



LoRaWAN

SMART CITY LIGHTING

Based on LoRaWAN protocol

optosmart.uk

01 | Smart Nodes



NEMA & Zhaga Luminaire
Control

02 | LoRaWAN Network



Long-Range Data
Transmission

03 | Network Server



Secure Data Processing &
Routing

04 | OptoOS Platform



Centralized System
Management

05 | Cloud Dashboard



Real-Time Monitoring &
Analytics



Highly Scalable



Maximum Reliability



Long Range
(Low Power)



AES128
Encryption



Easy to Manage



Smart Node

Roles & Functions

- Dimming (0–10V / DALI / D4i)
- Energy monitoring (kWh)
- Voltage / Current / PF monitoring
- Temperature monitoring
- Fault detection
- Astro clock
- Local logic autonomy



What is NEMA?

U.S.-based standard for electrical equipment compatibility.
Utilizes the ANSI C136.41 socket standard.
Focuses on seamless integration of LED luminaires with control systems.
Ensures cross-manufacturer hardware compatibility.



What is ZHAGA?

Global consortium standardizing LED lighting components.
Focuses on mechanical, electrical, and thermal interoperability.
Provides a collaborative platform for future-proof lighting design.
Enables easy upgrades and component changes (e.g., Zhaga Book 18).

ZHAGA NODES

ZHAGA Socket Options

- **ZHAGA (D4i Compatible):** Seamless integration with D4i certified drivers.
- **Compact Smart-Ready Design:** Minimalist footprint without compromising functionality.
- **Future-Proof Upgrade Path:** Easily adaptable hardware for evolving smart city requirements.



NEMA NODES

Nema Socket Options

- **Smart Control:** Comprehensive dimming and scheduling for enhanced energy savings.
- **Universal Compatibility:** ANSI C136.41 compliant for seamless integration with standard LED luminaires.
- **Plug & Play Installation:** Quick, tool-free deployment for rapid smart city scaling.





LoRaWAN Gateway

The core of OptoSmart wireless connectivity, built for seamless urban communication

- **Signal Reception:** Receives LoRa signals (868/915 MHz).
- **Data Transmission:** Forwards data to the main server via Ethernet / 4G.
- **Node Control:** Instantly sends control commands to all connected smart nodes.
- **Extensive Coverage:** 2-5 km in dense urban areas / Up to 15 km in rural areas.
- **High Scalability:** Effortlessly manages thousands of smart nodes simultaneously.

DIMMING & ENERGY

Smart Automation & Scheduling

- **Time Based Dimming:** Custom scheduling profiles.
- **Astro Clock Automation:** Precise sunrise/sunset synchronization.
- **Midnight Power Reduction:** Automatically lowers energy output during low-traffic hours.
- **Massive ROI:** Achieve an energy saving potential of 35% – 60% across the urban grid.

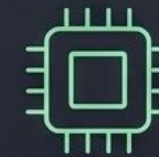


FAULT MONITORING

Proactive System Diagnostics



Lamp Failure: Instant detection of broken or degraded LEDs.



Driver Failure: Automated driver health tracking.



Power Loss: Real-time grid power interruption alerts.



