

# Gaia Sentinel

## Standard Operating Procedure (SOP)

**Module Name:** Gaia Sentinel – HEPA Node

**Version:** 1.1

**Prepared By:** Gaia Sentinel Development Team

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## 1. Purpose

This SOP defines the procedures for development, deployment, operation, and maintenance of the Gaia Sentinel HEPA Node.

The HEPA Node is an active air purification system designed to perform high-efficiency air scrubbing while integrating with the Gaia Sentinel ecosystem and cloud infrastructure.

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## 2. System Overview

The HEPA Node combines:

- High-efficiency HEPA filtration
  - 12V DC air circulation fan
  - ESP32-based monitoring and WiFi connectivity
  - Built-in 12V rechargeable battery backup
  - Integration with Gaia Sentinel dashboard and cloud
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## 3. Functional Objectives

1. Remove airborne particulate matter (PM2.5 and smaller).
  2. Improve indoor air quality.
  3. Transmit system status to dashboard and cloud.
  4. Continue fan operation during power outages.
  5. Respond automatically to high AQI detected by Air Node.
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## 4. Hardware Architecture

### 4.1 Core Controller

- ESP32 Microcontroller

### 4.2 Filtration System

- Replaceable HEPA filter cartridge

### 4.3 Air Circulation

- 12V DC high-speed fan

### 4.4 Power System

- External DC supply
- Built-in 12V rechargeable battery
- Automatic switchover mechanism

## 4.5 Enclosure

- Durable ventilated housing
  - Internal mounts for fan, filter, ESP32, battery
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## 5. Software Architecture

- WiFi-based connectivity
  - WebSocket real-time communication
  - Cloud dashboard integration
  - Device status monitoring
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## 6. Deployment Procedure

1. Install filter and fan securely.
  2. Connect ESP32 and battery system.
  3. Upload firmware.
  4. Configure WiFi and cloud endpoint.
  5. Verify dashboard connectivity.
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## 7. Maintenance

### Weekly

- Inspect airflow

### Monthly

- Clean vents

### Every 6–12 Months

- Replace HEPA filter
  - Inspect battery health
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## 8. Safety Guidelines

- Do not operate without filter.
  - Ensure correct battery polarity.
  - Keep vents unobstructed.
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## 9. Conclusion

The HEPA Node transforms Gaia Sentinel from passive monitoring to active environmental control.

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