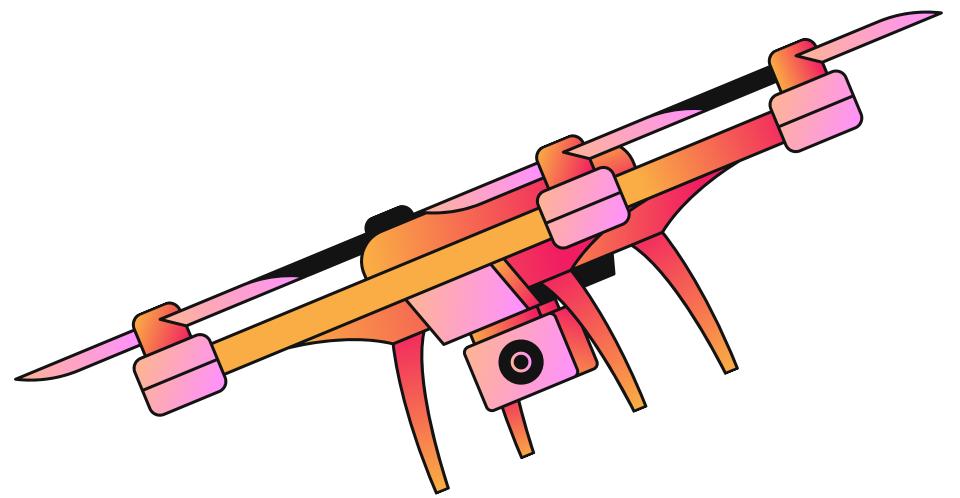
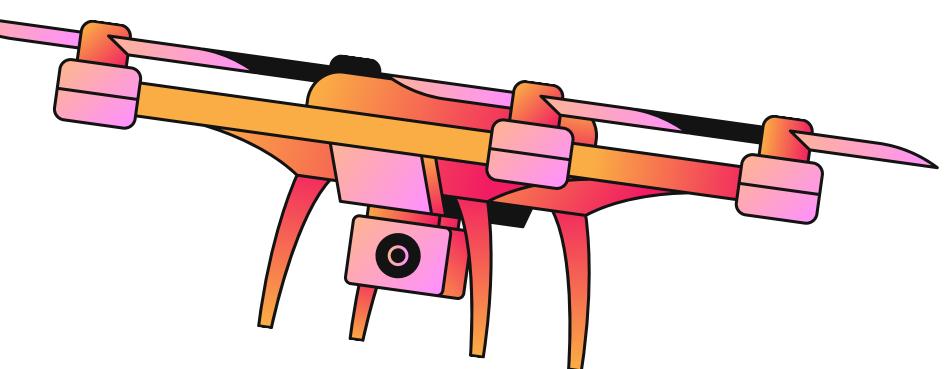