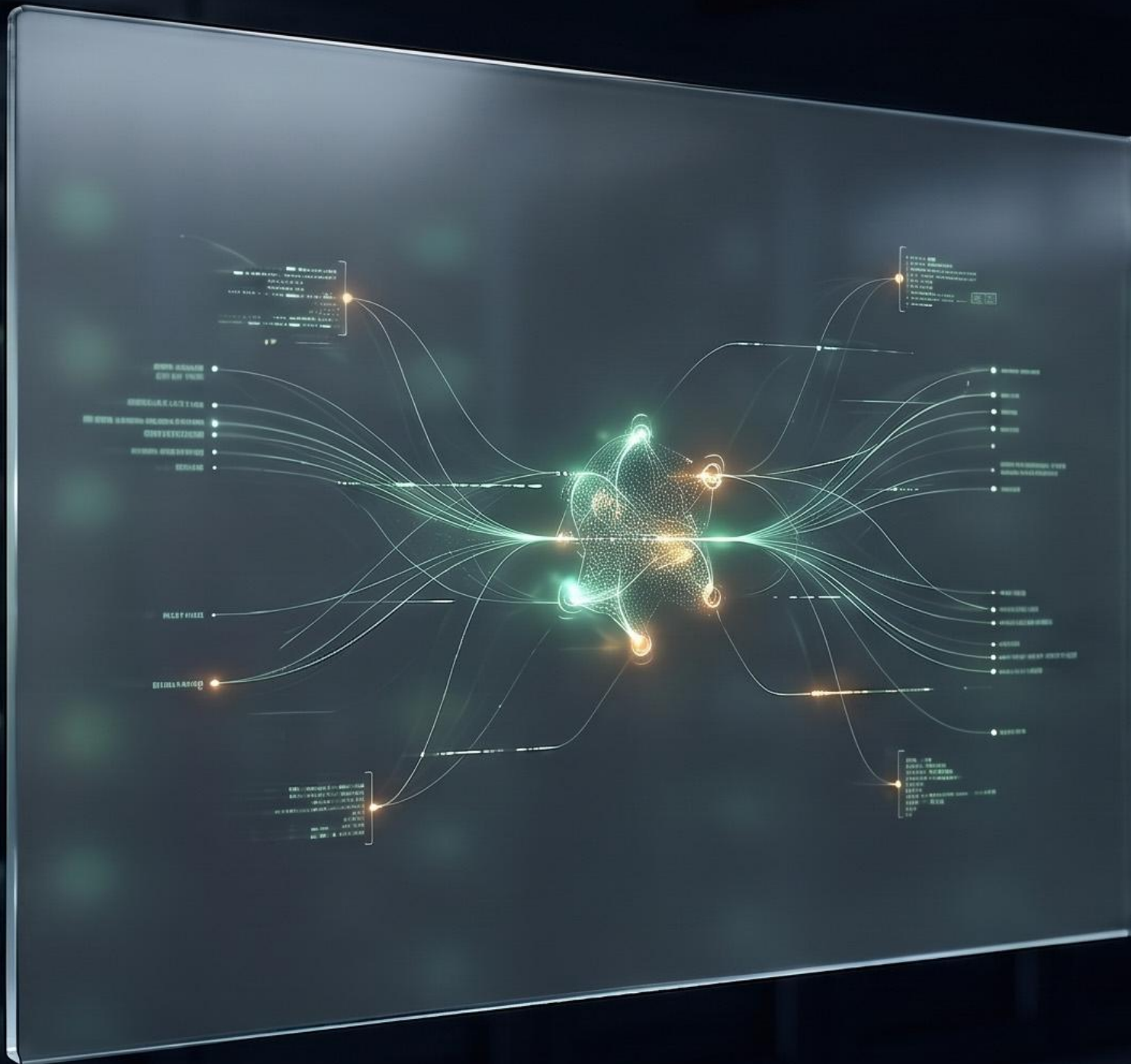
Voltage Anomalies: Over/under-voltage protection warnings.



Communication Failure: Node connectivity drop alerts.



