nodes were installed.
The gateway kit consists of an RIO-ETH module, connected to the SW platform via a 4G Internet connection, and an RIO-CRD coordinator module, remote in a separate box, to communicate with the luminaires in the tunnel.
For each arch a luminance probe was installed to control the dimming of the supporting lights at the entrance to the tunnel. Each sensor is connected to an analogue-to-digital converter, which in turn is connected to the coordinator module by cable.
The dimming of the permanent lights located in the body of the tunnel and those located at the exit is instead managed by the astronomical clock SW functionality installed on the RIO-ETH.
The installation phase was managed by a local company, while Algorab gave remote support both by providing specific training and by assisting local technicians in the phases of installation, node surveying, system node configuration and sensor calibration to optimize the dimming profiles.

18 Tunnels

36 Gateways

10.000 Light points

Smart Building

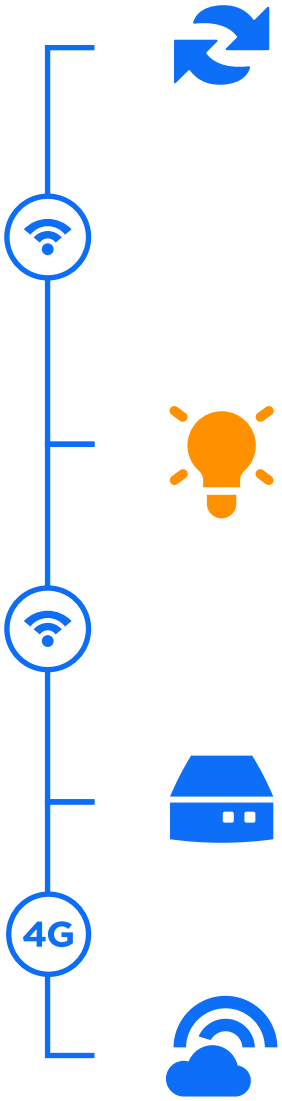
04

According to the definition of the Energy & Strategy Group of the Polytechnic University of Milan, a Smart Building is a building whose systems are managed in an intelligent and automated way, through a supervisory control infrastructure, to optimize the energy consumption, comfort and safety of the occupants, ensuring integration with the electrical system.

Algorab has applied its skills to intervene in areas where the size of the environments, the pre-existence of electrical and thermal systems and the logistic characteristics make wireless technology particularly effective and efficient, not having to make cable connections that would be invasive and expensive.
Several systems have been installed in public buildings (schools and offices), commercial buildings (supermarkets, offices) and industrial buildings (production sites, sheds, laboratories).
The system is designed specifically for each customer. In some cases, sensors are installed to measure the main parameters (presence, brightness and temperature) which, via our nodes, transmit the information to the central system for lighting and/or heating management. In other cases, the system is configured to send alert commands, such as opening doors or windows, malfunctioning of systems, and exceeding predefined thresholds.
Within the same complex, moreover, the system allows remotely applying diversified rules of operation according to the areas. Think of an industrial complex where there are production areas, offices and also illuminated outdoor areas, with well differentiated characteristics and needs.

Architecture

The architecture of a smart building system replicates the classical 4-layer architecture with the SW platform which, through the gateways, communicates with the nodes, which in turn collect the signals sent by the various sensors installed. In the indoor environment, in addition to the IEEE 802.15.4 standard, particular wireless protocols are used that meet specific needs such as EnOcean. The system, if necessary, can however also interface with systems not in wireless mode, through Modbus or PLC.



Sensors

The sensors can be flexibly distributed in various environments, having a wireless connection and therefore not requiring wiring. Depending on the type of building (office, commercial, industrial), various sensors can be installed: door or window opening/closing, ambient temperature or machinery for tracking (tag) material. Actuators can also be installed, which, on the basis of rules set by the system, carry out particular operations, such as switching on fan convectors or air conditioners.

Nodes

P5 nodes for an indoor wireless network are based on the same technology and logics previously described. In particular, the indoor version has a built-in motion sensor (PIR) and a luxmeter. In normal-size rooms it is usually sufficient to place a node on the ceiling in the middle of each room, so that it can detect the presence of people and the level of brightness.

