



Environmental Health Solutions

Turning Air Filters Into Alert Sensors

Air Particle ID (APID): a patent-pending computer vision and edge AI method that reads the particle data every air filter already collects.

We are not raising against a set price today. We are here to find the right partners, licensees, and referrals.

A U.S.-based licensing and advisory company | Springfield, Missouri, USA



THE PROBLEM

We Bridge The Environmental Gap

THE QUESTION WE KEEP ASKING

What if the firefighters, police, and volunteers working Ground Zero in the days after 9/11 had a way to identify the hazardous particulate they were breathing, in real time, instead of learning what was in that dust from lab analysis years later?

ENVIRONMENT

The exposure point.
Homes, vehicles,
factories, and buildings
where air is filtered every
day.

THE GAP

Unknown sub-PM2.5
particle debris: mold,
pollen, toxins, pollutants,
and product fragments.
Captured by filters, then
thrown away unread.

END-USER

People with unknown
exposures. No practical
way to know what they
are breathing at each
location.

That gap is not historical. It is the same gap sitting in every filtration system, HVAC unit, and vehicle cabin running today, unread.

The world's largest sensor network is already installed. Nobody is reading it.

Air Particle ID: Four Stages, One Closed Loop

01

Capture

Image the used filter media with any capture device. No physical sampling, no lab shipment.

02

Classify

Edge AI classifies particle debris into trained classes on the device.

03

Analyze

Results indexed and matched against the environmental database.

04

Automate Action

Downstream computing actions trigger, including geo-location zone alert notifications.

ARCHITECTURE-INDEPENDENT BY DESIGN

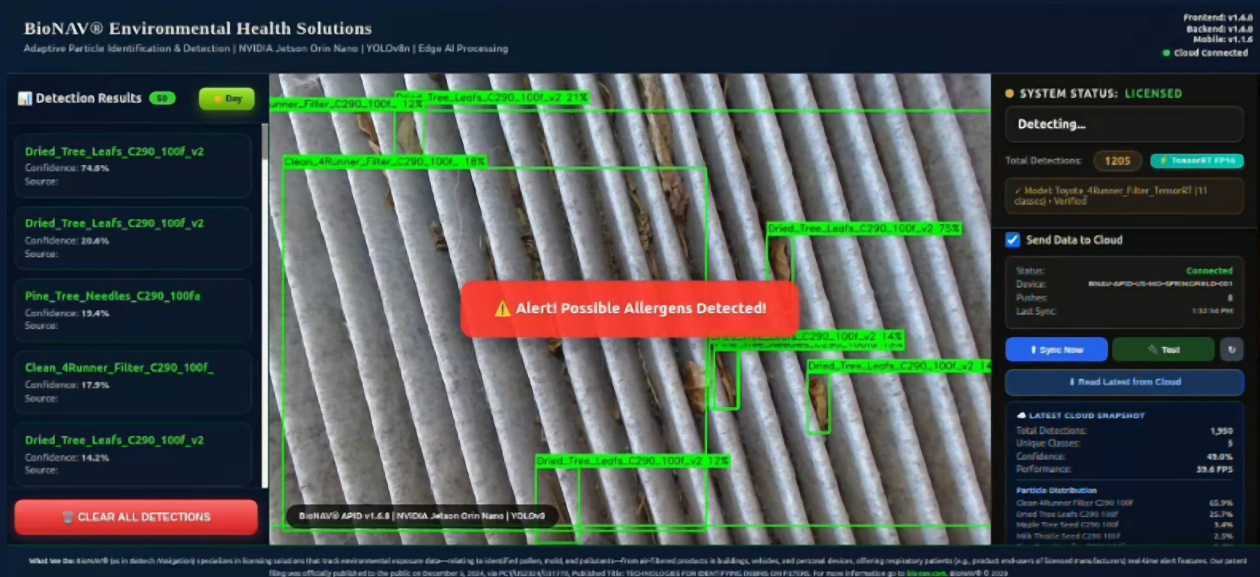
A first-principles process built to support multiple computer vision systems across multiple industries: Microscopes | Borescopes | Backscatter (X-Ray) | Laser | Ultra-Violet | Infrared | Thermal | Radar | Telescopes | Spectrographic | Sensor-to-Sensor

Patent pending: PCT/US2024/031776, published as WO2024/249697

We license the process. You build the product. You own your analyzed data.

