

Background

Introduction & Problem Statement

Natural disasters often trap survivors under debris, making manual search operations slow and risky. Existing drones lack the ability to detect stationary victims behind walls or rubble. The goal of this project is to develop an autonomous drone that uses infrared imaging and mmWave radar to detect human presence, navigate GPS, and provide real-time feedback to rescue teams.

Constrains

Criteria	Required	Status
Operates in Low-GPS Environments	Operate in weak or no GPS signals	YES
Balances Payload Weight and Flight Endurance	3 kg max weight, 25+ min flight	YES
Low Power Consumption for Extended Operation	Max power usage: 150W	YES

Specifications

Criteria	Required	Status
Weight	≤ 3 kg	2.5kg
Detection Range	detect within 3 meters	Yes
Heat Sensitivity	Detect Diff. ≥ 0.5°C	Yes
Localization Accuracy	±30 cm accuracy	Yes
Flight Endurance	≥ 25 minutes / flight	Yes
Data Latency	< 200 ms	Yes
Navigation Error	≤ 5% deviation	Yes
Temperature Range	-10°C to 50°C	Yes
Power Usage	Maximum ≤ 250 W	Yes

Prototype Design

Final Design Overview

AI Unit: Raspberry Pi 5 for thermal image processing and survivor detection.

Thermal Imaging Sensor: Identifies trapped victims using body heat.

mmWave Radar (LD2410): Detects motion and presence in real time.

Flight Controller: Pixhawk for autonomous flight and stability.

Power System: Li-Po 14.8V battery, 25+ min endurance.

Frame: Lightweight carbon-fiber for durability and flight efficiency.

Communication: Wi-Fi for real-time telemetry.



Figure 1: The Developed Drone

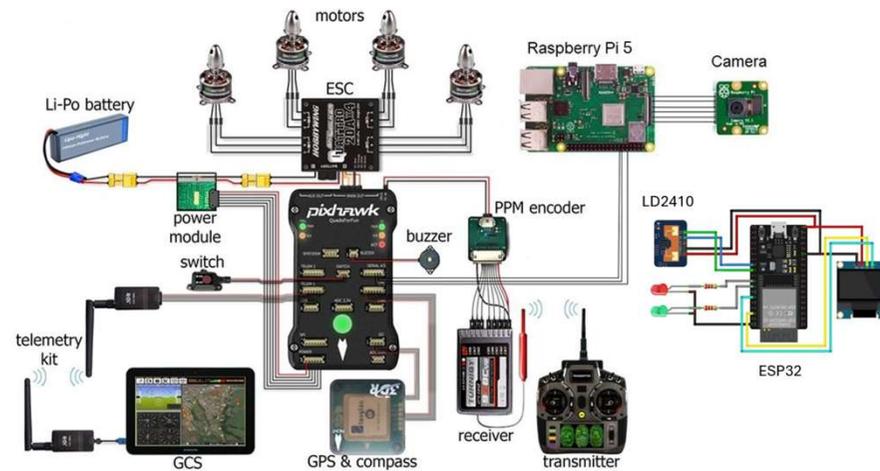


Figure 2: Overview Schematic

Testing & Validation

Verification Tests

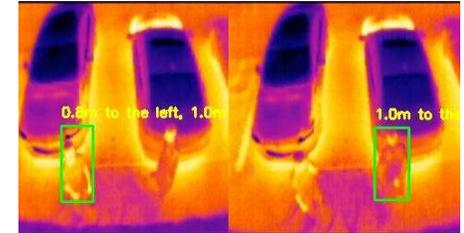


Figure 3: AI human detection in thermal images.

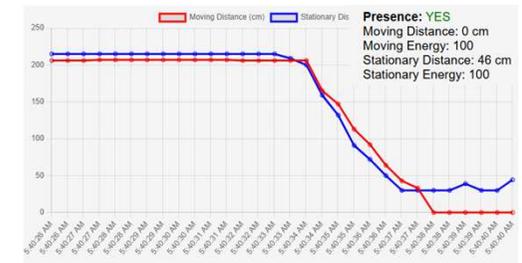


Figure 4: Detection of Radar (LD2410)

Conclusion

The project enables real-time survivor detection using AI and thermal vision, autonomous navigation in GPS-denied disaster zones, and offers a cost-effective, scalable solution with potential future upgrades like UWB and GPR.