Easy IoT Solutions

Agriculture · Factory · Building · City

RAK™
IoT Made Easy

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Smart Agriculture

The conventional agriculture industry continues to face numerous challenges - from labor shortages, and unpredictable monsoons to drastic price changes in produce and interventions by middlemen. a comprehensive smart agriculture system could reduce farmer dependency on labor, ensure that crops are fertilized, monitored, and irrigated for an optimal harvest.

RAKwireless' IoT solutions strive for profitable agribusinesses with automated management and control of different types of crops and farms.

Challenges

- Collecting a variety of data in the agriculture industry requires a wide range of IoT sensors, as well as types of applied techniques. Such data includes meteorology (temperature, humidity, air pressure, rainfall, wind speed, wind direction, dew point temperature, relative humidity, solar radiation), soil conditions (moisture, pH deviation, matter deficit, saline-sodic level, nutrients levels), plants (leaf wetness, chlorophyll), animals (heart rate, body temperature, breath emissions, sounds), GPS position, greenhouse gasses, etc.

- Field cabling over big field surfaces may incur high costs and is just not possible in some cases, like monitoring livestock.

- Different types of topographic and natural boundaries demand wide coverage and deep penetration features for wireless technology.

- Sensors need to be battery-powered and future-proof, with an autonomous operation lifecycle of several years.

- A quick configuration and batch-type configuration of parameters should be spread among the sensor network in order to easily adapt to each type of application.

- Sensor outputs should be effortlessly fed into different cloud data visualization and analytics vendors.

- Full duplex, real-time communication should be implemented in order to apply control signals to on-field devices and machinery.

- As the size of agricultural needs varies over time, the sensor network should adapt accordingly and allow flexible models for scaling.

- While increasing the number of possible touchpoints (attack surface) for attackers, the applied cybersecurity strategy must implement a secure-first architecture and allow for end-to-end implementation of global security standards.

- The virtual orchestration of the fleet of IoT devices should grant a straightforward workflow, including the performance of FUOTA (Firmware Update Over the Air) operations, real-time alarm monitoring, and remote troubleshooting.

Applications

Crop Management

Precision Agriculture

Greenhouse Automation

Livestock Monitoring

Water Resources Management

Autonomous Farm Machinery

Fertilizer Management

Smart Pest Control

Weather Sensors and Weather Forecasting

Predictive Analytics for Smart Farming

Use Cases

Sensor Hub

The Sensor Hub is a suitable and versatile solution platform for various IoT applications where environmental monitoring is needed – weather monitoring, soil monitoring, and water monitoring.

WisGate Edge

With industrial-grade components, WisGate Edge gateway achieves a high standard of reliability and is ideal for IoT commercial outdoor deployment. And with the RAK Battery Plus, it's perfect for deployments on and off grid.

WisGate Edge Full Duplex

The edge device improves LoRaWAN® protocol message response time for applications, which require fast acknowledgment from the gateway. It also enables Firmware Update Over-The-Air (FUOTA) while processing uplink traffic, and reduces the time and cost of operational management of end devices.

Battery Plus

It allows reliable outdoor gateway deployment in remote off-grid scenarios where power supply is unreliable or inaccessible. Not only will your gateway be powered 24/7 with a solar panel option, you will also get all the battery data and status in the WisGateOS* Web UI locally, and in WisDM** remotely.

WisGate Connect

As developer-oriented, the base station platform WisGate Connect, supports the containers driven development workflow: Code, Build, Push, Run. By these means, software developers may collect and analyze data in the very place where it is generated and execute their software solutions upon it, in almost real-time.

WisBlock

WisBlock ecosystem is an enabler of Smart Agriculture use cases from rapid prototyping and proof of concept to mass production without the need to create new hardware modules for each step.
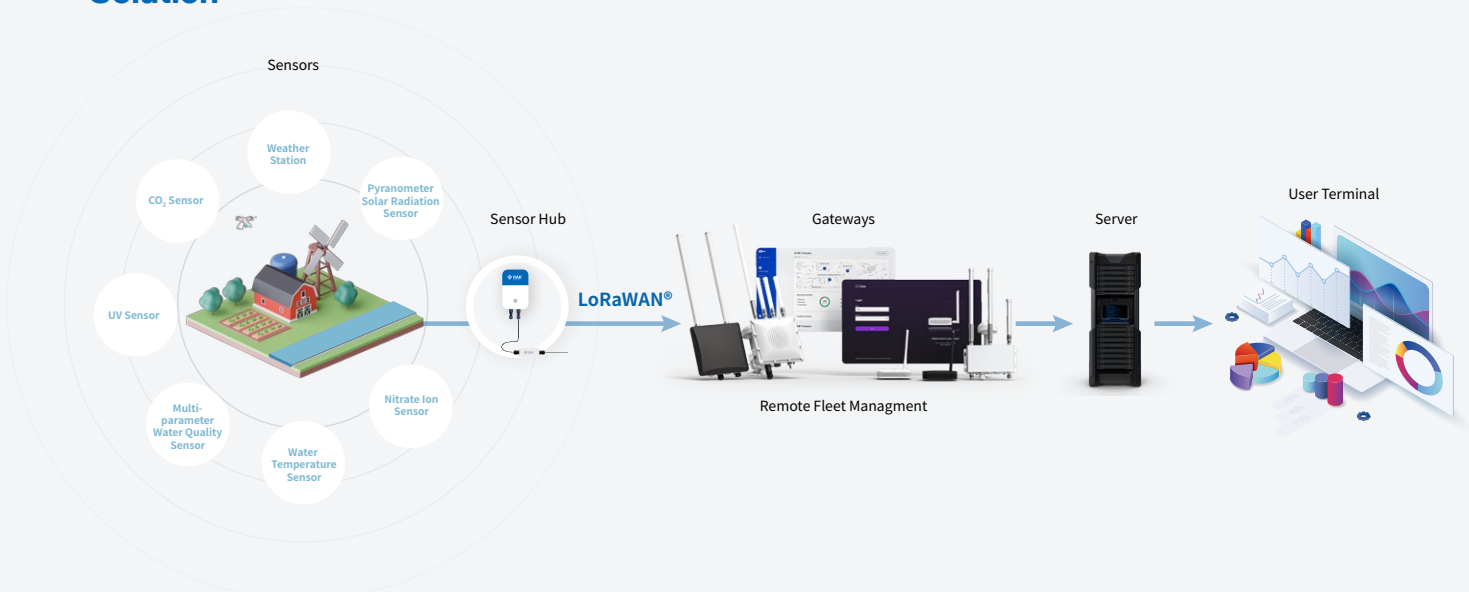
* Operation System designed for all WisGate Edge gateways.

** A simplified, cloud-based, IoT fleet management platform provided by RAKwireless.

Solution

Devices

Sensor Hub

The RAK2560 WisNode Sensor Hub is a modular sensor ecosystem consisting of the Sensor Hub Smart Datalogger and multiple pre-configured sensor probes.

Benefits for End User:
Ready to use, easily configurable with a smartphone. Pre-selected sensors.

Benefits for System Integrator:
Sensor Probe IO provides additional integration to sensors and already available sensors/ systems on the field. The software can be customized. Availability of LoRaWAN and NB-IoT

Sensors

Sensor	Model	Description
Soil pH	JXBS-3001-PH-RS	It is widely used in applications where pH value monitoring is required, such as soil pH measurement. The probe adopts a pH electrode, with stable signal and high precision. It is easy to use and works over long transmission distances.
Soil Moisture	RK520-02	It integrates the measurement of soil moisture, temperature and conductivity. Its stainless steel probe can be inserted directly into the soil surface for quick measurements. The product has a temperature compensation function to ensure the accuracy of the measurement. Probes can be permanently buried in the ground and connected to data loggers for unlimited measurements.
Soil Temperature	JXBS-3001-TR-RS	It is suitable for soil temperature and moisture measurement, featuring high accuracy, fast response and stable output. Less affected by soil salt content, it is suitable for all kinds of soil.

