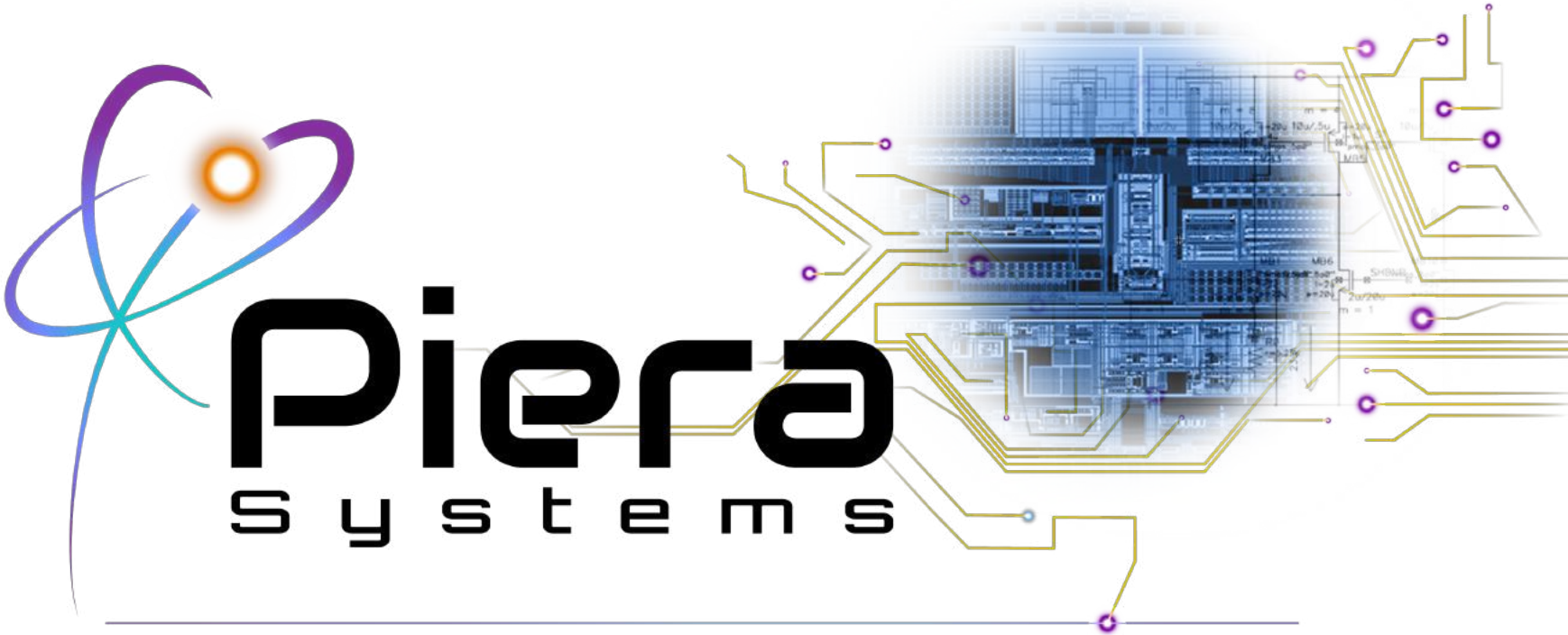
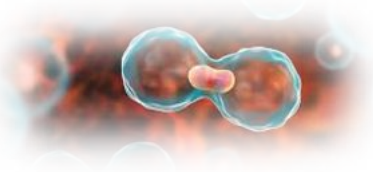


What's in your Air?

