

### What's In Your Air?

# **Air Pollution Affects Everyone**



Causes lung cancer, alzheimer's, and cardiovascular diseases<sup>1</sup>

Allows Covid-19 and other respiratory diseases to spread faster<sup>2</sup>



Debilitates people with respiratory issues<sup>3</sup>

Severely reduces cognition affecting health & productivity<sup>4</sup>

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



# **The Problem**

### Detecting the smallest particles has not been cost-effective





# Let's Talk About Air



**PM10** 

Vehicles Industries Construction Sandstorms Pollen



Fires, Wild and Controlled Vehicles Industries Bacteria & Fungi Biomass

PM2.5



PM1.0 - PM0.1

Cigarette & Vape Smoke Wood Burning Allergens Cooking Viruses



## **Canāree measures it all**

# **Challenges Hotels Face – In-Room Smoking**

A guests' highest priority is a clean and safe room

### **Cleaning Costs on the Rise**

- Smoked- or vaped-in rooms must be thoroughly cleaned reducing occupancy rates
- Tobacco smoke is expensive to clear out. Cannabis even more so
- Reputation to property is critical

### **Reducing Chargebacks**

 With no scientific proof behind smoking or vaping events, fine collection is problematic

### Room with clean air = Peace of mind for guests and hotel managers







# **The Solution**

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Canàree

### Accurately measure all particles and identify pollutants at a scalable price



# Revolutionary technology that identifies 'What's In the Air' to provide actionable insights



# Canāree: Next Generation Air Quality Monitors *2*



Canāree A-Series (USB) AQM



Canāree R-Series and iX-Series (PoE/WiFi)



Canāree I-Series (WiFi) AQM

- Highly accurate indoor air quality monitor
- SenseiAQ<sup>™</sup> real-time dashboard for alerts and insights
- Vape/smoke detection in real-time (VSD)
- Secure cloud-based storage and analytics
- Flexible pricing models
- Solutions available for Aruba and other Wireless APs
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**Canāree on Wireless AP Solutions** 

## **Classification is the New Frontier**



Pollutant signatures from Lawrence Berkeley National Laboratory



### Only Piera can measure PC0.1-1.0 Competition cannot classify particles

Particle Count + Particle Size + Number of Bins = Particle Classification



# **Canāree pollutant profiling works like Shazam**<sup>™</sup>

# How does Shazam work?





# **Classifying/Profiling Pollution Sources**





ML Model for Vape, Tobacco Smoke and Good Air



# **Piera Systems Classification/Profiling**





Air Quality Monitors & Sensors deployed indoors & outdoors



## **Classification/Profiling Roadmap**









# Vape/Smoke Detection on Canāree

- 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 Canāree flashes red for smoke and purple for vape





| Smoke detected | 1 Day Ago   |
|----------------|-------------|
| Smoke detected | 6 Days Ago  |
| Vape detected  | 12 Days Ago |
| Vape detected  | 18 Days Ago |
| Vape detected  | 25 Days Ago |
| Smoke detected | 29 Days Ago |
| Smoke detected | 1 Month Ago |
| Vana datastad  | 1 Month Azo |

SenseiAQ Cloud Dashboard enables event detection and alerting from remote sensors



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# **Actionable Data and Alerts**

### Real-time text / email alerts and alert logs for smoke/vape enforcement





Comprehensive environmental data for energy efficiency



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### PARTNER SOLUTION OVERVIEW Canāree is an Aruba Certified Solution



#### THE NEED FOR INDOOR AIR QUALITY MONITORING

Employees, customers and the general public are now aware of the need to monitor, measure and improve indoor air quality. Wildfires, global warming, COVID-19 and the increasing amount of time spent indoors has created a 'tipping point' for companies to take action. The source of most poor air quality is due to particulate matter (PM), a mixture of airborne solid particles and liquid droplets that can be inhaled and cause serious health problems. The World Health Organization (WHO) reports airborne particulate matter (particulate from 0.1-10 micrometer in size) as a Group 1 carcinogen and as the biggest environmental risk to health, with responsibility for about one in every nine deaths annually.

The EPA monitors and reports outdoor air quality but not indoor, and their monitoring stations are guite far apart, expensive and do not update in real-time. The EPA's Air Ouality Index (AOI) is a simple, easy to follow metric for classifying air quality and can be applied indoors. However, it doesn't classify sources of poor air quality. To do so requires more detailed information about particle size and count. A new class of air quality monitors based on more accurate, higher resolution, real-time data about particle size and count has been developed by Piera Systems. It can leverage existing wireless access points from Aruba to quickly and cost effectively allow monitoring of indoor air quality.