Sensor	Model	Description
Soil NPK Sensor	JXBS-3001-NPK-RS	It is designed for detecting the content of nitrogen, phosphorus and potassium in soil, determining the fertility of the soil and facilitating the evaluation of the soil condition by the customer system. It can be widely used in rice fields, greenhouse cultivation, rice, vegetable cultivation, orchard nursery, flowers and soil research.
Multi-parameter soil quality Sensor	JXBS-3001-TR	It is suitable for soil temperature and moisture measurement, featuring high accuracy, fast response and stable output, suitable for all kinds of soil. It can be buried in soil for a long time, resistant to long-term electrolysis, corrosion resistance, vacuum potting, and completely waterproof.
Weather Station	RK900-09	It is integrated with ultrasonic wind speed and direction sensors, high-precision digital temperature, humidity, and pressure sensors. It can accurately and quickly detect wind speed/direction, atmospheric temperature, atmospheric humidity and atmospheric pressure. The built-in signal processing unit can output RS485 signal, the high-strength structural design can work reliably in extreme weather. It is widely used in meteorology, ocean, environment, airports, ports, laboratories, industries , agriculture and transportation.
Pyranometer Solar Radiation Sensor	RK200-03	It is designed based on the principle of thermopile. The sensing component is made by winding a thermopile plated with multiple contacts. A temperature compensation circuit is designed to reduce the impact of ambient temperature effect. It is widely used in the measurement of solar radiation energy, such as meteorological detection, atmospheric environment monitoring, climate observation, solar energy utilization, agriculture, and building physics research.
CO_2 Sensor	RK300-03B	It uses the principle of non-dispersive infrared (NDIR) to detect the concentration of carbon dioxide in the air. It adopts advanced infrared absorption gas detection technology, with a precise optical path and a well-designed circuit. The sensor has a built-in temperature compensation circuit to ensure measurement accuracy.
CO_2 Sensor	RK300-03	
UV Sensor	RK200-07	It is a precision instrument used to measure the atmosphere of the sun's ultraviolet radiation (UVA & UVB). It is widely used in the exposure caused erythema dose, integrated environment ecological effect, the study of climate change and ultraviolet radiation monitoring and forecast.
Multi-parameter water quality Sensor	RK500-09	It adopts an integrated design and can measure up to 8 parameters at the same time, including DO, COD, pH, ORP, EC/salinity, NH4+ and turbidity.
Water Temperature	RK500-11	It is used to measure the temperature of the liquid medium, applied to the automatic meteorological station, pond or reservoir water temperature detection and other fields.
Nitrate ion (NO3-) Sensor	RK500-16	Animals decomposing in water or sewage from factories can cause an increase in nitrate ions in water. The sensor can be used to determine the mass of nitrate ion (NO3) in water. It is widely used in industry, environmental protection, education, IoT and other industries or flow cell installations.

WisGate Edge

WisGate Edge gateway supports up to 16 LoRa® channels for gathering data from end nodes. It forwards the data to the cloud analytics and visualization software via multi-backhaul options, including Ethernet, Wi-Fi, and cellular connectivity.

Benefits for End User:
Easy configuration and setup. It can be provided pre-added to WisDM (the simplified, cloud-based, IoT fleet management platform), so the user only needs to mount it and power it.

Benefits for System Integrator:
3 working modes – PF, BS, Built-In. Built-In support MQTT and HTTP integration for data sending.

Extensions provide additional features. Central monitoring and maintenance with WisDM

WisGate Edge Full Duplex

Full duplex LoRaWAN gateways support simultaneous transmission and receiving of data, lengthening the downlink window to enable gateways to send more data to end devices and removing the latency experienced with half duplex gateways.

Benefits for End User:
Easy configuration and setup. It can be provided pre-added to WisDM (the simplified, cloud-based, IoT fleet management platform), so the user only needs to mount it and power it.

Benefits for System Integrator:
Update the end dives firmware over the air. Control and set up the end devices with mass downlinks – multicast. All this without losing data due to half duplex.

RAK Battery Plus

Battery Plus is the RAK's latest battery system incorporating a solar charging system and status monitoring. It is specially developed for the WisGate Edge Pro gateways.

Benefits for End User:
Easy installation with the provided kit.

Benefits for System Integrator:
Off-grid deployments. Monitoring of the state of the battery and solar charge in the WebUI and WisDM.

WisGate Connect

RAK7391 WisGate Connect is a Raspberry Pi CM4-based gateway product meant to support different radio and WisBlock modules. With several hardware interfaces, WisGate Connect meets the needs of different developers (HDMI, Ethernet, USB, mPCIe, CSI, DSI, M.2, WisBlock, PoE, Raspberry Pi HAT) and constitutes a platform for IoT Edge Computing and Data Visualization.

Benefits for End User:
Faster, more reliable IoT solutions with better user experience. Enhanced privacy protection and data security.

Benefits for Embedded Developer:
Supports latency-sensitive applications, empowers the flexibility of application development, reduces costs.

WisBlock

WisBlock is a modular system that makes it easy to implement low power wide area network (LPWAN) into Smart Agriculture IoT solutions

Benefits for End User:
Quick time to resolution IoT technology, tested against his/her actual needs and under the specific production stage conditions.

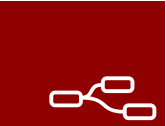**Benefits for System Integrator:**
Quick time to value IoT technology, with a clear business path for scaling up the solution and repeat it several times on customers with similar set of requirements.
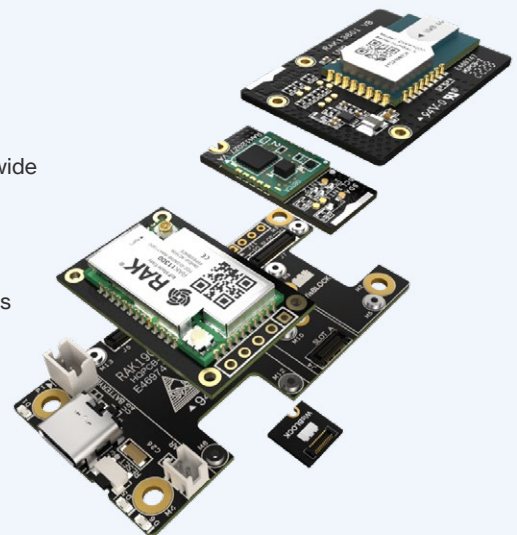
Cloud Options

RAK's Data Analytics & Visualization Software Partners

AWS IoT Core	DATACAKE
ubidots	PilotThings
Grafana	Tago**IO**
Node-RED	...and many, many more

Smart Factory

The manufacturing industry is undergoing a transformation brought about by digitalization. However, one of the major hindrances for manufacturers in utilizing data is the utilization of outdated manufacturing execution systems (MES). MESs are utilized to control and oversee the production process on the factory floor. They act as the central hub for traditional manufacturing operations. Notwithstanding, many of these systems were created prior to the emergence of IoT and are not equipped to incorporate data from the various sensors on the factory floor.

MESs also do not possess the ability for real-time data collection and long-term data retention. Due to these limitations, MES systems hinder the capability to gain a comprehensive understanding of the factory's operations and take effective action. Data is frequently isolated and not captured leading to the loss of valuable insights and being unable to fully utilize AI/analytics and optimize operations.

Implementing IoT solutions, in a retrofit approach for existing MES systems, enables companies to seamlessly integrate data from multiple sources, enhance overall equipment effectiveness, decrease expenses, and optimize key performance indicators in their production operations, while also rolling out new or improved applications.

Challenges

Although an increasing number of MES solutions will include IIoT platforms synchronized with microservices-based manufacturing operations management apps, providing near-real-time transaction management, control, data collection, and analytics, integrating Manufacturing Execution Systems and IoT solutions may become an arduous task as many IoT devices have proprietary nature, making it hard to standardize integration using a single blueprint. While MES systems have built-in interfaces for certain equipment, they were not intended to manage large amounts of data from IoT sensors as they were originally created to operate independently with their own data storage.

While implementing legacy MES systems, a traditional HTTP client/server architecture method has been implemented, driving a P2P flow of information (from MES terminals to MES server) and not taking into account the option for seamless communication workflow across all of the implementation. This derives into a rigid structure and poses a difficulty for flexibility and scalability accomplishment. Additionally, the need

for adding machine sensors and surveillance cameras increases the complexity of providing a solution by means of traditional architecture.

The smart factory standards for communication protocols offer a range of options including OPC UA, MQTT, AMQP, and CoAP, and these have a different concept from the ones widely used in IT/software systems like SNMP, HTTP, SOAP, and XML. So, migrating from a software-based solution to IoT architecture means understanding the protocol paradigms and tradeoffs in order to choose the proper one.

