Edifice Rx®
Healthier Environments for a Sustainable Future

PREDICTIVE HVAC HYGIENIC MAINTENANCE FOR HEALTHCARE FACILITIES

REMOTAIR
HVAC Cleanliness in Real Time

3 KINDS OF POLLUTION

1. Outdoor pollution
2. Indoor pollution
3. **HVAC pollution**

Pollution is not limited to outdoor environments. In fact, **pollutants can infiltrate indoor spaces where we spend our daily lives**, such as schools, houses, hospitals, offices, supermarkets, cinemas, and production sites, among others.

Moreover, **pollution can originate inside HVAC systems** due to poor hygienic conditions or inadequate air circulation within the rooms. When this occurs, indoor air quality can reach unhealthy levels, with great danger to human health.

THE LINK BETWEEN INDOOR AND HVAC POLLUTION

HVAC systems become contaminated over time. External pollution penetrates the system and it multiplies through the colonization of internal surfaces by microbiological agents (especially molds).

SO

If HVAC systems are not properly hygienically managed, with regular inspections and any necessary corrective actions, dangerous contaminants will spread into the environment, putting human health at risk (consider that a person inhales an average of 12,000 liters of air each day).

This is aside from the inefficiencies and waste caused by a damaged, weakened, or slowed system (clogged filters, air leaks, etc.).

While not all indoor pollution can be attributed to this, it's clear that without HVAC pollution, indoor pollution would be significantly less concerning.

CONTAMINATING AGENTS

Chemical agents

Chemical agents typical of indoor air pollution can originate from both outdoor and indoor sources.

They include:

- Environmental tobacco smoke (ETS)
- Nitric oxide and nitrogen dioxide (NOx, NO2)
- Sulfur oxides (SOx)
- **Carbon monoxide (CO)**
- Ozone (O3)
- **Particulate matter (PM10, PM2.5)**
- Benzene (C6H6)
- **Volatile organic compounds (VOCs)**
- **Formaldehyde (CH2O)**
- Polycyclic aromatic hydrocarbons (PAHs)
- Asbestos

CONTAMINATING AGENTS

Biological and microbiological agents

Biological indoor air contaminants include:

- microorganisms (such as **fungi**, **bacteria**, **viruses**);
- indoor allergens (like **dust mites**, **allergens** from plants and animals);
- **molds**.

Microbiological indoor air contaminants include:

- environmental bacteria belonging to the genera Bacillus or Micrococcus
- bacteria belonging to the genera Mycobacterium
- bacteria of the Legionella genus
- microorganisms belonging to the genera Staphylococcus, Candida, Clostridium
- viruses
- endotoxins and mycotoxins

CONTAMINATING AGENTS

Physical agents

- **Radon** is a gas that becomes very dangerous to health when it reaches particular concentrations in confined spaces.
- Then there's electromagnetic pollution, stemming from telecommunications infrastructure, radio and TV transmissions, household appliances, power lines, and industrial installations.
- Noise, a source of acoustic pollution, can also severely damage the human ear.

THE RISKS OF HVAC POLLUTION

Sick Building Syndrome (SBS)

It cannot be attributed to an identifiable etiological agent and presents with various, non-specific symptoms such as fatigue, headache, cough, chest tightness, mucous membrane and skin irritation, burning and redness of the eyes, and general discomfort.

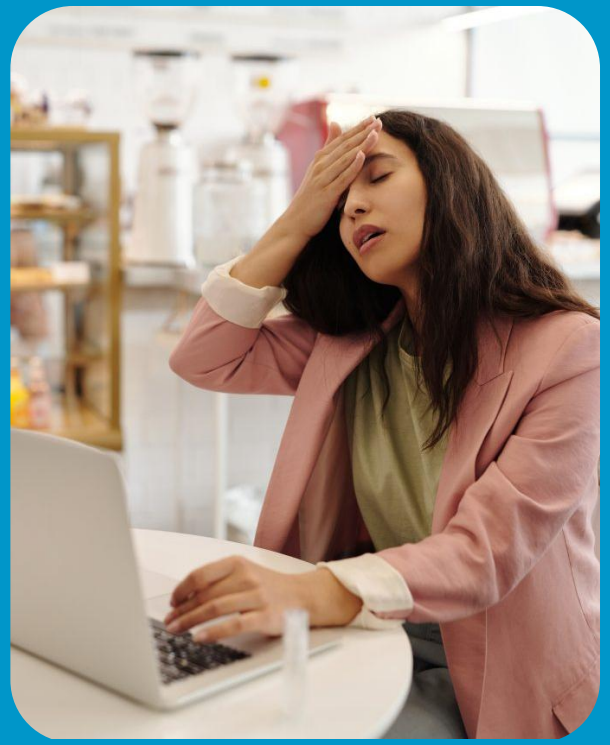
These symptoms appear in a high percentage of exposed individuals and are chronologically associated with work activity, as they often diminish or resolve when the individual leaves the unhealthy environment.