#### A BREAKTHROUGH IN AIR QUALITY MONITORING: CANĂREE

Canāree™ PM is a low cost, Air Quality Monitor that plugs into existing Aruba Access Points (APs) and measures air quality instantly. Canāree PM is an IoT device connected to the Microsoft Azure cloud for secure data storage and access. Piera's SenselAQ<sup>rv</sup> software application running on Azure is a real-time dashboard that reports AQI together with additional analytics and alerts about indoor air quality. Canāree PM installs by simply plugging into an existing Aruba AP USB connector without needing to remove the AP to

#### WHY ARUBA & PIERA SYSTEMS? · Highly accurate indoor air quality monitoring and

management Leverage existing wireless access points to reduce costs, simplify installation and deliver real-time analytics

 SensieAQ<sup>™</sup> application provides real-time dashboard, alerts and insight to take action and improve indoor air guality

· Vape/smoke detection in real-time · Secure, cloud-based storage and analytics integrates with existing IT and facilities management

applications · Flexible business models allow own/rent/lease for short or long-term business requirements



#### Figure1: Canāree PM

install. Power and secure IoT communications are provided by the AP. Data is logged and stored on Azure IoT Hub for easy integration with existing Building Management Systems. Canaree is easy to install, configure, maintain and update. A network of Canāree sensors monitored by SenseiAQ can be easily reconfigured as needed.

Canàree contains Piera Systems Intelligent Particle Sensor Module, "Piera-1", an optoelectrical sensor based on laser scattering. Piera-1 utilizes a proprietary "PCIC" (Particle Counting Integrated Circuit), a custom ASIC specifically developed for photon-counting and processing (3 granted US patents). PCIC can identify different sized particles and their concentration by directly counting pulses of different levels



#### BETTER TOGETHER

Aruba and Piera Systems have partnered to enable Aruba access points to 'anchor' Air Quality Monitoring for Indoor Spaces. Piera's Canaree PM (and PRO) Air Quality Monitors represents a breakthrough in the ability to measure Particulate Matter from 0.1-10 um with the accuracy and resolution of expensive reference instruments at a low cost. The location and separation of existing Access Points typically provides an ideal placement (ceilings) and distribution for Air Quality Monitoring (~ 10 m²). Canāree PRO augments Canāree PM with additional Sensors and Wifi and can be located remotely from Access Points (See Figure 2). PM and PRO can be deployed as needed across high traffic locations or where sources of emissions may occur.

Canāree and SenseiAQ software when installed quickly and easily report indoor Air Quality providing insight into poor ventilation, indoor pollution due to vaping, smoking, cooking or other activities. Mitigation can include adjusting HVAC systems, increasing fresh air flow, adding or moving air purifiers, alerting those with respiratory issues or limiting access to areas with poor air quality.

#### IQUE VALUE PROPOSITION

The joint solution delivers the operational visibility and robustness demanded by COOs and Facilities Managers, without the expense of installing a traditional wired sensor system. Plug and Play USB installation allows Canāree AQM's to be deployed anywhere an Aruba AP is installed or planned in an ideal ceiling mounted location without additional expensive conduit or installation costs. These savings multiply during facilities changeouts because adds, moves, and changes are just as easy and inexpensive.

**ARUBA AND Piera Systems** 

The demand for Air Quality Monitoring places unique demands on facilities, IT and finance with purchasing, installation and ongoing management challenges. Both companies are respected leaders in Air Quality and IT, respectively, and the joint integration allows data to flow reliably and securely across the existing network infrastructure. Flexible business models allow organizations to quickly install, operate and maintain the AQM network. And the insight provided will deliver peace of mind to employees, customers, and everyone visiting your facility.