SENTINEL

Anti-Drone Detection for Communication Jamming System for
Security Forces

Problem Definition

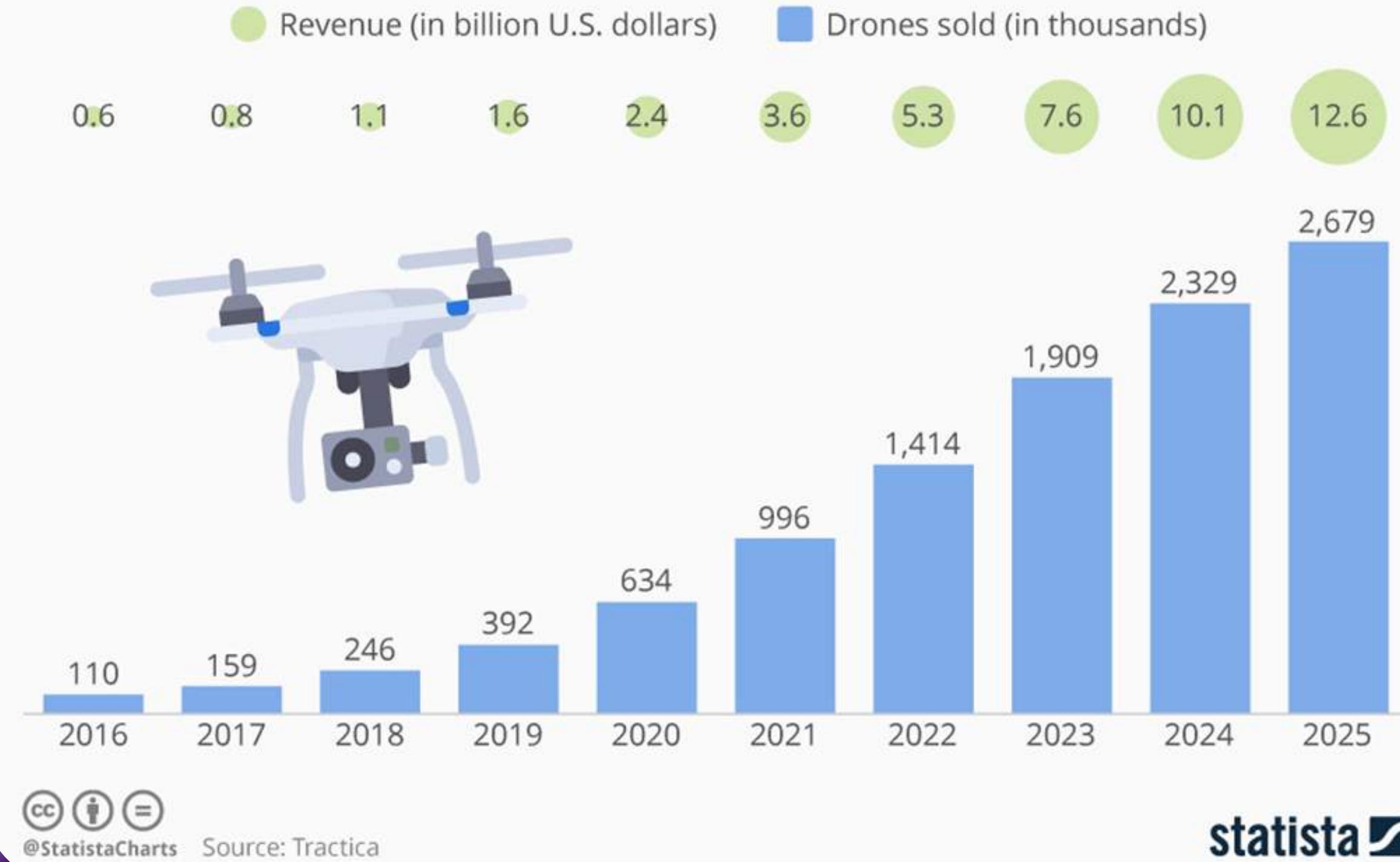


Growth of drone usage

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