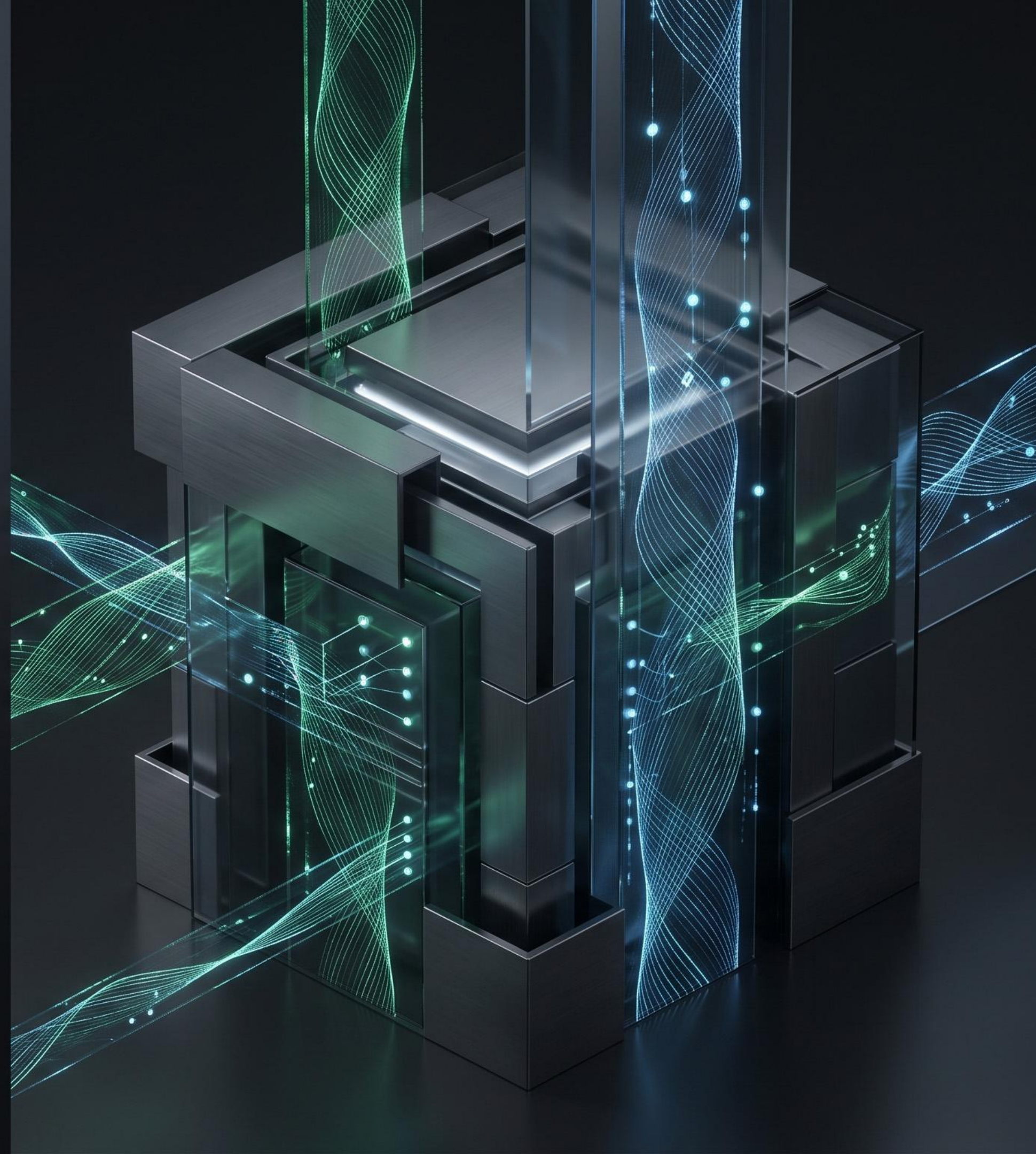
Instant Alerts: Automated push notifications via Dashboard, Email, or SMS.