Apart from the need for conveying legacy MES applications protocols into the domain of Smart Factory protocols, there is also the need to integrate the actual machinery that runs the manufacturer workflow, in order to convert such machinery into a deployment of Smart Machines CPPS (Cyber-Physical Production Systems). Since the vast majority of the automatic control systems implemented correspond to PLC units from various manufacturers that implement different methods of connection to software, the best strategy to look for a unified data collection from these sources consists in making use of the serial communication interface.
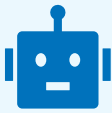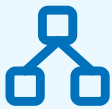
The integration of the communications of the machinery using the serial interface may require, in certain cases,

the electrical conditioning of signals for equipment for which the market does not offer connectors compatible with previous versions, and requires the development of firmware that implements certain proprietary protocols of communication. At the IoT application platform level, the use of the data coming from such machinery should be mainly used for the purpose of real-time monitoring and alarms visualization, and to feed AI-based prediction systems. Finally, the control loop should be completed by adjusting the PLCs parameters according to the insights generated by AI, in an almost real-time operation.

To ensure near real-time performance, the signal transmission must be a stable, uninterrupted data stream, regardless of the transmission medium used. In turn, the infrastructure used must allow sufficient flexibility to locate different types of sensors throughout the shop floor and allow easy scaling, in a phased implementation, growing from a proof of concept to full integration of the entire production plant.
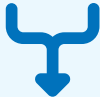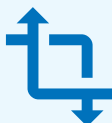
Finally, the hardware platform to be used must be open in a way that facilitates the implementation of the business logic on the basis of a mature and easy-to-use ecosystem for developers coming from the software environment.

Applications

Adaptive Manufacturing	Smart Machines CPPS	Smart Products	Smart Services	Smart Supply Chain
Vertical and Horizontal Manufacturing Data	IT/OT Convergence	Requirements Framework for Digital Twins	Cost-Effective Smart Factory Retrofit Projects	Build Manufacturing Resilience

Our Solution: Devices on connecting sensors or facility equipment

Sensor Hub

Sensor Hub, with the main unit, sensor probes, and probe IO, connects with all industrial sensors and interfaces.

Bridge IO

Bridge IO is based on nRF52840 with BLE and LoRa®, and can be equipped with NB-IoT modules, easily integrating a variety of sensors into routers or other network devices with gateway functions. It provides RS-485, SDI-12, RS-232, DI/DO, 4 ~ 20 mA, and 0 ~ 10 V sensor and control interfaces through STM32L071CB.

WisBlock Modules

- Motor control module
- Ultrasonic distance
- DC Current sensor
- 4 ~ 20 mA & ADC
- Rotary Input

Field Tester

Field Tester tests the signal and makes a better gateway deployment.

AI-Based Smart Audio

These WisBlock Audio modules turn all the sound generated in a factory into data which can be analyzed and acted upon.

Industrial Outdoor Gateway

- 8 ~ 16 Channels for maximumLoRaWAN® use in each region
- Multi-backhaul Wi-Fi, Eth, LTE
- Battery Plus Off-Grid Solution

Industrial Edge AI Gateway

RAK7391 WisGate Connect is a Raspberry Pi CM4-based gateway product meant to support differentradio and WisBlock modules. With several hardware interfaces, WisGate Connect meets the needs of different developers (HDMI, Ethernet, USB, mPCle, CSI, DSI, M.2, WisBlock, PoE, Raspberry Pi HAT) and constitutes a platform for IoT data edge computing and visualization.

Solutions
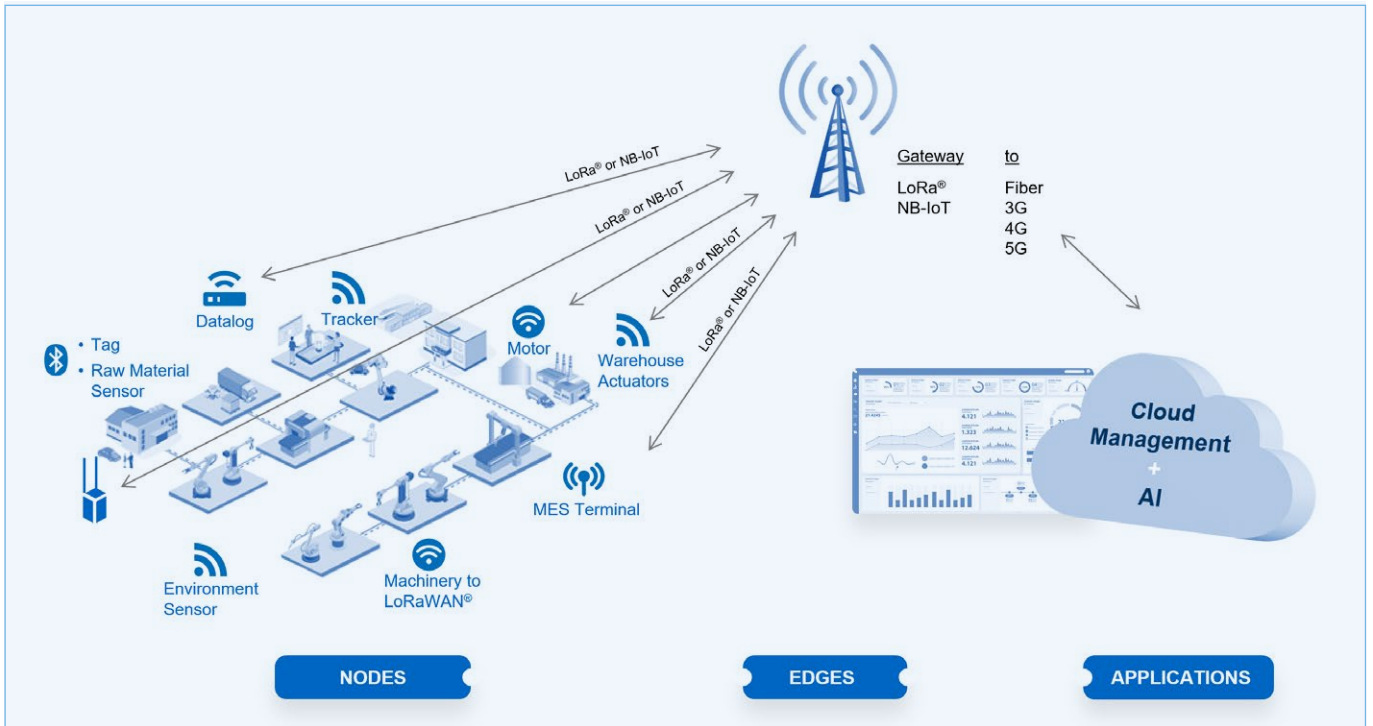
Devices

MES Terminal Retrofit Implementation

Based on the Compute Module 4, the industrial and flexible solution by Raspberry Pi, with a Quad Core 64-bit ARM-Cortex A72 @ 1.5GHz processor, up to 8GB of memory, and up to 32GB of onboard eMMC, WisGate Connect is a complete Edge AI and data visualization industrial platform.

Aside from the CM4 WisGate Connect includes a real-time clock, a 16-bit analog-to-digital converter, a temperature sensor, a fan driver, and two GPIO expanders. For industrial protocols compatibility, WisGate Connect offers two WisBlock I/O slots compatible with tens of different existing modules to cover protocols like Modbus/RS485, CANbus, LinBus, 4-20mA, Analog Input, and Digital In/Out.

As developer-oriented, the base station platform WisGate Connect supports the containers-driven development workflow: Code, Build, Push, Run. By these means, software developers may collect and analyze data in the very place where it is generated and execute their software solutions upon it, in almost real-time.

