APID Extreme Edge Platform
Air Particle ID | Edge-to-Cloud Ecosystem
Brownfield Development Platform for L5 Licensed Manufacturers | Version 1.6.8 | February 2026

System Overview

BioNAV's patent-pending APID (Air Particle ID) process transforms air filtration systems into intelligent sensors. Rather than discarding captured particles, APID identifies, classifies, and reports them in real time — turning passive filtration infrastructure into an active data source. The APID Extreme Edge platform enables operators to detect particles on-site, train new classification models in minutes without coding, and synchronize structured detection data to enterprise cloud dashboards. This brownfield development kit provides licensed manufacturers a complete foundation to build industry-specific solutions.

Key Capabilities

Capability	Description
Field Detection & Training	Identify unknown particles on-site and train new classification models in minutes — no cloud, no coding required
Multi-CV Input Support	USB cameras, IP/RTSP network streams, GigE Vision industrial cameras, and video file upload (.mp4, .avi, .mov, .mkv)
Pause/Resume Recording	Record up to 120 seconds per class with pause/resume to reposition samples, adjust angles, and vary lighting between captures
Built-In Annotation	Draw bounding boxes on up to 900 captured frames per class using the integrated annotation tool
GPU-Accelerated Inference	Real-time detection at 35–43+ FPS with automatic hardware optimization on supported platforms
Alert Notifications	Configure custom alert messages per particle class, triggered automatically during live detection
Cloud Synchronization	Push detection data and session reports to MongoDB Atlas with configurable intervals and offline buffering
Session Reporting	Comprehensive reports: detection summaries, confidence statistics, class distribution, and cloud sync status
Expandable Storage	USB-connected SATA drives or cloud storage for datasets, recordings, and archives
Enterprise Scalable	Edge-to-cloud architecture supporting multi-device fleet deployments with centralized dashboards

Hardware Platforms

Specification	Jetson Orin Nano Super	Raspberry Pi 5 + Hailo HAT+
Role	Dev kit: training + detection	Production: detection-only
Cost Per Unit	$350–$500+	$150–$210
AI Performance	67 TOPS	13–26 TOPS
Power	25W TDP	~12W
Inference Speed	35–43+ FPS	100–400+ FPS
On-Device Training	Yes	No — models deployed from Jetson or cloud
Storage	microSD + USB SATA	microSD + USB storage

Cloud Sync	Included	Included
Remote/Solar Ready	Yes (25W)	Yes (~12W)

Recommended strategy: Use Jetson units as development and training platforms. Deploy Pi 5 + Hailo units as cost-effective detection nodes in the field. Both platforms share the same software, licensing, and cloud infrastructure.

Compatible Imaging Technologies

Input Type	Examples
USB / UVC Cameras	Webcams, digital microscopes, portable imaging devices
IP / RTSP Streams	Network cameras for fixed installations (ONVIF/RTSP compliant)
GigE Vision Cameras	Industrial cameras: Keyence, Basler, FLIR, Allied Vision, Lucid, IDS, JAI
Video File Upload	Pre-recorded footage from phones, field cameras, lab systems, or drones
Advanced Optics	Microscopes, borescopes, UV, infrared, thermal, laser, radar, spectrographic
Sensor-to-Sensor	Integration with complementary sensor systems for multi-modal detection

Training Workflow

APID provides a complete record-annotate-train-deploy pipeline directly on the edge device. No external tools, cloud services, or coding knowledge required.

Step	Description
1. Record	Capture up to 120 seconds of video with pause/resume to vary sample positioning, angles, and lighting conditions
2. Annotate	Use the built-in annotation tool to draw bounding boxes on up to 900 frames per class
3. Train	Launch GPU-accelerated training from the browser UI — new models ready in minutes
4. Deploy	Optimized inference engine auto-exports on completion; model immediately available for detection
5. Share	Export trained datasets to other edge units, central labs, or cloud storage for team-wide deployment

Cloud Integration

APID supports MongoDB Atlas for enterprise cloud connectivity, enabling fleet monitoring, centralized data aggregation, and mobile companion access.

Feature	Specification
Cloud Database	MongoDB Atlas (free tier compatible for development and testing)
Sync Interval	Configurable (default: every 5 seconds)
Offline Resilience	Local queue buffers data when cloud is unreachable; auto-syncs on reconnect
Configuration	Built-in desktop UI for connection setup and live status monitoring
Report Push	Session reports simultaneously saved locally and pushed to cloud with unique report IDs

Fleet Support	Each device pushes to shared database with unique device identity for multi-unit dashboards

Security & Licensing

Feature	Description
License Validation	Hardware-bound license tied to each physical device; cannot be transferred or cloned
Demo Mode	Unlicensed units operate with limited functionality (class and detection caps, watermark)
First-Boot Setup	Guided wizard configures device identity: company, product, location, unit number
Device Naming	Enterprise-standard format (e.g., ACME-APID-US-TX-HOUSTON-001)
API Authentication	Key-based authentication for all external integrations
License Types	Demo, Standard, Enterprise, OEM — tailored to deployment scale

Mobile Companion App

The APID Mobile Companion provides remote monitoring and fleet overview from phones and tablets. No app store download required — access via mobile browser on the local network.

Feature	Specification
Version	v1.1.6 (Tested and validated in February 2026)
Access	Browser-based — connect via local network to edge device
Live Monitoring	Real-time detection data feed from connected edge unit
Cloud Status	View cloud synchronization status
OEM White-Label	Customizable branding and UI for licensee products
Planned Updates	Reports viewer, off-network proxy access, enhanced fleet dashboard

Session Reporting

Comprehensive reports document each detection session for analysis, quality control, and compliance documentation:

Report Section	Contents
Detection Summary	Total detections, confidence statistics, per-class distribution
CV Systems Used	All input sources with resolution and metadata
Dataset Library	Loaded models with per-class performance metrics
Training Activity	Recordings created, training runs, frames captured, QC recommendations
Cloud Sync Status	Push confirmation with report ID and originating device
Export	Downloadable text reports; structured data pushed to cloud

Licensing & Advisory Services

BioNAV's APID process is licensed exclusively by BioNAV LLC through multi-year enterprise subscriptions. Licensees receive a complete brownfield development platform as a foundation to build their own industry-specific solutions. Additional services available:

Technical consulting for computer vision system specification and selection
Referrals to qualified system integration firms for enterprise deployment
OEM licensing for product-level integration
Custom development partnerships and AI/ML advisory services

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