Considerations when deploying a sensor-based air quality network

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• Air quality sensor-based systems: Challenges and Issues

• Considerations: Air quality network

• Uses cases:
  • Spain
  • Ethiopia
  • Formula E – Germany
  • India
Quality Assurance (QA) - appropriate calibration ensures that data monitored are robust and accurate.

Quality Control (QC) - monitoring the long-term performance to ensure it remains calibrated and help notify the user when it needs to be corrected, removed or re-calibrated.

Snyder et al., 2013 “Data of poor or unknown quality is less useful than no data since it can lead to wrong decisions”.
• Important to develop and refine new **scalable calibration and quality control approaches**.

• Proper **QA&QC procedures allow users to better understand the quantitative capabilities** and are resource-efficient → keep the overall cost of the network operation low.

• **Developing, optimizing, and refining advanced techniques for sensor calibration and validation** is essential to obtain reliable and meaningful data.
CONSIDERATIONS - AQ NETWORK

Correct installation and maintenance to ensure the proper performance of the devices and the quality of the data.

✔ Usability → easy of use, reduced maintenance
✔ Portability → autonomy, mass and volume (Form factor)

SELECTING MONITORING EQUIPMENT

The monitor sensors you choose to add to your network will depend on:

• the pollutant(s) you want to measure
• the data quality
• the budget you can devote to purchase and maintain the equipment.
CONSIDERATIONS - AQ NETWORK

Examples:

• Solar Panel vs. Main Electrical Network
• Solar Panel Dimensions
• Easy&Fast installation vs. Difficult deployment in field
**USES CASES - Spain**

**Devices:** 10 Kunak AIR Pro stations + sound level meters + information screens

**Measurement parameters:**
- SO₂, NOₓ, O₃, CO and particles (PM1, PM2.5 and PM10)
- Noise level.
- Temperature, relative humidity and atmospheric pressure.
- Wind speed and direction.

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<th>CHALLENGES</th>
<th>SOLUTIONS</th>
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<td>AQ data accessible from web portal and screens.</td>
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<td>Civil engineering work. Poles installation.</td>
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<td>Public electrical network spots</td>
<td>Powered by public electric bikes chargers</td>
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<td>Lack of concern about the O&amp;M of the network</td>
<td>Operation and Maintenance Service in remote</td>
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<td>Public tender – fixed price</td>
<td>Price not adaptable for improvements</td>
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CONSIDERATIONS - AQ NETWORK

USES CASES - Ethiopia

**Devices:** 5 Kunak AIR A14 stations

**Measurement parameters:**
- NO₂, O₃ and particles (PM1, PM2.5 and PM10)
- Temperature, relative humidity and atmospheric pressure.
- Wind speed and direction.

**CHALLENGES**

- Not Official Reference Stations
- High temperature and humidity conditions
- Low budget

**SOLUTIONS**

- Factory calibration against reference standards
- Remote baseline and sensitivity correction
- Kunak temp/RH correction algorithm
- Automatic maintenance of the network (not technician hours)
USES CASES – Formula E (Germany)

Devices: 5 Kunak AIR PRO stations

Measurement parameters:
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CHALLENGES SOLUTIONS

- Fast deployment (1 week project) • Plug&Play installation
- Electrical network not fully accessible • Solar panel (small dimensions)
- Not RS data for calibration • Factory calibration against reference standards
- Pilot Project (low budget) • Remote baseline and sensitivity correction

Session 5D: Standard, Supplemental and Informational Monitoring
Friday 13th May - 9:50 AM-12:10 PM

How can non-exhaust motorsports events improve urban air quality in cities with hyper-local monitoring?
CONSIDERATIONS - AQ NETWORK

USES CASES - India

**Devices:** 5 Kunak AIR PRO stations
Official Air Quality Stations

**Measurement parameters:**
- CO, NO₂, O₃, SO₂ and particles (PM1, PM2.5 and PM10)
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**CHALLENGES**
- Temperature >40°C
- AQ data diffusion to citizens
- New country

**SOLUTIONS**
- Kunak temp/RH correction algorithm
- RS web widget development
- Local partner help
• **Visualize the operation** of the equipment and the data obtained → to monitor the health of the network and the status of the devices.

• **Detect errors and anomalies** in the devices and data **immediately**, consult them, and invalidate the data if needed.

• **Detect** that the gas and particle sensors need **calibration** and allow the **calibration remotely**.

• Availability of a validation tool for **validating and invalidating the data remotely**, to have reliable data for advanced analysis.

• A **Computer-based Maintenance Management System** → to facilitate network maintenance.
  ◦ maintenance tasks
  ◦ uploading of images and documents
  ◦ access to configuration history, logbook, etc.
Advanced platform for air quality networks remote management and noise levels analysis

- Data visualization
- Data integration
- Remote device configuration
- Warnings and alarms
- Calibration tools
- CMMS (Computerized maintenance management system)
- Validation tool
- Analysis tool
- Automatic reports
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Warnings and alarms
USES CASES – Formula E

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Data integration
https://kunakcloud.com/dashboards/india/karnataka.html
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