With a curated list of ready-to-deploy services and Python & Node-RED examples available, software developers have a shallow learning curve to get started with.
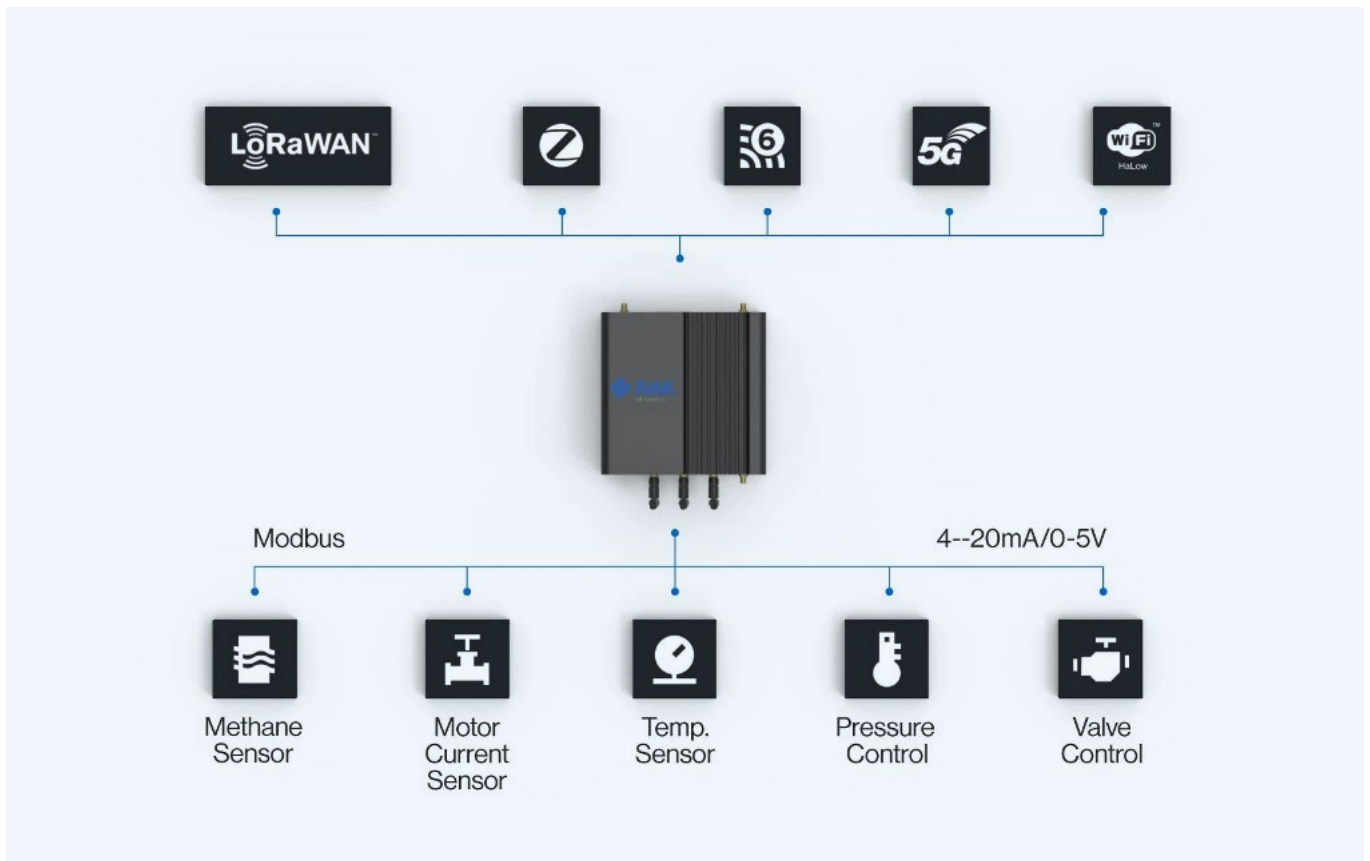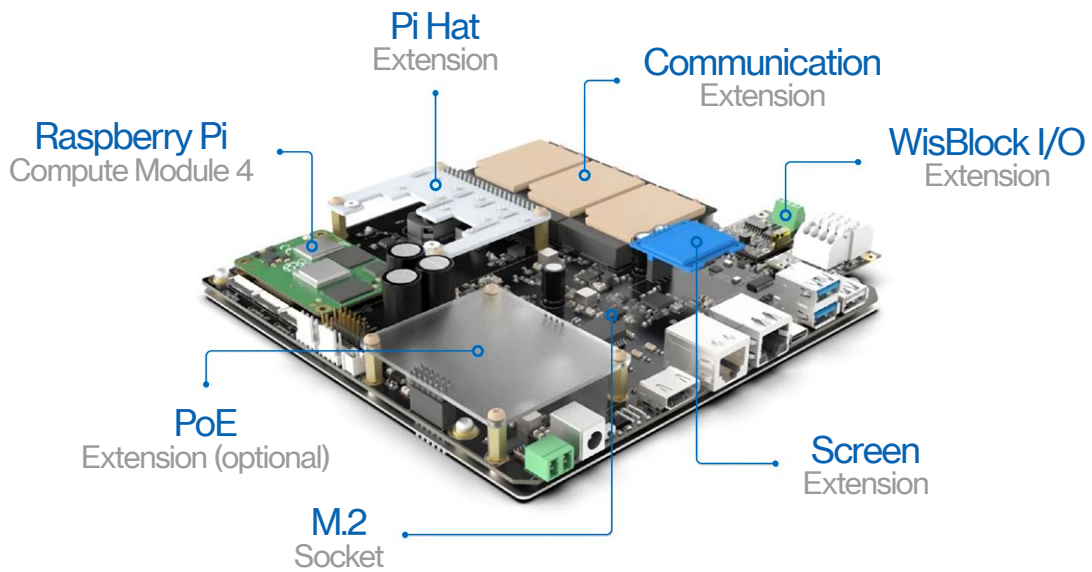
Gateways with LoRaWAN® for Any Scenario

Indoor solutions

WisGate Edge Lite 2

RAK7268

RAK7268 is a full 8-channel indoor gateway, based on the LoRaWAN® protocol, with built-in Ethernet connectivity for a straightforward setup. Additionally, there is an onboard Wi-Fi setup (supporting 2.4 GHz Wi-Fi) that allows it to be easily configured via the default Wi-Fi AP mode. It supports LTE uplink communication connections (optional).

Outdoor solutions

WisGate Edge Pro

RAK7289

RAK7289 is an ideal product for IoT commercial deployment. With its industrial-grade components, it achieves a high standard of reliability. The gateway provides for a solid out-of-the-box experience for quick deployment. With the RAK Battery Plus the gateway is perfect for deployments on and off grid.

WisGate Edge Prime

RAK7240

RAK7240 is ideal for large-scale LPWAN deployment where cost is essential, however, there are no compromises to be made on quality. It is based on the SX1303 LoRa® core. It is suited for any use case scenario, be it rapid deployment or customization with a custom brand.

PLC Serial Communications Retrofit

RAK7431 is an RS485 to LoRaWAN® protocol converter designed for industrial applications. Its open environment range is 15+km and in industrial cases, where there are heavy obstructions in the path of the RF signal performance, is improved compared to conventional wireless systems due to the characteristics of LoRa as a modulation technique.

This allows for consistently good signal quality within the confines of large factories, densely populated offices, storehouses, etc. This RS485-compatible device can address up to 16 client terminal nodes. The conversion from and to LoRa® frames is seamless and allows for real-time control and monitoring of multiple RS485 device bus data to access and control the RS485 terminal nodes.

RAK7431 allows for the reduction of the time-consuming process of retrofitting RS-485 devices. Designed using RAK's WisBlock Ecosystem, RAK7431 enables the extension of its functionality or upgrading the hardware with simple plug-and-play technology.

WisBlock Components:
- WisBlock Base RAK5005 - base board
- WisBlock Core RAK4201- low-power STM32L071 MCU and SX1272 LoRa transceiver
- WisBlock IO RAK5802 - RS485 Modbus to LoRa bridge