Commercial Drones are Taking Off

Projected worldwide market growth for commercial drones



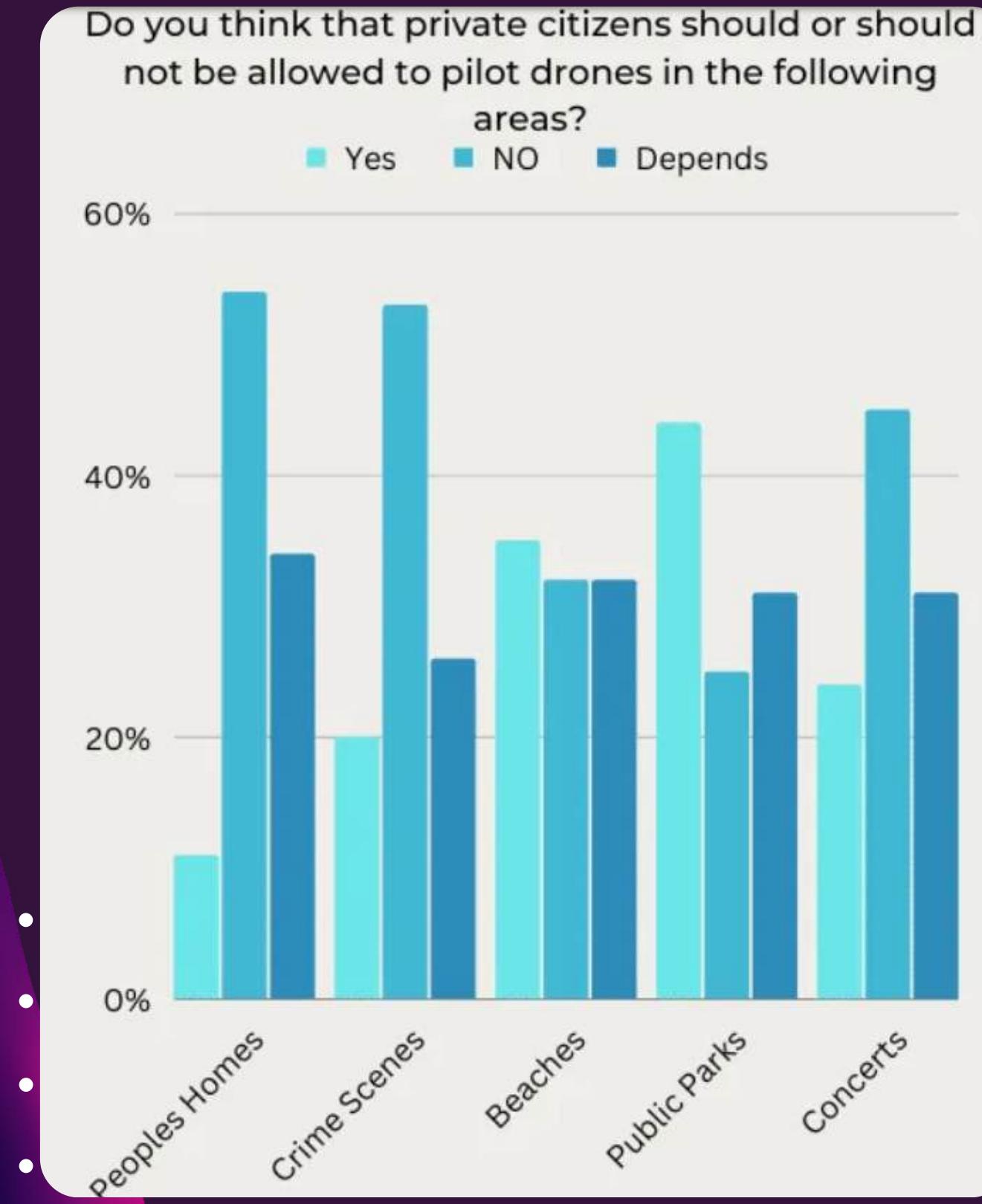
@StatistaCharts

Source: Tractica

statista

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.

