

FlareBot: Unmanned Firefighting Reconnaissance Robot



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Introduction

Project Goal

FlareBot is designed to work in parallel with firefighters to improve safety.

Objectives

1. Operate in class I, II, and III fires and survive short exposures in class IV fires
2. Reduce search times in structure fires
3. Report information about the environment
4. Traverse terrain and descend stairs

Literature Review

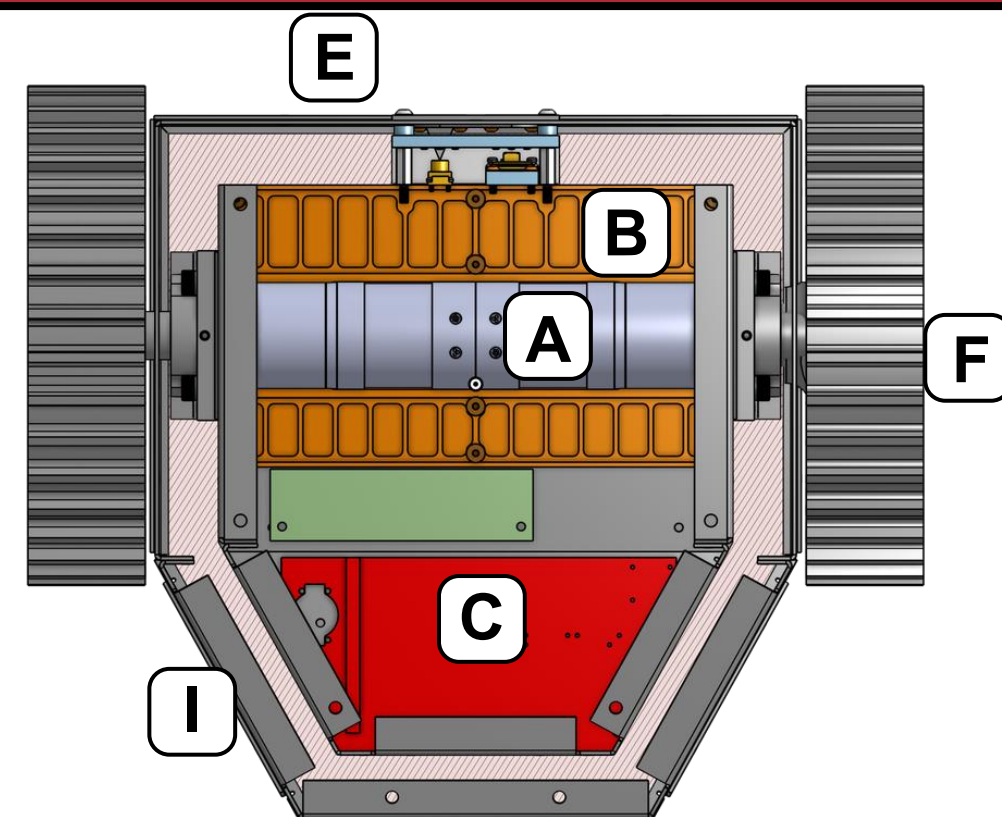
Classes of Structure Fires

	Class I	Class II	Class III	Class IV
Gas Layer Temp (°C)	100-150	150-300	300-600	600+
Corresponding Exposure in Heat Flux (kW/m ²)	2-5	5-10	10-20	20+



