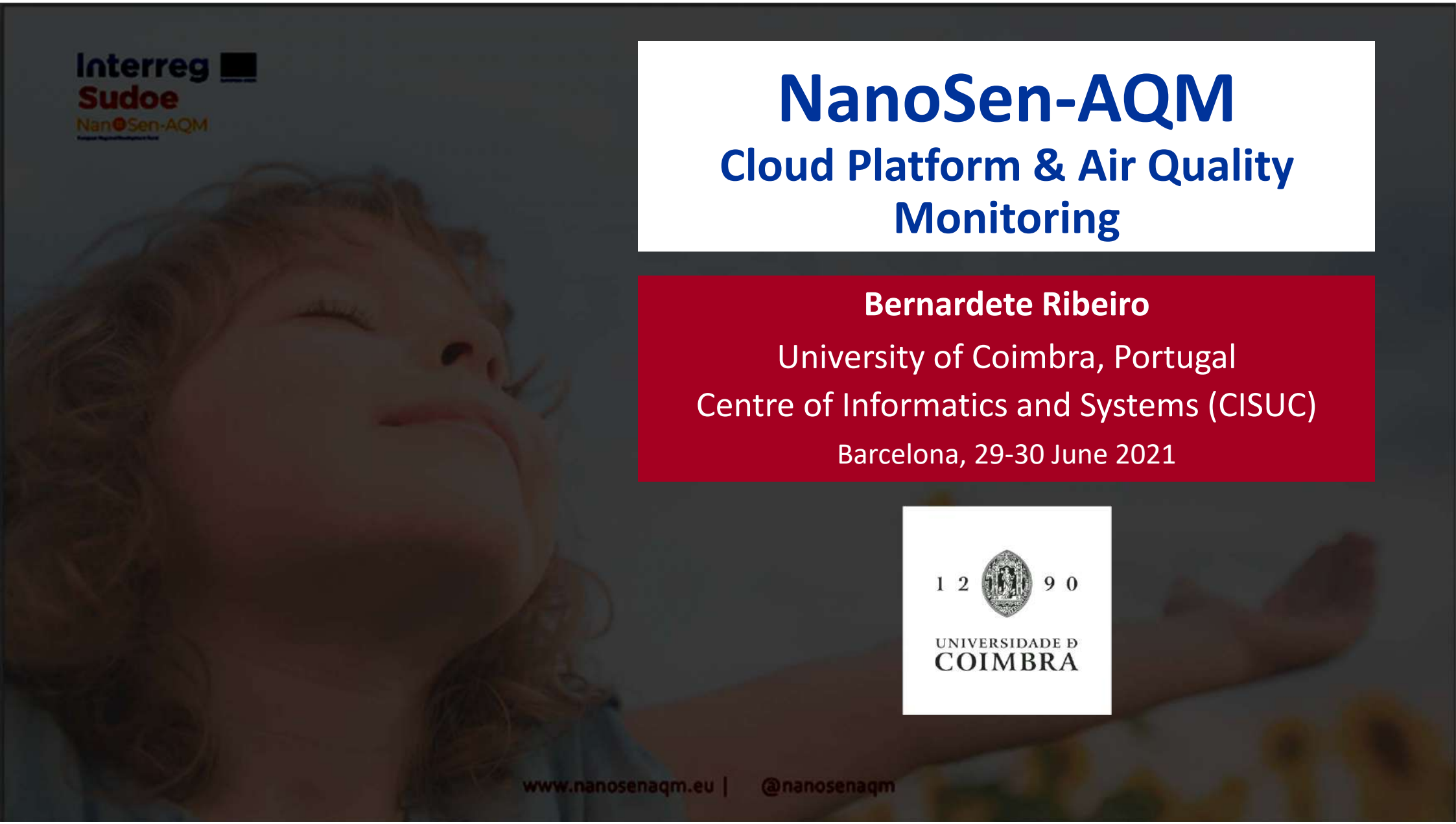

NanoSen-AQM

Cloud Platform & Air Quality Monitoring

Bernardete Ribeiro

University of Coimbra, Portugal

Centre of Informatics and Systems (CISUC)

Barcelona, 29-30 June 2021

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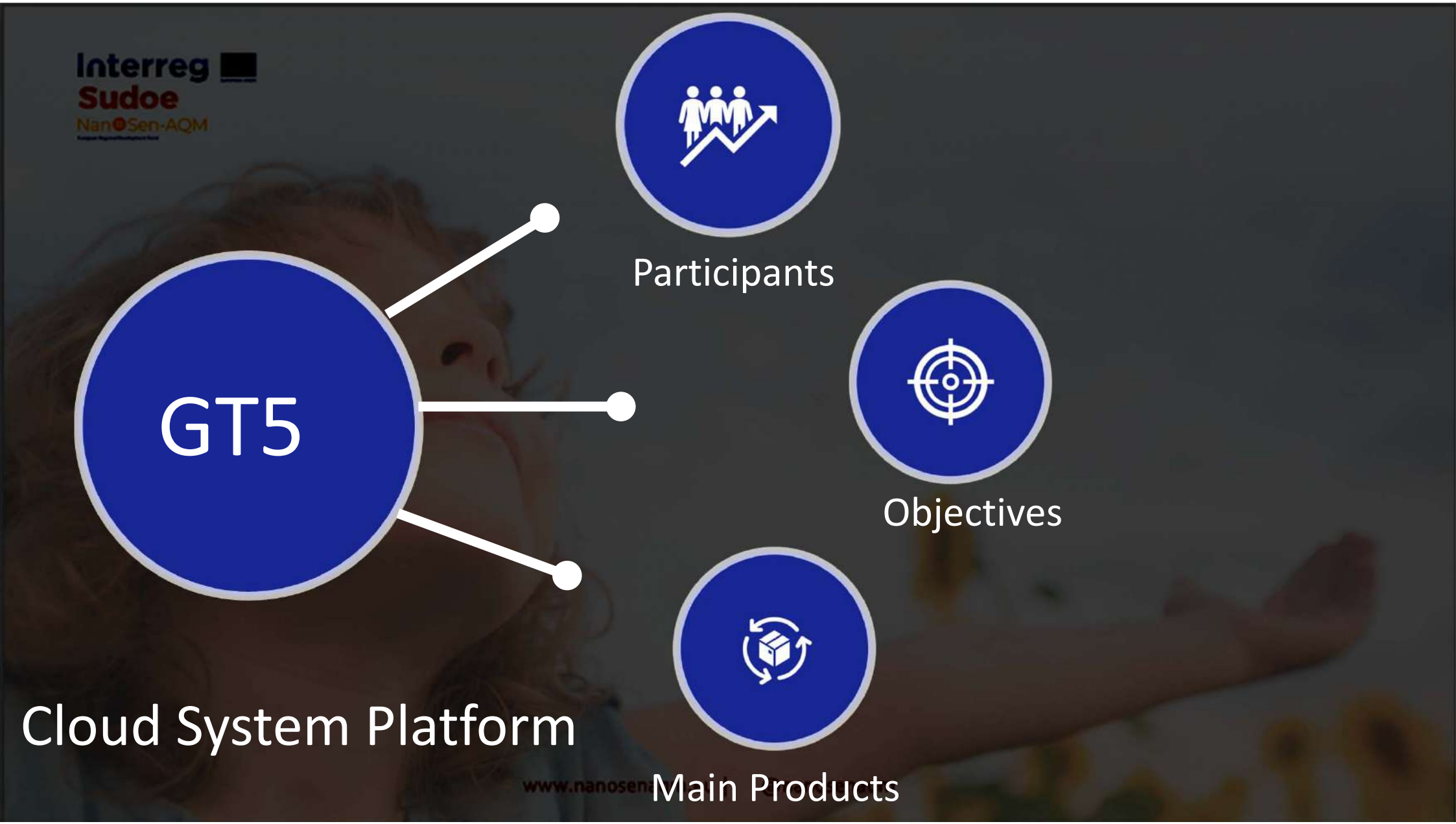
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GT5
Participants
Objectives
Main Products
Cloud System Platform

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AIGUASOL

Participants

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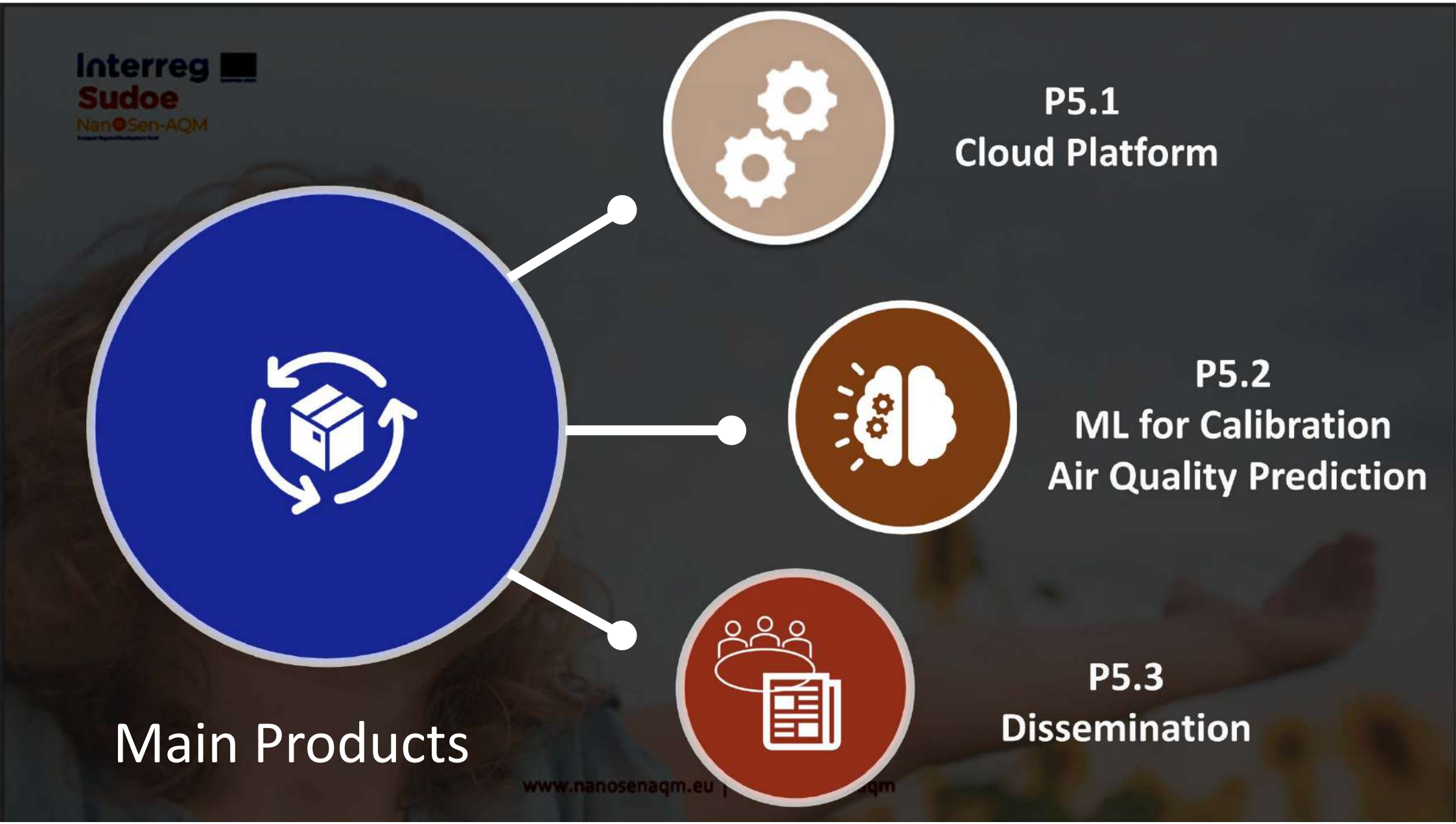
O1: Cloud as a Service

