# MOBILE AIR POLLUTION MONITORING SYSTEM

Traditional air quality monitoring relies on fixed stations. Although accurate, they offer limited spatial coverage and high deployment costs.

## KEY CHALLENGES:

1. Inadequate coverage in suburban or residential districts.
2. Lack of dynamic data during different times of the day.
3. Difficulties in tracking pollution patterns in motion-intensive environments.

## ASSUMPTIONS:

1. Pollution sensors mounted on public buses collect geolocated environmental data.
2. Data processed via industrial-grade concentrators and visualized on an interactive synoptic map
3. Real-time updates, cross-border research, scalable architecture.

## SOLUTIONS: Distributed sensoring via public transport

Public buses follow predefined urban routes daily. By equipping these vehicles with dedicated environmental monitoring systems, it is possible to:

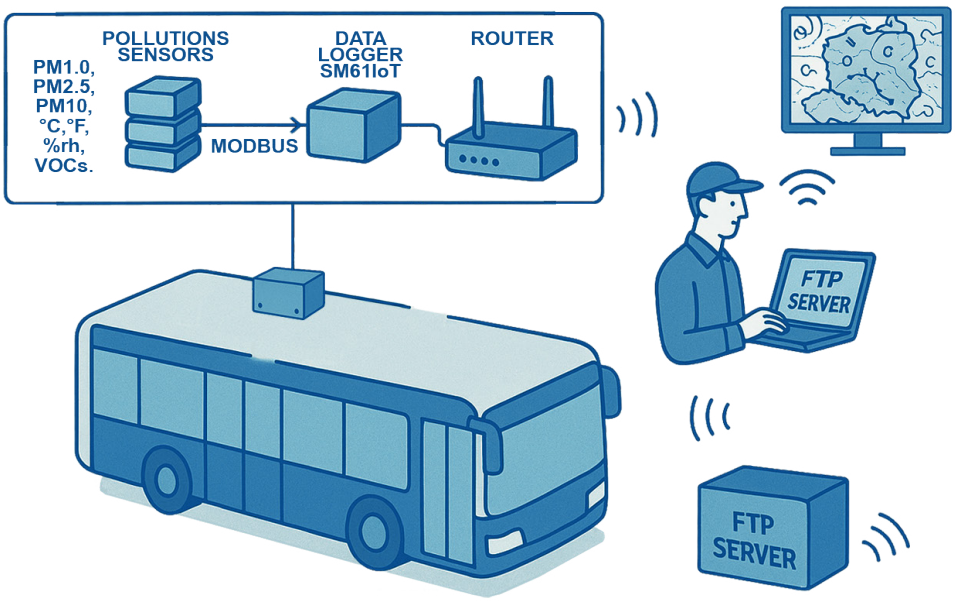
- Extend the effective sensor network footprint.
- Generate geo-tagged datasets across time and location.
- Enable low-cost, high-frequency sampling in motion.

Each sensor box functions as an autonomous mobile measurement station.

## SYSTEM COMPONENTS per:

- **Air Pollution Sensors:**
  For PM1.0 / PM2.5 / PM10, temperature, humidity, $VOC_s/O_3$, $SO_2$, $NO_x$.
- **MODBUS-compatible Adapter:**
  Collects and standardizes sensor outputs.
- **Data Logger (SM61IoT):**
  Handles real-time data acquisition, time-stamping, and memory buffering.
- **Industrial WiFi Router:**
  Provides local network via 2.4GHz WiFi; connected to the SM61IoT via Ethernet.

## DATA FLOW AND SYSTEM ARCHITECTURE




- **During vehicle operation:**
  - Air quality data is collected continuously and transferred via MODBUS RTU to the SM61IoT unit.
  - The concentrator performs initial pre-processing and stores data in its internal memory.
  - A router (WiFi AP) connected via Ethernet to the SM61IoT creates a dedicated WLAN, isolated from public networks.
- **At the depot:**
  - An authorized technician connects a laptop to the local WiFi access point.
  - Data is downloaded directly from the SM61IoT via FTP protocol (no cloud required).
  - Downloaded datasets are imported into a central server for analysis and visualization.
- **Visualization:**
  - A custom interactive synoptic map visualizes pollution levels by bus route and time.
  - The map is updated daily, offering real-time insights into air quality trends.

**EXAMPLE USE CASE:**

„Environmental officers can analyze peak PM2.5 levels along specific corridors and identify recurring pollution events."

## TECHNICAL ADVANTAGES AND PRACTICAL OUTCOMES

- Modular architecture: Scalable to multiple buses and cities.
- Offline data capture: No dependency on continuous mobile/GSM connectivity.
- Secure local FTP access: Ensures data integrity and user-controlled retrieval.
- Real-time spatial coverage: From streets with no fixed stations.
- Actionable insights: Support for public health alerts, smart city dashboards, and urban planning.
- Open data model (optional): Data can be shared with citizens or integrated via API.

Thanks to this solution, we can offer real environmental intelligence to our communities – and show that our region invests in sustainable living.

A pilot deployment by LUMEL S.A., University of Zielona Góra and BTU Cottbus.