RS485 Devices
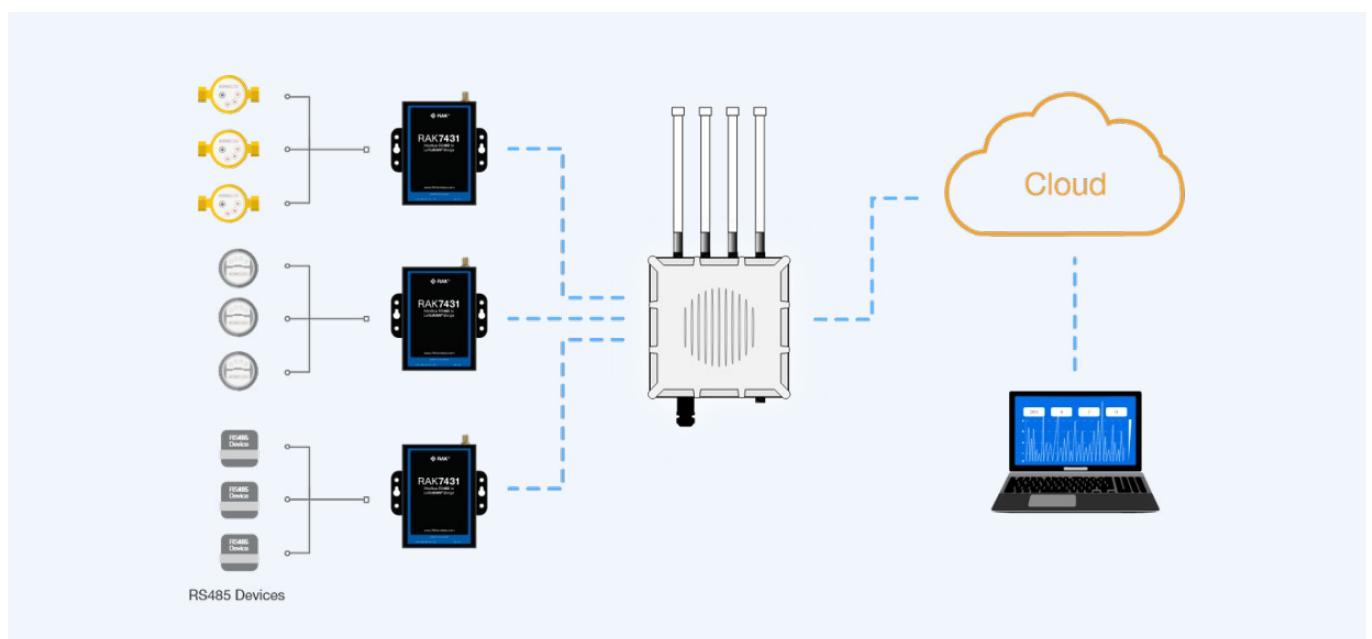
A Modular Sensor Ecosystem for Different Variables

The RAK2560 WisNode Sensor Hub is a modular sensor ecosystem consisting of the main body and multiple pre-configured sensor probes. With pluggable, interchangeable intelligent probes, and the option to add third-party sensors to the mixture, the Sensor Hub is a suitable and versatile solution platform for various IoT applications where conditions awareness is needed.

In order to connect the sensors, RAK2560 admits two kinds of probes: Sensor Probe and Probe IO.

Sensor Probe has two WisBlock sensor slots. After selecting the appropriate sensor modules and plugging the Sensor Probe into the Sensor Hub, a mobile app can be used to configure the sensor network behavior defining the way data is collected.

Probe IO offers various sensor data interfaces, such as RS-485, and 4-20mA, to work with the most prevalent 3rd party sensors in the market.

The IFTTT (if-this-then-that) style rules engine, is an additional intelligence layer that enables the checking for conditions to be met before a report is sent to the cloud application.

Sensors

Sensor	Model	Description
Tilt Sensor	RK700-01	It features a dual-channel gravity-tilt unit that converts static gravitational acceleration into a change in tilt. The product adopts secondary calibration technology with high measurement accuracy.
PT100 Transmitter Sensor	UTI1 PT100 (UTOP)	It adopts an integrated structure, which can directly measure the surface temperature of various liquids, gasses, and solids within the range of -200°C ~ 500°C. It uses a special temperature module to adjust the linearity of the temperature components and output standard analog signals. The product is widely used in temperature measurement in petroleum, chemical, textile, mining, medicine, electric power, environmental protection, municipal, food, scientific research and other industries.
PT100 Transmitter Sensor	RS67	It adopts PT100 thermocouple and thermal resistance acquisition module, RS485 digital signal output. It can be used in various industrial fields and ultra-high/low temperature applications.
Water Level Meter Sensor	ULB16 (UTOP) (Pre-builded)	It is based on silicon piezoresistive technology and designed for liquid level measurement by using silicon die. It adopts processing electric circuits of smart level transmitter, and digital temperature compensation technology and non linearity revision technology.

Cloud Options

RAKwireless is expanding its strategy from solely producing hardware to offering a comprehensive suite of IoT solutions leveraged on a categorized framework of ecosystem partners.

As a result, the network of IoT Software Platforms and Cloud solutions providers, already integrated with RAK's hardware, is continuously increasing and spanning different players, from Network Server providers to low code/no code and specific use case platforms, and reaching up to PaaS hyperscalers as AWS IoT, Azure IoT, and Alibaba IoT.

AWS IoT Core	LORIOT®	Azure IoT Hub
THE THINGS NETWORK	Alibaba Cloud	helium
ubidots	Integration to the customer's own platform is also possible, enabling a whole end-to-end private solution and unleashing in-house data management and privacy while keeping opex costs under control.	

RAK™
IoT Made Easy

Smart Building

A smart building could include quite a lot of scenarios, from building management, people counting, smart washrooms, small assets, to wellness, surveillance, and space utilization. Different scenarios require different sensors to measure data, either outdoors at a building facade, or indoors in offices. The sensors then need to be connected to sensor nodes for communication. Wireless data transmission and MQTT connection to a cloud server are mandatory.RAKwirele

Building Management
Share IoT data with BMS/BAS system to optimize heating, cooling, and ventilation

Smart Washroom
Monitor usage, paper dispensers, soap dispensers, legionella monitoring

Small Assets
Monitor usage of small assets such as fire extinguishers and trash cans

People Counting
Monitor utilization of areas, floors, and buildings

Wellness
Monitor temperature, humidity, CO_2, VOC, barometric pressure, ambient light, and ambient noise

Lite Surveillance
Monitor spaces with restricted access

Space Utilization
Of conference rooms, work desks, and restrooms

Large Assets
Monitor usage and estimate maintenance needs for large assets such as escalators, elevators, and pumps

Challenge

A wide variety of environment data outdoors at a building facade and indoors in offices and warehouse areas need to be measured. Small sensors are required and different sensors need to be connected to sensor nodes. Wireless data transmission and MQTT connection to a cloud server are mandatory.

Solution

Using RAKwireless Sensor Hub and RAKwireless Gateways makes it possible to cover the large number of sensors with its existing Sensor Probes and the Sensor Probe IO that allows the connection of third-party sensors to the Sensor Hub.

Sensor Hub is designed as an IP65-rated outdoor device and its connections to the Sensor Probes are weatherproof as well. This makes the deployment indoor and outdoor possible.
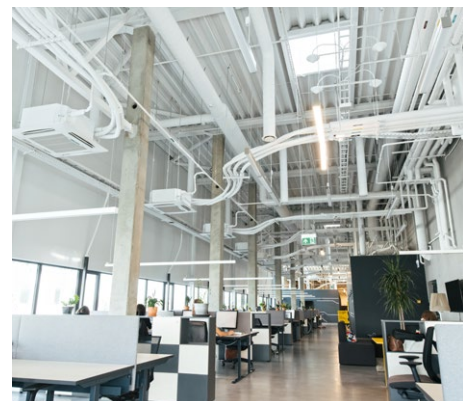
Sensor Hub: Connect All Sensors

A sensor data organizer and collector in the sensor network.

Sensor Hub

Connect up to 255 sensors via Splittler

Sensor Probe

Connect Sensors

Probe IO

Connect Control

Audio

Connect Sound Sensor

	Maintenance room monitoring and equipment room monitoring including boiler pressure, temperature, vibration alerts, flood conditions, clogged pipes or drains or abnormal humidity all help is maintaining the building infrastructure
	Temperature monitoring for internal spaces such as near windows and between wall spaces is important in detecting early on freeze conditions and potential freezing pipes. This is another layer of validation in leak / flood detection
	Monitoring water leakage is a critical aspect of ensuring a basic building management service quality with respect to commercial building tenants. Any risk of failure of detecting and attending to floor flooding as a result of water leakage can be detrimental to the normal operation of the building management service.