O2: Sensors Calibration

O3: Pollutants Prediction

O4: Web & Mobile App

Specific Objectives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P5.1
Cloud Platform
P5.2
ML for Calibration
Air Quality Prediction
P5.3
Dissemination
Main Products
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Air Quality Monitoring
European Air Quality Index
Intelligent Data Analysis
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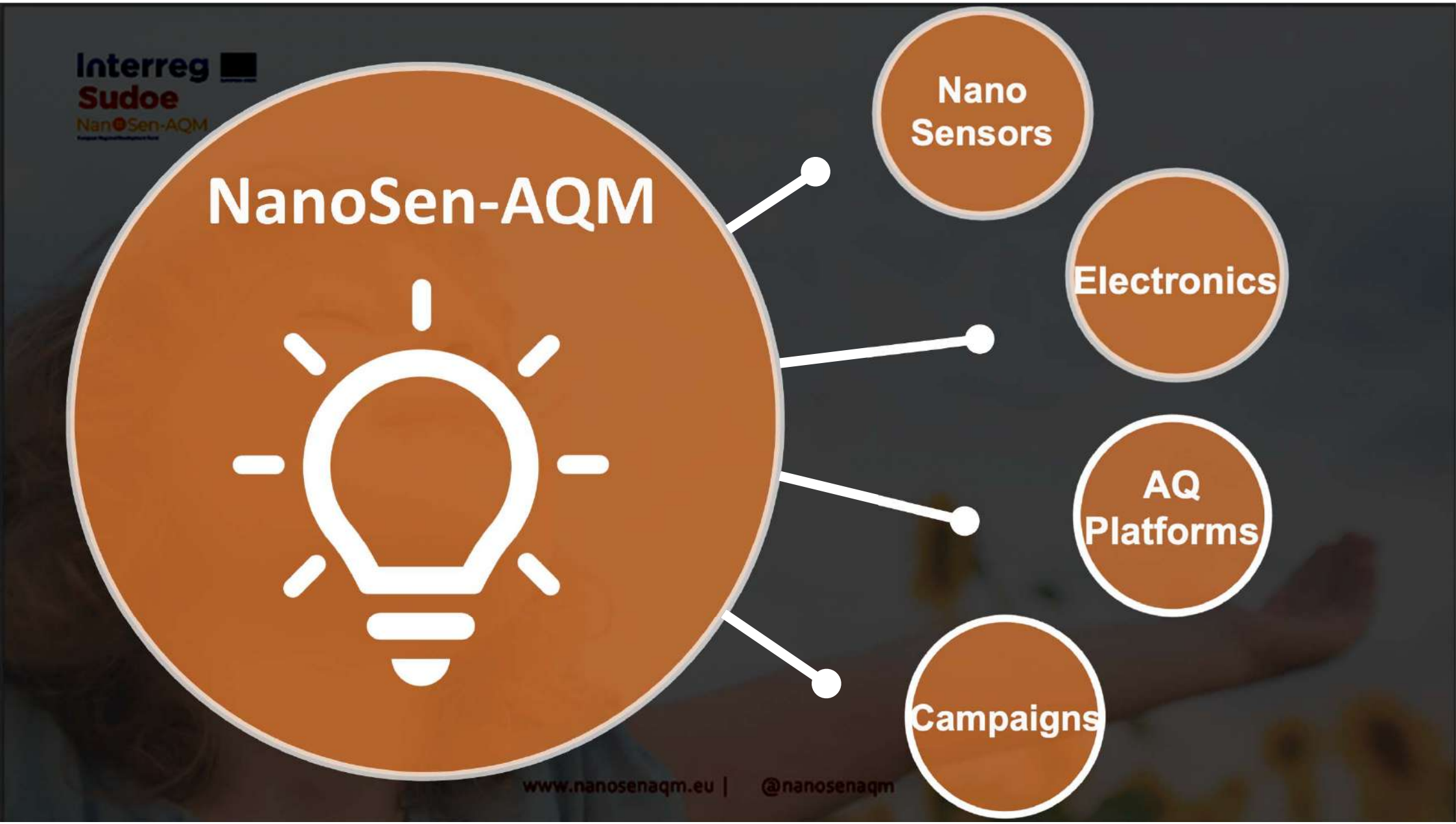
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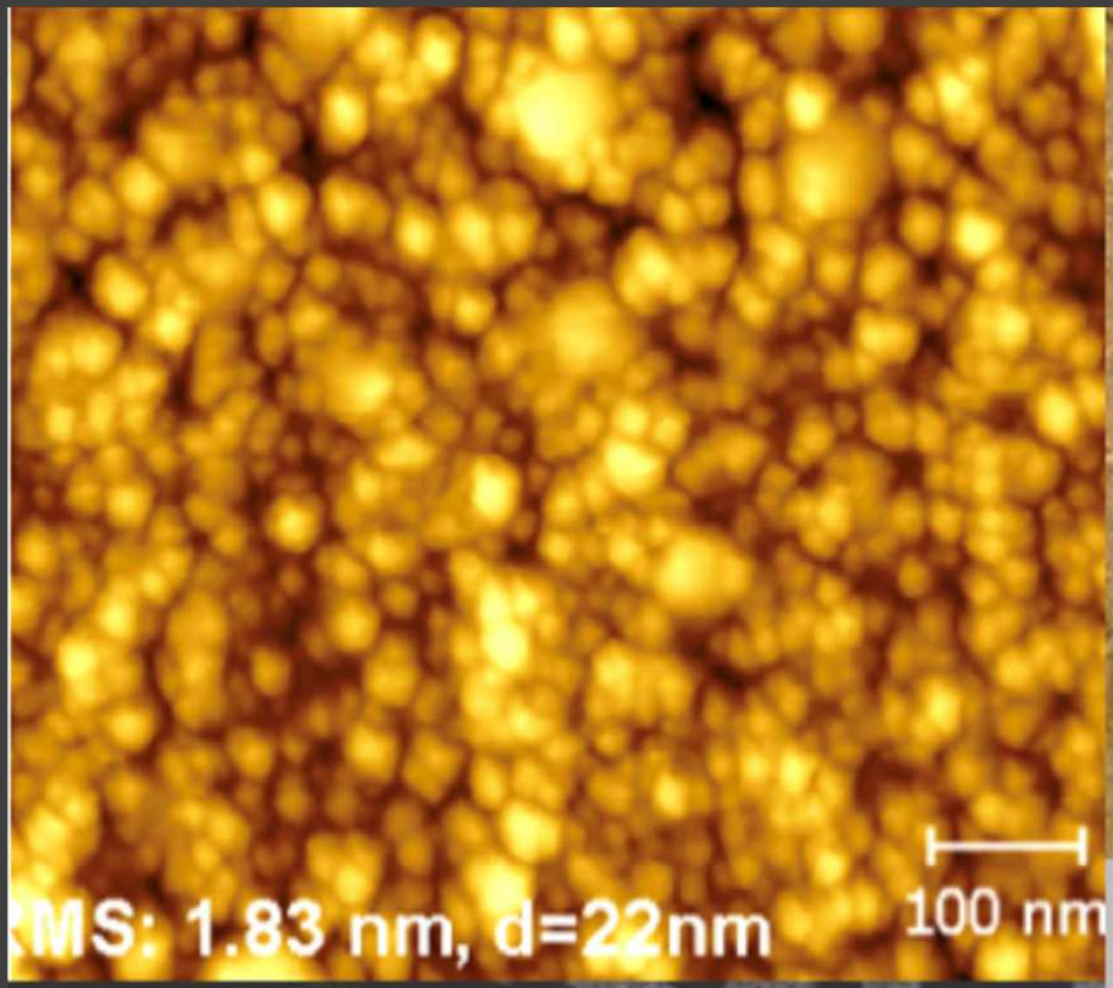
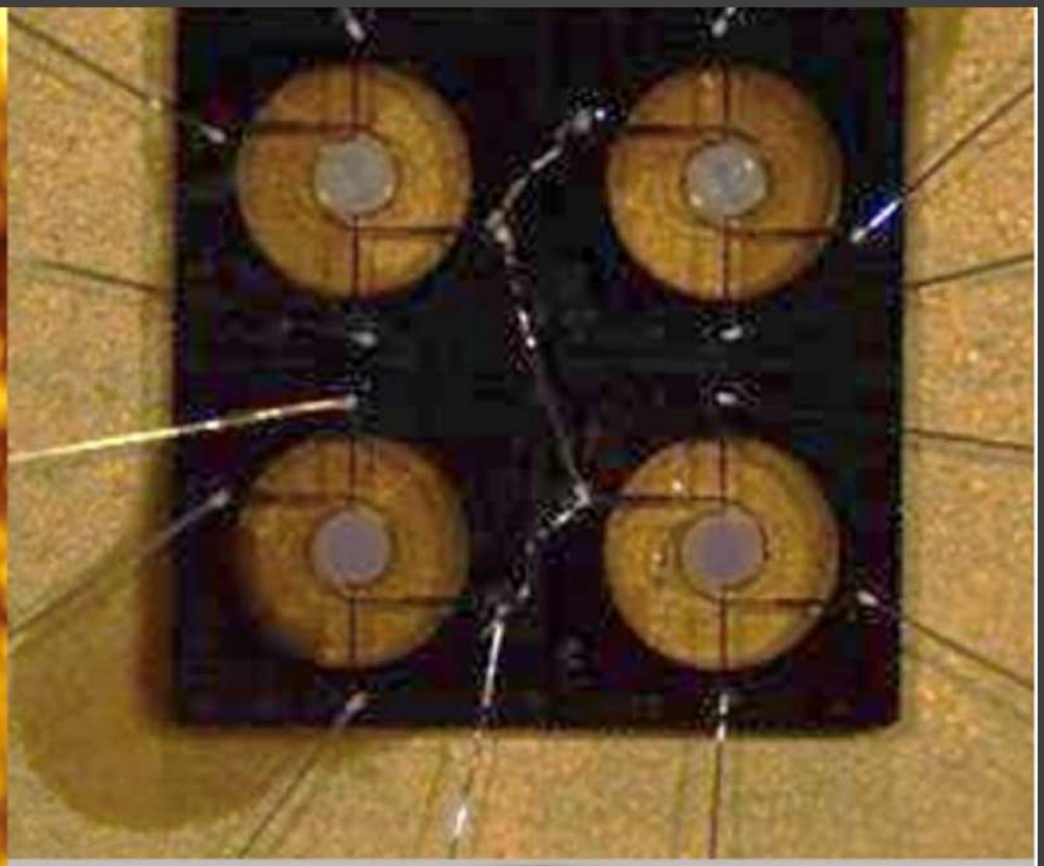
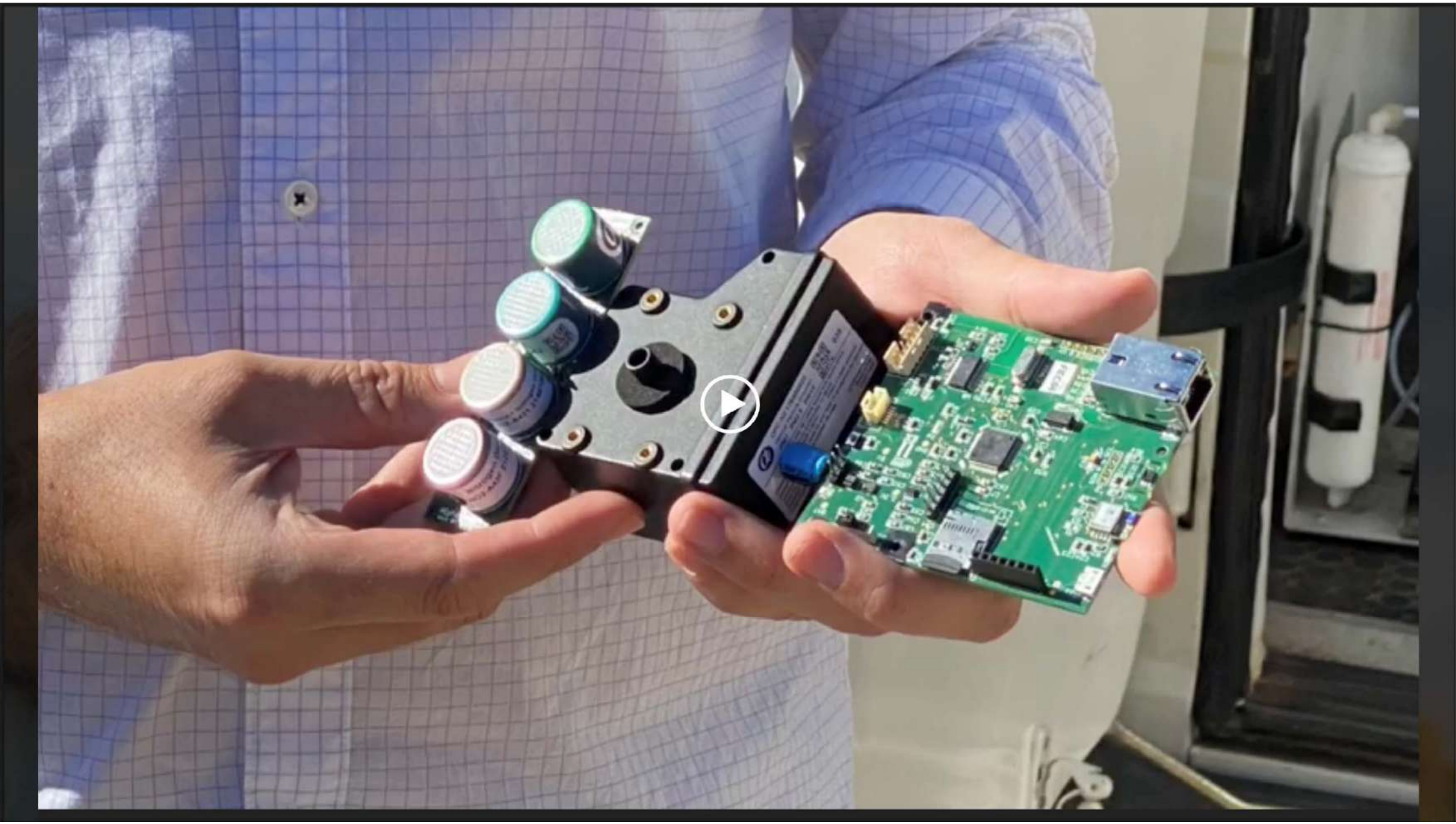