THE RISKS OF HVAC POLLUTION

Building Related Illness (BRIs), conditions caused by bacteria, fungi, viruses, and those resulting from dust and chemical contaminants.

These illnesses are much more severe than the previous ones. They generally present a uniform clinical picture, a well-identified etiology and defined clinical and laboratory signs.

They require prolonged recovery despite leaving the building, and the need to remove the contaminating agent to achieve patient recovery.



SCIENTISTS SAY…

Prevention of Nosocomial Infections, an essay published on the National Library of Medicine

***The Causes of Hospital-Acquired Infections*, by Galfand Berger LLP (injury law firm in Philadelphia)**

***Guidance on Indoor Environmental Quality in Health Care Facilities*, by PAHO and WHO**

HVAC pollution: the risk for people's health and safety

HVAC pollution can’t be detected with current IAQ environmental sensors. For this reason, it’s important to check contaminations at their source: directly inside HVAC.

Ex. CONTAMINATED AHU

Ex. CONTAMINATED DUCT

BUT INSPECTIONS

- **Require much expertise** → you need a trained technician
- **Require to turn off the systems** → it is possible?
- **Take time** → time has a cost, especially in the night
- **Are invasive** → all the spaces are always accessible?
- **Are limited to a single day** → what happens untile the next inspection?

Could we automate the inspection process, collect data remotely and continuously?

ABOUT REMOTAIR

Remotair is a patented HVAC monitoring system based on **symbiotic** Artificial Intelligence that guarantees the hygienic surveillance of HVAC systems **24 hours a day, 365 days a year**.

Compared to traditional inspection methods, **Remotair constantly monitors the hygienic conditions of HVAC systems and immediately send an alert if an intervention is needed.**

ABOUT REMOTAIR

Thanks to its machine learning capabilities, Remotair performs predictive analysis on the trend of HVAC contamination over time, predicting well in advance. The phenomenon potentially dangerous to human health.

Remotair makes it possible to intervene promptly in case of bad
hygienic conditions and allows you to save time and money for unnecessary interventions.