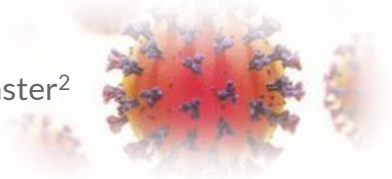
Air Pollution Affects You

"By converting air pollution concentrations into tangible terms—its impact on life expectancy—the AQLI establishes particulate air pollution as the single greatest threat to human health globally." Michael Greenstone, EPIC



Causes lung cancer, alzheimer's, and cardiovascular diseases[1]

Allows Covid-19 and other respiratory diseases to spread faster[2]



Debilitates people with respiratory issues[3]

Severely reduces cognition affecting health & productivity[4]

Indoors 2-5X worse than Outdoors and as much as 100x[5]

Air pollution costs 8 million deaths/year, $5 trillion in welfare costs, $225B in lost income[6]

Piera Systems

Indoor Air Quality

5 Things You Need to Know

Air pollution is **one of the top 5 factors** causing chronic disease according to the World Health Organization [along with unhealthy diet, physical inactivity, tobacco use, harmful alcohol use][1]

Almost 90% of our time is spent indoors and almost 70% in our homes [indoors: 87%, at home: 69%][2]

We consume **nearly 8 times** as much air by volume as food and **4 times** as much air as water. [air: 31 lbs., water 8 lbs., food 4 lbs.][3]

Indoor air often **contains 2x–5x as much pollution** as is typical in outdoor air, and as much as 100x.[4]

High-performance homes constructed today **let in significantly less fresh air** than those in older, less efficient homes [about ¼ the natural infiltration].[5]

[1] World Health Organization, Chronic diseases and their common risk factors, 2005
[2] Lawrence Berkeley National Laboratory. The National Human Activity Pattern Survey (NHAPS), 2001
[3] Sam Rashkin. Housing 2.0, 2021
[4] U.S. Environmental Protection Agency (EPA). The total exposure assessment methodology (TEAM) study: Summary and analysis, 1987
[5] Sam Rashkin, Housing 2.0, 2021

Piera Systems

The Problem

There has not been a cost-effective solution to detect the smallest particles

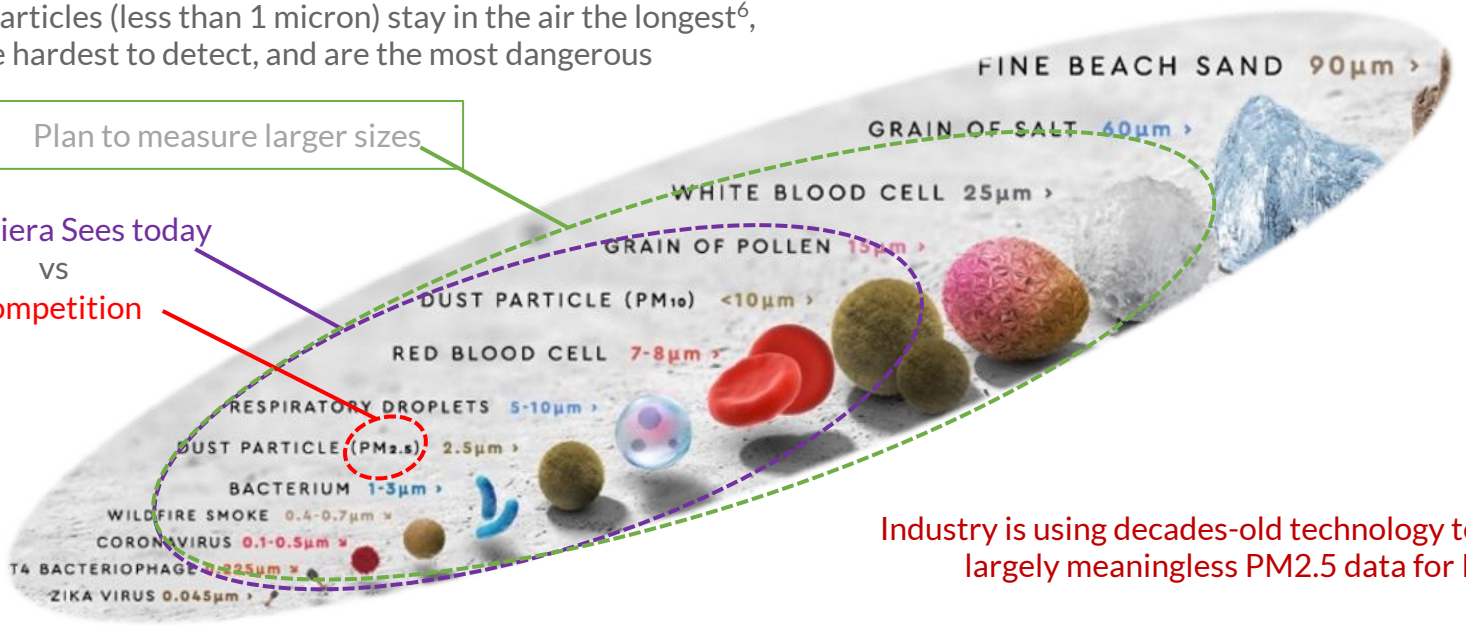
Smallest particles (less than 1 micron) stay in the air the longest[6], are hardest to detect, and are the most dangerous

