

Real-Time Environmental Monitoring at Gelephu International Airport, Bhutan



INTRODUCTION: Building a Mindful Future with Smart Environmental Monitoring

As part of Bhutan's visionary "Mindfulness City" project, the development of Gelephu International Airport represents a significant step toward sustainable urban infrastructure. Located in Samtenling Gewog, Sarpang District, this airport is one of Bhutan's strategic aviation hubs and is currently under active development.

In alignment with the country's ecological values, the airport authorities recognized the urgent need to monitor environmental quality during construction. To achieve this, they partnered with Ecolab Analytical and Technical Centre Bhutan and deployed Oizom's Polludrone Custom, a comprehensive, continuous air quality monitoring system designed to maintain air quality and enhance efficiency in fast-evolving construction environments.



THE CHALLENGE: Monitoring Amidst Complex Environmental Conditions

The early phases of constructing an international airport over 750 acres of land in Bhutan's dynamic terrain presented numerous environmental and operational hurdles:

1. **High-Impact Construction Emissions:** Excavation, grading, and heavy equipment led to increased levels of PM₁, PM_{2.5}, PM₁₀, and PM₁₀₀, posing health and visibility risks.
2. **Multi-Source Gaseous Pollutants:** Emissions from machinery released CO, CO₂, SO₂, NO, NO₂, and O₃, requiring constant tracking to ensure safe exposure levels.
3. **Weather-Driven Operational Risks:** Variable wind, rain, UV exposure, and temperature affect on-ground safety and material handling.
4. **Public and Stakeholder Accountability:** Being a high-profile project, the airport development required a transparent environmental strategy that could be publicly communicated.
5. **Future-proofing Infrastructure:** As part of a smart city initiative, the environmental monitoring solution had to be scalable, integration-ready, and capable of supporting future urban infrastructure goals.
6. **Instant Visibility for On-Site Decisions:** Quick decision-making required instant visibility into environmental trends to avoid delays and ensure workforce safety.

To navigate this complex matrix, Gelephu Airport needed a reliable, scalable, and compact solution capable of delivering real-time, multi-parameter insights with remote accessibility.

THE SOLUTION: Oizom's Polludrone Custom—Designed for Smart Infrastructure

To address these multifaceted challenges, Oizom deployed two units of Polludrone Custom at the Gelephu International Airport construction site in April 2025

Key highlights of the solution:

1. **Comprehensive Environmental Monitoring:** Polludrone ensures high accuracy in measuring CO, CO₂, SO₂, NO, NO₂, and O₃ along with PM (PM₁, PM_{2.5}, PM₁₀, PM₁₀₀), and meteorological parameters like, noise, UV, light intensity, wind direction and speed, and Temperature, Humidity & Pressure (THP) for safety and compliance during unpredictable construction emissions.
2. **Remote Monitoring with Minimal Maintenance:** With remote data access and self-diagnostics, the system requires minimal maintenance, perfect for Gelephu's remote site with limited on-ground technical manpower.
3. **Envizom for Centralized Decision-Making:** Envizom enables centralized monitoring with real-time



**INSTALLATION
DETAILS**

**2 UNITS
of
POLLUDRONE**

dashboards, alerts, and historical analytics, supporting proactive decisions and transparent environmental reporting.

4. **Weatherproof and Rugged Design:** IP65-rated enclosures and climate-resilient sensors ensure uninterrupted performance in Bhutan's varying weather conditions, from high humidity to monsoon rains.
5. **On-Ground Support:** Local partner Ecolab provided seamless installation, calibration, and ongoing support, ensuring high system uptime and localized technical expertise.
6. **Real-Time Alerts for Proactive Response:** Threshold-based alerts for dust, noise, gas, and UV help project teams take quick actions, reducing environmental risk and ensuring worker safety.

This solution was implemented with local expertise from Ecolab Analytical and Technical Centre Bhutan, ensuring seamless integration, calibration, and operational continuity.

THE TRANSFORMATION: From Reactive Monitoring to Proactive Environmental Control

The deployment of Oizom's Polludrone Custom at Gelephu Airport led to tangible and multi-layered benefits:

1. **Proactive Pollution Management:** Continuous tracking of particulate and gas pollutants allowed for timely mitigation and ensured compliance with Bhutan's environmental norms.
2. **Data-Driven Construction Planning:** Real-time environmental insights via Envizom enabled project teams to schedule work based on favorable weather and pollutant trends, minimizing ecological disruption.
3. **Sustainability Reporting:** Regular reports with accurate and continuous environmental data, streamlined compliance documentation, and sustainability disclosures, supporting the long-term environmental goal of the city.
4. **Future-Ready Infrastructure:** Installing air quality monitors established the foundation for smart city integration, supporting Bhutan's larger vision for intelligent urban ecosystems.
5. **Early Warning Alerts:** Threshold-based notifications on the Envizom platform empower on-ground teams to swiftly respond to spikes in pollutants, UV radiation, or noise.

The successful deployment of Oizom's continuous air quality monitoring solution at Gelephu International Airport showcases the critical role of environmental intelligence in modern infrastructure development.

BROADER IMPACT: Supporting Bhutan's Vision of Sustainable Development

The installation is more than a monitoring initiative, it is a foundation for Bhutan's long-term sustainable development vision:

1. **Transparent Sustainability Reporting:** Reliable, exportable data from Envizom supports

compliance reporting and stakeholder communication.

2. **Smart Infrastructure Readiness:** The system aligns with the larger smart city framework, enabling long-term scalability for future urban development.
3. **Environmental Consciousness:** Real-time environmental awareness has fostered a culture of mindfulness and ecological sensitivity among workers and stakeholders.

CONCLUSION: Leading with Data for a Sustainable Tomorrow

The collaboration between Gelephu International Airport, Ecolab Analytical and Technical Centre Bhutan, and Oizom exemplifies how real-time environmental monitoring can drive sustainable infrastructure development. By integrating Polludrone Custom into the early phases of airport construction, stakeholders ensured that sustainability was embedded, not added later.

As Bhutan moves forward with its ambitious Mindfulness City vision, Gelephu now stands as a benchmark for data-driven, future-ready development where environmental stewardship and progress go hand in hand.

Oizom is a company specializing in environmental monitoring solutions. They offer products to monitor air quality, weather conditions, and other environmental factors. Utilizing advanced sensor technology and data analytics, Oizom aims to provide actionable insights for construction, industrial compliance, and community awareness. Their solutions can be applied in various sectors including government, industries, and community initiatives.