

Modular CubeSat for Autonomous Power Line Monitoring and Infrastructure Data Acquisition

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Multidisciplinary
Strength

AE · ISE · ICS

INTRODUCTION

Smart and modular CubeSat designed to autonomously monitor power lines and detect faults in real time. The system combines RGB + Thermal imaging, AI-based detection, GPS geotagging, and 4G LTE communication to provide safer, faster, and lower-cost inspection compared to helicopters and manual patrols.

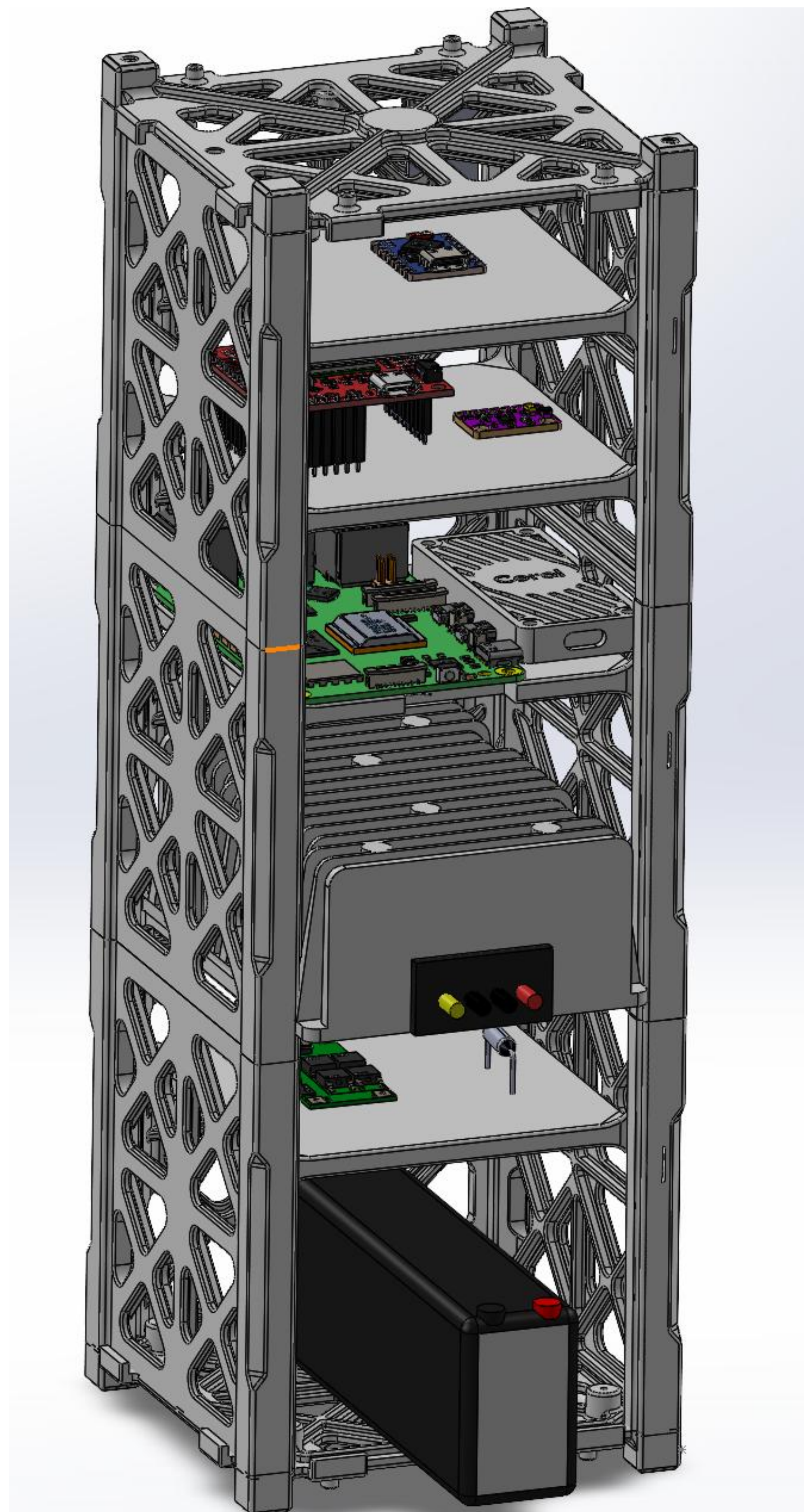
OBJECTIVES

- Build a functioning 3U CubeSat ground prototype.
- Detect power line anomalies with $\geq 75\%$ AI accuracy.
- Achieve real-time alerts (≤ 3 seconds).
- Demonstrate stable ADCS pointing ($\leq 5^\circ$ error) using IMU + pan-tilt.
- Ensure 1–3 hours operation within 10 W power budget.

MISSION STATEMENT

To develop a modular, upgradeable CubeSat platform capable of safe, autonomous, and efficient monitoring of critical electrical infrastructure using integrated AI, multi-sensor payloads, and reliable communication.

PROTOTYPE



CONSTRAINTS

- Weight: ≤ 7 kg.
- Form factor: 3U (10×10×34 cm).
- Budget 7200 SAR.
- 45–60 min operation limit.
- Works between 20–40°C.
- Uses Wi-Fi or 4G LTE.
- Minimal operating cost.

SPECIFICATIONS

- 5–10 W solar input.
- ≥ 1 hour battery runtime.
- ADCS accuracy $\leq 5^\circ$.
- Camera $\geq 720p$, ≥ 8 MP.
- AI accuracy 70–80%.
- ≥ 4 GB storage.
- Reliable video/alerts at 10 m.

HOUSE OF QUALITY

What	Who	How											Now				
		AI fault detection accuracy	Camera resolution	Video latency	Alert generation time	Operational endurance	Battery capacity	Solar input power	ADCS pointing accuracy	System mass	Data compatibility	3U form factor compliance	1	2	3	4	5
Functionality	Saudi Electricity Company Electricity Regulatory Authority Research Centers & Universities	9	9	1	1					3	1						
Operations		1	1	1	1	3	3	1	9	3	1	3					
Performance						9	9	9									
Scalability																	
	Saudi Electricity Company	24%	26%	23%	23%	34%	24%	18%	24%	5%	24%	8%					
	Electricity Regulatory Authority	23%	26%	24%	24%	30%	22%	16%	28%	6%	25%	9%					
	Research Centers & Universities	16%	20%	17%	17%	29%	23%	20%	19%	3%	31%	13%					