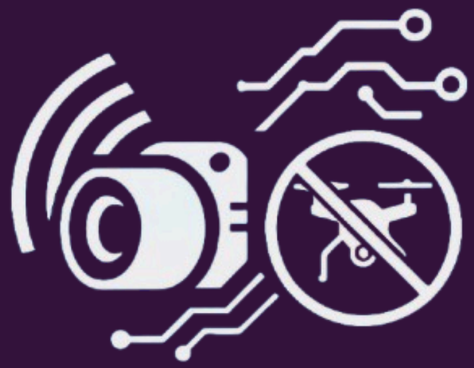
TÉCNICO LISBOA



SENTINEL

Anti-Drone Detection for Communication Jamming System for Security Forces

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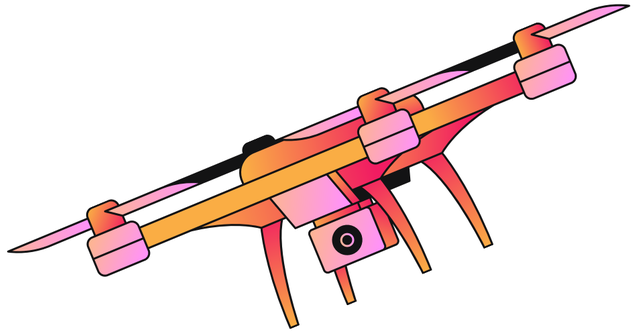
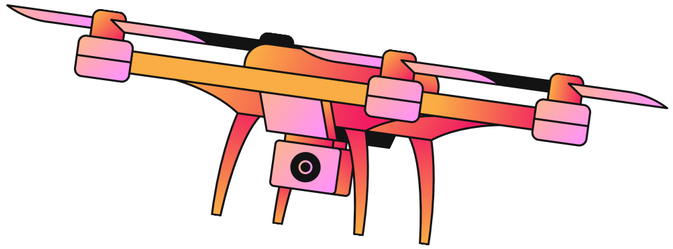
Francisco Rodrigues 106695; João Firmino 107485; Rodrigo Sanguino 84342