MS: 1.83 nm, d=22nm
100 nm




44.3 nm

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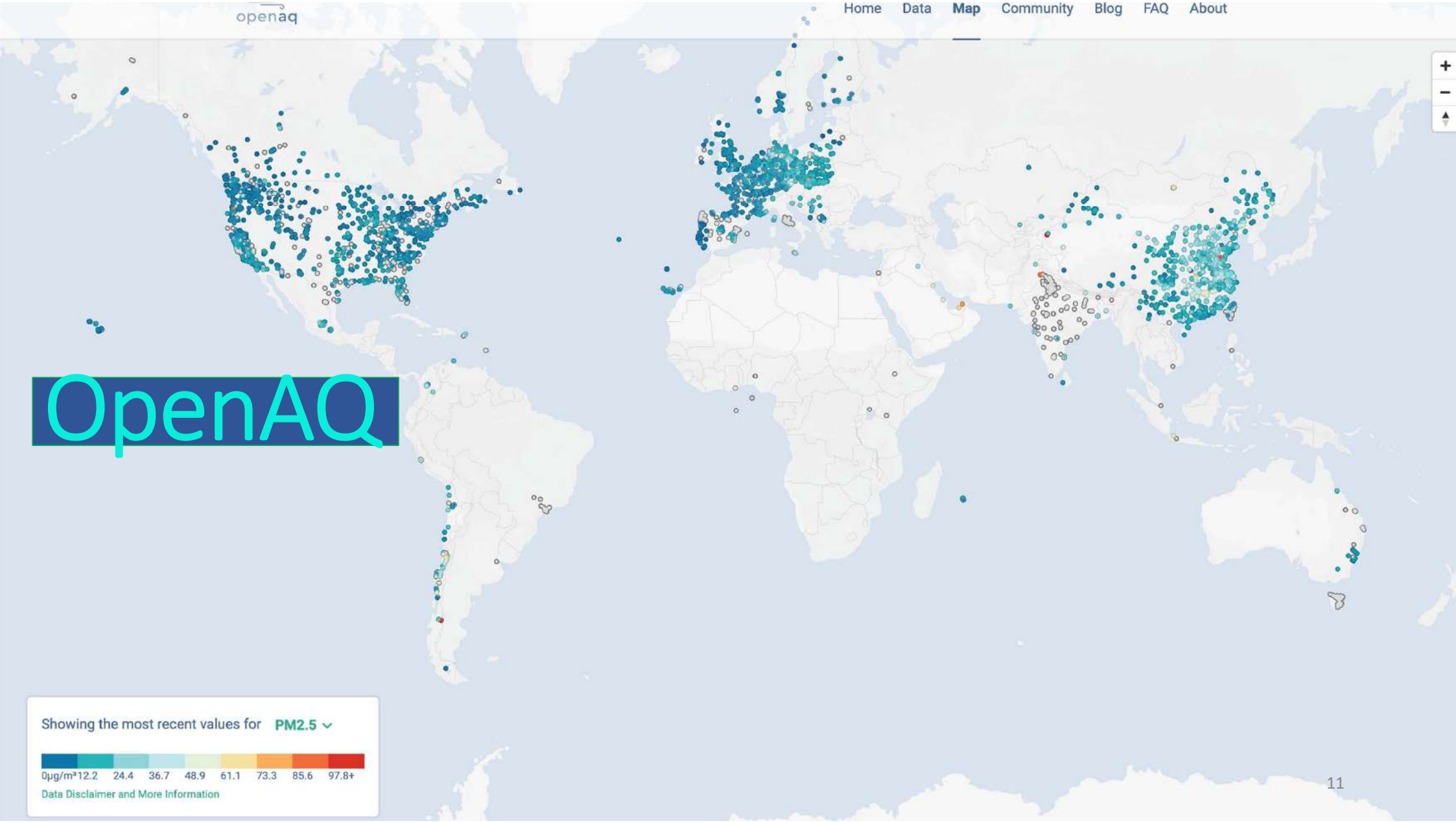
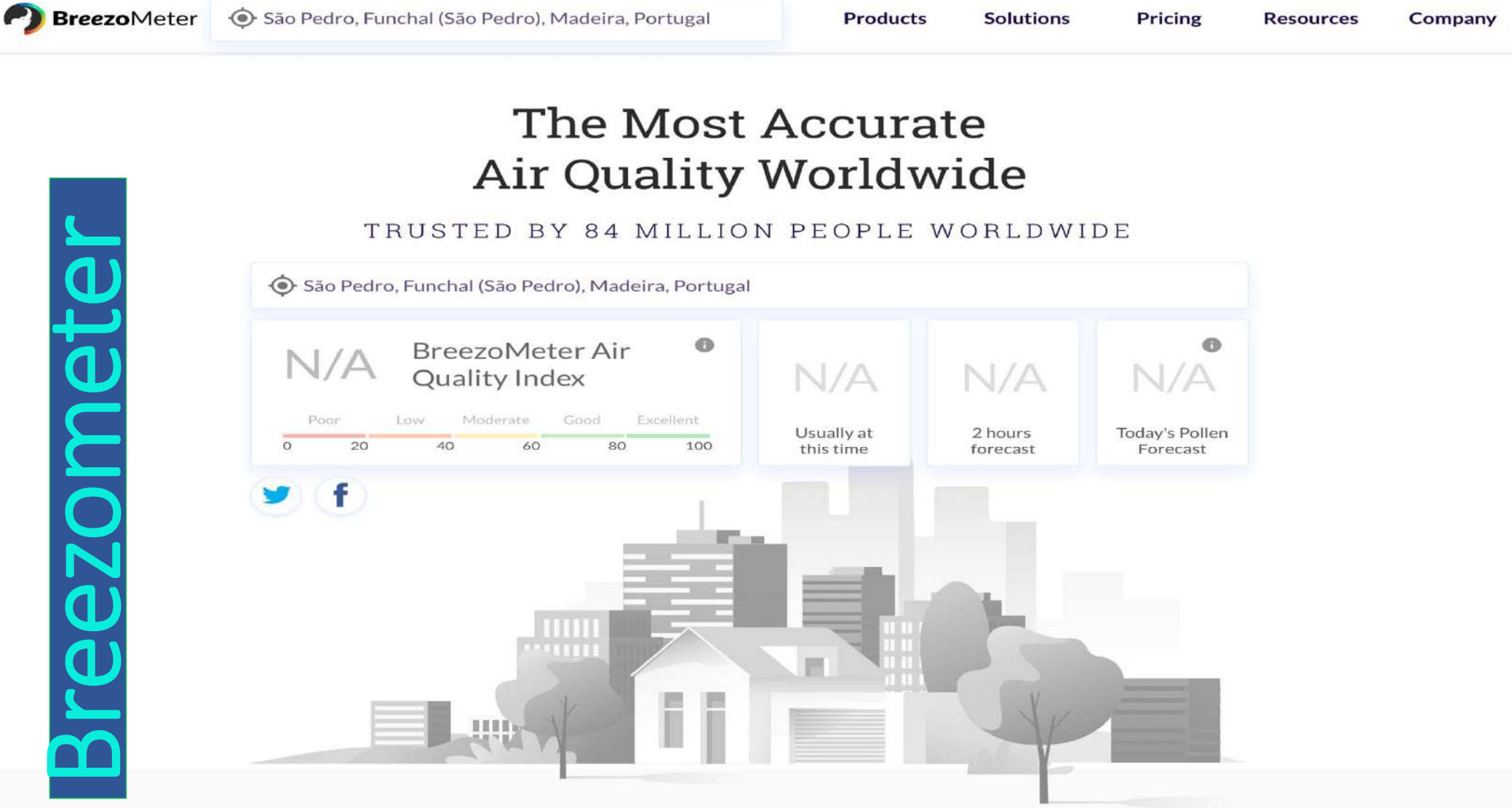
Air Quality Platforms
OpenAQ
Breezometer
Other
www.nanosenaqm.eu |