Sensors

Outdoor Sensors Used in Smart Buildings

Type	Sensor
Air Temperature & Relative humidity	Sensor Hub Sensor Probe IO with Weather Station RK900-09
Precipitation	3rd Party LSI MW9000-ENG-18 – Integration with Sensor Probe IO
Barometric Pressure	Sensor Hub Sensor Probe IO with Weather Station RK900-09
Global & Diffuse Solar Radiation	Sensor Hub Sensor Probe IO with Pyranometer Sensor RK200-03
Long-Wave Atmospheric Conterradiation	3rd Party LSI MW9000-ENG-07 – Integration with Sensor Probe IO
Wind Velocity + Direction	Sensor Hub Sensor Probe IO with Weather Station RK900-09

Indoor Sensors Used in Smart Buildings

Type	Sensor
Humidity Probes	Sensor Hub Sensor Probe Temp & Humidity Sensor RAK1901
Thermohygrometer	Sensor Hub Sensor Probe Temp & Humidity Sensor RAK1901
Thermal - Surface Temperature	3rd Party LSI MW9000-ENG-04 – Integration with Sensor Probe IO
Mean Radiant Temperature	Sensor Hub Sensor Probe Temp & Humidity Sensor RAK1901
Air Velocity	3rd Party LSI MW9001-ENG-08 – Integration with Sensor Probe IO
Illuminance	3rd Party LSI MW9001-ENG-10 – Integration with Sensor Probe IO
Window Optical Properties	3rd Party Gigahertz LCRT-2005-S – Integration with Sensor Probe IO
CO2 Concentration (Ventilation)	3rd Party Onset Hobo CO2/T/RH – Integration with Sensor Probe IO
Total VOC	3rd Party LSI VOC Sensor – Integration with Sensor Probe IO
Pressure Taps	3rd Party Onset Diff. Air Pressure Sensor - Integration with Sensor Probe IO

Benefits

- Sensor Hub as standardized Sensor Nodes for all required sensors

- Easy installation options for indoor and outdoor sensor nodes

- Customization options of Sensor Hub allows usage of 3rd party sensors

- WisGate Edge gateways with internal network server and MQTT communication fits into the customers requirements without any development effort.

Smart Room Sensor

Smart Room Sensor RAK10702 is an indoor device used to test air quality. It can detect temperature, humidity, pressure, ambient light, VOC gas, carbon dioxide, particulate matter (PM), etc. It also supports a pyroelectric infrared sensor (PIR) to detect whether there is anyone in the room.

Applications:

- Air Quality Monitoring
- Ambience Monitoring
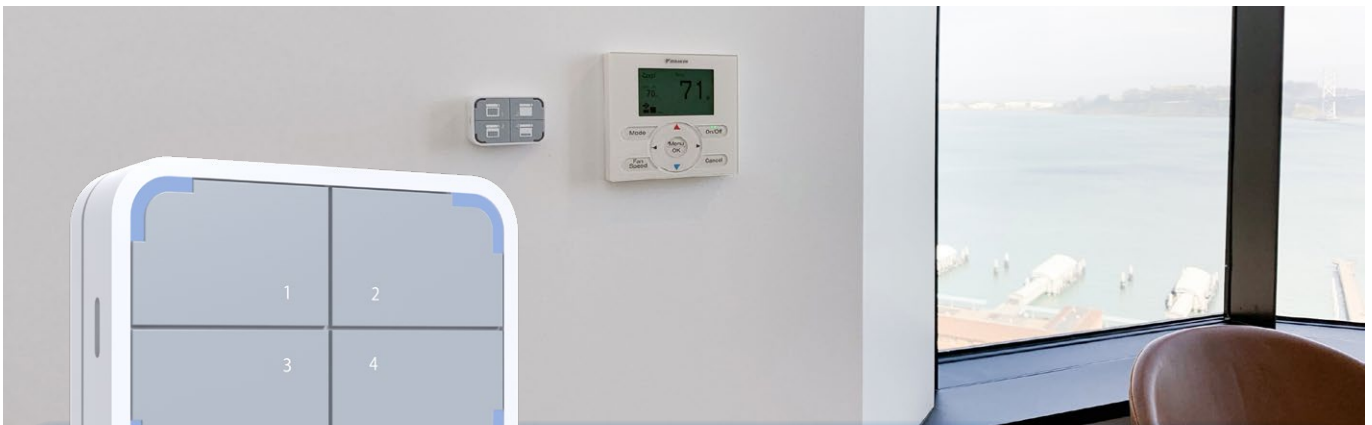
Button 4K

WisNode Button 4K RAK7201 is a remote wireless trigger device. It is suitable for a variety of smart home applications including, but not limited to, entertainment system control, control of lights, a snooze button for the alarms, or a remote trigger. A device with long-range wireless connectivity, amazing battery life, and four programmable buttons. There are tons of applications this device can fit into.

Applications:

- Safety Button
- Ordering Button

Smart City

A smart city is a technologically modern urban area that uses different types of electronic methods and sensors to collect specific data. The information gained from that data is used to improve operations across the city.

The smart city concept integrates Information and Communication Technology (ICT), and various physical devices connected to the Internet of Things (IoT) network to optimize the efficiency of city operations and services and connect to citizens. This includes data collected from citizens, devices, buildings, and assets that are processed and analyzed to monitor and manage traffic and transportation systems, power plants, utilities, water supply networks, waste, criminal investigations, information systems, schools, libraries, hospitals, and other community services. ICT is used to enhance the quality, performance, and interactivity of urban services, and to reduce costs and resource consumption. Smart city applications are developed to manage urban flows and allow for real-time responses.

In smart cities, the sharing of data is not limited to the city itself but also includes businesses, citizens, and other third parties that can benefit from various uses of that data. Sharing data from different systems and sectors creates opportunities for increased understanding and economic benefits.

Challenges

There are a lot of variables to be taken into account when creating a comprehensive smart city plan. All must be considered from the earliest stages of development.

Gathering data – This is a crucial step. The challenge here is that you will need reliable data from different sources like temperature, humidity, soil chemical composition, rainfall levels, wind speed and direction, solar radiation, atmospheric pressure, GSP position, body count, greenhouse gases, audio input, and so much more. This presents the need for a wide range of the IoT sensors ecosystem and its continuous growth in uses and complexity.

Scaling and flexibility – As this fast network will cover a huge area that is constantly growing, solutions that are scalable and can be easily modified to fit the changing environment are a must. That includes quick configuration and batch-type configuration of parameters spread across both the sensor and gateway networks to easily adapt to each type of application.

Deployment – Extending long lines of field cabling over big areas may represent high costs and, in some cases, is just not possible. Therefore, the devices are preferred to be battery-powered and future-proof, with an autonomous operation lifecycle of several years.

Landscape – Different types of topographic, natural, and infrastructural boundaries demand wide coverage and deep penetration features for wireless technology.

Security – While increasing the number of possible touchpoints (attack surface) for attackers, the applied cybersecurity strategy must implement a secure-first architecture and allow for end-to-end implementation of global security standards.

Device management – The virtual orchestration of the fleet of IoT devices should grant a straightforward workflow, including performing FUOTA operations, real-time alarm monitoring, and remote troubleshooting.