SCADA / CMS INTEGRATION

Seamless Data Processing & Secure
Device Management

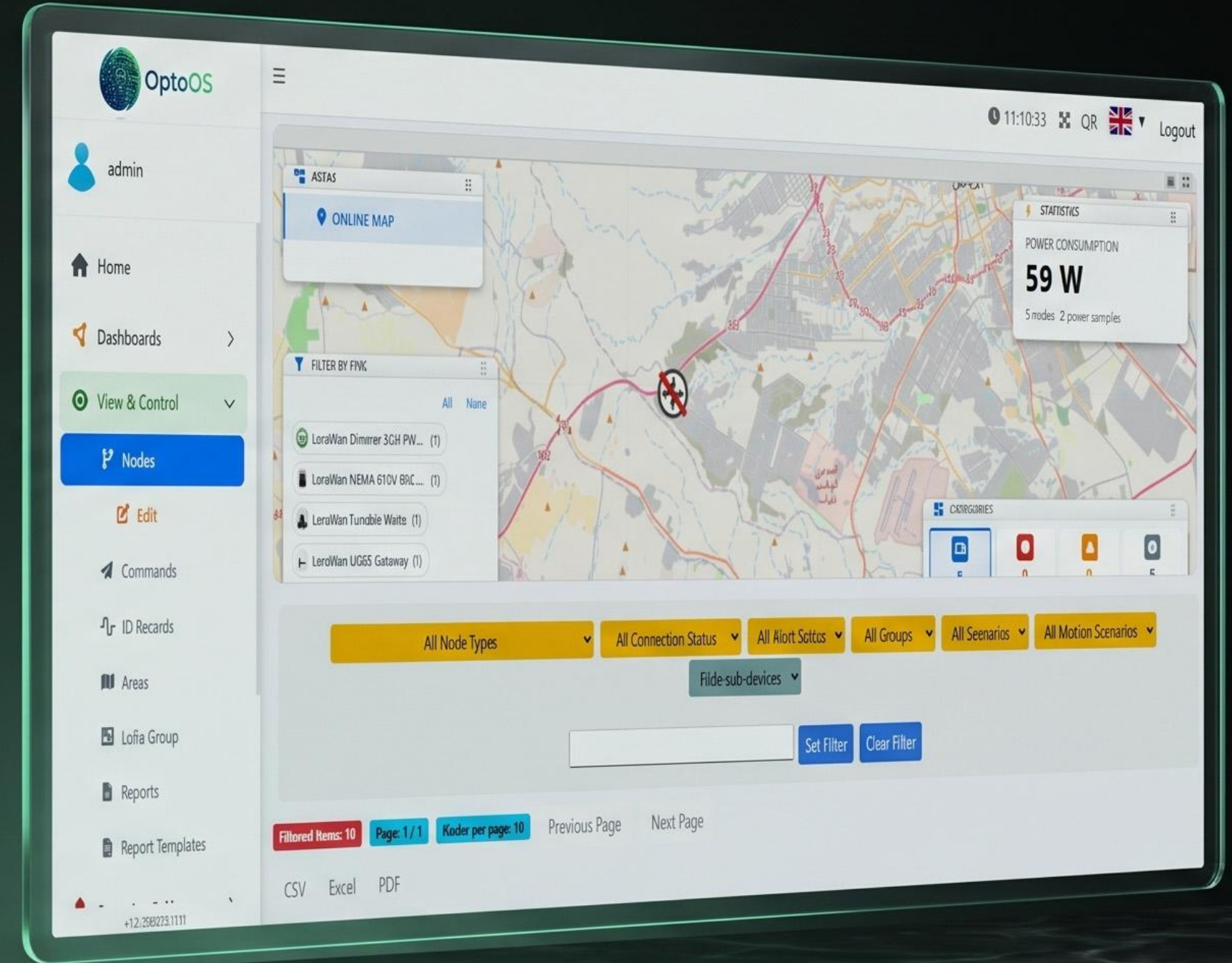
- **REST API & MQTT:** Effortless integration with third-party Smart City platforms.
- **OPC Compatibility:** Direct connectivity to industrial SCADA environments.
- **Central Control Room Ready:** Centralized management for large-scale municipal grids.
- **Bank-Grade Security:** Reliable transmission secured by AES128 encryption.



OptoOS CMS

Central Smart City Management Platform

- **Real-Time GIS Mapping:** Live geographic tracking and status visualization of all smart nodes.
- **Granular Control:** Precise dimming and ON/OFF scheduling at both individual and group levels.
- **Proactive Alarm Management:** Automated fault detection and instant alert routing.
- **Comprehensive Analytics:** Continuous live monitoring of power consumption and grid health.



DATA & ANALYTICS

Actionable Insights & Comprehensive Reporting



Operational Logs: Detailed ON/OFF and system command history.



Energy Reports: In-depth power consumption and savings analysis.



Fault History: Complete archive of system alerts and diagnostics.



KPI Tracking: Real-time performance metrics and grid efficiency.



CO2 Reduction: Automated sustainability and environmental impact reports.



Easy Export: One-click data extraction in Excel and PDF formats.



SYSTEM ADVANTAGES

Empowering the Future of Urban Infrastructure

- **Long-Range Communication:** Seamless connectivity across vast urban landscapes.
- **Minimal Infrastructure:** Plug-and-play deployment with no heavy construction required.
- **Limitless Scalability:** Effortlessly expand from a single street to an entire metropolis.
- **Bank-Grade Security:** Data transmission protected by advanced AES-128 encryption.
- **Smart City Ready:** Fully compatible with diverse IoT sensors and municipal platforms.
- **Maximized ROI:** Significant reduction in both CAPEX (Capital) and OPEX (Operational) expenses.
- **Centralized Control:** 24/7 real-time monitoring and automation from a single dashboard.



FINANCIAL IMPACT & R.O.I.

Smart Investment, Rapid Returns

63% Energy Savings

Intelligent dimming profiles and automated scheduling reduce total energy consumption by up to 63% per luminaire.

1.05 Years Payback (ROI)

Massive reduction in OPEX ensures the entire smart lighting system pays for itself in just over one year.

Optimized Hardware Costs

Strategic integration of future-proof D4i drivers and cost-effective Zhaga nodes significantly lowers initial CAPEX compared to legacy systems.