Team 25

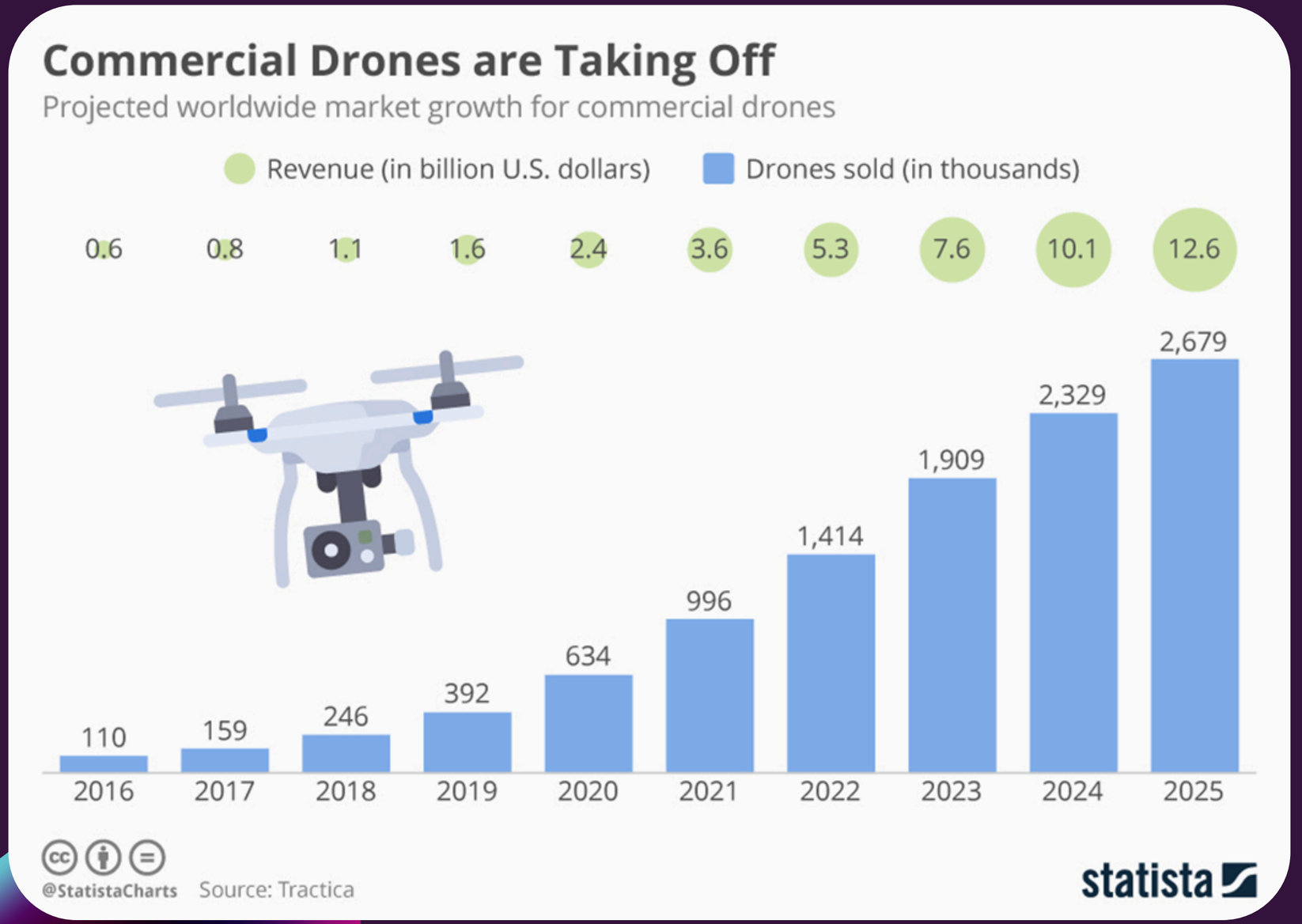


Problem Definition



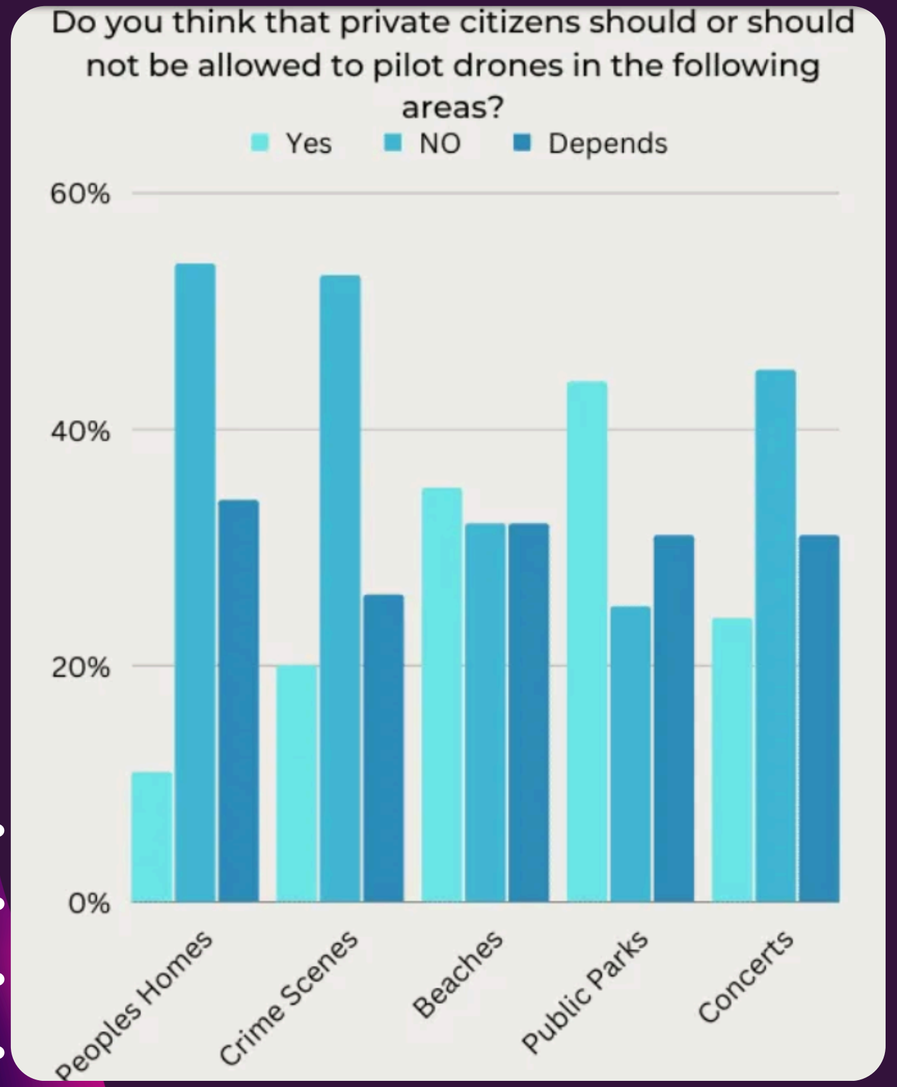
Growth of drone usage

Drones have gained widespread use for a variety of