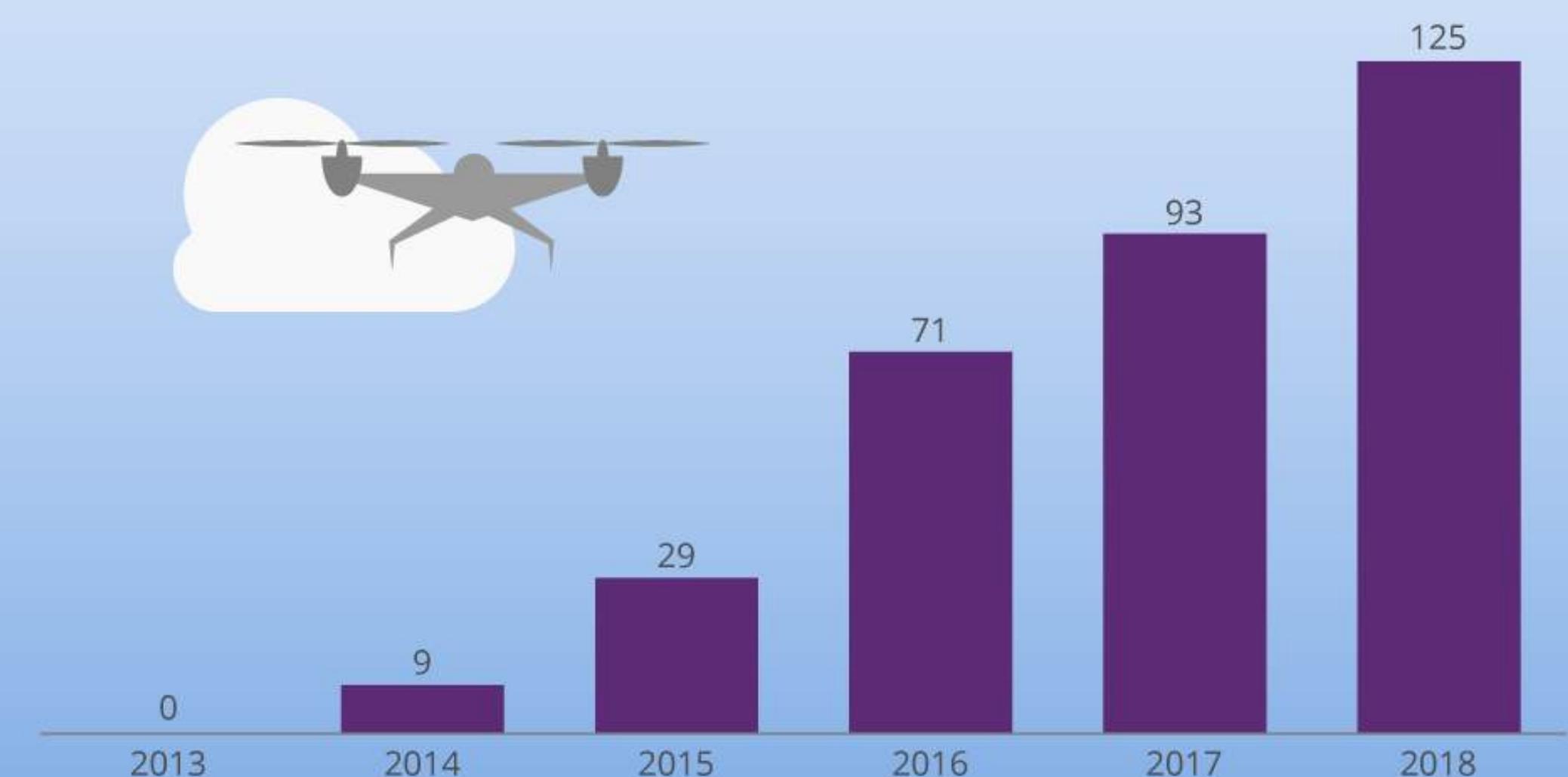
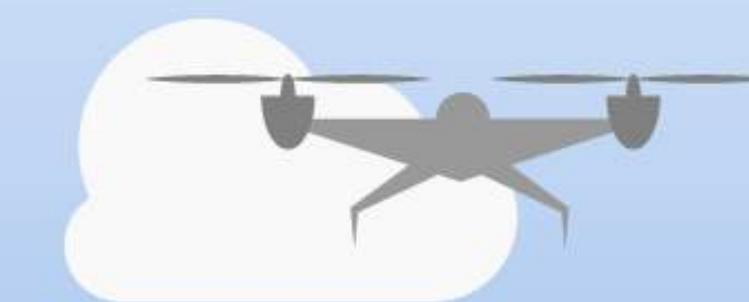


• Drone Intrusions and Security Threats

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.