Plan to measure larger sizes

What Piera Sees today

vs

Competition



Industry is using decades-old technology to produce largely meaningless PM2.5 data for IAQ

Piera Systems

The Solution

Revolutionary technology that identifies 'What's In the Air' to provide actionable insights
Instead of just telling you the Air is bad

Air Quality Monitors & Sensors
deployed indoors & outdoors

Air quality data
aggregated in the cloud

Software and Services provide
alerts, insights, mitigation

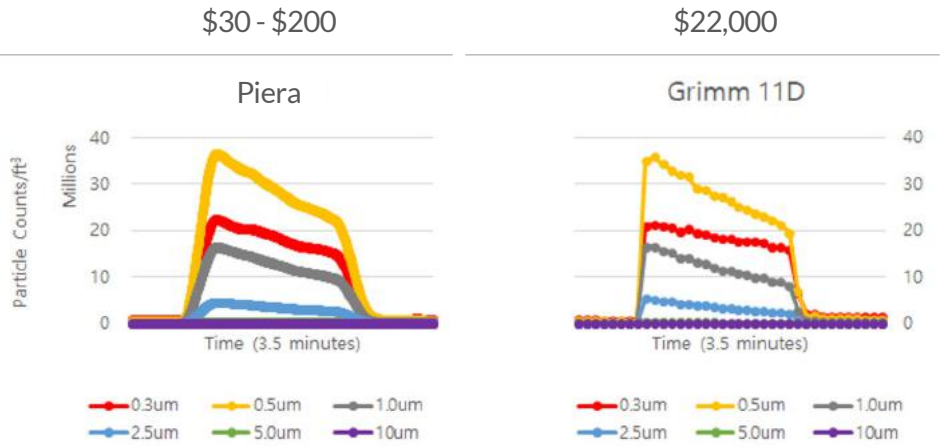
AI/ML pollutant models
identify likely pollutants

Accurately measure particles from 0.1-10 um as unique signatures,
identifies pollutants at a scalable price

Piera Systems

Break-through Particle Sensing Technology

Reference Instrument quality at a fraction of the price



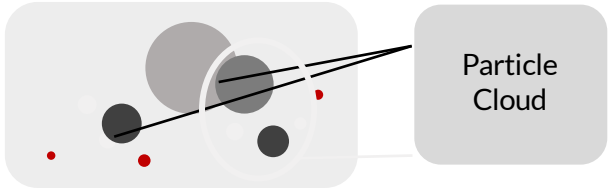
Only certified low-cost sensor that accurately counts particles and size in real-time
Only low-cost sensor to achieve ISO 21501-4 (cleanroom standard) certification

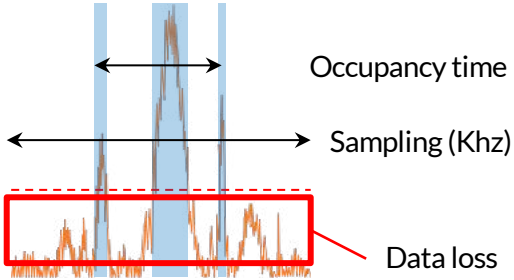
KETI Korea Electronics Technology Institute

