LoRa-based IoT Monitoring and Control Platform

A multi-tenant platform that monitors and controls offline field devices from one panel

A sensor added in the panel starts reporting within seconds — no device restart

CLIENT	BayPro
INDUSTRY	Industry
PROJECT TYPE	R&D
DURATION	4 months
TECHNOLOGIES	Php-Laravel, C++, TypeScript, Laravel Reverb, Node.js, MySQL, Docker, LoRa, MQTT (Mosquitto), ESP32, Raspberry Pi

Monitoring sensors beyond Wi-Fi from a single panel

Sensor monitoring, relay control, alarms and remote configuration with ESP32 field devices, a LoRa gateway and a multi-tenant Laravel panel.

Highlights

4 Layers: device, gateway, broker, panel	**3** Supported ESP32 board families	**191** Automated gateway tests

The problem: no data where it matters most

Cold room temperature, the boiler room, a warehouse door, a generator battery… A business's most critical points are often where Wi-Fi and cabling don't reach. Giving every point its own internet link is expensive and leaves dozens of independent devices to manage. Off-the-shelf IoT kits are usually tied to one sensor type or one cloud vendor, and adding a sensor often means reprogramming the device. Read sensors at remote points without an internet connection
Drive relays, pumps and lighting safely from the panel
Add a sensor without removing or reflashing the device
Get notified when a threshold is crossed, and react automatically if needed
Manage several sites or customers separately on one platform

Field devices never touch the internet

Live value, history and configuration of every device on one screen

A new sensor goes live without reprogramming the device

Notified when a threshold is crossed — and automatic action if needed

How the LoRa link is protected

Supported sensors and outputs

Field reliability is part of the design

Lessons from the field

Every stage was tried on real hardware (ESP32-S3, an E22 LoRa module, a Raspberry Pi). Most problems that never show up on a desk surfaced there and fed back into the design: The never-seen device. A device with no sensors defined was never handed to the gateway and stayed "never seen". Devices now announce themselves with a signed message.
Late first reading. Adding an hourly sensor meant the first value arrived an hour later. A one-off read is now triggered as soon as the config is applied, so the first value arrives in seconds.
Low voltage readings. The raw ADC formula read about 20% low without calibration; readings now use the chip's own calibration data.
Colliding radio traffic. Independent timers for several devices could collide on the half-duplex module; all radio transactions now go through one ordered queue.
False "offline". A device with a failed sensor but working link looked offline; link and sensor health were separated.

Panel screens

How it developed

2026-05 — Architecture decisions and protocol
Four-layer structure, LoRa security model and single-source code generation decided.

2026-05 — End-to-end telemetry on real hardware
Continuous data from an ESP32 sensor to the cloud chart; gateway and broker live.

2026-06 — Device setup from the browser
One firmware for three boards, browser flashing and one-command gateway setup.

2026-06 — Remote configuration and commands
Hot configuration and driving a real relay from the panel verified in the field.

2026-06 — Alarms and sensor health
Alarm rules, automatic actions, notification settings and self-announcing devices added.

Points in your facility you want to monitor?