ADVANTAGES

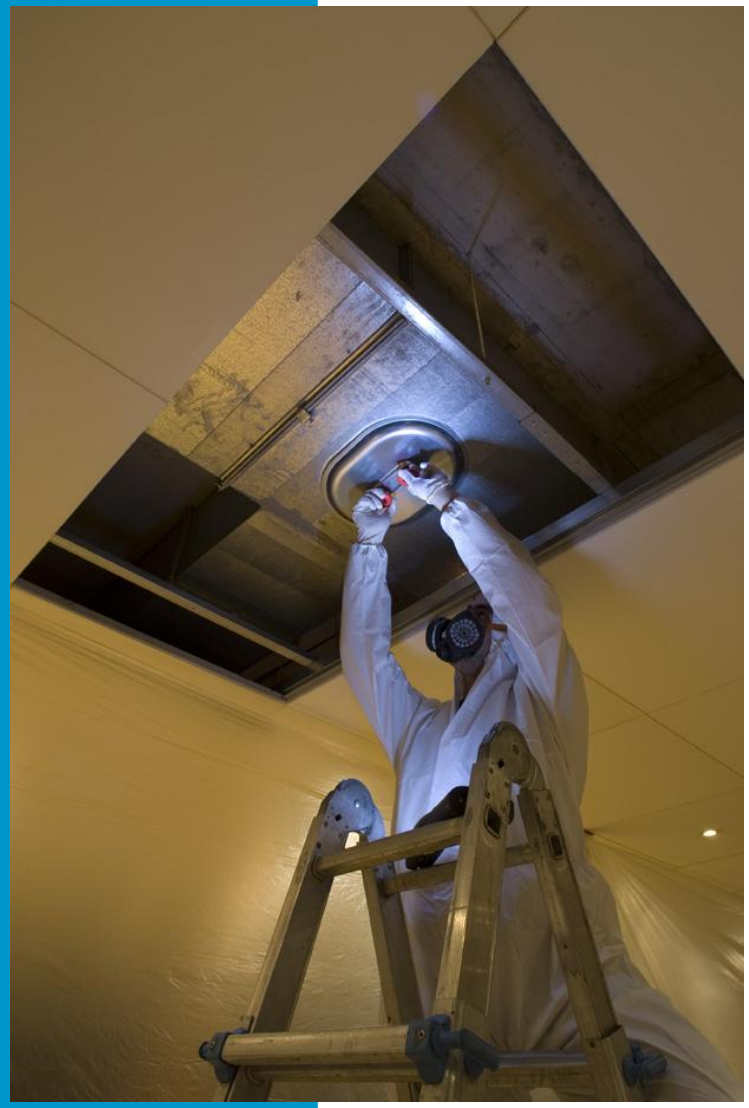
Thanks to the continuous control of the hygienic conditions of HVAC systems, 24 hours a day for 365 days a year, the system offers great advantages from the point of view of **health, legal protection and costs**.

Potentially dangerous phenomena are **immediately recorded and reported**, so that the most appropriate corrective actions can be quickly performed.

ADVANTAGES

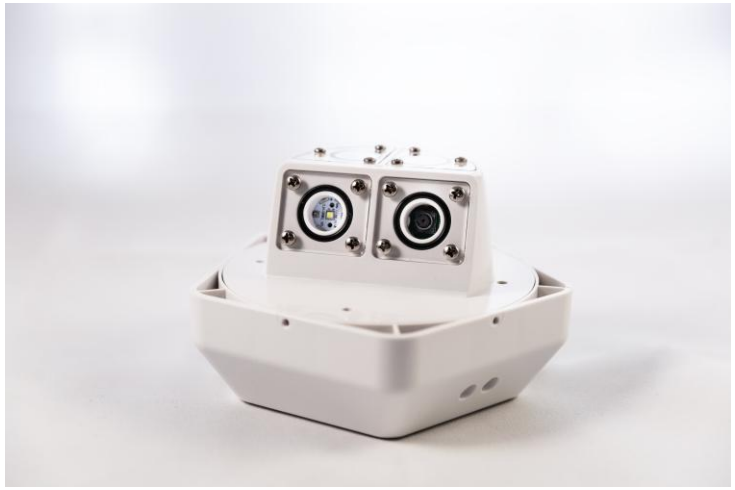
The system allows you to physically intervene on the systems **only if necessary.**

Remotair doesn’t replace the direct intervention on HVAC systems by a specialized technician, it reduces it only to the cases in which it is actually necessary.



ANATOMY OF REMOTAIR

Thanks to AI, Remotair **autonomously understand whether the HVAC system is clean or dirty** and it makes long term predictions on contamination dynamics.



CAMERA DEVICE

Two high resolution cameras designed and configured to take images inside air ducts and AHU several times a day.

FILTER DEVICE

Two differential pressure sensors capable of detecting the DeltaP values of filters and/or heat exchange coils.