Data management – The sensor outputs should effortlessly be fed into different cloud data visualization and analytics platforms to help users make informed decisions.
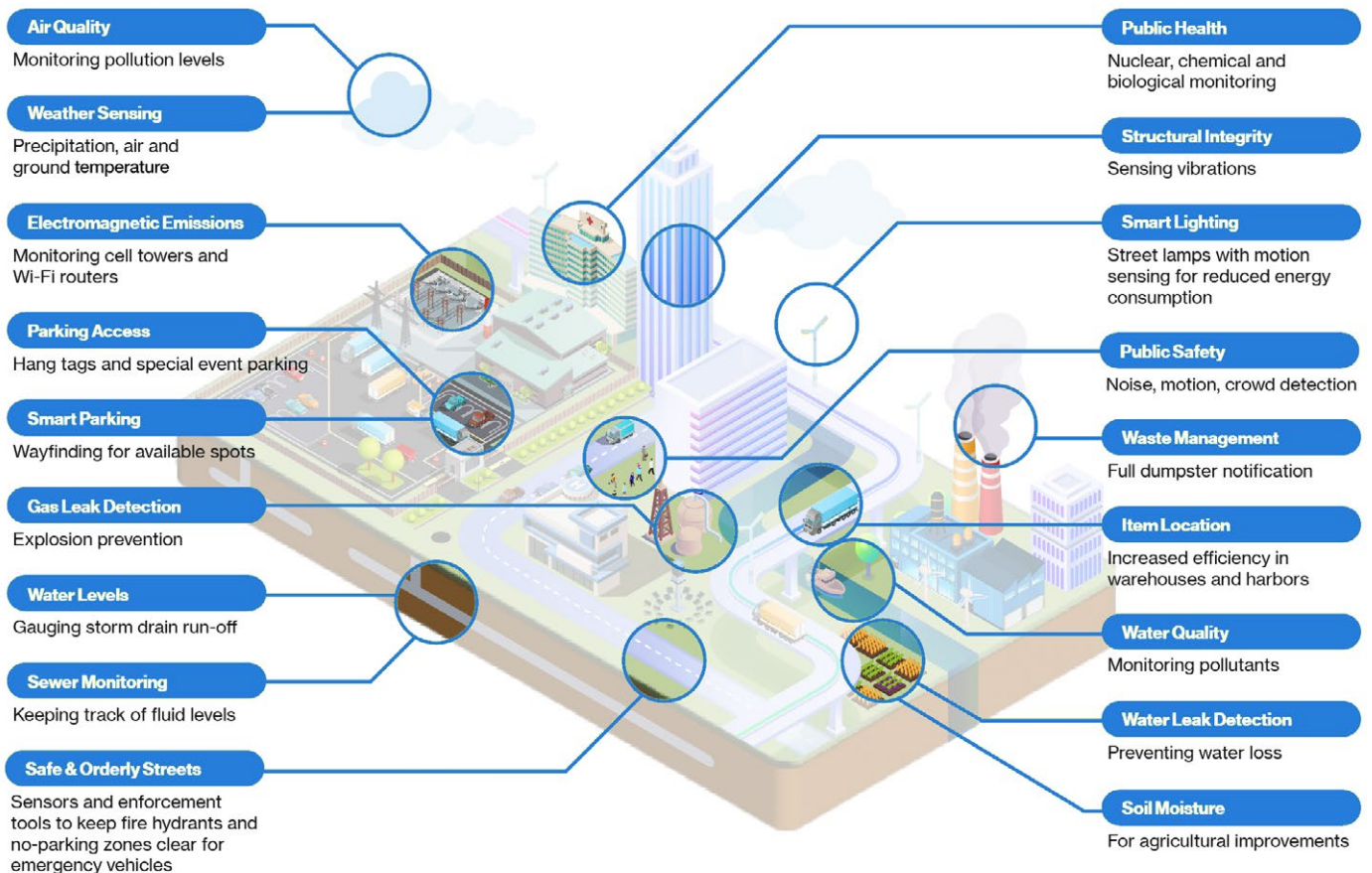
Use Cases

Smart monitoring and control across all aspects of city life are transforming the urban landscape. Reliable data gathering is key for smart solutions in Transport, Environment, Buildings, Infrastructure, Utilities, and Life.

Green buildings and urban farming – Rooftop gardens or vegetation on the side of the buildings to help with insulation, CO2 absorption, O2 production, growing of food, and helping bees.

Perimeter access control and safety – Controlling access and monitoring of restricted areas with CCTV, intruder detection, and alarms.

Air pollution control – Controlling CO2 emissions levels of factories and monitoring car pollution by gathering reliable real-time data and implementing immediate measures.

Green energy harvesting and usage – Energy consumption monitoring and management. Solar panels are integrated into the urban infrastructure to power vital aspects of the smart city and its solutions.

Air Quality
Monitoring pollution levels

Weather Sensing
Precipitation, air and ground temperature

Electromagnetic Emissions
Monitoring cell towers and Wi-Fi routers

Parking Access
Hang tags and special event parking

Smart Parking
Wayfinding for available spots

Gas Leak Detection
Explosion prevention

Water Levels
Gauging storm drain run-off

Sewer Monitoring
Keeping track of fluid levels

Safe & Orderly Streets
Sensors and enforcement tools to keep fire hydrants and no-parking zones clear for emergency vehicles

Public Health
Nuclear, chemical and biological monitoring

Structural Integrity
Sensing vibrations

Smart Lighting
Street lamps with motion sensing for reduced energy consumption

Public Safety
Noise, motion, crowd detection

Waste Management
Full dumpster notification

Item Location
Increased efficiency in warehouses and harbors

Water Quality
Monitoring pollutants

Water Leak Detection
Preventing water loss

Soil Moisture
For agricultural improvements

Waste management and control – Detecting leakages and waste for factories and garbage depots. Monitoring garbage levels in containers to optimize collection routes.

Smart parking – Monitoring and real-time updates of parking space availability.

Natural disaster prevention – Earthquake early detection via sensors. Weather stations provide data for the current weather and rapid changes in it and storm alarms. Landslide and avalanche prevention by monitoring soil moisture, vibrations, and density.

Water monitoring – As the most valuable resource, water must not be wasted via monitoring tap water quality and leakage detection.

Traffic control – Real-time traffic updates for better route planning and congestion avoidance. Implementing fast lanes based on data gathered by sensors. Monitoring of vehicles and pedestrian numbers to divert traffic according to conditions.

Smart public transport – Solutions can be implemented in the public transport systems to help with Human flow monitoring, Control over violators, Monitoring the condition of the vehicles and fuel supply, Ticket systems, Timetables and delays, and Safety.

Smart electricity solutions – Intelligent and weather-adaptive streetlights. Electric vehicles and public transport with charging stations across the city. All are powered by the city infrastructure itself with an optimized comprehensive process.

Fire safety – Fire and smoke detection and intelligent extinguishing systems tailored to each specific room/space.
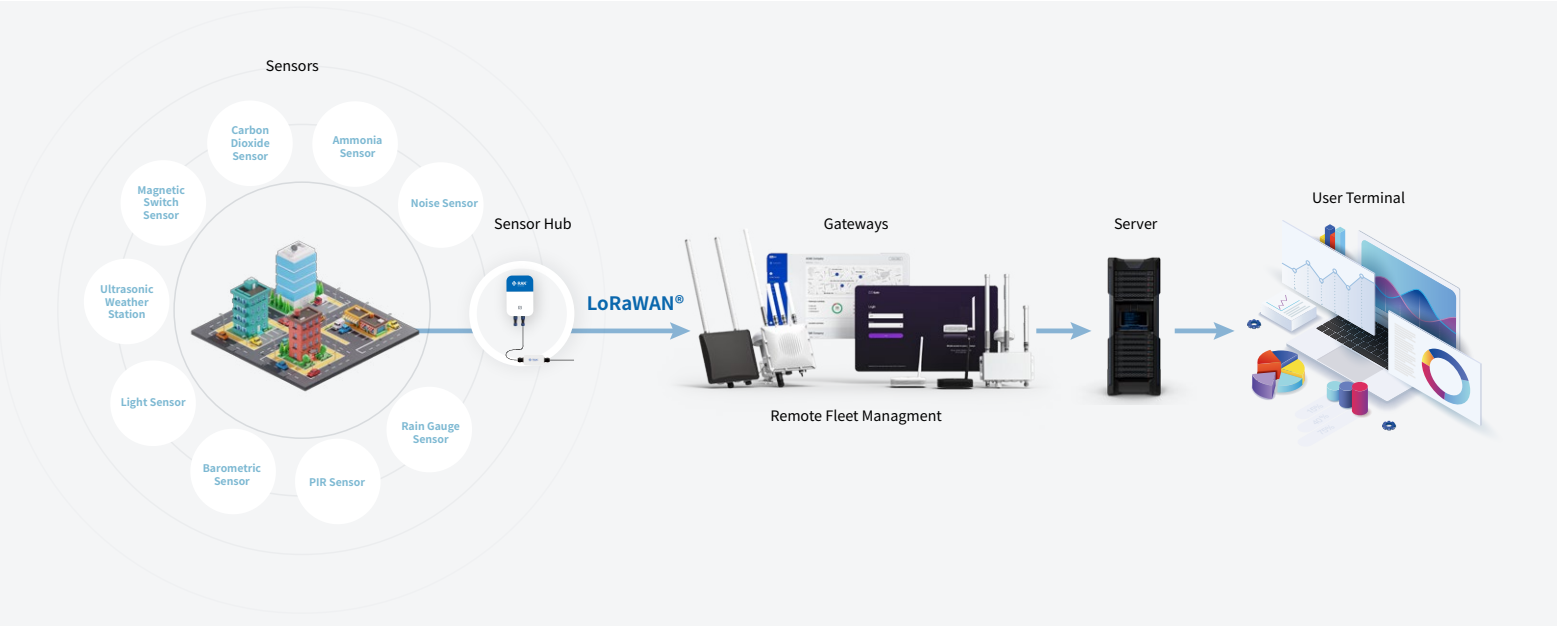
Devices