OUR PROJECTS



GLOBAL IMPACT

Proven performance across diverse urban
landscapes and critical infrastructure.

CASE STUDY

SEKAPARK SMART CITY

LoRaWAN Lighting Control System

A massive intelligent lighting deployment spanning Kocaeli's premier urban park, utilizing a star network topology across 820 luminaires and 5 gateways.

Achievements

- >50% Energy Savings: Massive reduction in operational costs.
- Centralized Control: Full remote monitoring and dimming capabilities.
- Proactive Maintenance: Automated fault detection and real-time reporting to the command center.
- Zonal Management: Regional lighting profiles tailored for event center requirements.



CASE STUDY

ADNAN MENDERES AIRPORT

Apron Lighting Automation System

A mission-critical intelligent lighting deployment across the airport apron, utilizing a secure LoRaWAN infrastructure for seamless data transmission.

Achievements

- **>50% Energy Savings:** Significant cost reduction in high-power apron operations.
- **Advanced Dimming:** Dynamic control over individual luminaire intensity.
- **Real-Time Diagnostics:** Instant fault detection and central reporting.
- **Zonal Automation:** Precise regional control for active and inactive apron sectors.



CASE STUDY

TURKISH TECHNIC

Emergency Lighting Automation

A massive-scale safety deployment at Sabiha Gökçen Airport hangars, integrating over 5,000 emergency luminaires via LoRaWAN and DALI protocols.

Achievements

- **DALI Self-Testing:** Automated health checks and compliance reporting.
- **Battery Monitoring:** Real-time status and fault alerts for every unit.
- **Complete Traceability:** Comprehensive log records maintained centrally.
- **Remote Management:** Full visibility and control of the emergency grid.



CASE STUDY

İSTANBUL TEKNOPARK

Smart City Lighting Control

An advanced urban lighting network deployed across one of Türkiye's premier technology hubs, connecting 517 luminaires through 5 strategic gateways.

Achievements

- **>50% Energy Savings:** Maximized efficiency for campus-wide operations.
- **Centralized Dashboard:** Comprehensive remote monitoring and control.
- **Automated Reporting:** Real-time consumption data collection and fault tracking.
- **Adaptive Zoning:** Regional lighting profiles based on campus activity.



DOHA INTERNATIONAL AIRPORT

RAA DECORATIVE STREET LIGHT



CASE STUDY

HAMAD INT. AIRPORT

RGB Streetlight Control Upgrade

A prestigious 26-kilometer upgrade of Doha's main access road, featuring 220 intricately cladded 28-meter light towers with vibrant RGB illumination.

Achievements

- **High-Durability System:** Deployed modern, efficient infrastructure to address past performance issues.
- **Dynamic RGB Control:** Vibrant, scalable lighting profiles for a welcoming traveler experience.
- **Cultural Integration:** Illumination seamlessly synchronized with intricate cladding featuring Qatar's national song.
- **Stakeholder Excellence:** Successfully delivered to the exacting standards of KTC International and Ashghal.



HAMAD INTERNATIONAL AIRPORT OF DOHA

RGB
LIGHT
TOWERS



LEGACY ARCHITECTURE

THE COMPLEXITY BOTTLENECK

- ⚠ **Hardware Dependency:** A fragmented chain of DMX converters and antennas increasing potential points of failure.
- ⚠ **Signal Limitations:** The 500m restriction of W-DMX antennas creates significant vulnerability across the 26km project scope.
- ⚠ **Maintenance Blindness:** Lack of direct end-to-end telemetry prevents real-time fault detection at the luminaire level.