Colossus: Existing Firefighting Robot

FlareBot Design



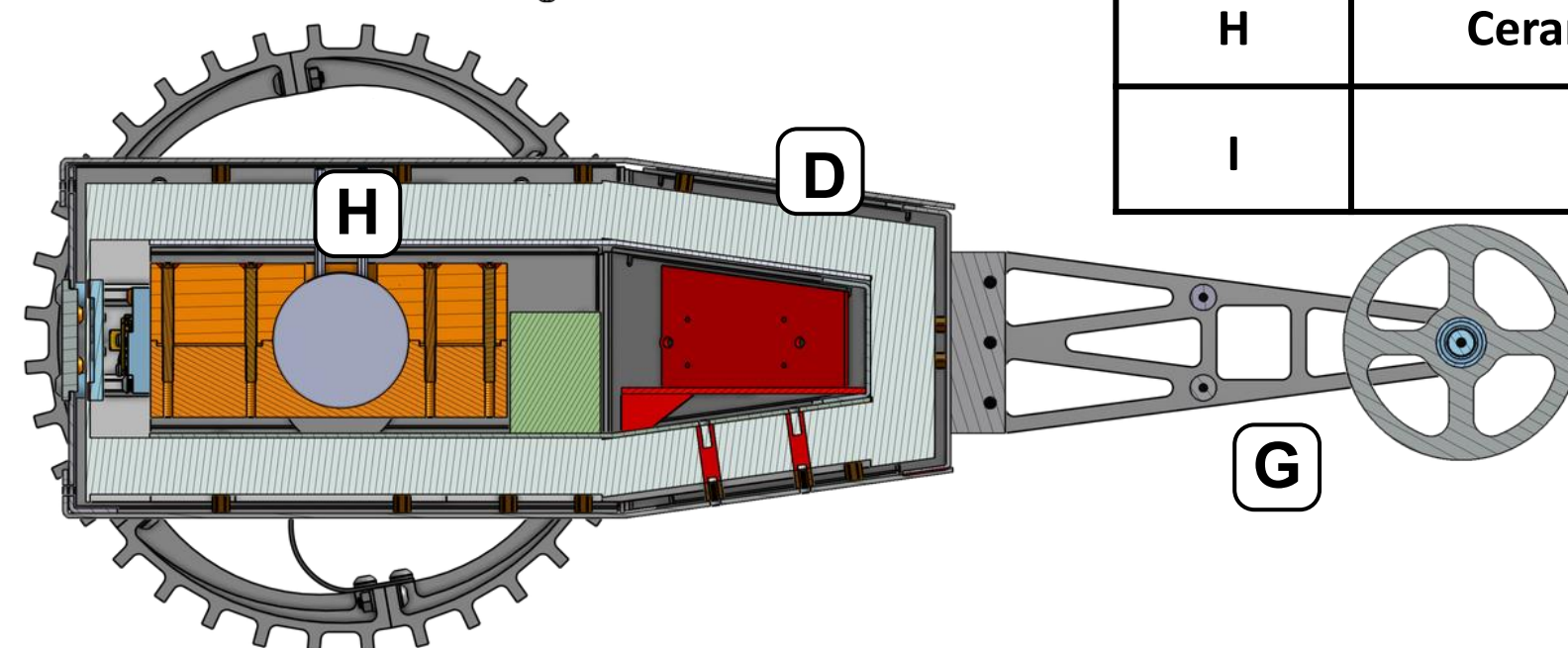
Location	Component
A	Motors
B	Phase Change Material Heatsink
C	Electronics Bay • Jetson Orin Nano • Battery • Sensors
D	Sheet Metal Chassis
E	Optical and Thermal Cameras
F	Drive Wheel
G	Tail Assembly
H	Ceramic Fiber Insulation
I	Antennas

