TEAM INTRODUCTION

TechnoCognition '25

Startup, Innovation & Incubation

Title: Cost-Effective Disaster Management UAV- Autonomous Survivor Detection

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PROBLEM STATEMENT & PRACTICALITY

The Challenge:
Disaster zones (earthquakes, floods) are often inaccessible and pose high risks to human rescue teams.
Delay in locating survivors significantly reduces survival rates.

Our Solution:
A semi-autonomous UAV capable of navigating hazardous environments.
Replaces human risk with robotic efficiency.

Impact: Provides medical services and rescue teams with real-time location data of survivors without endangering personnel.

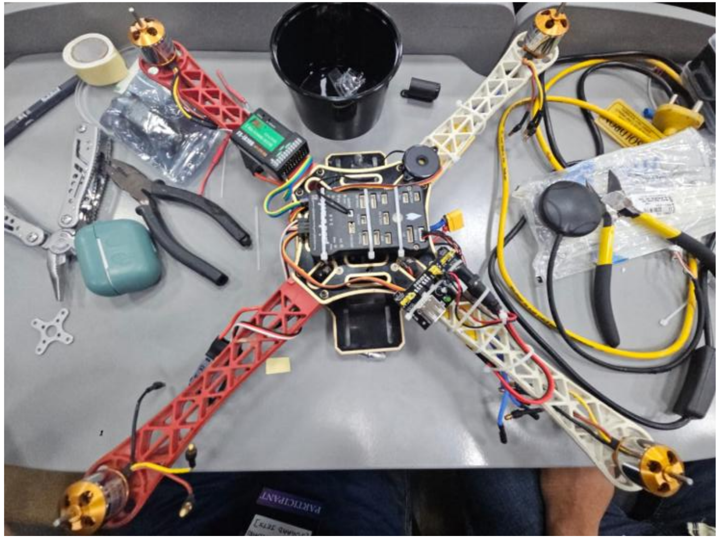
INNOVATION & CREATIVITY

Core Innovations:

1.Custom BEC (Battery Eliminator Circuit): Unlike standard drones, we engineered a specific power distribution system to handle high-load spikes.

2.Cost-Efficiency: Replaced expensive industrial sensors with the **ESP32-CAM**, utilizing smart coding to achieve high-end results.

3.Application: First-of-its-kind integration of low-cost IoT hardware for critical disaster management tasks.



HARDWARE ARCHITECTURE & ENGINEERING

Technical Specifications:

1. **Propulsion:** High-efficiency Brushless DC Motors paired with manually calibrated Electronic Speed Controllers (ESCs).

2. **Navigation:** Integrated Flight Controller with GPS module for precise positioning and stabilization.

3. **Communication:** Complex TX/RX (Transmitter/Receiver) mapping for low-latency control.

4. **Power Source:** Optimized LiPo battery configuration for extended flight time.

THE CUSTOM BEC [BATTERY ELIMINATOR CIRCUIT]

1. The Problem: Supply Chain Constraint
Context: Standard commercial BECs were unavailable during the critical build phase.
Decision: Instead of delaying, we engineered a **custom power solution** to utilize the existing **Servo Rail**.

2. The Technical Challenge
Risk: Connecting the **Pixhawk** directly to the Servo Rail is dangerous due to high-frequency motor noise and voltage spikes.

3. Integrated Custom Wiring: Designed a specific wiring harness to seamlessly integrate the filter between the Servo Rail and the **Pixhawk**, minimizing cable clutter and resistance.
Result

4. Operational Stability: Successfully powered the Pixhawk with stable voltage and **zero brownouts**, validating the custom wiring architecture.

Engineering Design & Implementation

1. **Hardware Architecture:**

2. **Propulsion System:** High-efficiency Brushless DC Motors paired with calibrated ESCs.

3. **Custom Power Architecture:**
    1. Input: High-discharge LiPo Battery.
    2. Regulation: **Custom-built BEC** ensuring stable 5V logic levels without thermal overload.

