Q3/2025 Maintenance Report

Device Performance Report and Maintenance of Comprehensive City-owned LCS AQ Monitoring Network

Contents

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Introduction

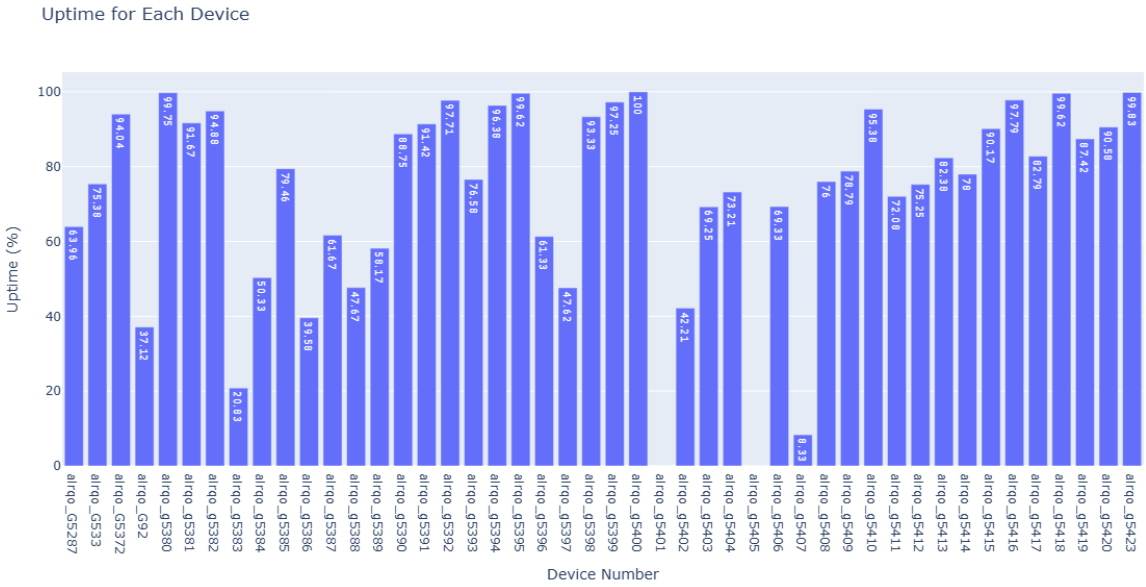
Within the framework of the project "***Procurement and deployment of a comprehensive city-owned low-cost sensor AQ monitoring network"*** in Nairobi City County Government, the Air Quality Systems East Africa (AQSEA) deployed 50 sensors across the county. The deployed devices provide near real-time data on particulate matter concentrations with sizes from PM2.5, and PM10 including temperature and humidity readings. The network has enabled tracking of the ambient emissions and understanding of the concentrations of pollutants and informing the actions. This report provides insights on the performance of the devices and recommendations for optimizations wherever required.

Overview of device performance

This is a comprehensive summary of the performance of the air quality monitoring devices over the specified period from 1st June 2025 to 31st August 2025 regarding data availability and quality.

Device runtime

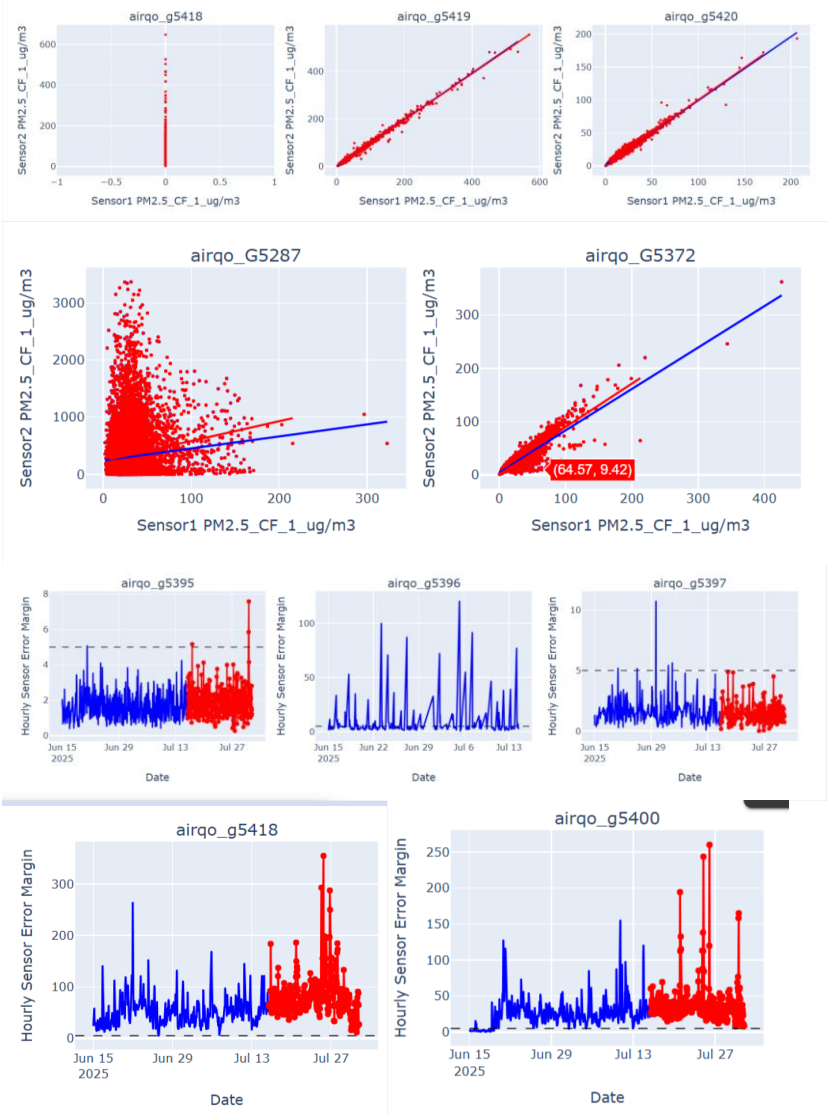
The devices are expected to provide data throughout the day and thus should be available 100% of the time for the selected period. Below is the availability of each device