Torque

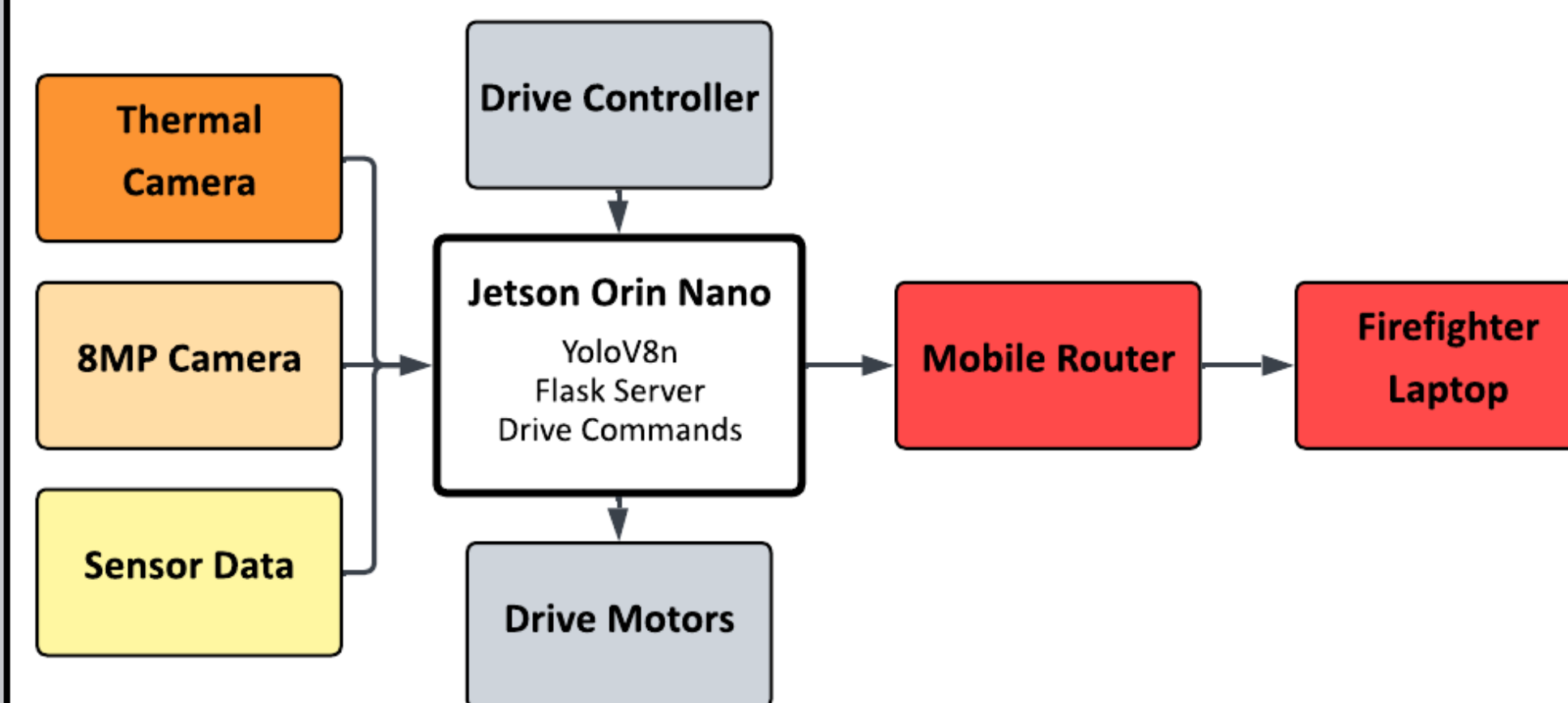
Motors produce 20 N-m of torque

Insulation

25.4 mm of ceramic wool and 6 mm of air



System and Controls