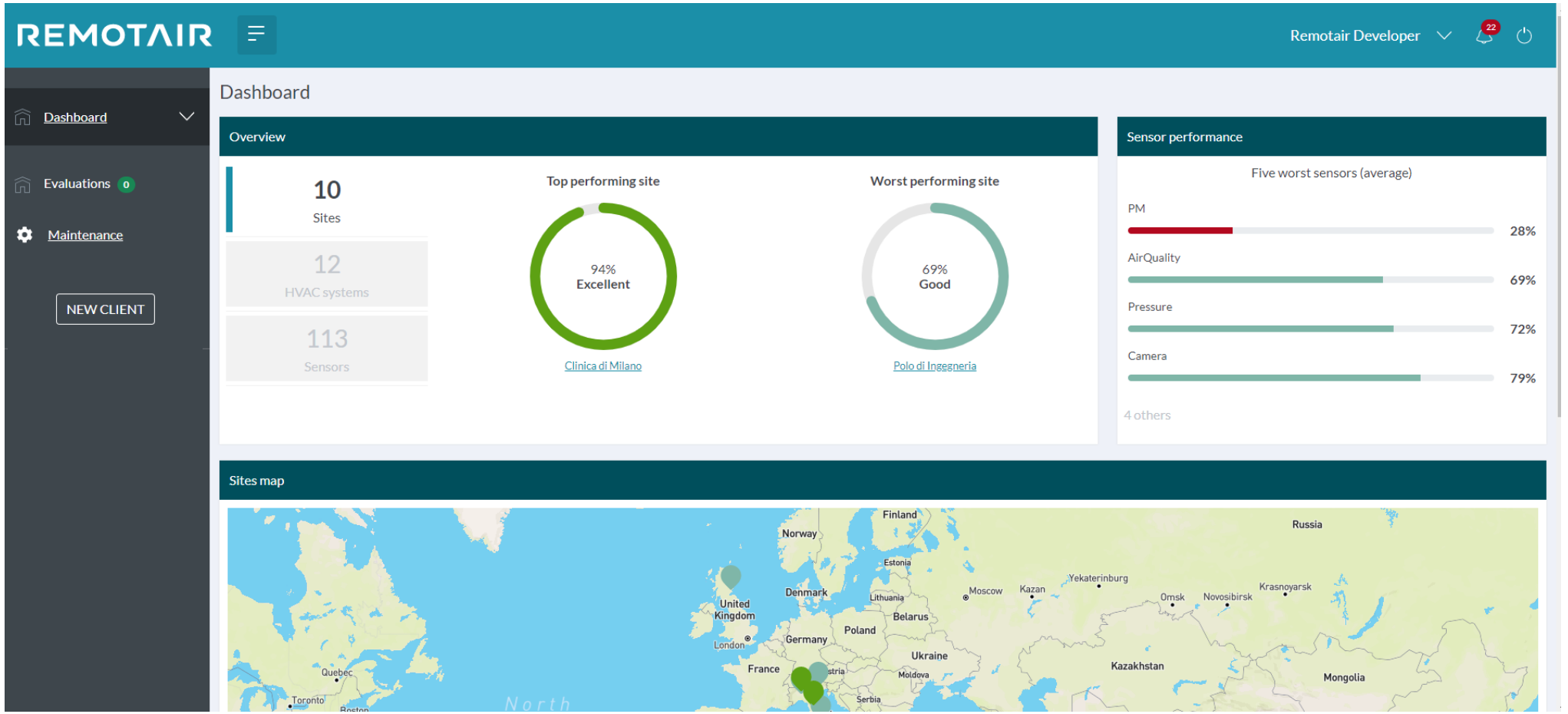
IAQ DEVICE

Monitors air quality inside an HVAC system.