applications, from recreational flying to industrial uses like surveillance, monitoring, and package delivery.



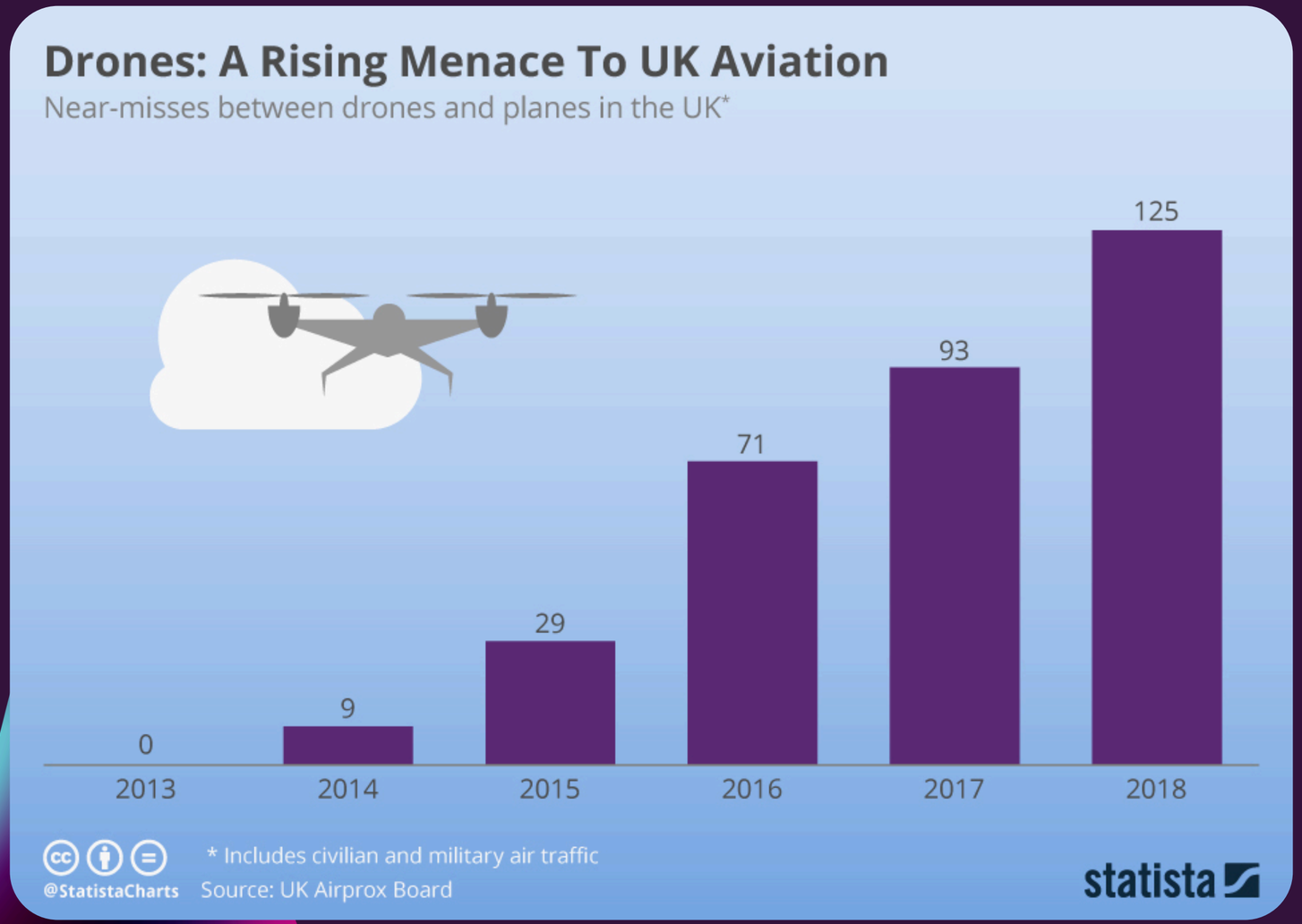
Unauthorized surveillance of private areas