Piera Systems

Custom Photon Counting Processor:PSC-1

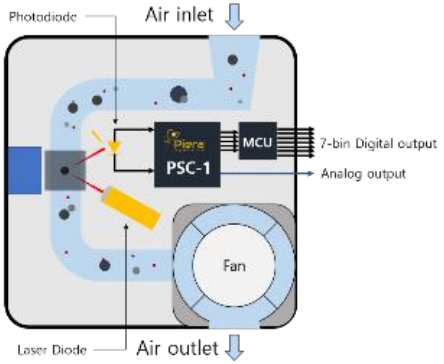
Competition

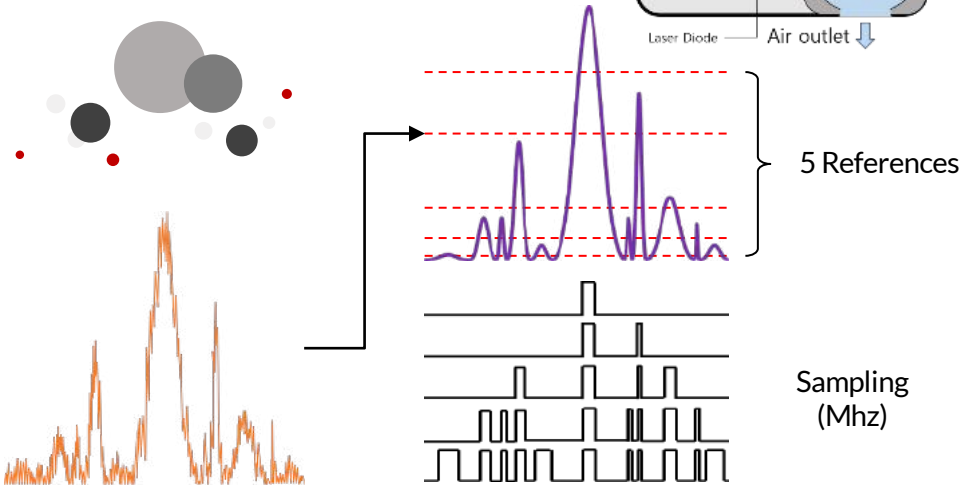




Estimated Concentration
PM2.5 only

Piera

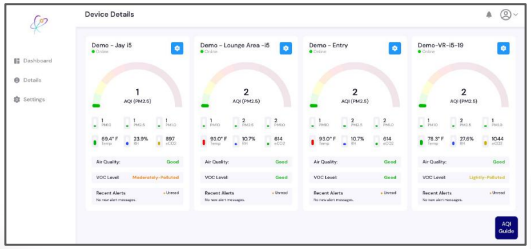




Software–Defined bin sizes detect and count particles from 0.1-10 microns

Piera Systems

Products and Services



Pollutant Models

- Licensable, subscription service provided by Piera
- Customer developed in partnership with Piera
- OTA updates

SenseiAQ Software and Services

- Air quality monitoring subscription service
- Data and insights from SenseiAQ software
- Stand-alone application or connected to Piera MS Azure Cloud
- API for integration with third party applications
- Software updates

Canāree Air Quality Monitors

- Easy to deploy in Smart Spaces, Hospitals, Schools, and other verticals
- Wireless Access Points (HPE/Aruba)