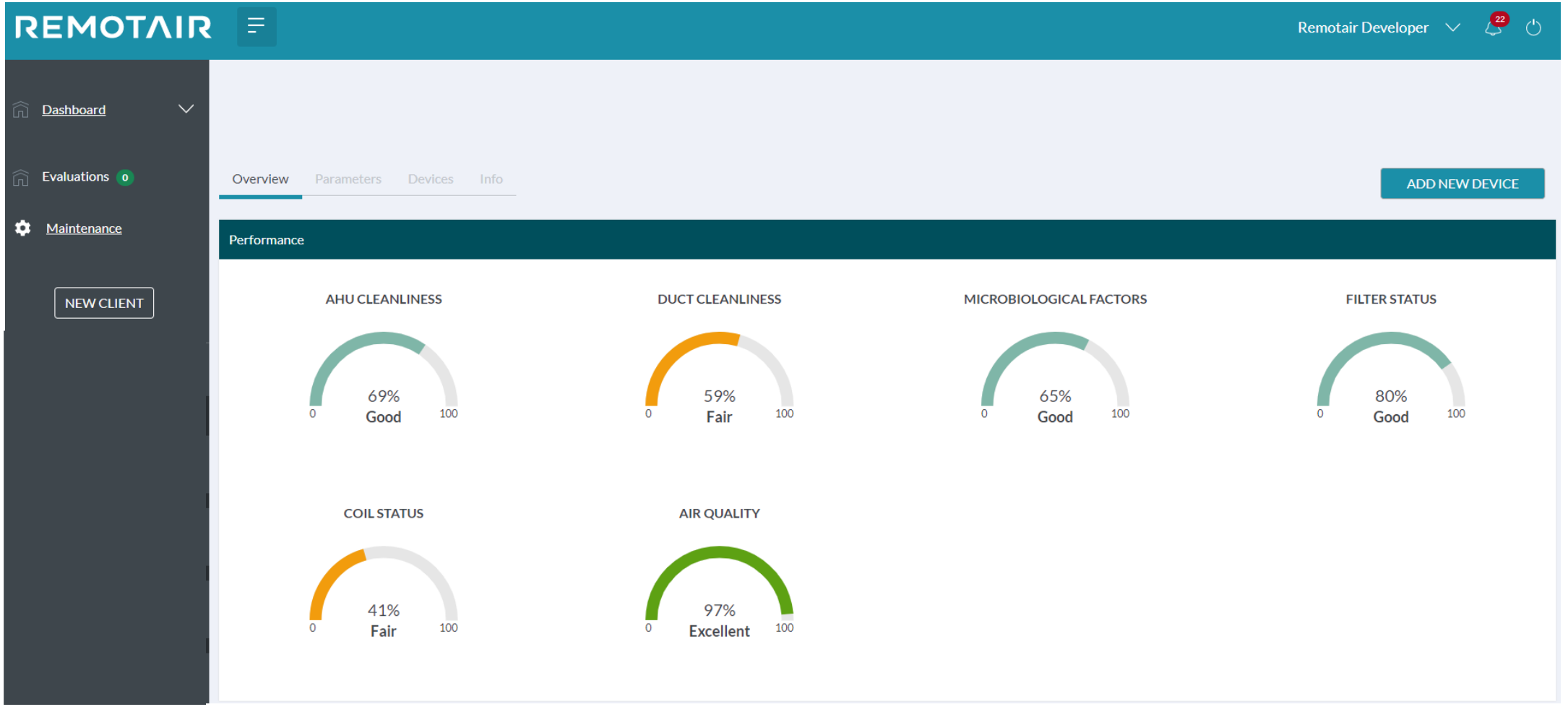
Portal

HOW IT WORKS

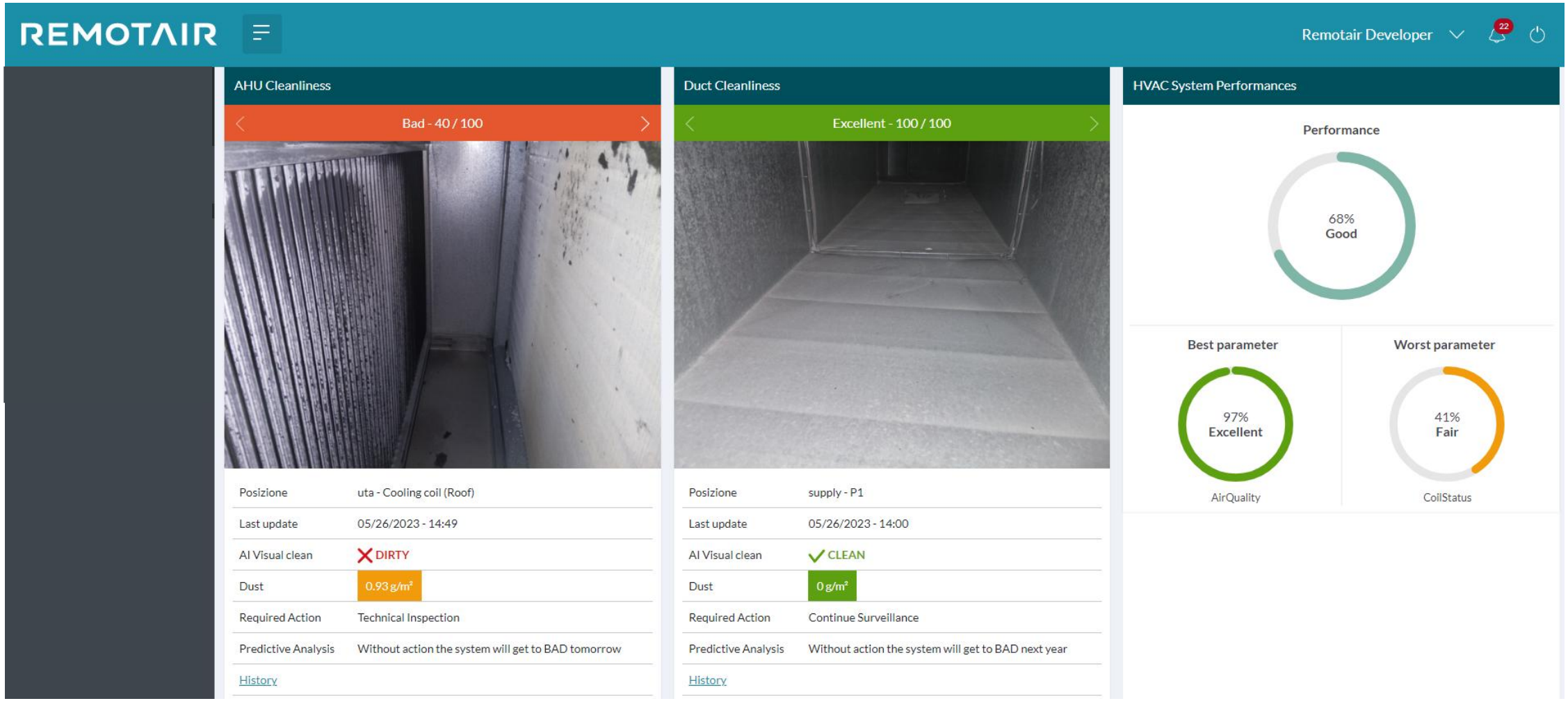
The Remotair portal allows you to constantly monitor the hygienic status of HVAC systems and the quality of the air they supply through a **cloud-based platform accessible from any device at any time**.