PROOF

Validated on Toyota Cabin Air Filters



WORKING PROTOTYPE

NVIDIA Jetson Orin Nano, YOLOv8n with TensorRT. Python/Flask backend, React frontend, mobile companion app, MongoDB Atlas cloud sync. Operational today; CAD and BOM available for DFM review.

- ✓ Multi-class particle model trained on Toyota cabin air filters, our narrow entry point into a broad methodology.
- ✓ Inference runs on the edge device itself. No cloud round trip required to classify.
- ✓ Complete closed loop demonstrated: capture, classify, analyze, automate action.
- ✓ Licensees design their own implementations. Frame volume, class count, and training depth scale to each use case.



DEMO VIDEO: 1st Stage Proof-of-Concept

youtube.com/watch?v=AMZbDn85WPO

A Process Patent, Not a Model Patent

The claims attach to the sequence of actions, from capture device through pattern detection, descriptor identification, database matching, and the downstream computing action. No algorithm, vendor, or chip generation is load-bearing, so advances in computer vision extend what a licensee can build without eroding the claim.

EDGE TOPOLOGY (LICENSE #1)

L5 Edge + Mobile, collocated processor

- 1 Capture the filter media in place or at the point of service
- 2 Classify on-device; no network round trip required
- 3 Analyze against local thresholds and trend history
- 4 **Alert on the device and the mobile companion app**

SERVER TOPOLOGY (LICENSE #2)

Licensee server application, network deployment

- 1 Capture, then send the image through the network interface
- 2 Server detects the pattern and identifies the descriptor
- 3 Match against the environmental database at fleet scale
- 4 **Geo-location zone alert notification to the end user**

ALERT NOTIFICATION FLOWS THROUGH BOTH. Two licenses, one platform, covering the licensee's edge build and server build, so no competitor can design around the method by moving the workload.

2023

Priority date, May 31

2024

PCT filed and published: PCT/US2024/031776,
WO2024/249697

2025

U.S. publication in December; national phase strategy in progress

Two Build Paths, One Platform

Pure methodology IP licensing, similar to the Dolby and ARM architecture models. BioNAV sells no hardware and no software products. The manufacturer owns the product, the customer relationship, and the revenue. BioNAV provides the patented method, the reference edge design, and the license framework.

A Extracted-Filter Edge Analysis

FAST PATH | 3 to 6 months

Filters removed from vehicle cabins or building air handling units are imaged and classified on the L5 edge device at the point of service.

BUILD: a field service application on the edge device, deployed against filtration assets already in the market. Revenue without product redesign or an OEM cycle.

B OEM-Embedded CV Module

LONG PATH | 1 to 3+ years

A CV module embedded into a manufactured air handling or automotive product, moving Air Particle ID into the product itself.

BUILD: an embedded vision module plus the licensee server application for fleet and portfolio telemetry. Durable differentiation, license carried in shipped volume.

Master License Agreement finalized and ready for partner negotiation. Partner-collected data stays under partner control; IP boundaries are pre-defined in the MLA.

Six License Segments, One Methodology

APID licenses into markets that already run capture-and-filtration infrastructure. Figures describe the underlying market backdrop in each segment, not IP value captured directly.



Industrial Manufacturing

\$25.1B → \$43.8B

by 2033 • 7.2% CAGR
HTF Market Intelligence, 2026



HVAC / Building Mgmt.

\$9.6B → \$13.9B

by 2031 • 7.4% CAGR
MarketsandMarkets, 2026



Transportation / Fleet

\$417M → \$836M

by 2036 • 7.2% CAGR
Fact.MR, 2026



University Research Labs

\$489M → \$662M

by 2031 • 6.2% CAGR
Mordor Intelligence, 2026



ML / CV System Integrators

\$18.4B → \$31.9B

by 2034 • 7.1% CAGR
Straits Research, 2026



Gov't / Defense

\$18.4B → \$25.5B

by 2032 • 5.5% CAGR
ResearchAndMarkets, 2026

WHY REAL-TIME DEBRIS ID MATTERS

This month marks 25 years since 9/11. Published research on the World Trade Center response found the industrial hygiene community was largely unprepared to characterize an unknown airborne debris mixture in real time; composition was reconstructed from dust samples collected days later. APID's edge classification is built for exactly this gap: on-site, real-time identification of unknown particulate across industrial, HVAC, transportation, and public-safety settings.

