Avalanche Response Drone Station With Automatic Deployment and RF Search Module

1. Introduction

This document establishes prior art for an autonomous avalanche-response drone system designed
to detect, localize, and support rescue operations for avalanche victims. The system integrates, autonomous drone deployment, RF-based buried victim localization, avalanche detection sensors, and a permanent autonomous drone hangar. This publication prevents external patent claims while preserving the author's rights to improve, publish, or patent specific subsystem implementations.

2. System Overview

This system consists of avalanche detection hardware, sensor fusion logic, an autonomous drone hangar, a UAV platform with autonomous flight, a 457 kHz RF receiver module, real-time localization algorithms, and a cloud interface for rescue teams. The block diagram below provides a high-level overview of system architecture and data flow between components.

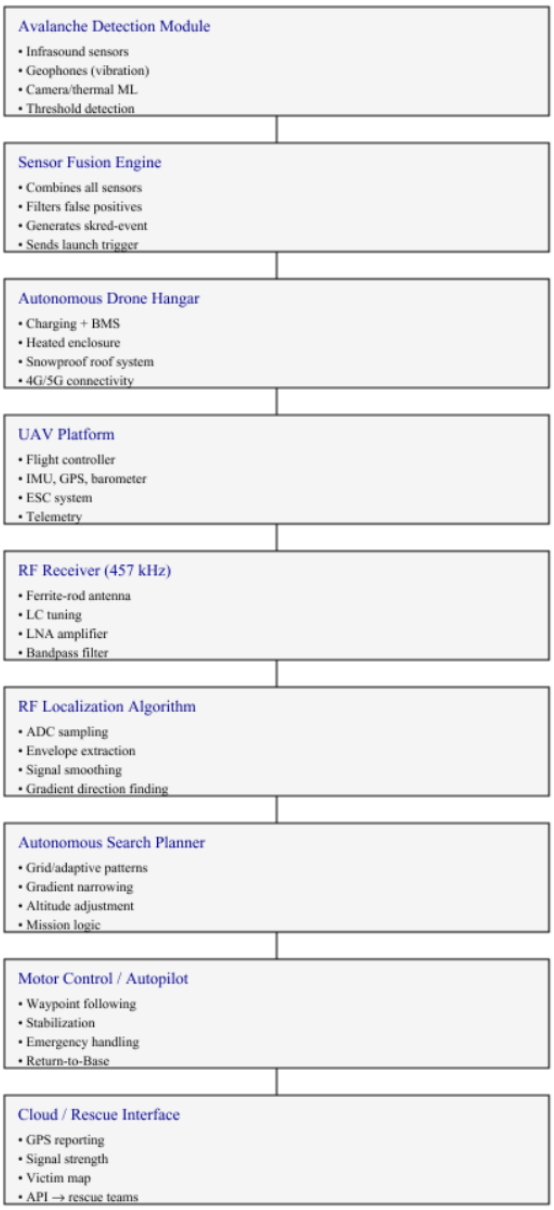

Figure 1: System Architecture Block Diagram

3. Avalanche Detection Module

Avalanche detection combines multiple sensing modalities including infrasound sensors, ground vibration geophones, long-range microphones, and optional thermal/optical

cameras powered by machine learning models. Detection logic identifies characteristic signatures of snow mass movement and forwards a trigger to the drone station.

4. Sensor Fusion and Trigger Logic

The fusion engine combines vibration, acoustic, and visual signals. It filters false positives caused by wind, vehicles, or wildlife. When the confidence index exceeds a threshold, the drone is launched automatically.

5. Autonomous Drone Hangar

The drone hangar provides full-weather protection, battery management, heating, roof actuation, diagnostics, and autonomous readiness. It allows 24/7 operation regardless of weather or temperature.

6. RF Search Module (457 kHz Receiver)

The drone includes a purpose-built RF module for avalanche transceiver detection. It contains a ferrite antenna tuned to 457 kHz, analog signal conditioning, envelope detection, and onboard ADC sampling for digital filtering. This enables buried victim detection under deep snow layers.

7. RF Localization Algorithm

Localization works by sampling magnetic field strength from the transceiver signal while the drone executes search patterns. Signal gradients are mapped onto GPS coordinates to determine the likely buried victim position. This method is effective even without visual cues.

8. Autonomous Flight and Search System

The drone executes grid and adaptive search paths. Real-time signal gradients cause the UAV to refine its path. The flight controller manages position hold, stabilization, and altitude correction, ensuring safe autonomous operation.

9. Cloud / Rescue Team Interface

Once a likely victim position is determined, coordinates and signal intensity maps are transmitted to cloud infrastructure and rescue teams. This enables faster localization and reduces rescue latency.

10. Purpose of Disclosure

This document is intentionally published as prior art. It prevents external parties from obtaining patent rights on the described full system architecture while allowing the author to patent individual technical improvements later.

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