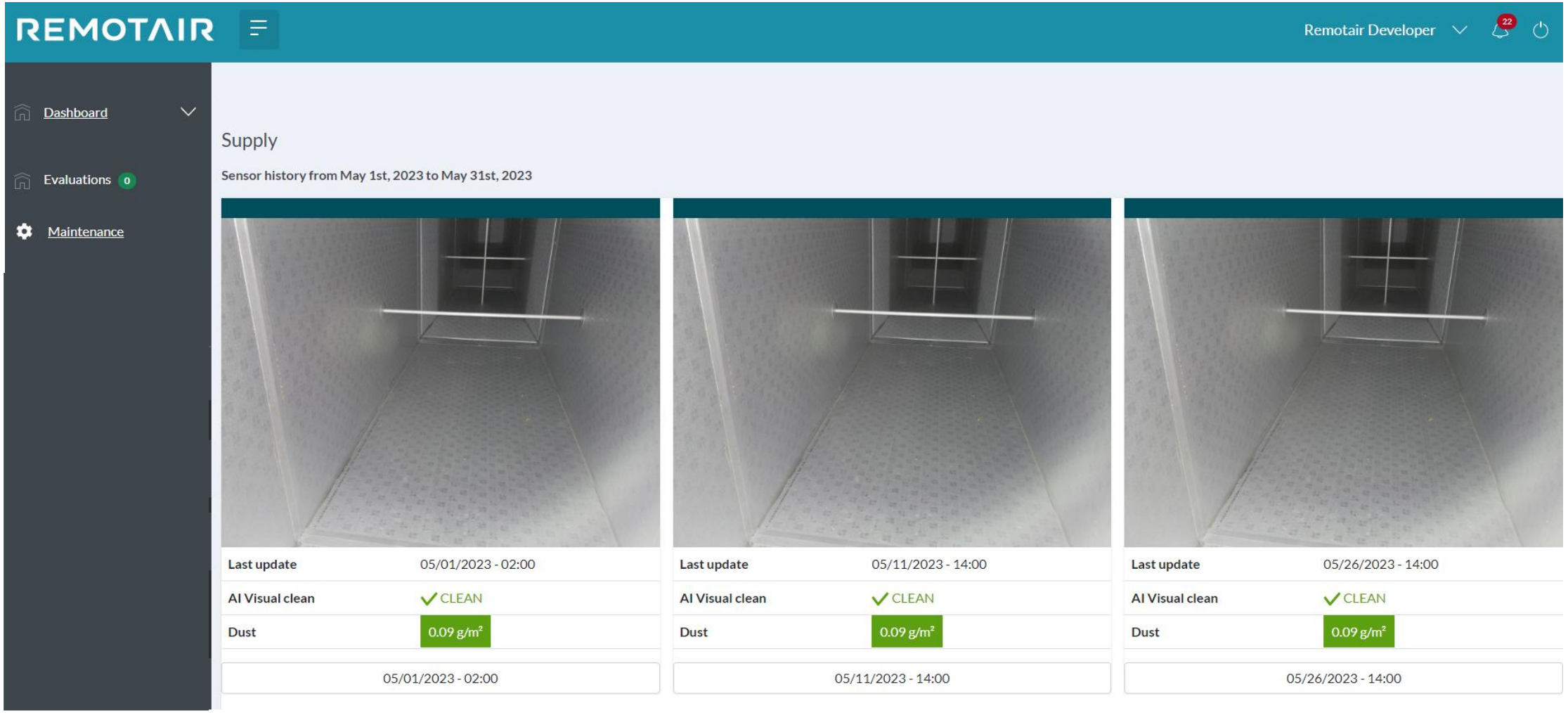
HOW IT WORKS


REMOTAIR
Remotair Developer
22
Dashboard
Evaluations 0
Maintenance
NEW CLIENT
Overview
Parameters
Devices
Info
ADD NEW DEVICE
Performance
AHU CLEANLINESS
69%
Good
0
100
DUCT CLEANLINESS
59%
Fair
0
100
MICROBIOLOGICAL FACTORS
65%
Good
0
100
FILTER STATUS
80%
Good
0
100
COIL STATUS
41%
Fair
0
100
AIR QUALITY
97%
Excellent
0
100

HOW IT WORKS


REMOTAIR
Remotair Developer
22
AHU Cleanliness
Bad - 40 / 100
Posizione
uta - Cooling coil (Roof)
Last update
05/26/2023 - 14:49
AI Visual clean
DIRTY
Dust
0.93 g/m²
Required Action
Technical Inspection
Predictive Analysis
Without action the system will get to BAD tomorrow
History
Duct Cleanliness
Excellent - 100 / 100
Posizione
supply - P1
Last update
05/26/2023 - 14:00
AI Visual clean
CLEAN
Dust
0 g/m²
Required Action
Continue Surveillance
Predictive Analysis
Without action the system will get to BAD next year
History
HVAC System Performances
Performance
68%
Good
Best parameter
97%
Excellent
AirQuality
Worst parameter
41%
Fair
CoilStatus

HOW IT WORKS


REMOTAIR
Remotair Developer
22
Dashboard
Evaluations 0
Maintenance
Supply
Sensor history from May 1st, 2023 to May 31st, 2023
Last update 05/01/2023 - 02:00
AI Visual clean CLEAN
Dust 0.09 g/m²
05/01/2023 - 02:00
Last update 05/11/2023 - 14:00
AI Visual clean CLEAN
Dust 0.09 g/m²
05/11/2023 - 14:00
Last update 05/26/2023 - 14:00
AI Visual clean CLEAN
Dust 0.09 g/m²
05/26/2023 - 14:00