Gateways

Gateways communicate wirelessly with the nodes located in the various rooms. Their number depends on the characteristics of the building, but usually one gateway per floor is sufficient. In turn, the gateways can communicate with the server over the LAN, if present, or also M2M with a 4G SIM card.

SW platform

The Auge-G4 management platform manages, processes, stores and displays data received or sent by the remote control system. For indoor systems, specific synoptic displays must be developed to display the specific characteristics of the remote-controlled systems and rooms.

sinottico di un punto vendita

P5-TWT

Wireless ambient temperature and humidity sensor

P5-LVL

WSN device for controlling a luminaire equipped with a PIR motion sensor and a luxmeter. IEEE 802.15.4 2.4 GHz communication. EnOcean Bluetooth and 868 MHz communication interface.

P5-IOV

Wireless sensor for door and window open/ closed detection

P5-REED

Wireless device for operating convector heaters (fan convectors/fancoils)

Case study

Public Company

The customer is a public company owned by the Province and more than 50 Municipalities in Piedmont. The company manages all the buildings of the Province and of some Municipalities with the aim of identifying solutions to achieve an efficient reduction in energy expenditure. In particular, it provides heating services, fuel supply, management of technological systems and more generally it deals with public lighting and building automation.

Briefing

The customer had a project for the energy redevelopment of 14 public buildings, including the Palazzo of the Province and 13 school complexes, for a total of several hundred rooms. The project concerned both the lighting system, changing the lighting fixtures to LED technology, and the heating system, with modifications to the central heating plants.
Within the project, particular importance was given to the installation of an automatic attendance detection system that allowed modulating both the lighting and heating with a view to energy savings. Moreover, a remote control system was required, allowing the parameters of these systems to be managed remotely, consumption to be measured so as to have up-to-date statistics and to monitor the operation of the systems in the field.
The project was completed in cooperation with a major ESCO.

Solution

The heart of the system comprises P5-LVL nodes, which, thanks to the presence of a PIR sensor, allow detecting the presence of people inside a room. The nodes, connected to the electrical network by means of a Zhaga receptacle and related power supply unit, have been located on the ceiling or, in cases of particular rooms with architectural constraints, on the wall. In rooms of normal size one node, properly placed, was sufficient while in larger rooms, such as corridors or gyms, more nodes were placed. In this case, the nodes of a room are grouped into a logical unit.
The P5-LVL nodes themselves, by means of the built-in luxmeter, are able to detect whether the level of brightness in the room is lower than a certain setpoint and, if they detect the presence of persons, send a power-on command to the lights via the DALI bus.
The P5-TWT temperature/humidity sensors were then installed, which wirelessly communicate the information to the P5-LVL node. If the temperature is below a given setpoint, and there are people present, the same P5-LVL node sends wireless

1.264 Light points

675 Sensors

>700 Remotely controlled rooms

commands to the P5-IOV sensors installed in the fan convectors via the 2.4GHz IEEE 802.15.4 standard. In the rooms with radiators, third-party wireless valves have been installed, which are again controlled by the P5-LVL node but in this case using the EnOcean 868MHz protocol.
The data collected by the P5-LVL is then sent via the IEEE 802.15.4 standard to the RIO-ETH gateways, located one per floor. In turn, the gateways of a single building are connected via Ethernet to a router that communicates via a cellular connection with the Auge-G4 SW platform installed on a server of the customer.
The SW platform allows the user to remotely define temperature and brightness setpoints for each remote controlled room, as well as send any other operating parameters. On the other hand, the platform collects the data measured, which then feed the various statistics and reports on consumption and operation. The platform is also equipped with a control module that detects any malfunctioning of the main components, such as boiler pumps or nodes. In order to give more precise information, specific synoptic displays have been developed for all the floors of the different buildings with the location of the lights, pumps, fan convectors and other relevant components highlighted in order to be able to access each component's specific data.

Why Algorab

05

30 years of experience at the service of our customers.

Algorab has always been at the cutting edge of wireless technology application in many areas, even before anyone talked about IoT or Smart Systems.