During the analysis period, approximately 14 of the devices had less than the desired uptime performance of at least 75% as prescribed by the manufacturer. Two devices, airqo_5401 and airqo_g5405 were offline the entire period of analysis.

Selected device performance indicators

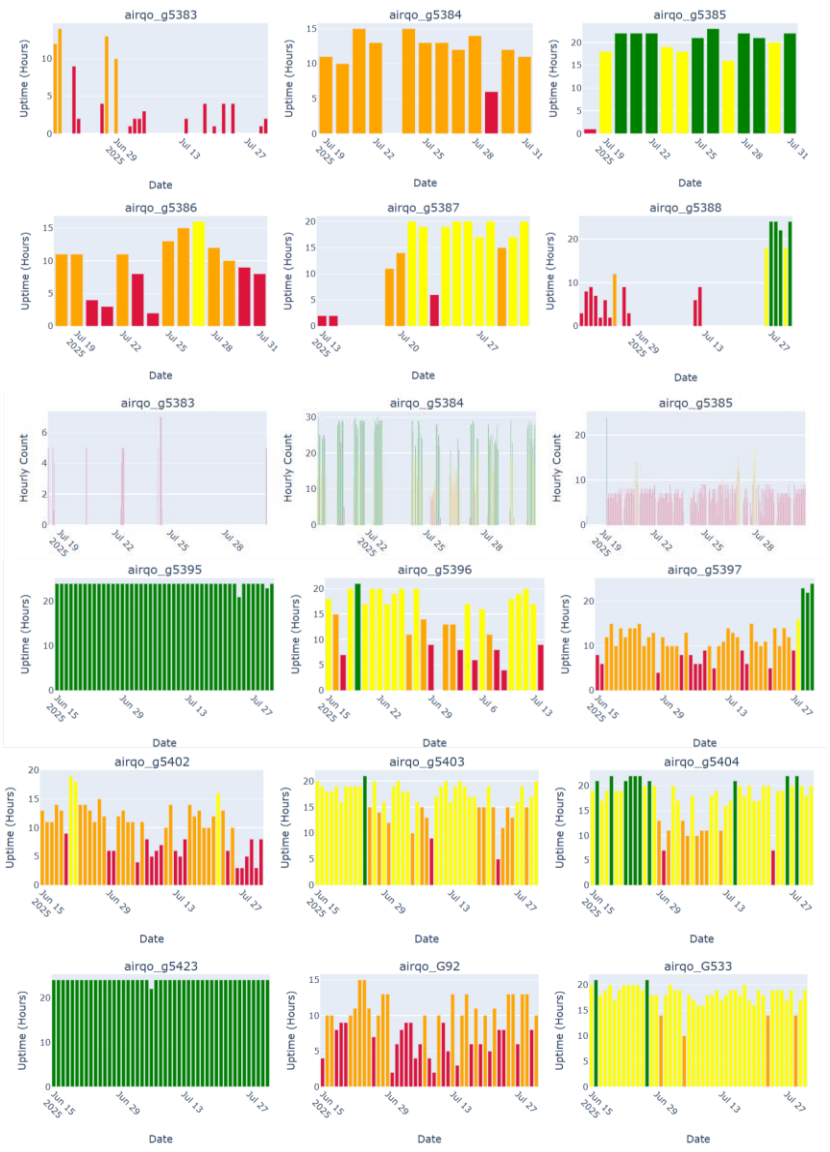
PM Sensors -



- Indicators:
  - Intra-sensor correlation
  - Average error margin
- Poor intra-sensor correlation - device airqo_g5418 had a faulty sensor (sensor 1) and airqo_g5287 showed deteriorating correlation
- Error margin - devices airqo_g5396, airqo_g5418, airqo_g5400 had error margin above 5.
- Preventive maintenance :
  - Blowing off dust from the sensor inlet
  - Clearing cobwebs from the inlet
- Corrective maintenance:
  - Replace PM sensors for airqo_g5418

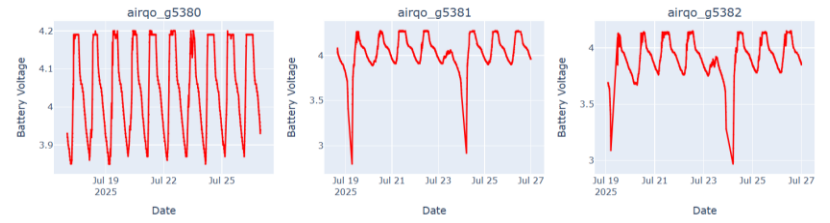
- The device gives 24-hour data availability with consistency in hourly communication

General Performance - Battery and Communication

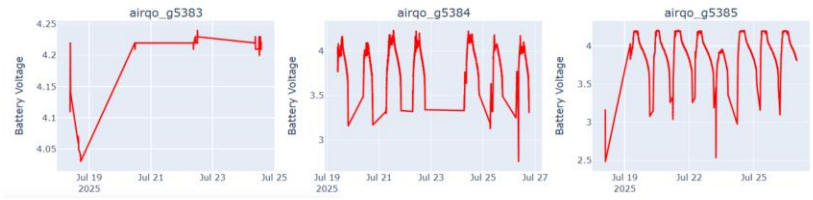


- Daily active hours were used to understand how frequent the devices sent data. Approximately 12 devices had frequent outages with most of them active for at least 15 hours every day.
- Recommendations:
  - Review of the device communication and battery health to understand the frequency of the downtime
  - Firmware updates
  - Battery upgrades

Battery Health



- Two devices airqo_g5383 and airqo_g5384 had poor charge and discharge patterns. Issues related to solar charging or battery life.
- Recommendations:
  - Solar or battery check and replacement

	○ GSM test and rectification for communication issues ○ Firmware update

General Recommendations

Air quality monitors require preventative maintenance every 6 months to prevent failures, limit unplanned downtime and ensure high data quality. It is generally recommended to perform both preventative and corrective maintenance. Critical components, such as sensing elements and batteries, should be replaced or serviced as needed. Maintenance activities will include firmware upgrades (to the latest software version), sensor replacement and cleaning, battery upgrades, solar panel upgrades (where applicable), and secure SD card data logging and backup.