HOW IT WORKS

Filter status

Dimension	Position	Last update	Value	Predictive analysis	Score	Required action	
Differential Pressure	G4 Filter (Air Intake)	05/26/2023 - 17:39	83.60 Pa	Without action you will have to REPLACE the device in 2 months	68/100	Continue Surveillance	History
Differential Pressure	G4 Filter (Return)	05/26/2023 - 17:39	16.92 Pa	Without action you will have to REPLACE the device next year	99/100	Continue Surveillance	History
Differential Pressure	F7 Filter	05/26/2023 - 17:39	76.15 Pa	Without action you will have to REPLACE the device next month	75/100	Continue Surveillance	History

Average score: 80/100

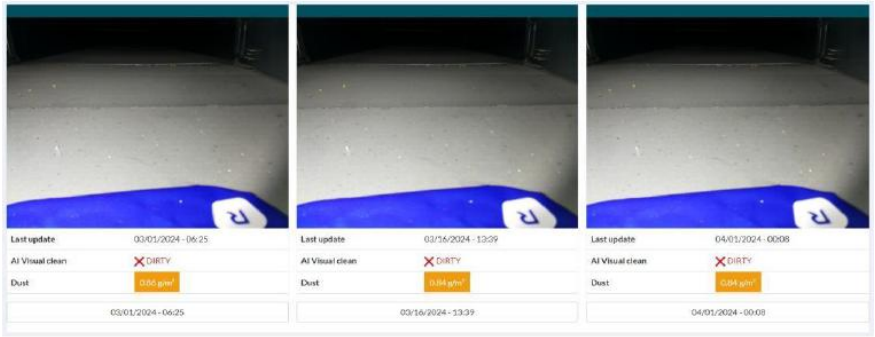
Coil status

Dimension	Position	Last update	Value	Predictive analysis	Score	Required action	
Differential Pressure	Cooling Coil	05/26/2023 - 17:39	121.80 Pa	Without action you will have to CLEAN the device in 2 months	83/100	Continue Surveillance	History
Differential Pressure	Pre Heating	05/26/2023 - 17:39	69.80 Pa	Without action you will have to CLEAN the device today	13/100	Clean Coil	History
Differential Pressure	Heating Coil	05/26/2023 - 17:39	6.30 Pa	Without action you will have to CLEAN the device next year	29/100	Clean Coil	History

Average score: 41/100

MONTHLY REPORT

DUCT CLEANLINESS



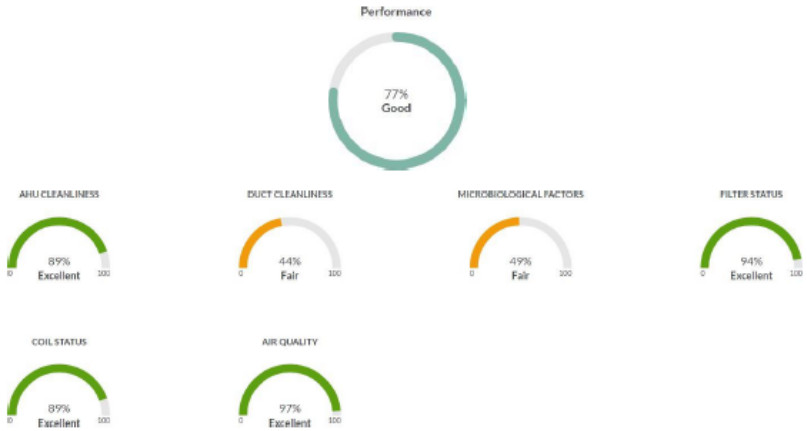
POSITION	SCORE	REQUIRED ACTION	PREDICTIVE ANALYSIS
supply - Floor 6	45/100	Technical Inspection	Without action the system will get to BAD next year

TREND OF DEPOSITED DUST

Note. *The green band is the optimal range of the parameter considered*

Below is a summary report of the actual hygienic status of the HVAC system at **04/09/2024 8:00 am CET**

ACTUAL HYGIENIC STATUS



DETAILS

The System is in **GOOD** conditions.

- supply – floor 9 is **DIRTY** and next to 1 g/m²
- Camera supply – floor 6 is **DIRTY** and next to 1 g/m²
- Microbiological Factors performance are low due to high dust level into the ducts

The performance is calculated based on the values of all sensors involved in the functions listed. Please refer to the following specifications for the performance of individual devices and the related corrective actions.