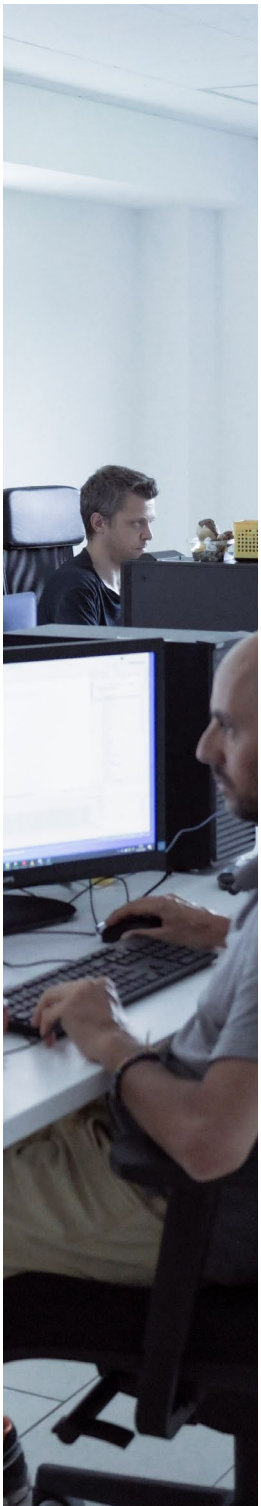
We have worked in very diverse areas along this path, in addition to those already presented in this document. For example, in the broadcasting sector, remotely controlling thousands of radio television transmission devices throughout the nation; in the railway sector, where we have developed and implemented systems to support the equipment at the service of railway lines: service order management, telemetry and maintenance, smart displays for travellers; in the infrastructure sector, where our products have been installed on high-voltage power supply lines and pylons or in aqueducts to monitor events; in the retail sector, where systems have been installed to remotely control numerous systems in supermarkets.

Our diversified experience in all these sectors has allowed us to build a vast and thorough knowledge base, which we are ready and happy to bring to the benefit of our customers.

Our desire to go further never stops and every day we work to bring innovation to the world of remote control.

Organization

The organization of the company is of fundamental importance in order to better complete the challenges that the market sets for us. In this section we illustrate the logical order of work in managing a project, with a brief description to help you understand the roles of our teams specifically.



1 Hardware Design & Embedded Firmware

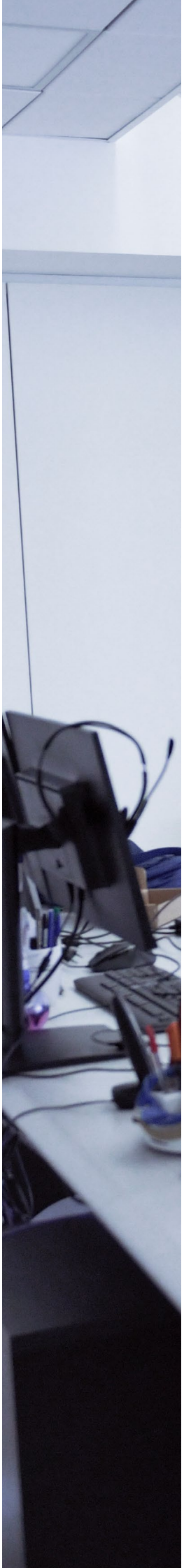
Algorab products are conceived and designed entirely within the company: from the CAD of electronic diagrams to the prototyping of microcontroller boards to the specific development of firmware. This department also supports the customer in sharing ideas for innovation and improvement.

2 Software Design

The remote control SW platform has been designed and developed internally. It is constantly updated and improved also on the basis of customer input, for which specific customizations are made if required. For more flexible management, apps are also created for different operational features.

3 Sales and Marketing

Our specialists in drafting offers are engineers specialized in analysing the customer's requests, evaluating the most suitable product alternatives and suggesting a solution that combines effectiveness and efficiency for a long term result.



4 Technical Office

In order to function properly, remote control systems need a successfully completed professional installation. This is why our technical office is available for support during the go-live phase of projects, for a result that will satisfy the customer.

5 Purchases, Production and Quality Control

Internal design allows us to be flexible in finding the most performing and reliable components on the market. Production is entrusted to loyal partners and is controlled step by step. Lastly, we have created quality control processes to ensure excellent performance.