Drones increasing use has also led to significant security concerns. Unauthorized drones, especially those used for illegal surveillance or nefarious purposes, pose a threat to privacy, security, and public safety.

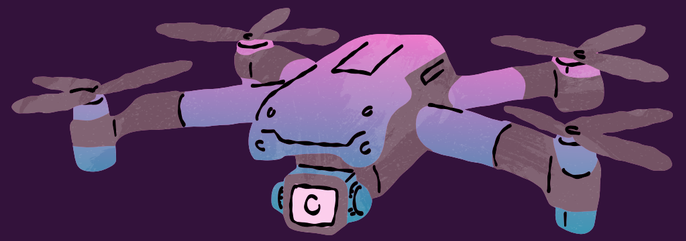


Drone Intrusions and Security Threats

Security forces often struggle to detect and stop UAVs due to their small size, mobility, and secure communications, making threats like espionage or attacks harder to prevent.



Project Objectives



Detection

Detect unauthorized drones using radars, computer vision and machine learning

Jamming

Develop and test jamming techniques for drone neutralization

Real-Time Alert

Implement a real-time monitoring and alert platform

Adaptability

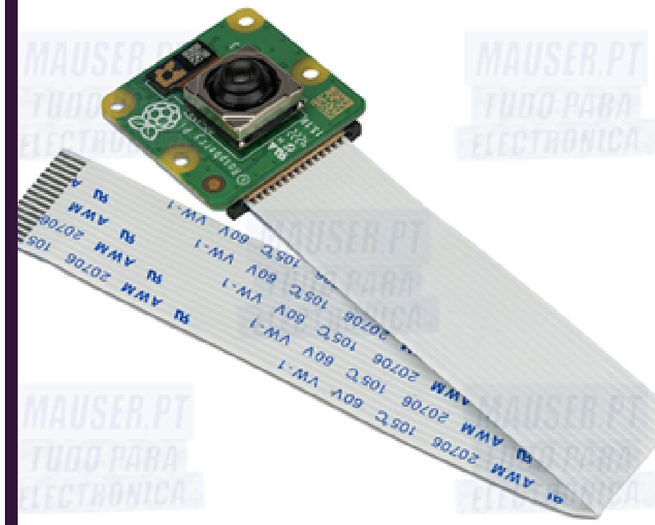
Ensure system adaptability for various security scenarios