IPS Particle Sensors

- Integration into air quality monitors, air purifiers, and HVAC equipment

Piera Systems

IPS: A Software Defined Sensor Family

IPS Family			Eval	Series 3		Series 5			Series 7	Series X	
			PEK	Piera-305	Piera-3100	Piera-525	Piera-5100	Piera-5500	Piera-7100	Piera-X7	Piera-X7U
# of Particle Bins			7	3	3	5	5	5	7	7	7
Dynamic Range	Binning Output in Mass Concentration (PM)	<0.1	X*	X		X			X	X	
		0.3	X	X		X			X		
		0.5	X	X		X	X		X		
		1.0	X		X	X	X	X	X		X
		2.5	X		X	X	X	X	X		
		5.0	X				X	X	X		
		10	X		X		X	X	X		
		50						X			
		100									
Features	Output in Particle Counts		X	X	X	X	X	X	X	X	X
	Serial Key for Networking		X			X	X	X	X	X	X
	Firmware Upload Capability		X			X	X	X	X	X	X
	Limited Programmability		X				X	X	X		
	Full Range Programmability									X	X
Release Date			Q3 2020	Q1 2021	Q1 2021	Q1 2021	Q1 2021	Q3 2021	Q4 2020	Q2 2022	Q2 2022
Pricing ($) MOQ of 1,000			199	40	30	60	50	60	70	95	95

Piera Systems

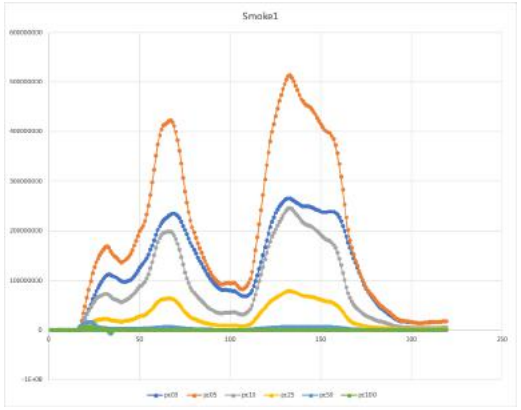
Canāree Family of Devices

Canāree A1	Canāree I1	Canāree I5
Plug-n-Play Air Quality Monitor Measure particulates from PCs, mobile devices, and wireless access points USB powered Weight 42g	**Standalone Air Quality Monitor** Monitor particulates anywhere using WiFi, bluetooth, or ethernet & all features of A1 USB or external power Weight 42g	**Comprehensive Environmental Monitor** All features of I1 & temperature, pressure, humidity, & TVOCs USB or external power Weight 50g

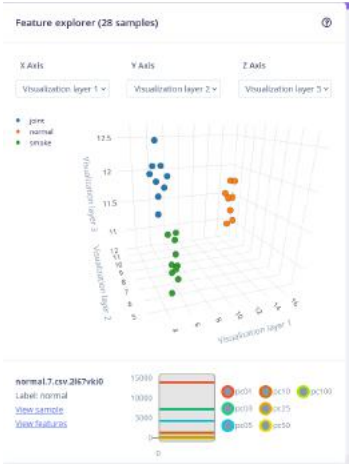
Measure across entire PM range – PM0.1 to PM10
Built-in Vape/Smoke Detection
Fully integrated with the cloud. Intuitive UI included
Seamless integrations to BMS / BAS solutions
Dimensions: 8.98cm x 6.13cm x 2.06cm
Covers 100m^2, 1,000ft^2

Piera Systems

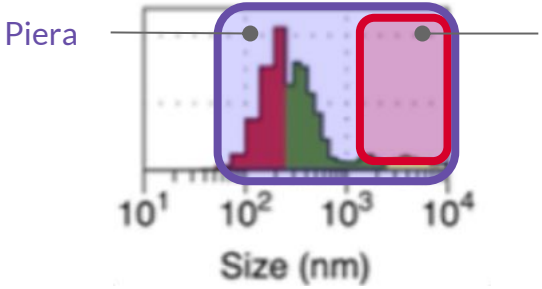
Classifying Pollution Sources



Classification requires accurate particle count and size data, from multiple ‘bins’, over time