openaq
Home
Data
Map
Community
Blog
FAQ
About
OpenAQ
Showing the most recent values for PM2.5
0µg/m³12.2 24.4 36.7 48.9 61.1 73.3 85.6 97.8+
Data Disclaimer and More Information

Breezometer



BreezoMeter Air Quality Heatmap

IQAir

Aranet4 (Indoors)

Temtop

Temtop M10i WiFi Air Quality Monitor Meter for PM2.5 TVOC AQI HCHO

Temtop M2000 CO2 Air Quality Monitor Easy Calibration Audio

Temtop P10 Air Quality Monitor w/ Real-time PM2.5 & AQI Readings

Temtop LKC-1000S+ 9-IN-1 Air Quality Monitor Data Histogram

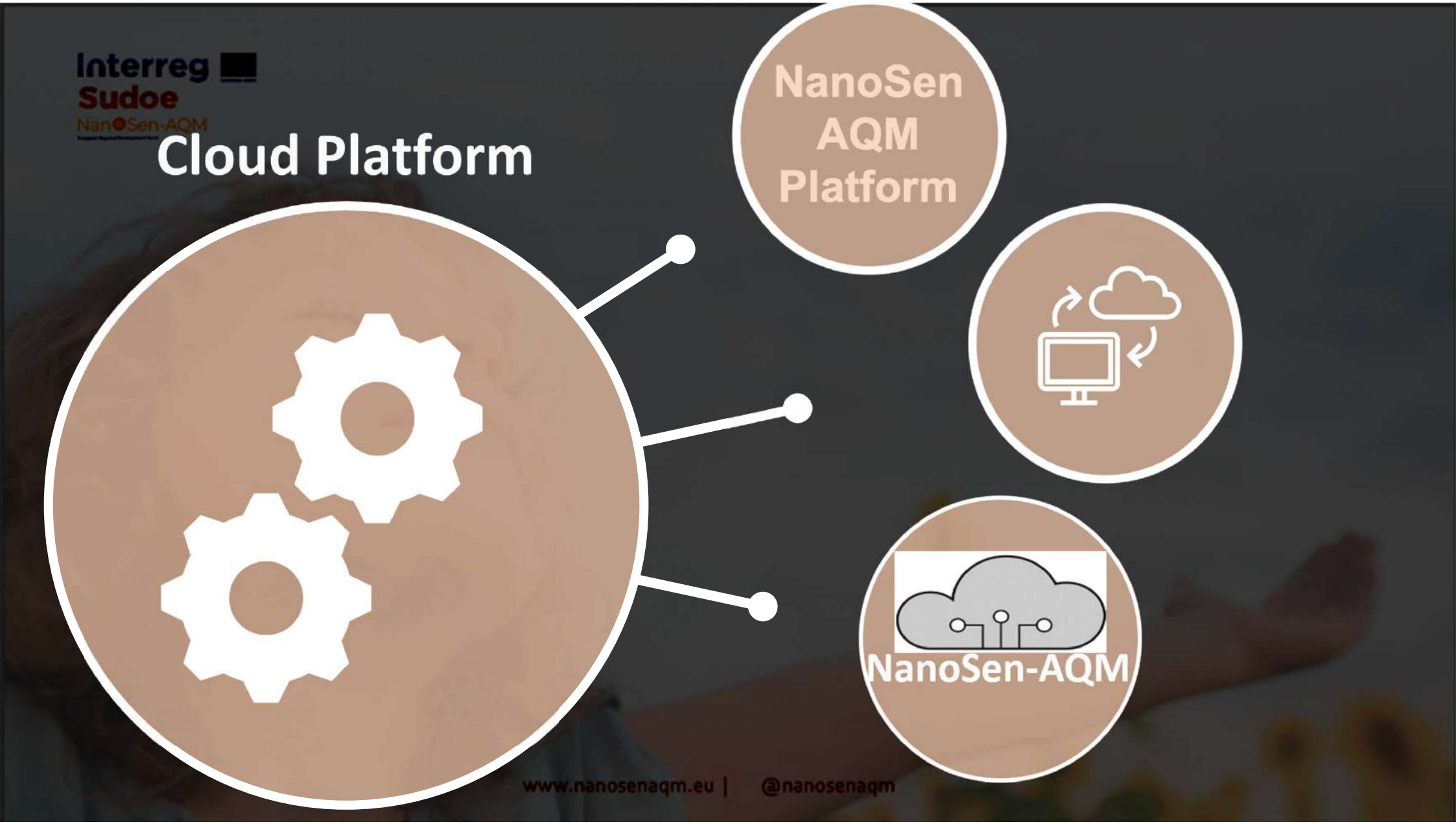
Temtop M2000C Air Quality Monitor (PM2.5,PM10,CO2)

Tomorrow.io

Measurements in Barcelona Metropolitan Area:

3 type of different sensors:

- fixed sensors located at the official air quality measuring stations,
- sensors placed in bicycles
- small personal sensors that will be carried by individuals.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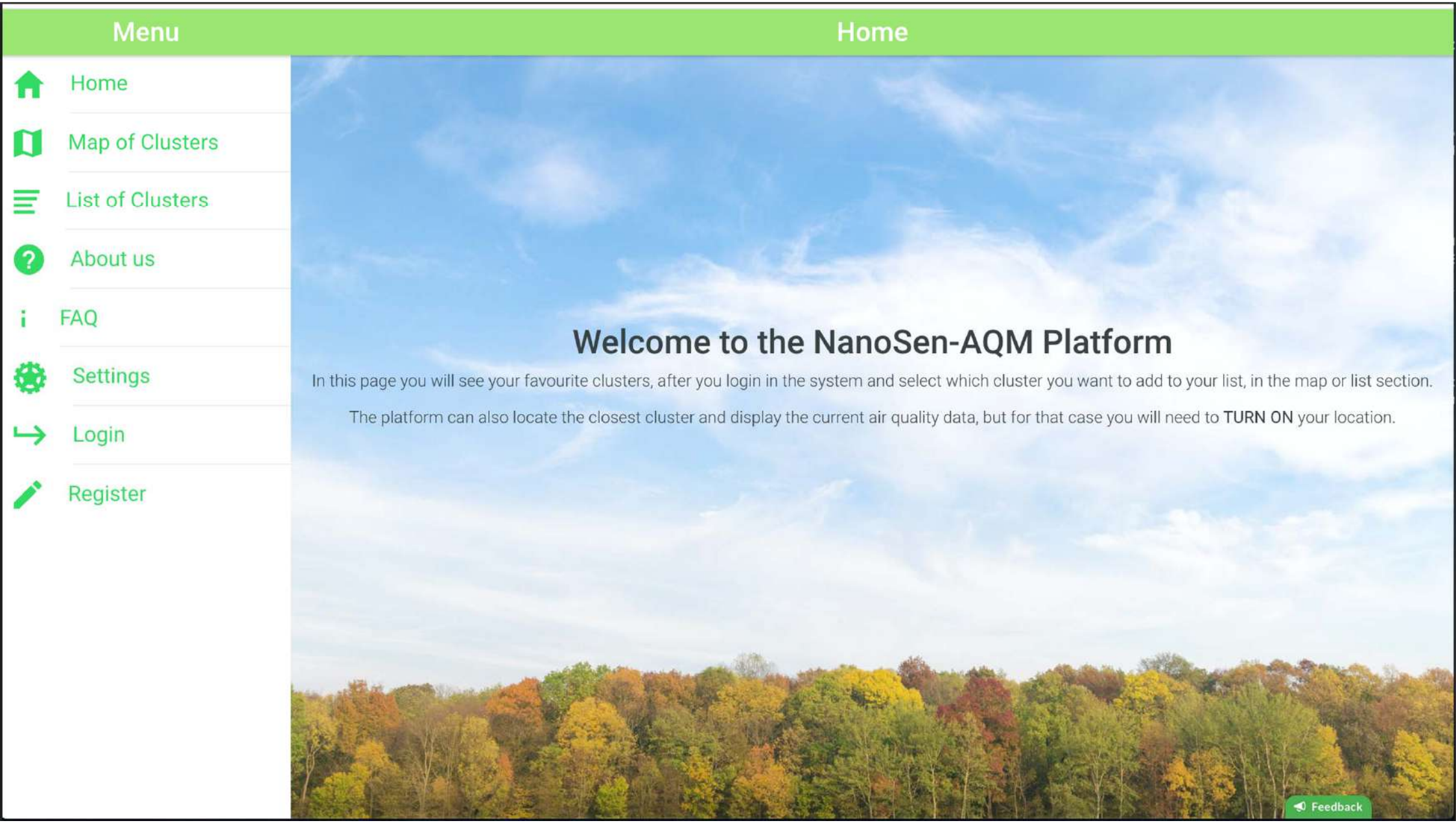
Menu
Home
Home
Map of Clusters
List of Clusters
About us
FAQ
Settings
Login
Register
Welcome to the NanoSen-AQM Platform
In this page you will see your favourite clusters, after you login in the system and select which cluster you want to add to your list, in the map or list section.
The platform can also locate the closest cluster and display the current air quality data, but for that case you will need to TURN ON your location.
Feedback