How the Model Compounds

Revenue is licensing and advisory fees, not product margin. There is no bill of materials, no inventory, and no manufacturing risk carried by BioNAV.

TWO SUBSCRIPTIONS

Each licensee can carry an Edge + Mobile license and a Server (Enterprise) license. Both are recurring, not one-time.

ROYALTY UPSIDE

Co-developed products carry a royalty on licensee product revenue, so a licensee's success compounds into BioNAV's base.

SELF-REPORTING + AUDIT

The finalized MLA carries licensee self-reporting with BioNAV audit rights, so the model scales without per-unit tracking overhead.

NO COGS TO DEFEND

Every incremental license is close to pure contribution. Cost to serve is advisory time, not production capacity.

THE SHAPE OF THE OPPORTUNITY

Six addressable segments. Each segment supports multiple licensees, and each licensee can carry two subscriptions plus royalty-bearing co-developed products. The constraint on this model is not market size or unit economics; it is the pace at which we can reach and qualify licensees. That is where the right partners change the trajectory.

Pre-revenue. Specific license terms and figures are discussed privately, not published.

Founder-Led, Momentum Before Scale



Robert Freeman

FOUNDER & CEO

Three decades of launching early-stage technologies. Inventor of the Air Particle ID method and builder of the L5 edge prototype. Engages directly through the full program.

ADVISORY BENCH



Dave Hodgson

Strategic Partnerships



Ena Sanguinetti

Commerce



Tim Kotschwar, PharmD

Clinical & Scientific

TOP 80

Innovator and selected Showcase presenter, 2026 ATS Respiratory Innovation Summit

70+

ML/CV integrator firms in the active licensing pipeline, plus university research lab outreach

1

Working edge prototype running live classification on Toyota cabin air filters

2

Continents with distribution: U.S. direct licensing and an established European reseller

Master License Agreement finalized. Multi-agency SBIR grant strategy in active pursuit.

From Add-On to Embedded to Personal

A CV MOVES INTO THE PRODUCT

Computer vision shifts from bolt-on accessory to embedded module, producing the fastest real-time edge-to-cloud ecosystem in air handling. The license is carried in shipped volume rather than sold per site.

B THE THIRD SUBSCRIPTION: “FOLLOW ME”

BioNAV introduces a personal-exposure tier tracking air quality across home, vehicle, and personal devices, regardless of which licensed manufacturer built the hardware. The ecosystem widens; the patent does not need to change.

“BioNAV is not an AI company. Our patent is based on the action of AI results. As AI advances, our patent doesn't become obsolete. It becomes more valuable.”

SEQUENCING CHOICE. Data-security infrastructure and analyzed-data signatures come first; medical and regulatory compliance follows the third license. This keeps go-to-market moving instead of getting buried in policy review.

Three Ways This Could Work

We are not raising against a set price today. BioNAV is pre-revenue with a finalized license framework, a working prototype, and a published patent filing. What we are looking for is the right kind of relationship.

PARTNER

Introductions to best-of-breed ML/CV integrators as license resellers, university researchers for a phase-2 SEM/STEM particle ID PoC, and the policy relationships behind analyzed-data security signatures.

REFER

Portfolio companies already building AI-driven products that could license a proven particle ID method instead of building one from scratch, plus international networks for faster global acceptance.

INVEST

If the model fits your thesis, capital to accelerate the global licensing platform, international filings, and the next proof-of-concept phase. Terms are a conversation, not a posted price.

We don't know yet which of these fits best. That's the conversation.



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Scan to watch the
Proof-of-Concept demo



Visit bionav.com/solutions to schedule a free confidential discovery call