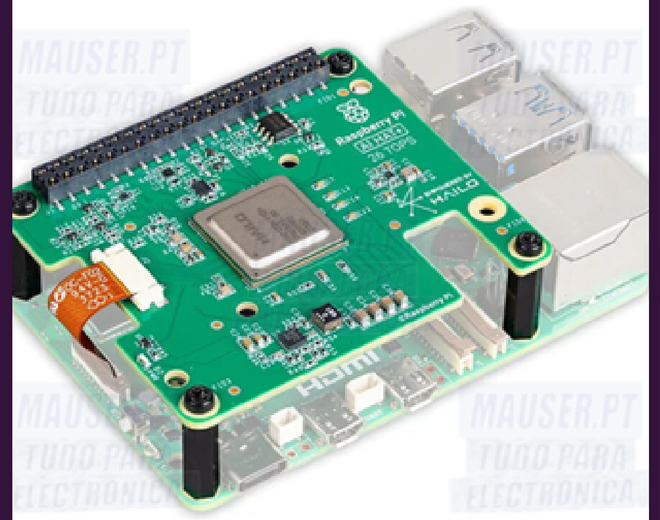
Our Solution

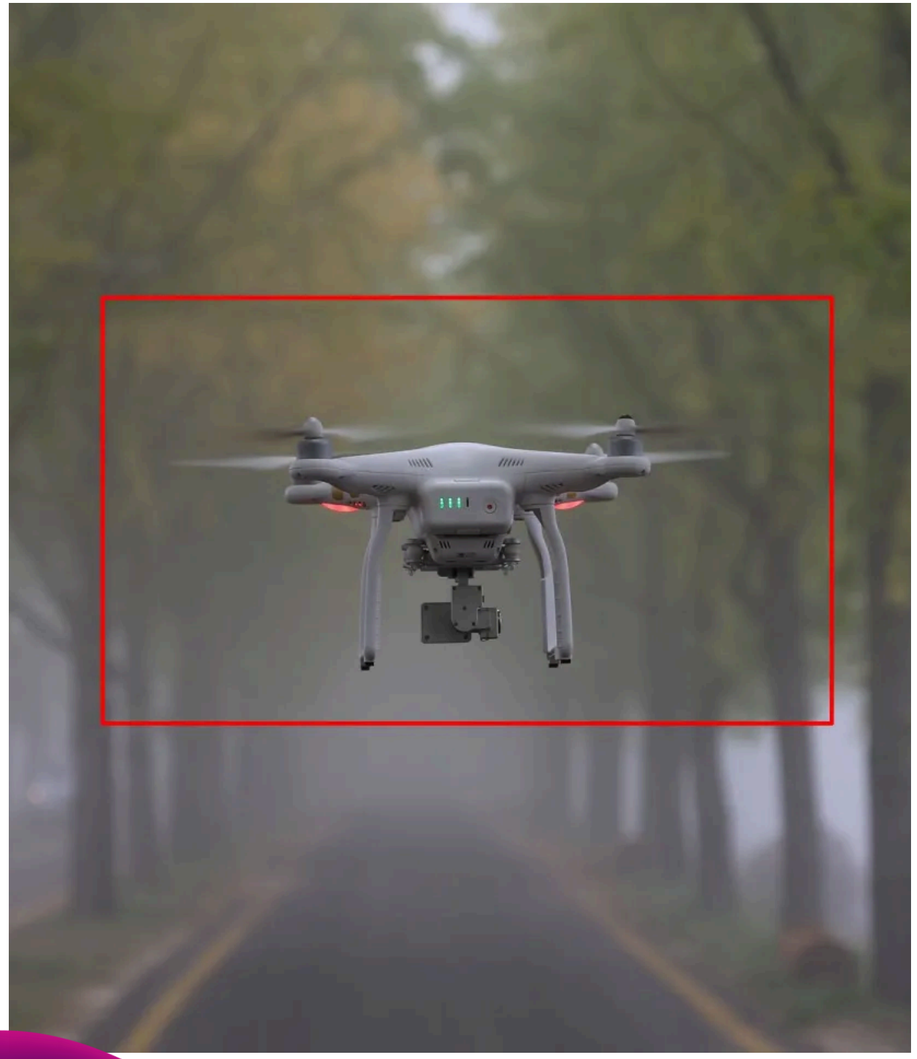
We developed a computer vision–based drone detection system featuring a rotating camera that tracks drones in real time, using machine learning to distinguish them from other airborne objects, complemented by a web app for live monitoring