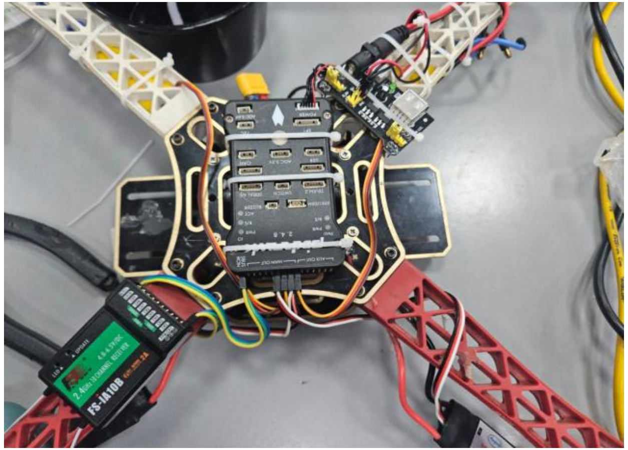
4. **Wiring & Schematics:** Complex wiring harness designed to minimize electromagnetic interference
5. Clean cable management for aerodynamics and safety.

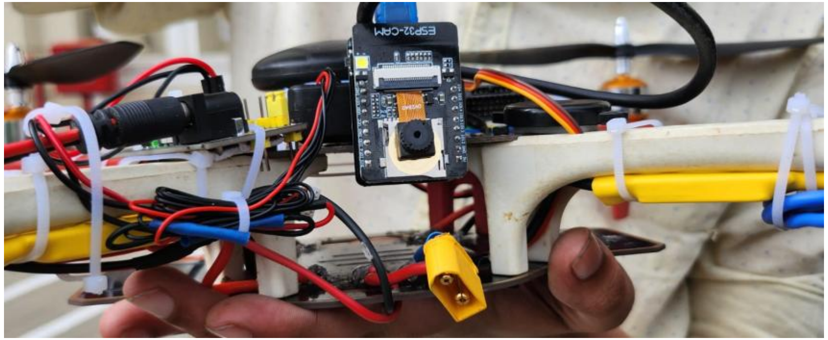
AI/ML Integration & Functionality

1. **Semi-Autonomous Operation:** The drone executes mission paths while scanning for survivors, reducing pilot workload.

2. **Edge Processing:** Image recognition happens on-board, reducing latency and bandwidth requirements compared to cloud-only processing.

Drone Images





POV from UAV

GPS Co-Ordinates

Practicality & Real-World Impact

Disaster Management Application:

1. **Mission Profile:** Identifying survivors in earthquake or flood zones where terrain is unstable.

2. **Risk Reduction:** Allows medical services to assess survivor condition and location *before* deploying human rescuers, significantly reducing risk to personnel.

3. **Rapid Deployment:** Lightweight design allows for immediate launch in critical "golden hour" rescue windows.

Design, Architecture & Build Quality

System Robustness:

1. **Software Architecture:** Modular code structure allowing for easy updates to the flight control or image processing logic.

2. **Physical Build:** Rugged frame assembly designed to withstand field vibrations.

3. **Professional Execution:** High-quality soldering on the custom BEC and rigorous stress-testing of the frame and motor mounts.

Objective to Product (Commercial Viability)

Market Potential:

1. **Startup Ready:** A functional, low-cost prototype with a clear value proposition for the Humanitarian Tech industry.

2. **Scalability:** The use of readily available components (ESP32, Brushless motors) ensures the supply chain is scalable.

3. **Competitive Advantage:** Significantly lower price point than military-grade thermal drones, filling a gap for local fire and rescue departments.

Conclusion & Future Scope

1. **Summary:**
   Successfully demonstrated a functional, custom-engineered UAV for life-saving applications.
   Proven integration of complex electronics (Custom BEC) and AI (ESP32 Vision).

2. **Future Scope:**
   Integration of thermal imaging.
   Swarm technology for covering larger areas.
   IoT Dashboard for real-time video streaming to command centers.

Thank You

“Drones that save lives.”