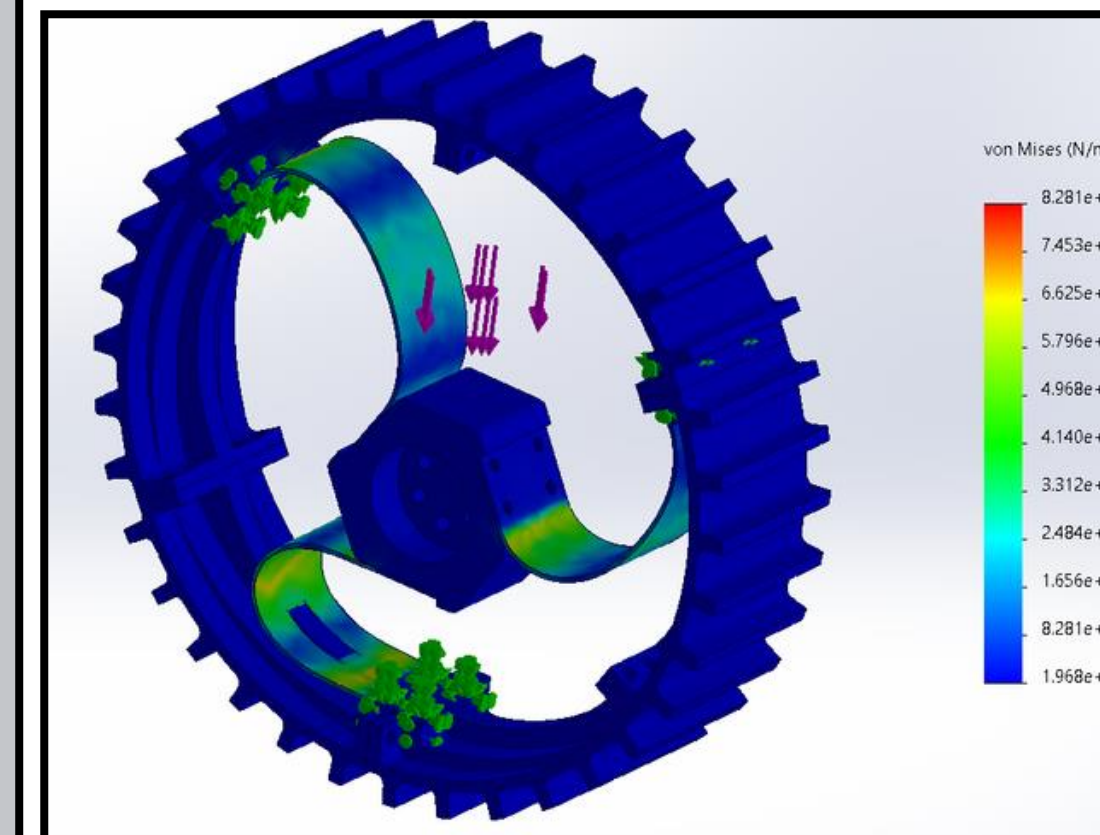


Sensor inputs and controller commands feed into the Jetson Orin Nano which controls movement and transmits data to a remote user device