ML Model for Vape, Tobacco Smoke and Good Air

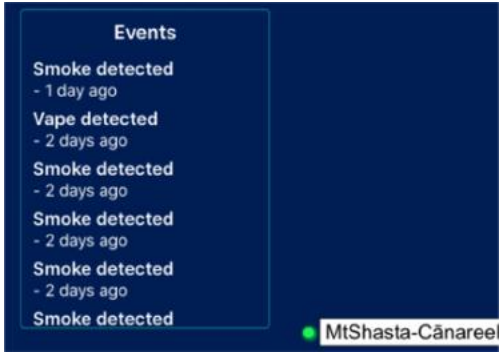


Only Piera can measure PM0.1-1.0
with 7 distinct particle sizes
Competition cannot classify particles

Piera Systems

Vape/Smoke Detection

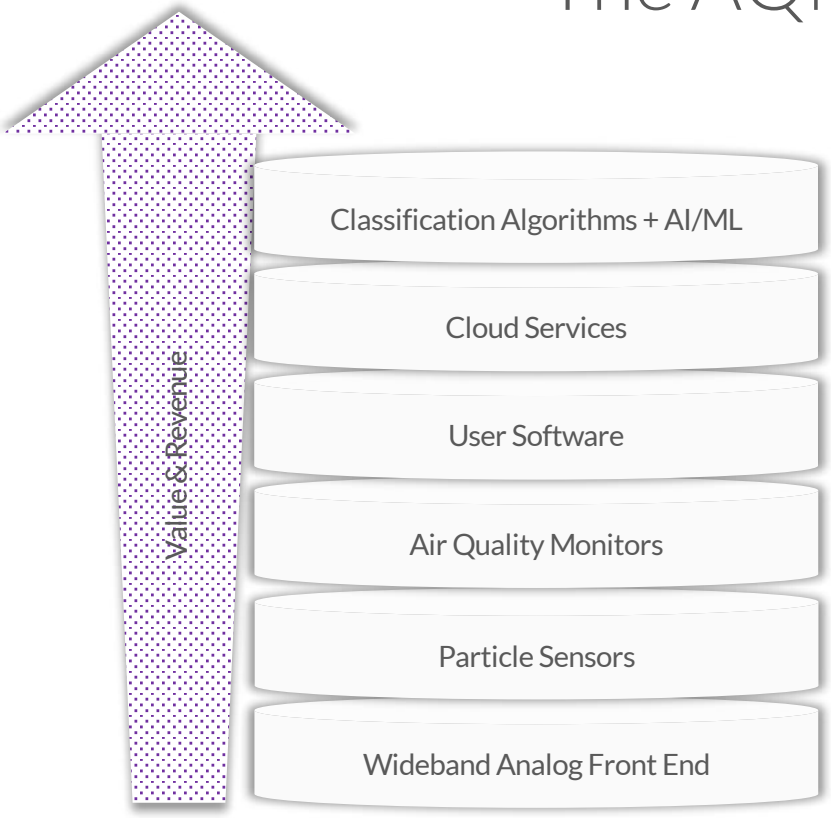
- Highly accurate event detection; within 30 seconds
- Distinguishes smoke from vape with proprietary algorithms
- SenseiAQ displays events as they happen and logs them
- LED on Canaree flashes red for smoke and purple for vape



SenseiAQ Cloud Dashboard enables event detection from remote sensors

Piera Systems

The AQM Solution Stack



Vape, Smoke, Diesel, Pollen, ….