Reliable and versatile devices that bring modularity and customization to any smart city application. RAKwireless covers all aspects of the device network needed for smart city applications – network infrastructure, device management, ready-to-use and custom end devices.
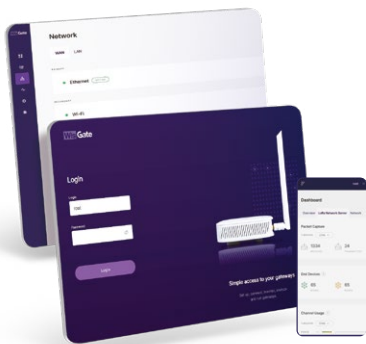
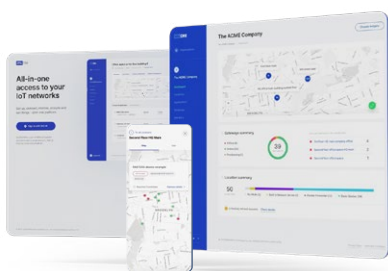|	
WisGate Edge Pro	With its industrial-grade components, this gateway achieves a high standard of reliability. The new RAK7289 V2 supports up to 16 LoRa channels, and multi-backhaul with Ethernet, Wi-Fi, and Cellular connectivity. Optionally, there is a dedicated port for different power options, solar panels, and batteries. Its new enclosure is designed to allow the LTE, Wi-Fi, and GPS antennas to be inside the enclosure. Simply said, the RAK7289 V2 is suited for any use case scenario, be it rapid deployment or customization with regard to UI and functionality.
WisGate Edge Lite 2	It is an ideal product for indoor deployment with its built-in Ethernet connectivity for a straightforward setup. Additionally, there is an onboard Wi-Fi setup (supporting 2.4 GHz Wi-Fi) that allows it to be easily configured via the default Wi-Fi AP mode. The new RAK7268 V2 supports power-over-Ethernet (PoE) in cases of a wall or ceiling mounting, where installing additional power lines is not an option. Moreover, the gateway supports LTE uplink communication connections (optional, only in RAK7268C V2). RAK7268 V2 is especially suitable for small and medium-sized deployment scenarios in smart city applications, saving the additional cost for server and R&D investment, and has the advantage of high execution efficiency.
WisGateOS	The WisGate Edge V2 gateways all run WisGateOS 2, which is based on the latest OpenWRT kernel and accommodates the latest security updates like IPv6, OpenSSL 1.1 support, multiple accounts access, and more. The web UI has a fresh new look, with more user-friendly information tooltips. It gives you access to all the needed features for an easy and reliable network building like the Built-in Network Server (full LoRaWAN support V 1.0.3), OpenVPN, Software and UI sit on top of OpenWRT, Full LoRaWAN Stack support with Semtech SX1303, LoRa Frame filtering (node whitelisting), MQTT v3.1 bridging with TLS encryption, Buffering of LoRa frames in Packet Forwarder mode in case of NS outage (no data loss), Full-duplex (optional), Listen Before Talk (optional), Fine timestamping (optional).
WisDM	A solution for remote fleet management. WisDM is RAKwireless' cloud-based device management platform. It is designed to help you optimize the ways of controlling your gateways by allowing you to access them from a distance and configure them. WisDM device management software supports IoT networks of any scale built around commercial-grade LoRaWAN Edge gateways from RAKwireless. RAKwireless WisDM platform offers you remote configuration, OTA updates, and scalable management.

WisNode Track & Map

Under this sub-category are the nodes with onboard GPS or GNSS, which utilize the power of IoT to relay data coordinates.
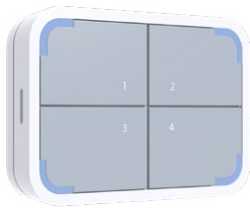

WisNode Button

Designed for user interaction, this node can act as a simple button, a switch to your equipment, or a four-key button for the programmable hub to execute a series of tasks. Perfect for home/office automation.

WisNode Bridge

Those devices convert conventional industrial networks into a wireless, monitoring solution. It can operate as RS485 converters, CAN bus converters, or Analog or digital ones that are suitable for industry 4.0 deployment scenarios. As every city's infrastructure (water supply, garbage disposal, and many more) relies on industrial structures, this node binds those "rougher" aspects of city life into the "smart" era.
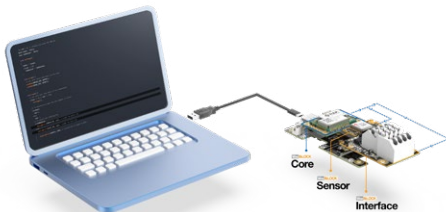
WisBlock and RUI

The ever-growing IoT industry presents new challenges every day. To answer that RAKwireless developed this modular system that allows you to create custom end devices for every new use case that appears. Vast example code libraries and easy-to-use configuration software make this product line perfect for quick specific problem-solving.

Battery Plus + Solar Panel Kit

This battery system incorporates a solar charging system and status monitoring. It is specially developed for the WisGate Edge Pro gateways. It will allow reliable outdoor deployment of the gateway in a modern and green smart city where solar energy is the main power source. Not only your gateway will be powered 24/7 with the solar panel option, but you will get all the battery data and status in the WisGateOS' Web UI locally, and in the WisDM remotely.

WisNode Sensor Hub

Connect your sensor network with the plug-and-play setup of Sensor Hub. It is a modular sensor ecosystem that offers intelligent probes for multiple applications, from managing complex office blocks or factories to monitoring large land areas. With the vast collection of sensors available and supported, this device is your all-in-one data-collecting solution.

Sensors

Sensor	Model	Description
Sound/Noise Sensor	RK300-06	It adopts a digital signal processing chip and digital detection technology, featuring high reliability, good stability, and wide dynamic range. The sensor is widely applied to industrial noise measurement for machines, vehicles, ships, and electrical appliances. It can also be used for environmental noise measurement, labor protection, and industrial hygiene.
Sound/Noise Sensor	PR-300BYH-ZS-01	
Ammonia sensor	RK300-07	It adopts a three-electrode electrochemical sensor and a high-performance microprocessor. A temperature sensor is built in for temperature compensation. It can accurately measure the concentration of ammonia in the environment. The electrochemical sensor and transmission circuit are perfectly combined to meet the customer's demand for ammonia concentration measurement.
Carbon Dioxide Sensor	RK300-03	It uses the principle of non-dispersive infrared (NDIR) to detect the concentration of carbon dioxide in the air. It adopts advanced infrared absorption gas detection technology, with a precise optical path and a well-designed circuit. The sensor has a built-in temperature compensation circuit to ensure measurement accuracy.
Magnetic Switch Sensor	OKD-MC38	It comes in a pair, consisting of a reed switch and a magnet. The wired part of the module is the reed, and the other part is the magnet. It produces the signal when moved away from each other which can be fed to the microcontroller to perform the desired action as per requirement. It is commonly used in security alarm systems for home, hotel, and office.
Ultrasonic Weather Station	RS-FSXCS-N01	This smart weather station can be widely used in outdoor meteorological environment detection. It integrates measurement for wind speed, wind direction, temperature, humidity, noise, PM2.5 and PM10, atmospheric pressure, and rainfall. It is suitable for scenarios such as marine ships and automobile transportation.
Light sensor	RS-GZ-N01-XD	It adopts a ceiling shell and is easy to install and use. Communication address and baud rate are configurable. The product is mainly used in laboratories, archives, electronic equipment production lines and other occasions that require light intensity monitoring.
Barometric Sensor	NH122Y100～1100-I	It adopts a high quality sensing core and comes with metal shell structure. It complies with World Meteorological Organization CIMO Guide, and can be widely used in air pressure measurement in various scenarios, such as agriculture, aquaculture, greenhouses, and laboratories.
PIR Sensor	DH-ARD631-50	It includes a transmitter and a receiver: the transmitter sends infrared signals, while the receiver receives and outputs an alarm signal. It applies 3-beam simultaneous interruption detection as its alarm mode, which can detect a distance of 100 meters outdoors. It is commonly used in household anti-theft alarm system, anti-theft alarm in museums, factory warehouses, shopping centers, and parking lots.
Rain Gauge Sensor	RS-YL-*-4	It is a rainfall station device integrating rainfall data collection, storage, transmission and management. It can perform accurate on-site measurement around the clock. The product is widely used in industries such as agriculture, forestry, water conservancy, meteorology, emergency response, environmental protection, land, railway and road.

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