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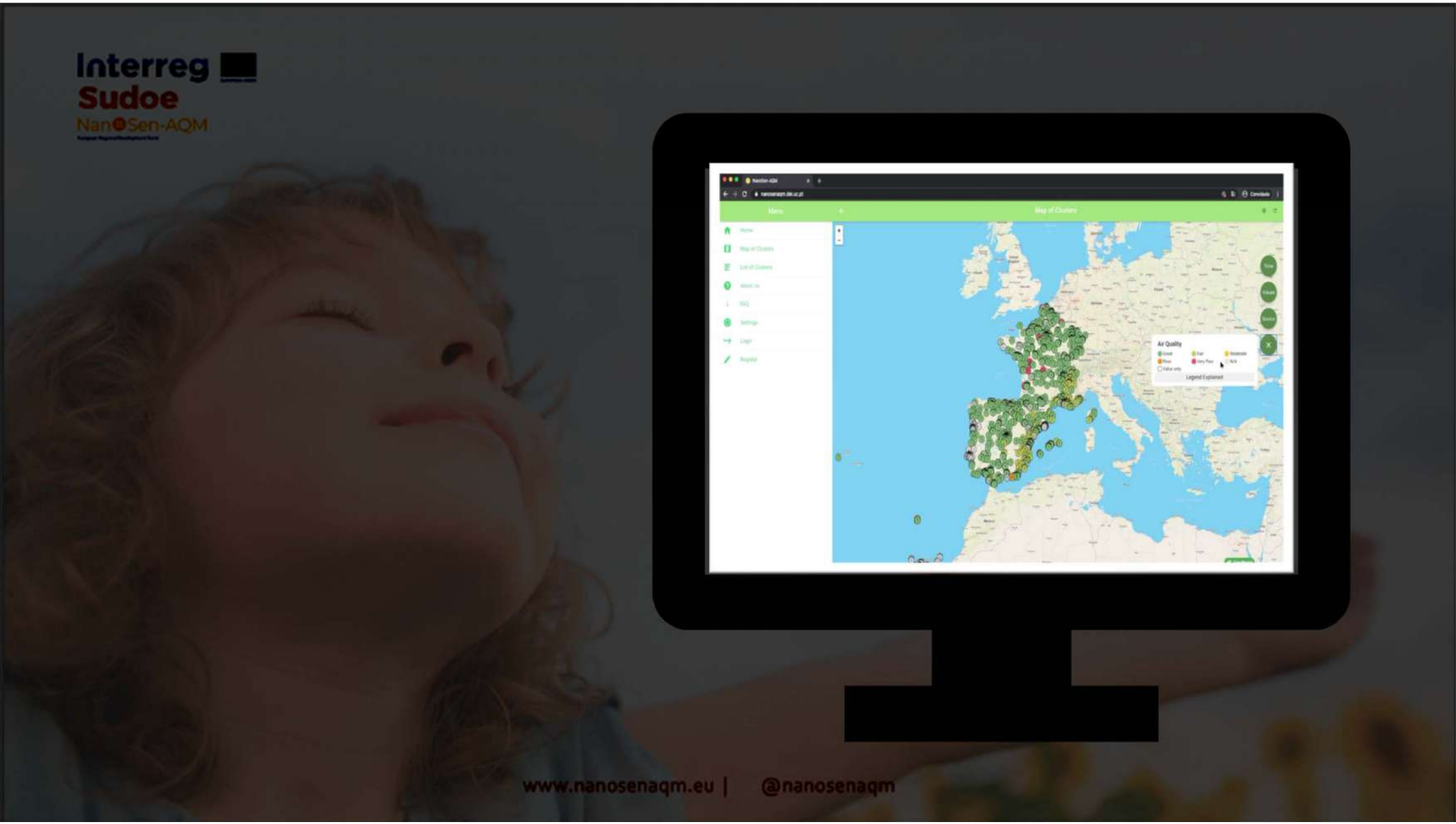

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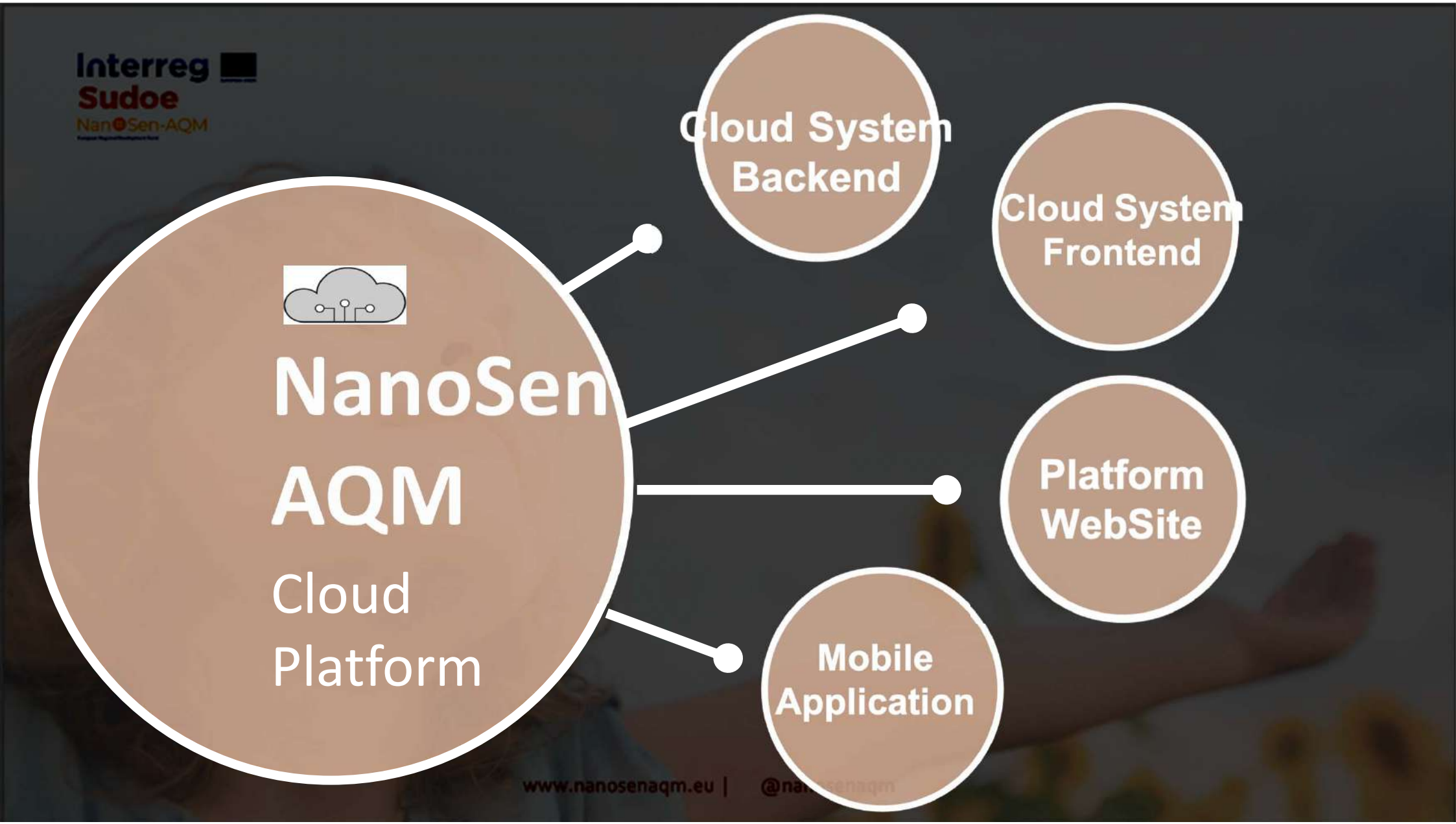
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Cloud System
Backend
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Frontend
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WebSite
Mobile
Application
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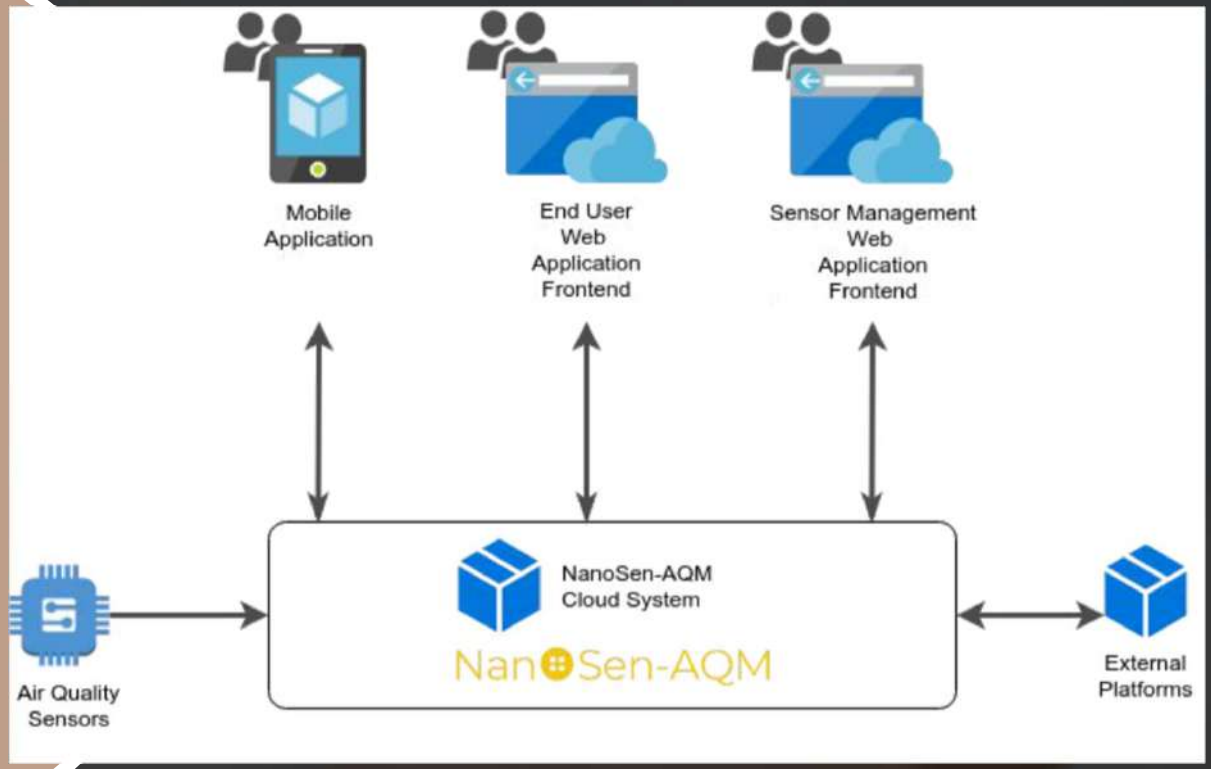
Cloud System Backend