Microsoft IoT Hub or cloud service of your choice

SenseiAQ, easy-to-use data visualization software

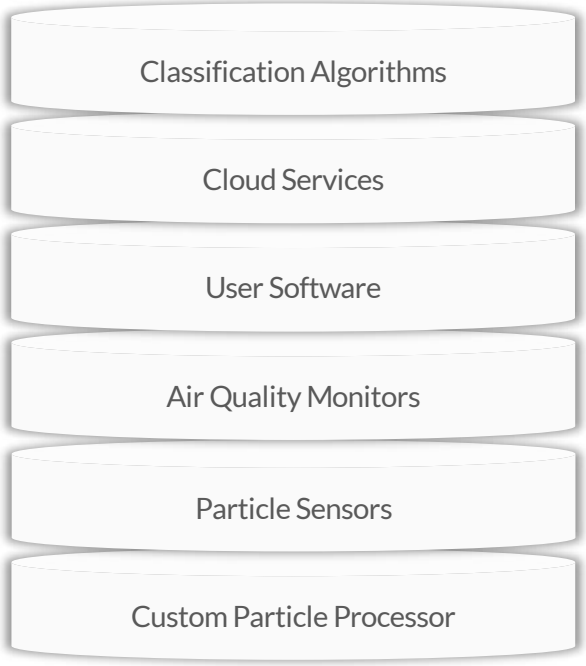
Canāree family of Air Quality Monitors

IPS, Intelligent Particle Sensors

PSC-1, proprietary ASIC, 3 US patents

Piera Systems

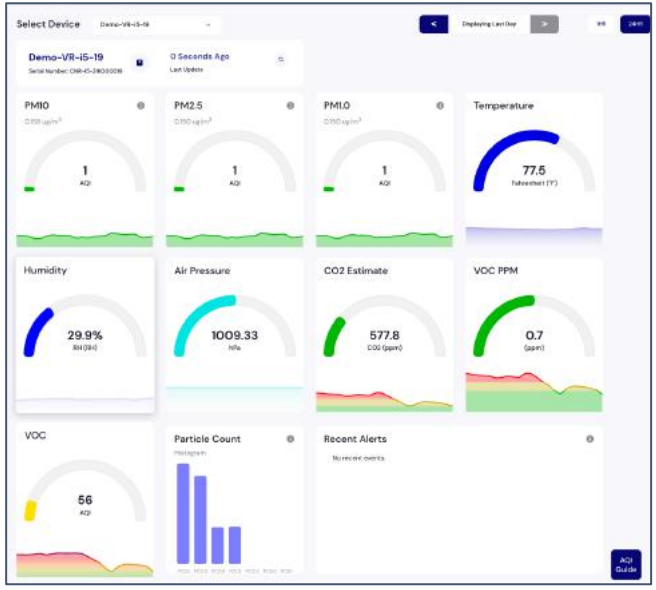
The Competition

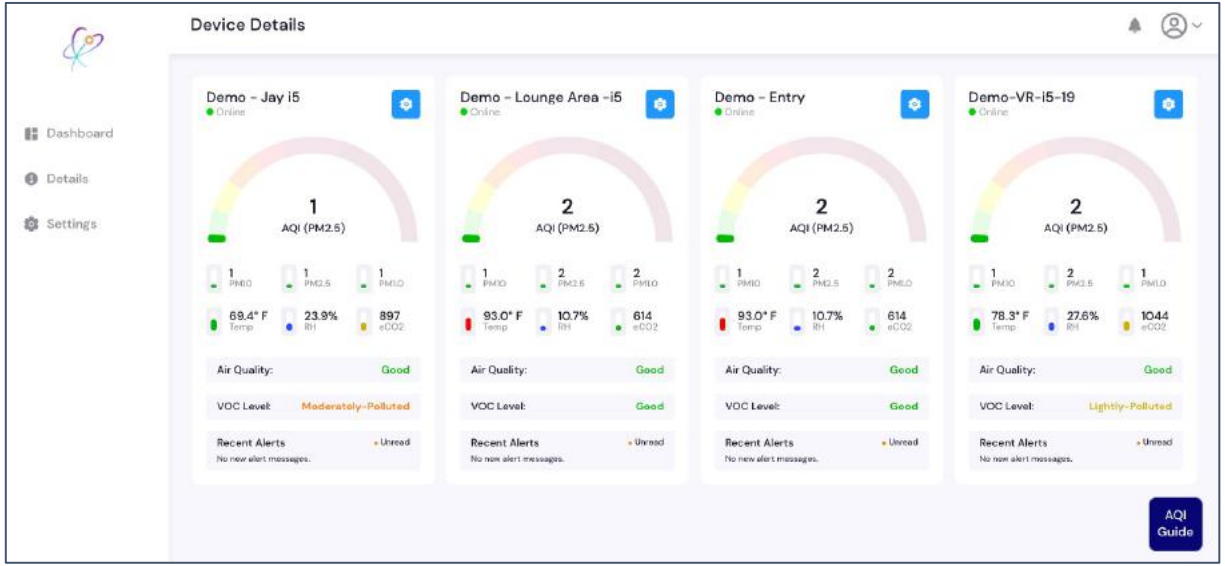


Piera Systems	Sensor Companies (PLANTOWER, SENSIRION)	AQM Companies (kaiterra, Carrier)
✓		
✓		✓
✓	✓	✓
✓		✓
✓	✓	✗
✓	✗	

Piera is the only company that can classify and identify pollutants

SenseiAQ Software and Dashboard





sensei.pierasystems.com

Our Customers

"Your sensor is so powerful that it'd be a shame to use it just to control the range hood"

- Chief Engineer, Faber Spa, Kitchen Appliance Maker

"We have picked Piera as our long-term partner to attack a vastly untouched sector with a huge demand for robust industrial sensing technology"

- CEO, Trolex, Mining and Industrial Solutions

"Human health is directly correlated to sub-micron particles and Piera's sensors are a game-changer as this allows us to monitor air quality at an unprecedented scale"

- *VP, Build Equinox, HVAC equipment & Prof, Univ of Illinois – Urbana Champaign*

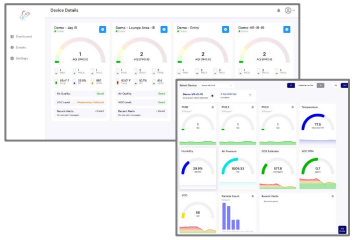
"Air pollution is an enormous global health problem and our ability to combat it starts with accurately measuring it. We couldn't be more pleased with our collaboration with Piera and the quality of their particle sensors, We are now able to offer highly accurate outdoor air quality monitors while unlocking brand new applications."

David Löwenbrand, CEO of Sensorbee.

150+ evaluations by commercial, industrial, academic, and citizen scientist groups on 6 continents across a broad range of applications

Piera Systems

Building Automation Goals:
Energy, Health, Occupancy



- Monitor accurately measure the air quality