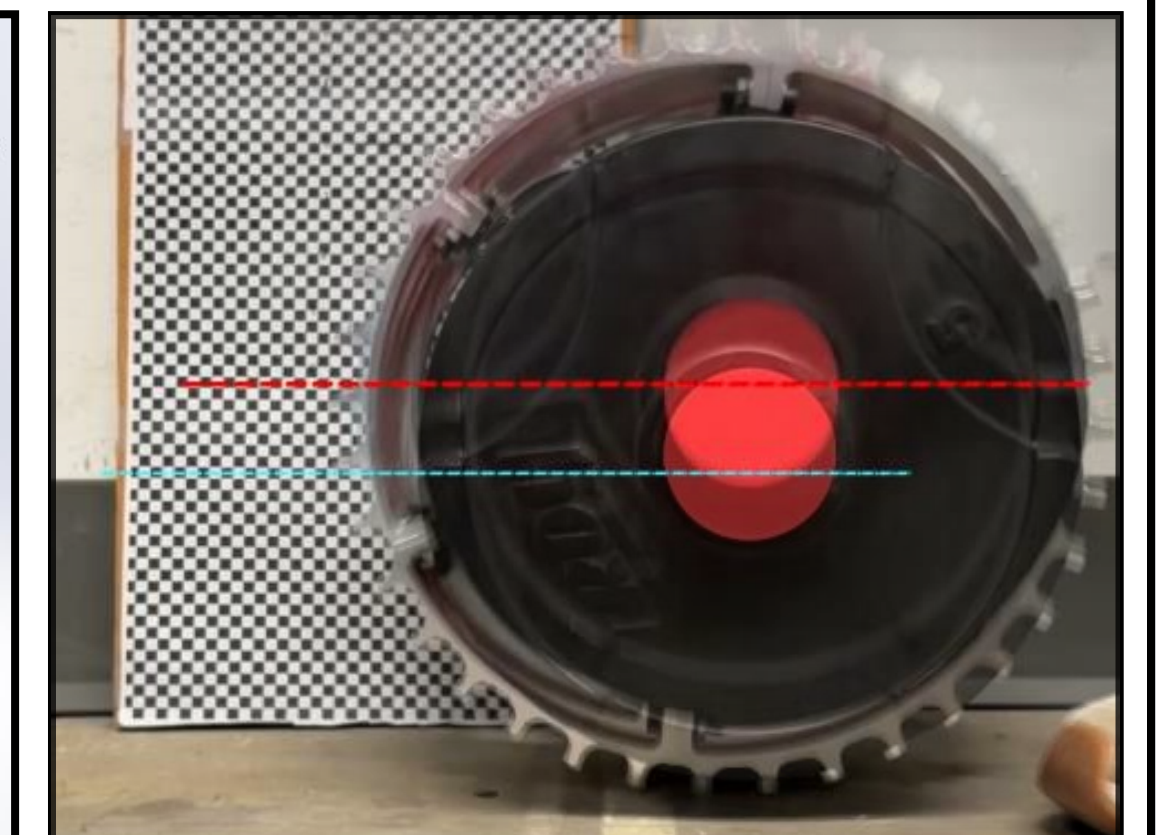
Future Work

- Thermally resistant communication antennas
- Enhanced autonomous driving
- Material enhancement
- Onboard light source