- air quality measurements
- Process the data using calibration functions
- Fetch air quality data from external platforms
- client applications



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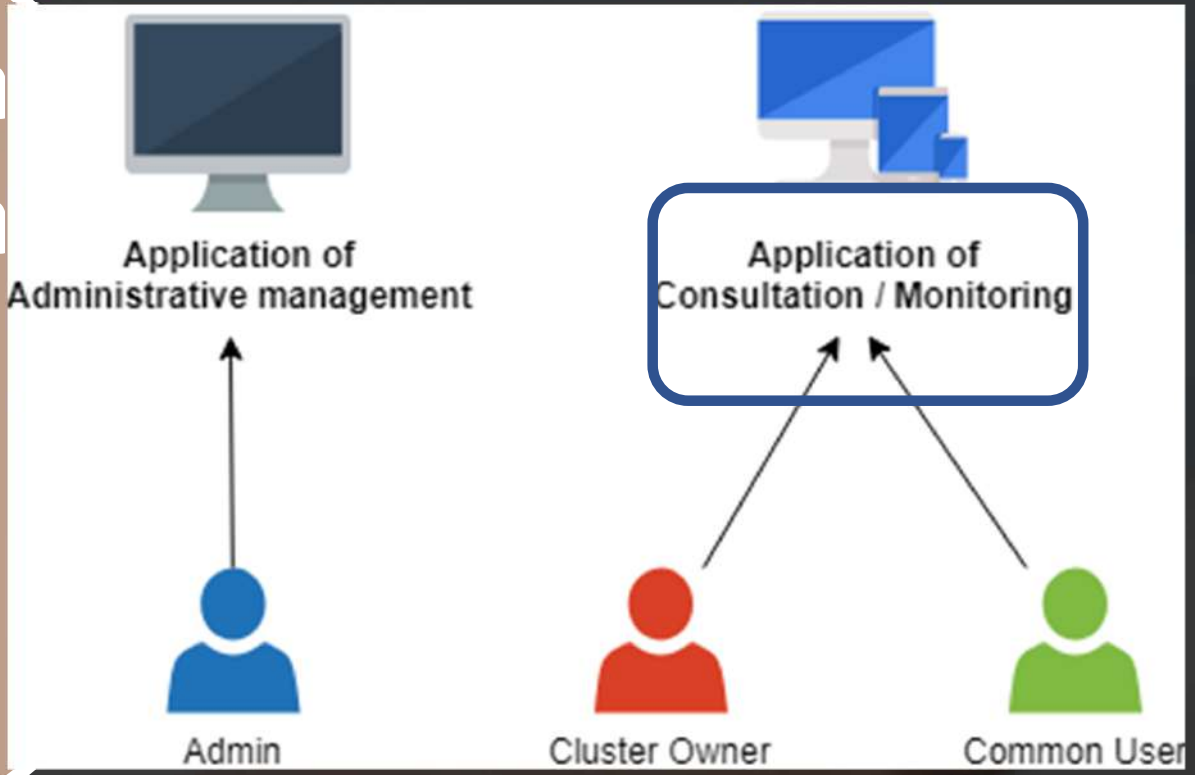
Cloud System Implementation

Ionic Platform

- *"Write once, run anywhere"*
- Available for Android, iOS and Web
- Typescript, HTML5 and CSS



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Cloud Platform Implementation

https://nanosenaqm.dei.uc.pt

Scan Me:

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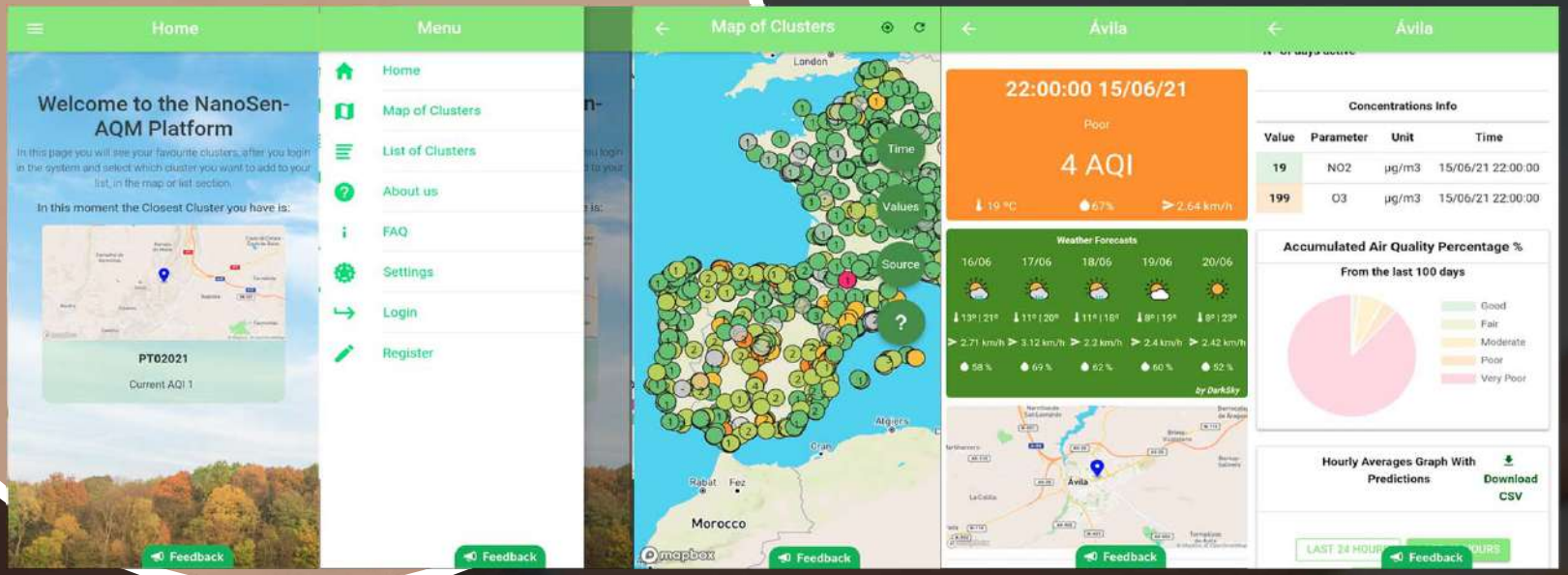
Mobile Application



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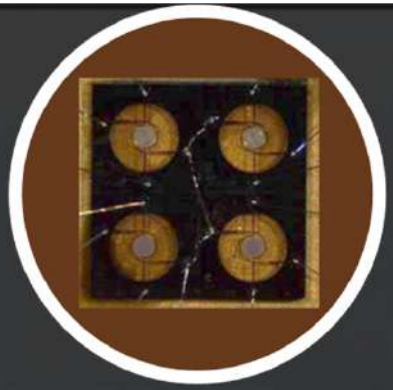

Calibration

Model

Prediction

Forecasting

Intelligent Data Analysis

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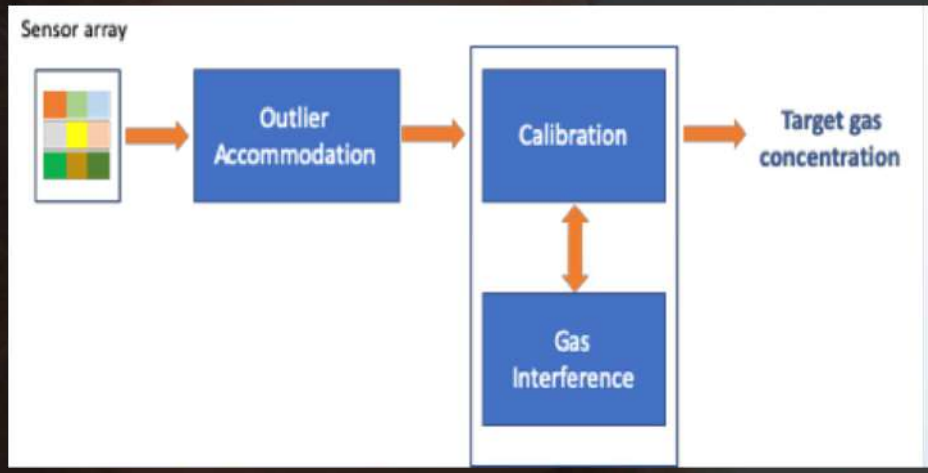
Sensors Calibration: Methodology



The methodology for dealing with the process of calibration of gases transducers and accommodation of gases interferences on the actual gas reading is carried out in two main stages:

- **Outlier detection and accommodation**
- **Calibration and gas interference correction**

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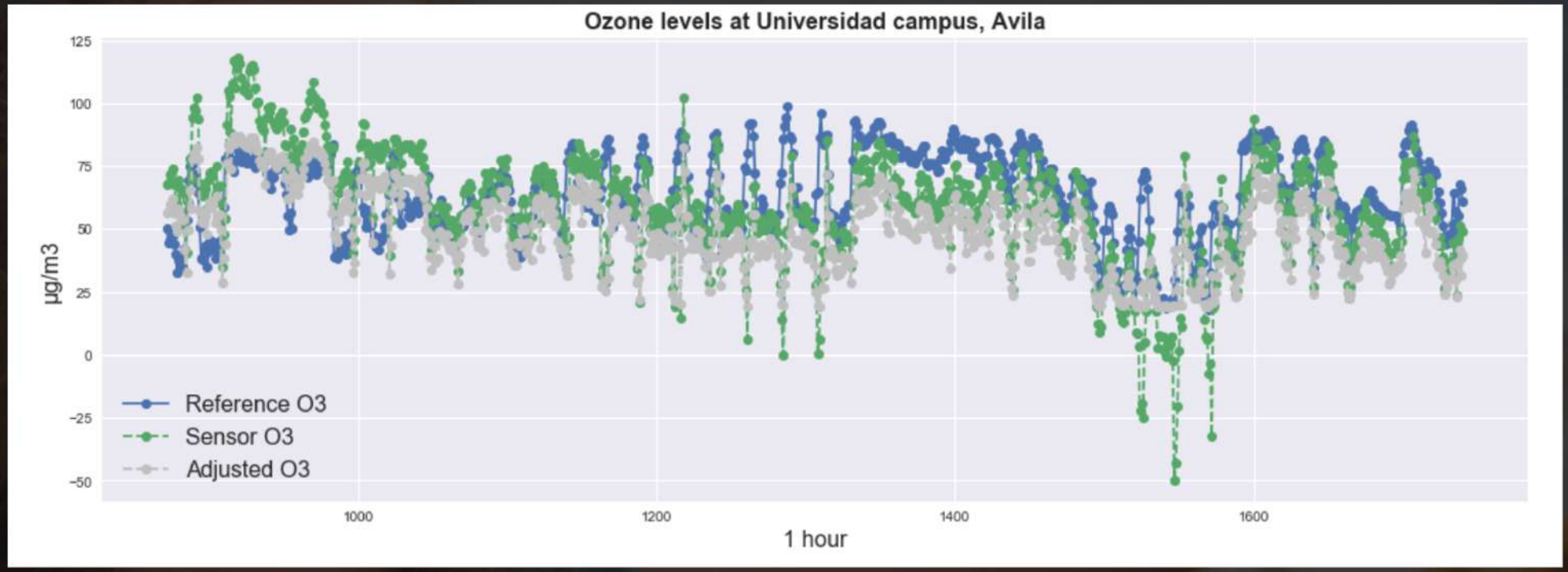
Calibration Model: Low Cost vs Reference Sensors