Componenents

- Raspberry Pi 5 8GB
- Raspberry Pi - 12MP 76°
- Placa HAT+ with AI Hailo acellarator
- Micro servo rotors







Technological solution

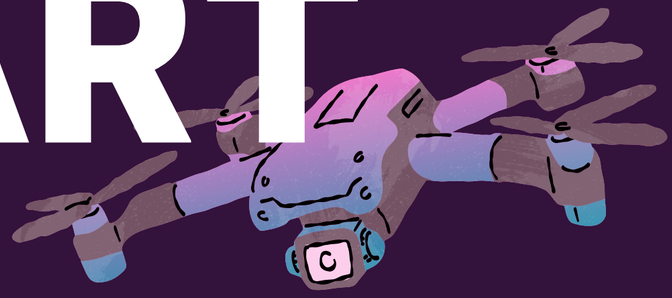
Drone Detection Systems

Optical sensors (such as cameras and infrared systems), radar, acoustic sensors and Rf Receivers to visually detect and track drones

Machine Learning Algorithms

To distinguish drones from other flying objects, such as birds, based on detected video

FLOWCHART



Technological solution flowchart

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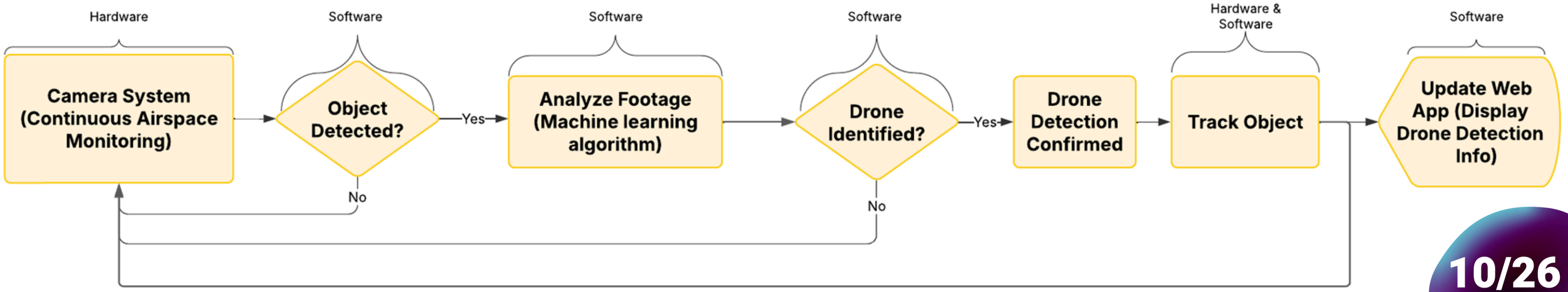
Anti-Drone System



3-Mode Solution

Sweeping

The camera continuously pans (“sweeps”) the sky in defined increments (0°-180° H / 0°-90° V)

Detection

Detects drones via our real-time image-detection neural network

Tracking

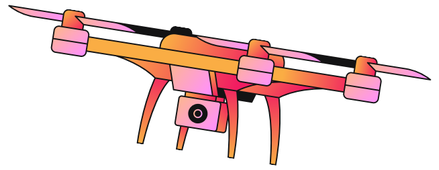
The dual-rotor mount follows the drone’s movements to keep it centered

Sweeping Mode

Proactively searches for any UAV intrusions across the entire field of view

Detection Mode

The camera instantly locks onto the target. A snapshot and timestamp are sent to the web application.