- Inform derive insights, classify sources, identify causes
- Mitigate employ effective methods to clean the air

Act Now: Install Monitors and start gathering data before committing to Sustainability or ROI goals

Piera Systems

HVAC Systems need the Accuracy

"… we found very strong correlation of submicron particulates with occupancy, unlike larger particles (>1micron) that did not correlate with occupancy."

"Some fraction of these small particulates are respiratory, and our experiment showed that we could reduce their concentration through both increased fresh air ventilation and improved filtration (MERV13)."

"… we think today's standards are half of what they should be …"

"Air cleaning products require in-situ monitoring and control"

Certifications, Standards

Challenge: Indoor Air Quality Test Standards

LEED – Building and its services not health of occupants

WELL - is for People, not prescriptive, audits,

RESET – Focused on Air: A, B, C Grade Monitors

ASTM D8405-1 Certification by AQ-SPEC

ISO 21501-4 Standard for Calibrating Optical Particle Sensors

Solution

Indoor Air Quality Metrics based on EPA PM 2.5, 10 MC

Most sources of indoor emissions are PM <1.0

Canāree meets WELL, RESET Grade A specs at low cost

ISO 21501-4 complete, ASTM D8405-21 underway.

Piera Systems

ROI for Improving Air Quality

- Improved IAQ for healthier, more productive employees
- Improved Employee Health = $34 per sq. m
- Improved Staff productivity => $410 per sq. m
- Possible ROI = 120 %

Source: 75F

No more guessing, know exactly ‘What’s in your Air’

- Most accurate, affordable sensors and air quality monitors

Gain Insight into your Air Quality

- Fine, Very-Fine and Ultrafine particle data needed to identify sources

Let’s partner on new possibilities

- Our disruptive technology empowers new markets and applications
- www.pierasystems.com