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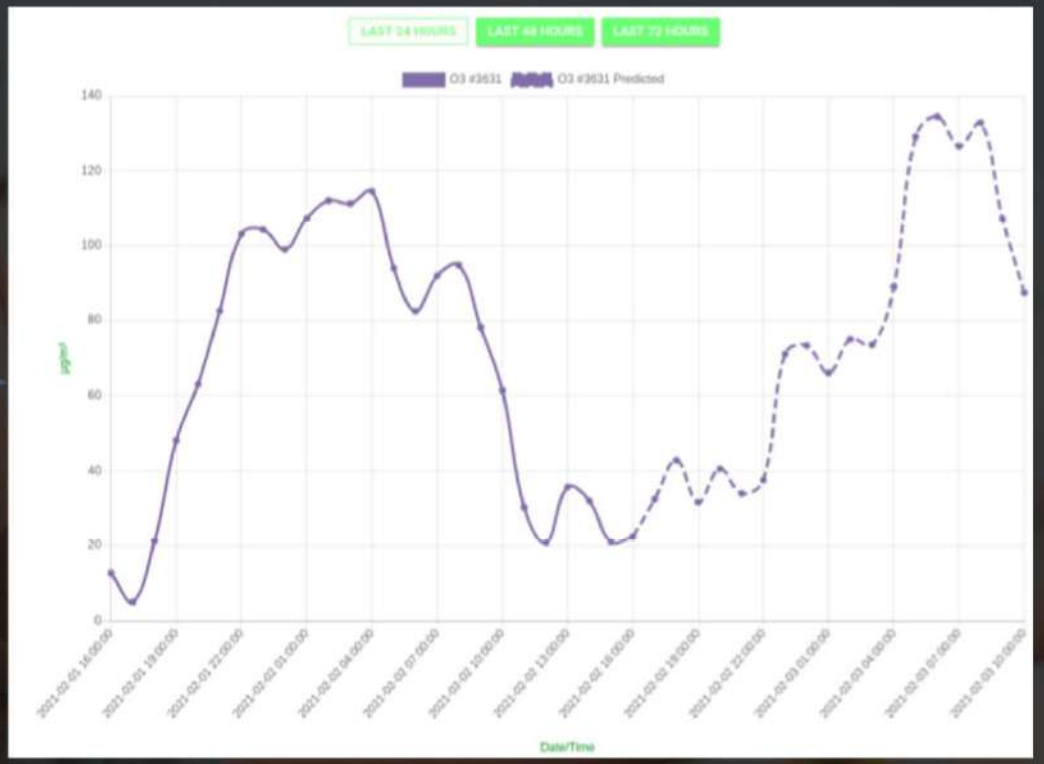
Cloud Platform O3 Forecast upon User Request

Forecast Model



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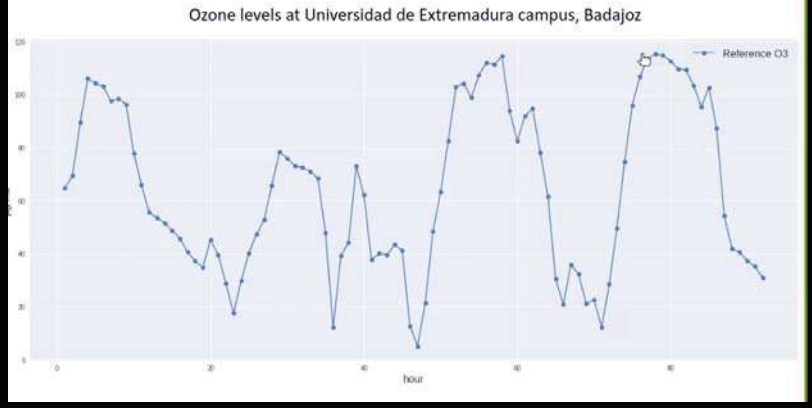
Forecast: Problem statement



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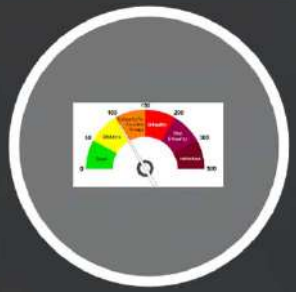

Air Quality Index

Field Validation

Visualization

Air Quality Monitoring

European Air quality Index

Pollutant	Index level (based on pollutant concentrations in µg/m3)				
	Good	Fair	Moderate	Poor	Very poor
Particles less than 2.5 µm ($PM_{2.5}$)	0-10	10-20	20-25	25-50	50-800
Particles less than 10 µm (PM_{10})	0-20	20-35	35-50	50-100	100-1200
Nitrogen dioxide (NO_2)	0-40	40-100	100-200	200-400	400-1000
Ozone (O_3)	0-80	80-120	120-180	180-240	240-600
Sulphur dioxide (SO_2)	0-100	100-200	200-350	350-500	500-1250

- Measurements of up to **five key pollutants** supported by modelled data determine the index level that describes the current air quality situation at each monitoring station.
- The index corresponds to the poorest level for any of five pollutants


Badajoz


Avila


Évora


Sines


Lisboa


Barcelona

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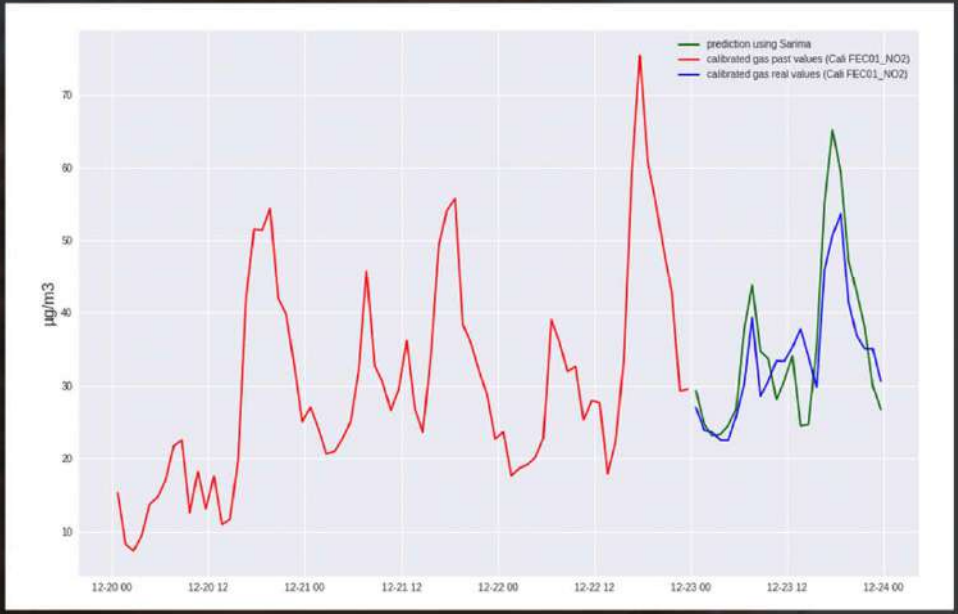
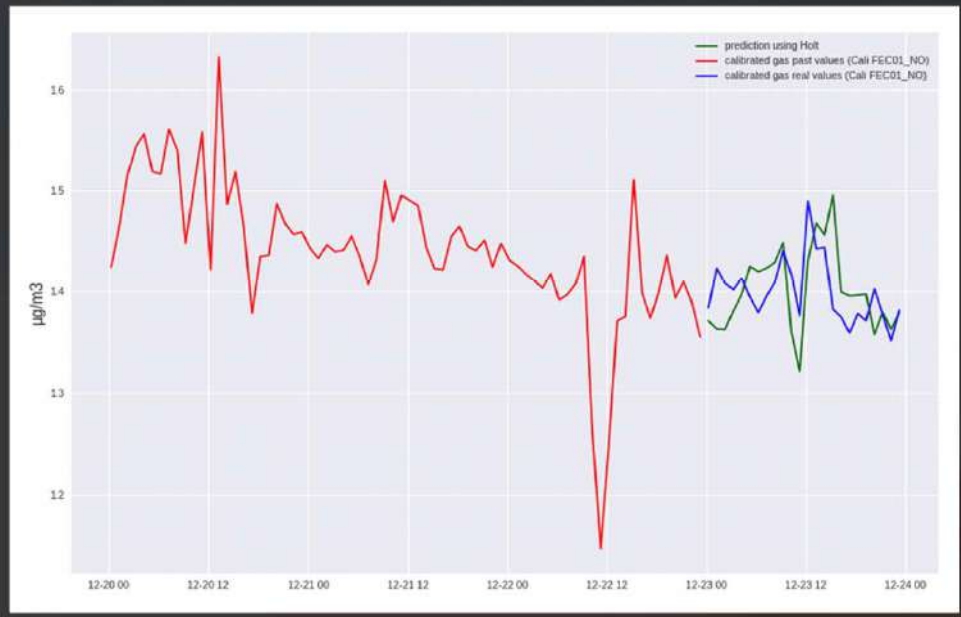
NO2: 24h Forecast