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Home About Our Team Our Project Our Schedule Blog Contacts Live Data

US EN

Web-App:

Live Detection Data

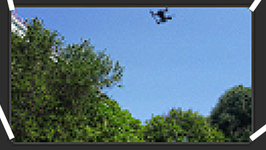
Detection events from our anti-drone system

System Online

Refresh Data

Pause Auto-Update

Event: drone_detected
ID: -OSKNKL8G3Hk9fiQ1Rbd
6/9/2025 4:48:51 PM



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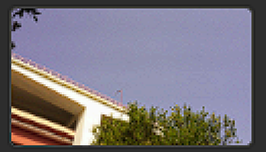

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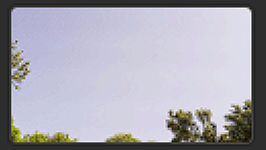
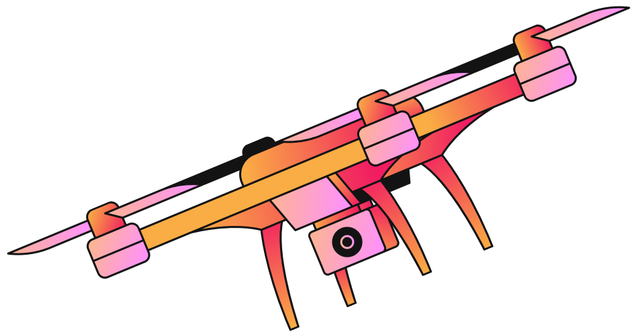
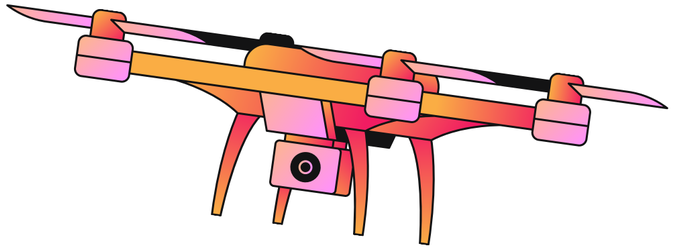


Tracking Mode

After detection, the system tracks the drone down. Demonstrating how an attached directional jammer or antenna could remain pointed at the drone for neutralization.



Solution Beneficiaries



Target customers

01

Security Agencies

Security forces, military personnel, and border control entities that need to protect restricted or high-risk areas against drone incursions

02

Governmental institutions

Authorities responsible for overseeing national security, airports, government buildings, and sensitive locations