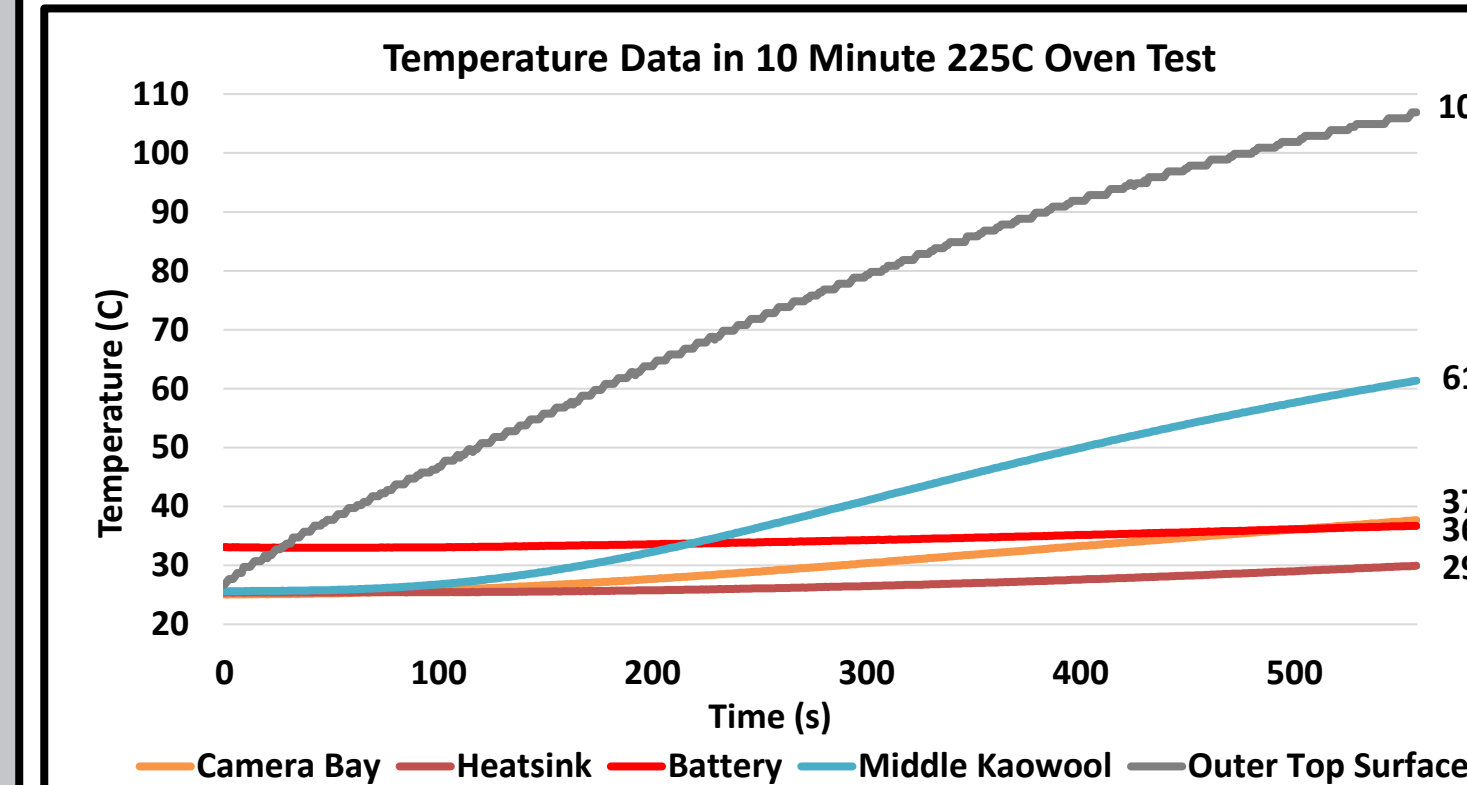
Results



Spoke stress concentration simulated with Solidworks' Finite Element Analysis

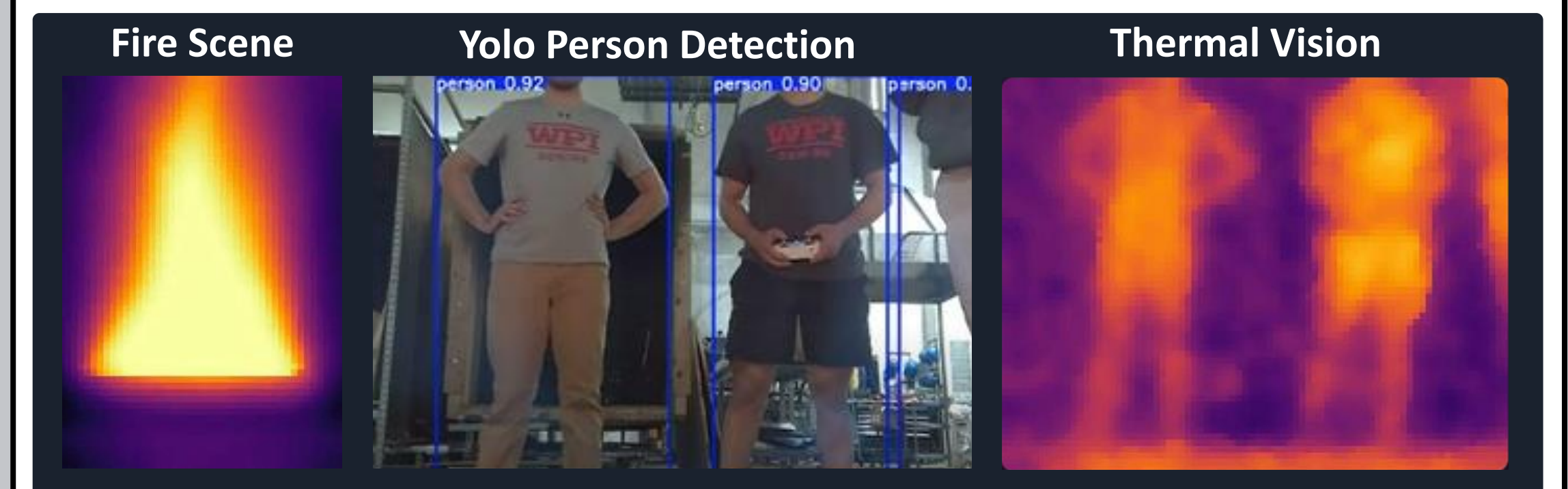


Dynamic drop testing for verifying performance and spring calculations



Thermocouple readings from various locations during oven test

Survives in class II fire environment (225°C) for over ten minutes



YOLOv8n model trained on smoky conditions to detect people with high confidence, enhanced by thermal imaging

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