Badajoz

NO: 24h Forecast



Avila

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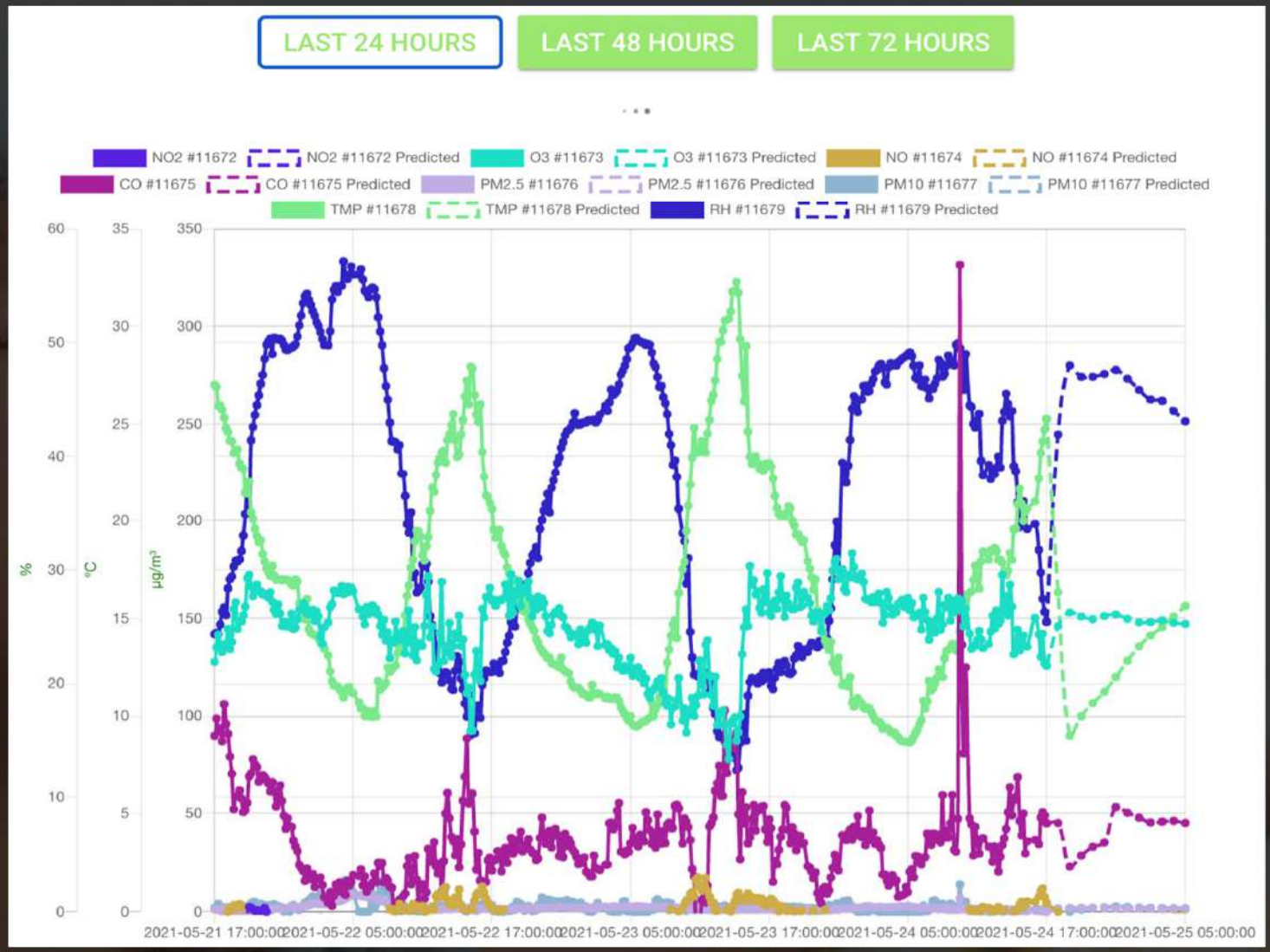
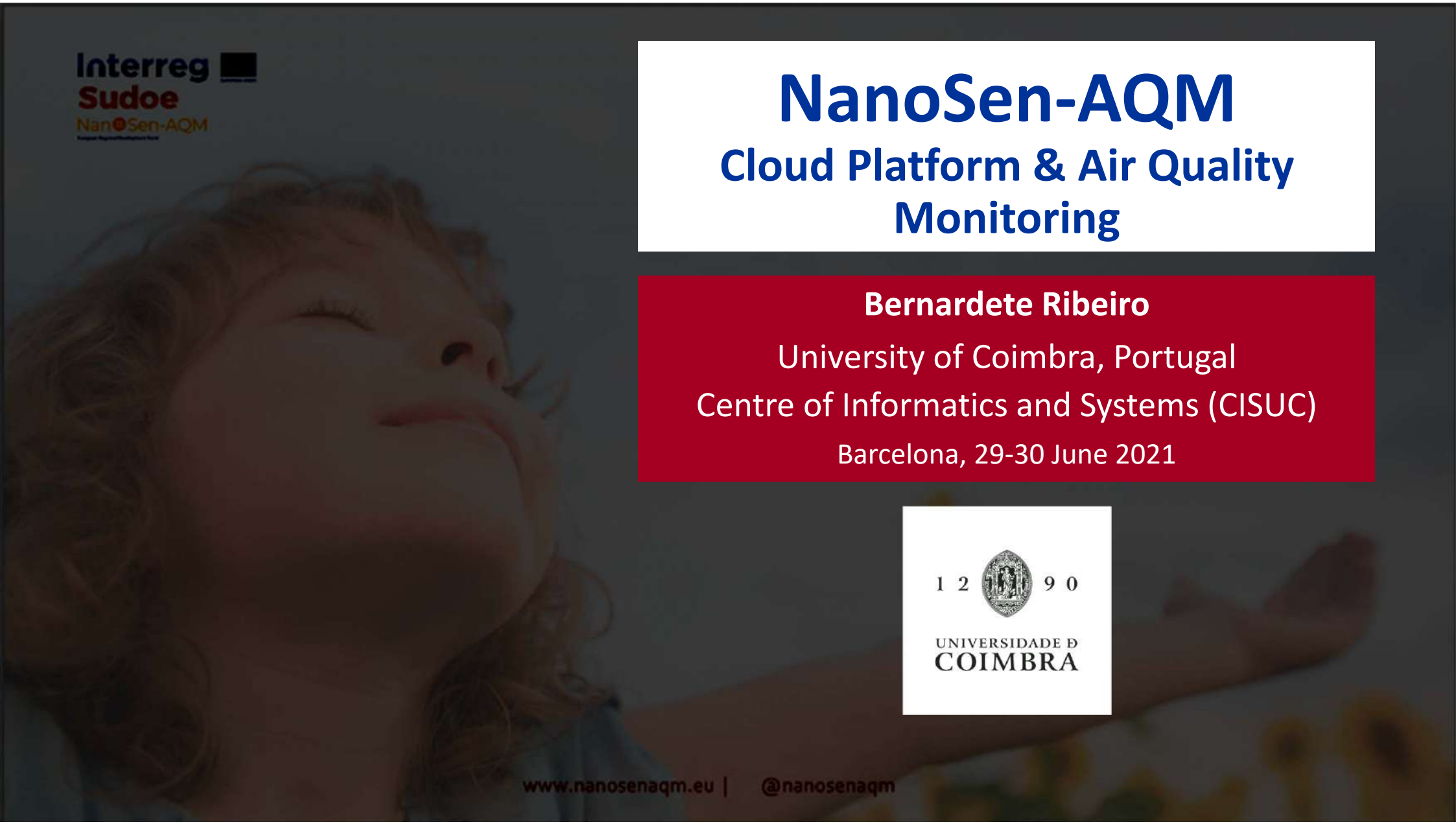
Cluster Avila – FEC07





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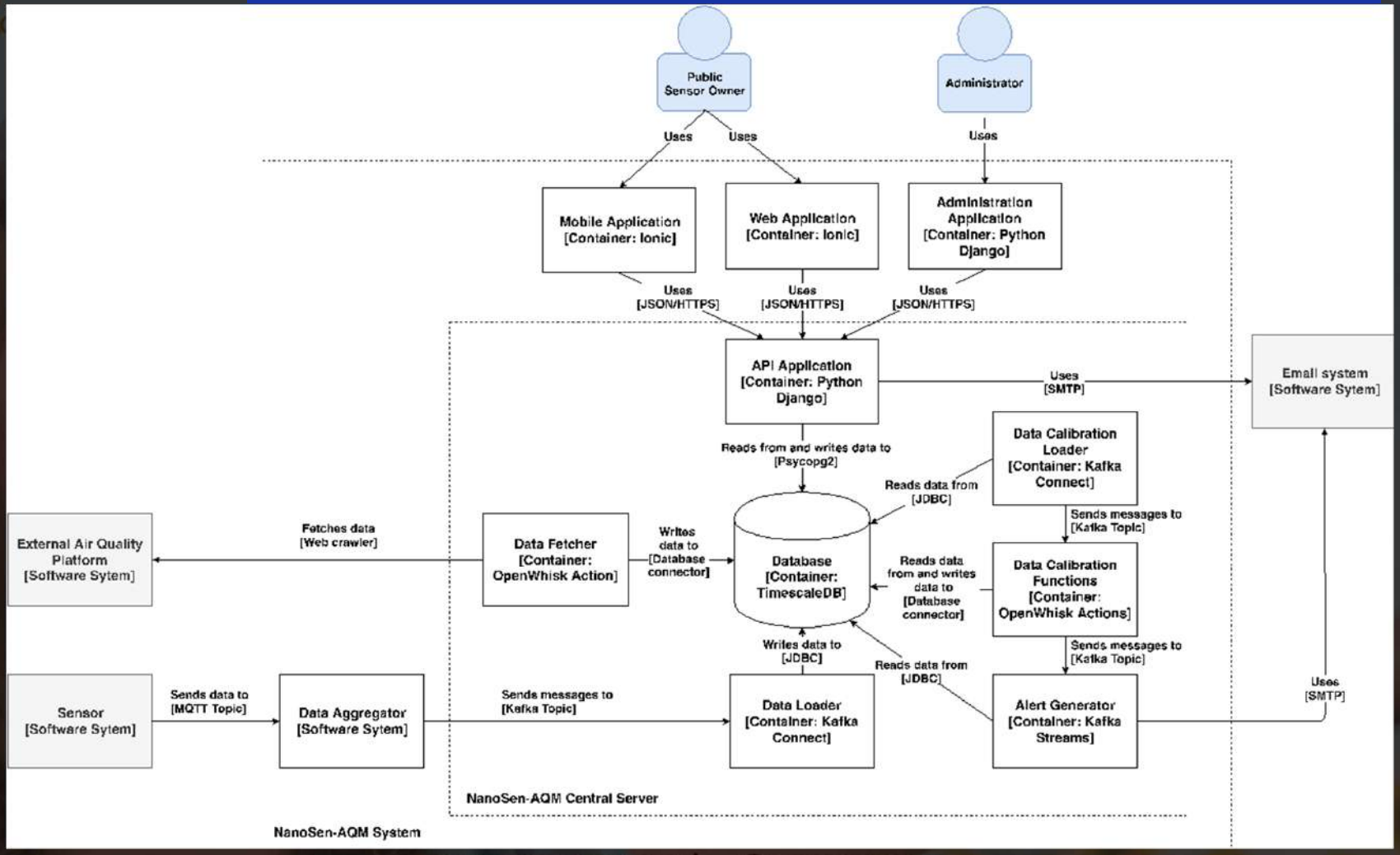
Container Diagram of the Platform



Current Work

- Docker Swarm
  - We divided the implementation in Docker containers
    - BD
    - Django
    - Redis
    - Nginx
    - And a container to get data from OpenAQ
- Continuous Integration/Continuous Delivery
  - With gitlab