# **Aruba Intelligent Edge-IoT Transport**







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## **Canāree i-Series**





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# SenseiAQ Software and Dashboard

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Dashboard

O Details

Settings

- Browser or application for Windows/Mac
  - iOS, Android apps (Q4 '22)
- Standalone or connected to cloud
  - Our cloud or yours
- Dashboard: EPA AQI, vape/smoke, alerts
- Detailed analytics tab and logging capabilities
- Manage Canāree installation, setup, control
  - Name Sensors, Set Locations, Make AQI Data Public
- API for integration with other applications





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# **SenseiAQ Details View**



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Scan QR Code to see AQ and alerts

Piera

Demo Site <u>https:// demo.pierasystems.com</u> login: demo / demo

# **Custom Smart Floorplans (optional)**

Ideal Sensor Placement in the Hotel

- Hotel Rooms
- Common Areas
- Executive Offices
- Lobby / Entryway
- Pool change rooms

High-Density WiFi designs are great for full AQM coverage









# **Hotel Room Installations**

Canāree can be installed and powered using the latent USB-A port on network access points. In addition, they can be installed in the USB ports of either the TV or set-top box located behind the TV. Customers have secured in place with either lock straps, zip ties or glue.





▲ Use a dedicated USB port or adapter capable of 5W output (min), not shared with other devices

# **Access Point or Set-Top Box Powered**

If the environment has Wireless APs deployed with side- or top-mounted USB-A connectors, the Canāree can be powered and managed directly from the AP. The AP Itself is typically powered by 48V PoE+ Ethernet, or its own 12V aall charger

If the environment has STBs deployed with USB-A connectors, the Canāree can use the STB power and transmit data to the cloud through the local SSID.



Use a dedicated USB port or adapter capable of 5W output (min), not shared with other devices

# **Real-time Solution for Hospitality**

**Canāree is a cost-effective air monitor** 

Real-time vaping/smoking alerts using patented technology

Vape/smoke data logged for further enforcement

Deploy tamper-free in every room



Enforce vaping/smoking bans, cut down on cleaning costs, and ensure healthy spaces



# **Canāree Pays for Itself**

- Each smoking incident can cost between \$500 \$1500 to clean
- Powerful deterrent to prevent activity before it starts
- Accurate air data will result in energy savings
- Improved occupancy rates for additional revenues
- Differentiate your property with 'clean marketing'

**ROI Spreadsheet Available Upon Request** 



## **Key Values for Hospitality**

Improve customer experience and health

Differentiate your property – vape and wildfire proof

Increase revenues with enforcement, cleaning, and energy savings



## **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.

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

Diera

# The Team



Vin Ratford CEO



**Aaron Soh** Founder & CTO



**Howard Pakosh** Sales & Business Development



Andy Soh Chief Architect

- Decades of startup and corporate experience
- Serial entrepreneurs, innovation-focused
- Successfully scaled multiple companies
- Multiple exits through M&A, IPO
- Semiconductors, Software, AI/ML, Crypto,

Biotech, Environmental Data





**Mark Hobaugh** VP Manufacturing Operations



**Neil Klepeis** Environmental Research Scientist







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# What's in your AIR?



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# **Additional Details**

The Technology Behind Canāree

### **IPS - Breakthrough Family of Sensors**





World's <u>only</u> certified sensor that accurately counts every particle from 0.1 um - 10 um in real-time

# Piera IPS vs. PM2.5 Sensors

## **Measurement Differentiation**

X Some low-cost monitors measure only one particle size (e.g. PM2.5) and interpolate to give readings for other particle sizes.

✓ Piera Systems IPS measures and count each particle size: PM0.1, PM0.3, PM0.5, PM1.0, PM2.5, PM5.0, and PM10 for reliable, high accuracy data, in real-time.







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## **Piera IPS vs PM2.5 Sensors** *Accuracy*



The plots are not drawn to scale, intended for illustrative purpose only. The error can be different depending on test particles used, reference instrument used and environment.



## **Piera IPS vs PM2.5 Sensors** *Technology*



## **IPS Certification**

 Extremely accurate particle-counting mixed signal IC (PCS-1)



 Accurate, cost-effective Intelligent Particle Sensors (IPS Family)







The Only Certified Sensor that counts every particle from 0.1um-10.0 um in real-time Piera

## **PASCAL – Piera Automated Sensor Calibration**

### **The PASCAL Process**

A standardized process developed by Piera Systems to calibrate <u>each individual particle sensor</u> according to a set of strict standards

3-in-1 process

Includes a programmable device functionality testing step; particle size/mass calibration step; a final validation and QA step Industry's first automatic volume production chamber capable of calibrating devices based on both particle counts and mass concentration for the widest concentration range in the industry (0-6,000ug/m3)

Testing capacity: ~4,000 units per week

### Advantages

Enables precise device calibration

Minimal labor involvement

Scalability and adaptability

Provides complete individual device calibration record for traceability