Objective	Key results	Outcome
CORRECTIVE AND PREVENTIVE MAINTENANCE Restore the air quality sensor network to full operational status, ensuring all sensors are functioning correctly and providing accurate, reliable data within acceptable performance standards.	● Clean sensor filters for all devices. ● Sensing element replacement for all devices ● Battery replacements for all critical devices. ● Firmware upgrade for devices.	● Improved air quality monitoring to support awareness and policy engagement ● Improve uptime for device operation. ● Extended runtime on battery ● Improve charging, allowing for longer float periods.

Maintenance Activities

Description	Image
Site name: Lower Kabete Primary School Devices: AIRQO_G5387 Issues fixed: Communication (offline device)	
Site name: New Kihumbuini Primary School Devices: AIRQO_G5384 Issues fixed: Communication (offline device)	
Site name: Karura Primary School Devices: AIRQO_G5381 Issues fixed: Communication (offline device)	

Site name: Kasarani Mwiki Road Devices: AIRQO_G5386 Issues fixed: Communication (offline device)	
Site name: Kasarani Primary School Devices: AIRQO_G5406 Issues fixed: Communication (offline device)	
Site name: Cheleta Primary School Devices: AIRQO_G5385 Issues fixed: Communication (offline device)	

2.2 post-maintenance analysis

Device performance comparison a week before and after maintenance involved analysis of battery charge-discharge curves, intra-sensor correlation, and average hourly data points to quantify uptime.

Observations:

- Improved battery performance, network uptime and sensor correlation.
- New firmware update improves overall battery performance and device uptime.
- Firmware update with 100% SPV setting leads to reduction in hourly data points. Observed drop from over 40 to 20 data points reported per hour.