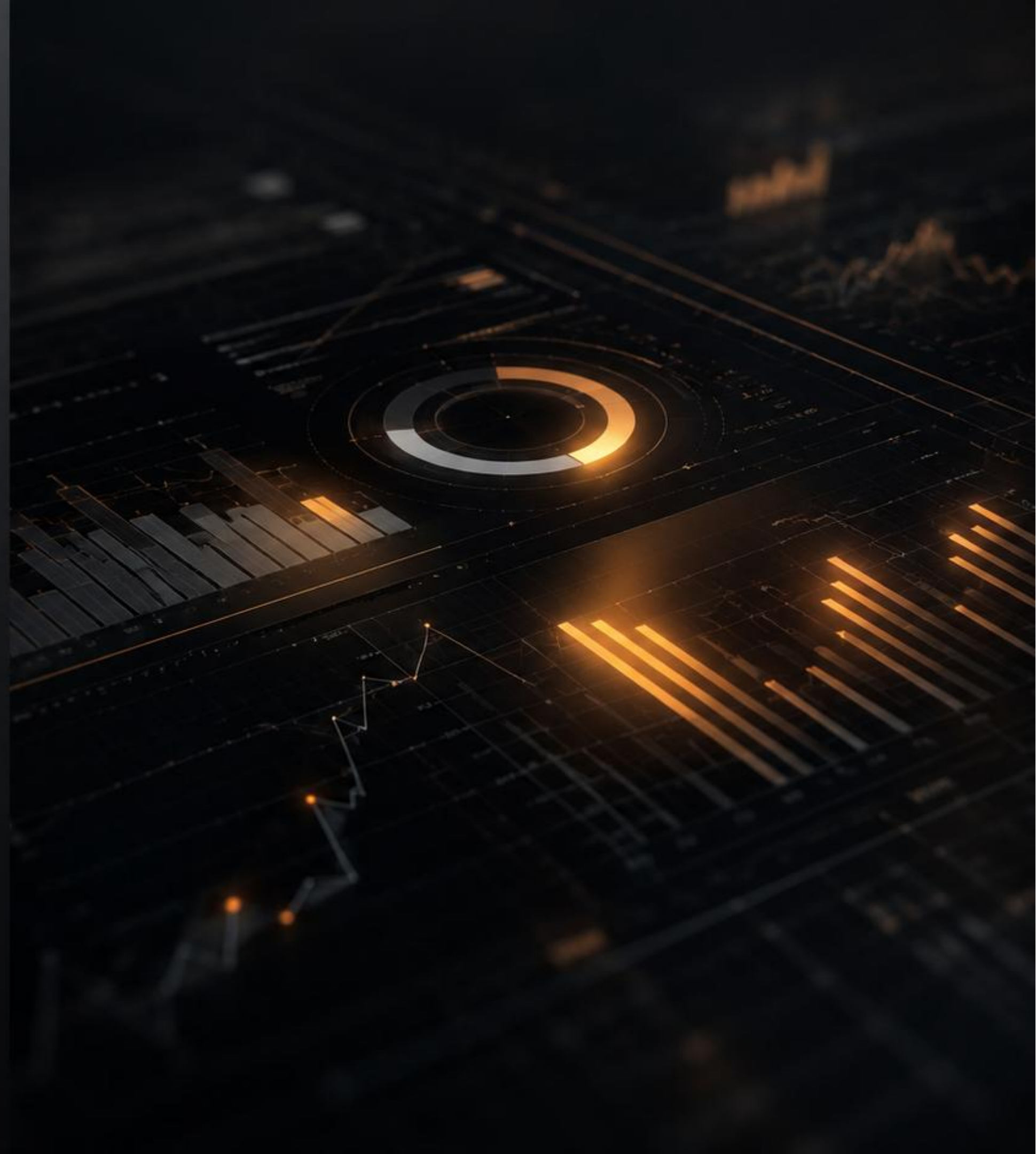


CRITICAL ANALYSIS

OPERATIONAL CHALLENGES

Why Modernization Was Essential

- **Communication Instability:** Limited wireless range inherent to the legacy W-DMX architecture caused frequent dropouts and unreliability over large distances.
- **Maintenance Blind Spots:** The absence of real-time LED failure reporting completely obscured grid health, complicating proactive maintenance.
- **End-of-Life Components:** With LEDs rapidly approaching their 50,000-hour operational lifespan, the lack of telemetry made targeted replacements impossible.



THE OPTOSMART SOLUTION

NEXT-GENERATION ARCHITECTURE

Streamlined, Scalable, and Fully
Synchronized

- ✔ **Hardware Simplification:** Complete removal of vulnerable intermediate hardware, eliminating all legacy DMX converters and localized antennas.
- ✔ **Long-Range LoRaWAN:** Implementation of an industrial-grade LoRaWAN protocol, ensuring reliable, long-distance telemetry across the entire 26-kilometer stretch.
- ✔ **Precision Timing:** Integration of GPS-based real-time clock synchronization for flawless, unified control of the RGB towers.
- ✔ **Future-Proof Scalability:** A highly scalable architecture that dramatically reduces hardware dependency and maintenance overhead for ASHGHAL.



LoRaWAN Control Diagram





Let's Build the Future of Smart Cities Together

optosmart.uk