03

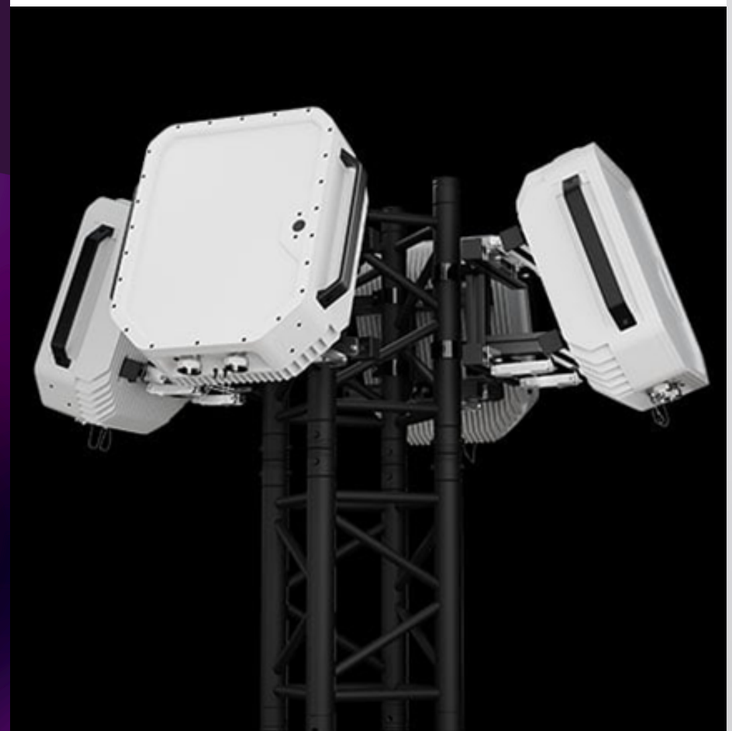
Private Sector

Organizations and industries concerned with protecting infrastructure, assets, and sensitive data from unauthorized aerial surveillance

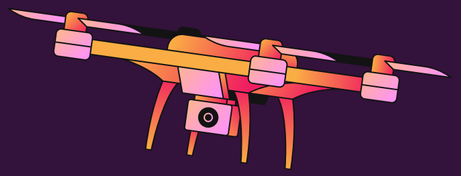
Competitors

Current counter-drone solutions like radar, acoustic sensors, and RF jammers work in some cases but often face key issues:

- Bulky and Expensive
- Lack of Autonomy
- Limited Adaptability
- Poor Discrimination
- Low Scalability



Us vs Them



Our system is:

Autonomous

Our system operates independently by detecting, identifying, and tracking drones in real time without the need for constant human intervention.

Easy to adapt

The modular design and flexible software make it simple to adjust the system for different environments and security needs.

Highly scalable

The solution can be easily expanded to cover larger areas or integrated into existing security infrastructures.

Costs & Benefits

Low Cost Implementation

Can be deployed using existing surveillance cameras in critical infrastructures

Automated Alert Platform

Fully autonomous system requiring no human intervention for detection or tracking

Scalability & Future Integration

System architecture allows integration of jamming modules in the future. Camera tracking mechanism enables precise targeting of drones with potential RF neutralization systems.

The Team

Guilherme Martins

Project Manager

João Firmino

MLA Specialist
& Website developer

Afonso de Mello

Backend developer

Guilherme Luis

Poster Maker

Francisco Rodrigues

Prototype designer

Rodrigo Sanguino

Video Maker

Advisors and Mentors

Tenente Coronel João Boita

Scientific Advisor - Air Force

Major Francisco Machado

Scientific Advisor - Air Force

Prof. Emmanuel Cruzeiro

Co-coordinator

Prof. João Felício

Coordinator

Prof. João Gonçalves

Mentor

Team members' contributions

Guilherme Martins	Management and coordination	Engagement with Partners & interviews	Blog Update	PowerPoint Maker	Rotor Code development	Video maker
João Firmino	MLA Training and validation	Website Development	Blog Development	Rotor Code development	Video maker	
Afonso de Mello	Engagement with Partners	Web-App Development	Backend Development	Blog Update		

Team members' contributions

Francisco Rodrigues	**Prototype assembly**	**Interviews**	**Metalworker**	**Poster Maker**
Guilherme Luís	**Rotor Code tweaking**	**Poster Maker**	**Video Maker**	
Rodrigo Sanguino	**Rotor Code tweaking**	**Video Maker**	**Poster Maker**	

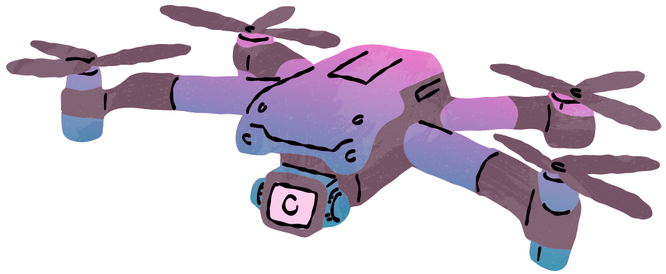
Partners

Portuguese Air Force

Expertize

Thales

Know-How



Mauser

Components

THANK YOU

Website

Video