6 Support and IT

Even after the commissioning of a system, if the customer so requests, we can offer a support service based on customized SLAs, especially in settings where reliability and functionality are critical.

7 Administration and Finance

The administration and finance department follows the various paperwork along the path of an order, from deliveries to order confirmations, from payments to any other administrative needs to ensure an excellent service for the customer.

Certifications

Company Certifications

Algorab has always been particularly attentive to the issue of quality, having begun over 20 years ago receiving ISO 9001 quality certification. Today this attention has consolidated in the Integrated Management System which in a single body includes the certifications of quality, environment and safety at work.

In addition to quality certifications, Algorab has adopted the Organizational and Management Model pursuant to Italian Legislative Decree 231/2001 and has drawn up a Code of Ethics.

It is also registered in the special section of the Companies Register as an Innovative SME, meeting all three of its requirements.

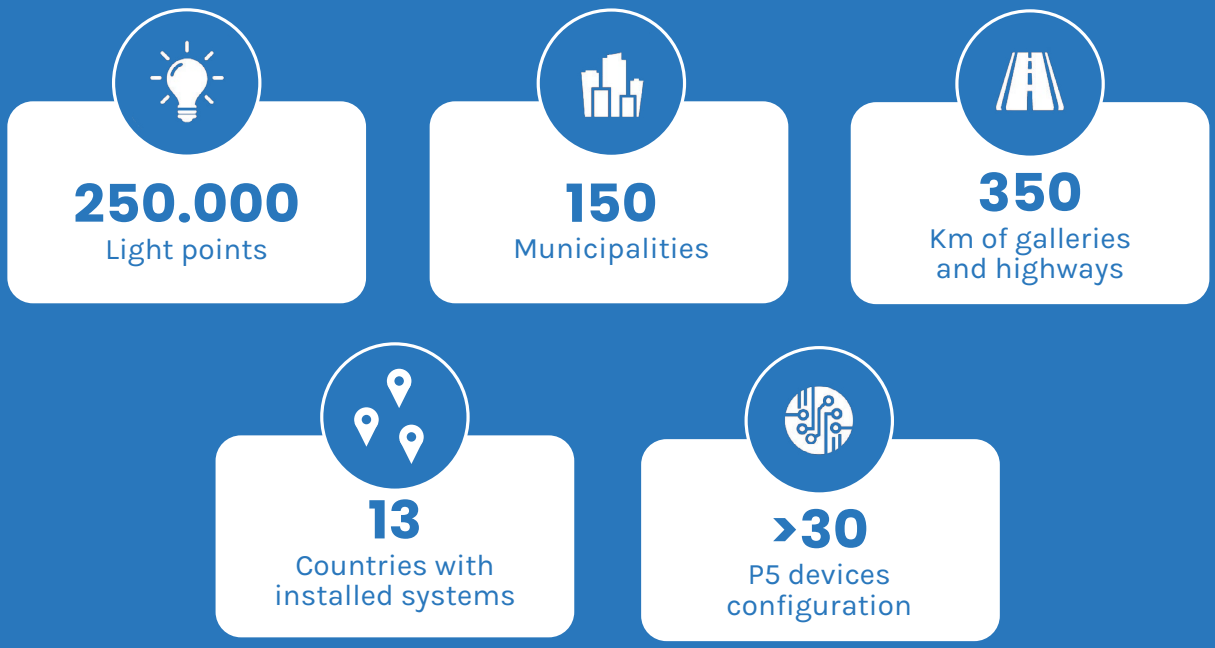
Product Certifications

In addition to the mandatory CE certification, Algorab has received the voluntary certification for its products from ENEC, a third party certifying compliance with a number of harmonized electrical safety standards (EN).

Algorab is also the first Italian company to have certified remote control products in accordance with the innovative global D4i standard of the DALI Alliance, created to promote widespread use of IoT connectivity in the lighting sector.

Algorab is a member of the TALQ Consortium, which has defined a globally accepted Smart City protocol to configure, control and monitor networks of heterogeneous smart city devices via a single central management software package.

Our numbers



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