

CASE STUDY

Centralized IoT Device Lifecycle Management for Oilfield Operations



 Zemoso

Introduction

A Fortune 500 oilfield services company partnered with Zemoso Labs to solve a fundamental challenge: how to run hundreds of IoT devices across distributed oilfields without fragmentation, delays, or risk. Fragmented workflows, inconsistent module deployment, and siloed telemetry were limiting operational control and slowing innovation.

Zemoso built a centralized, modular IoT management platform that unified onboarding, module orchestration, and telemetry pipelines into a single intelligent system. Beyond reducing downtime, the platform created a foundation for predictive maintenance, autonomous operations, and operational insights at a planetary scale.

Industry challenge

In oil and gas, even a few days of unplanned downtime can cost millions—\$38 million on average per company per year. Legacy systems and manual processes amplify this risk: devices are registered inconsistently, modules are deployed ad hoc, and failures often go unnoticed until field engineers intervene.

Without a unified approach, companies face:

- Blind spots in operational monitoring, leading to delayed responses.
- Inconsistent device behavior, driving maintenance overhead and asset unreliability.
- Barriers to automation, preventing predictive analytics and AI-driven decision-making.

The industry needed more than just dashboards or monitoring tools. It needed an IoT backbone that could orchestrate, secure, and scale devices at global oilfield operations.

Zemoso's partnership challenge

The client's existing systems lacked a unified framework for device lifecycle management. Devices were onboarded manually, certificates installed through field-level interventions, and software modules deployed inconsistently by different teams.

Bringing order to this fragmented environment required designing a platform that worked seamlessly with:

- SAP-based device ordering systems
- Azure IoT Hub for connectivity
- A distributed network of field-deployed sensors

Security was a non-negotiable requirement, demanding hardware-backed authentication and end-to-end encryption at every stage. The goal was to create a scalable, secure, and resilient IoT backbone that could support both current operations and future automation initiatives.

Impact created

The unified platform reduced response latency, and enhanced visibility across distributed oilfield devices. Continuous telemetry analysis now enables early detection of anomalies, helping the client minimize downtime—an issue that can cost oil and gas operators up to \$38 million annually.

How did we do this?

Zemoso designed a resilient, composable IoT platform capable of managing distributed oilfield devices while maintaining security, reliability, and operational intelligence.

- **Modular Microservices Architecture:** Independently orchestrated services handle device registration, module deployment, telemetry ingestion, and alerting—ensuring the system can evolve without breaking existing operations.
- **Secure, Certificate-Based Communication:** End-to-end mTLS with hardware-backed YubiKey authentication and EST-managed certificates guarantees trust between devices, hubs, and backend services.
- **Dynamic Telemetry Routing:** MQTT-based pipelines intelligently prioritize and route telemetry from devices to processing hubs, enabling proactive anomaly detection without human intervention.
- **Cloud-Native, GitOps-Ready Platform:** Kubernetes, Docker, and Argo CD enable fully automated deployments and elastic scaling across hundreds of sites, supporting fleet-wide orchestration.
- **Extensible Interfaces for Teams and Clients:** ReactJS dashboards and charting modules provide tailored visibility to operations teams while maintaining robust access controls, allowing future extensions like AI-based predictive analytics without re-architecture.

Conclusion

Zemoso reimagined device lifecycle management at planetary scale. What was once a patchwork of siloed devices is now an intelligent, self-orchestrating network.

The client can now:

- Minimize downtime and operational risk.
- Deploy modules reliably across hundreds of devices without field intervention.
- Capture actionable insights for predictive and autonomous operations.
- Build on a secure, extensible architecture that future-proofs oilfield IoT for years to come.