Drones: A Rising Menace To UK Aviation

Near-misses between drones and planes in the UK*



@StatistaCharts

* Includes civilian and military air traffic
Source: UK Airprox Board

statista

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

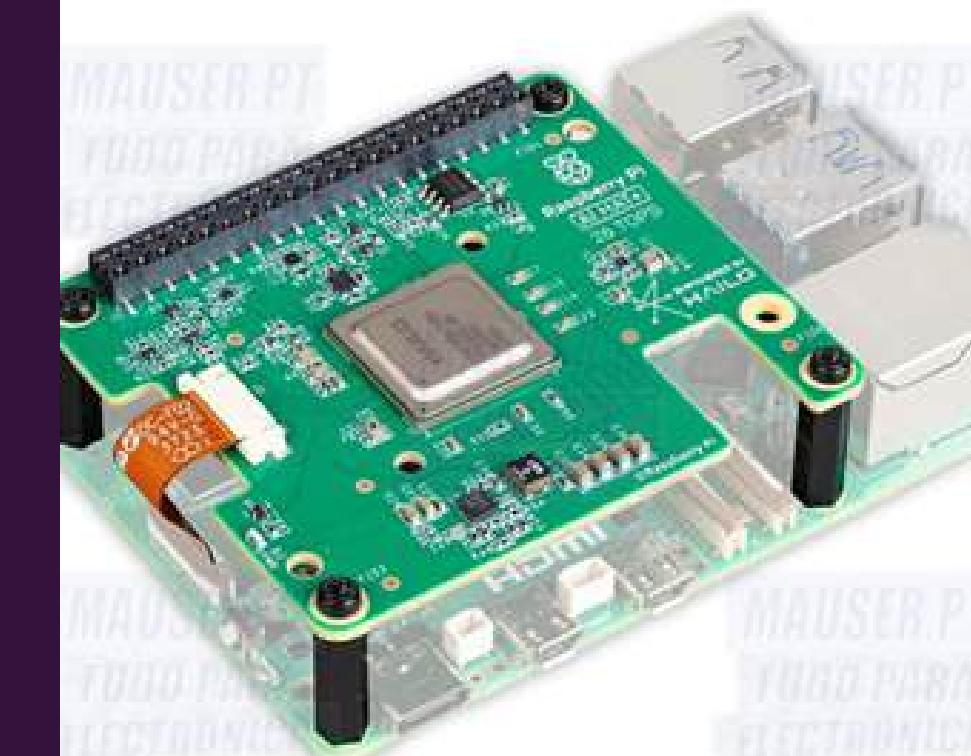


Components

Raspberry Pi 5 8GB

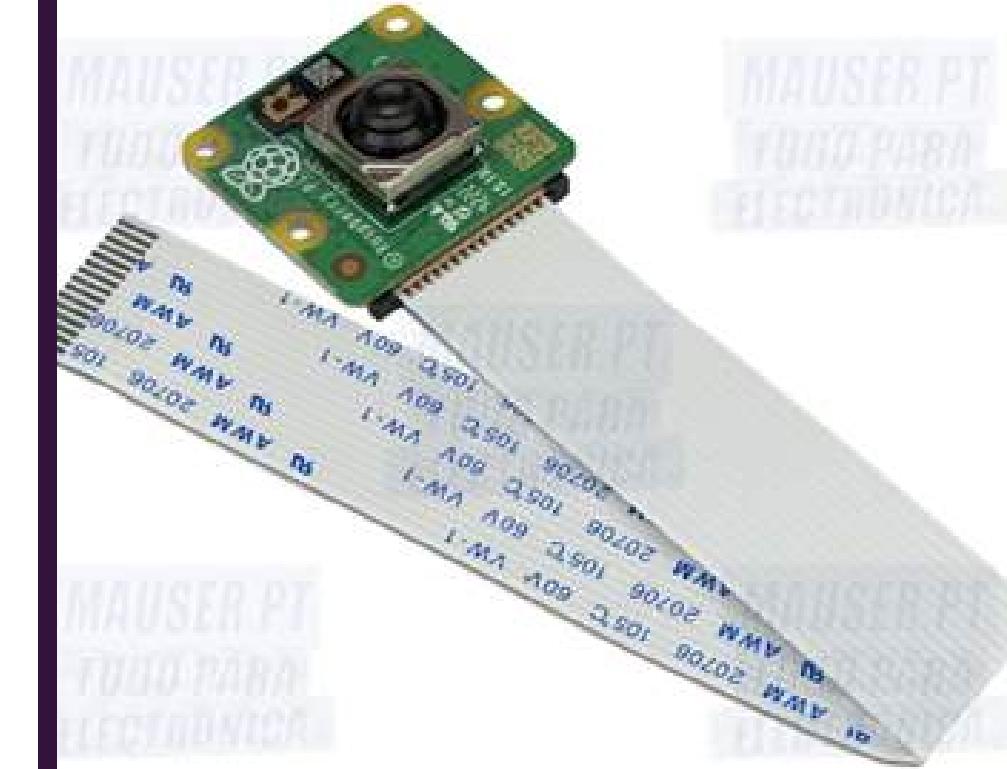


Raspberry Pi - 12MP 76°

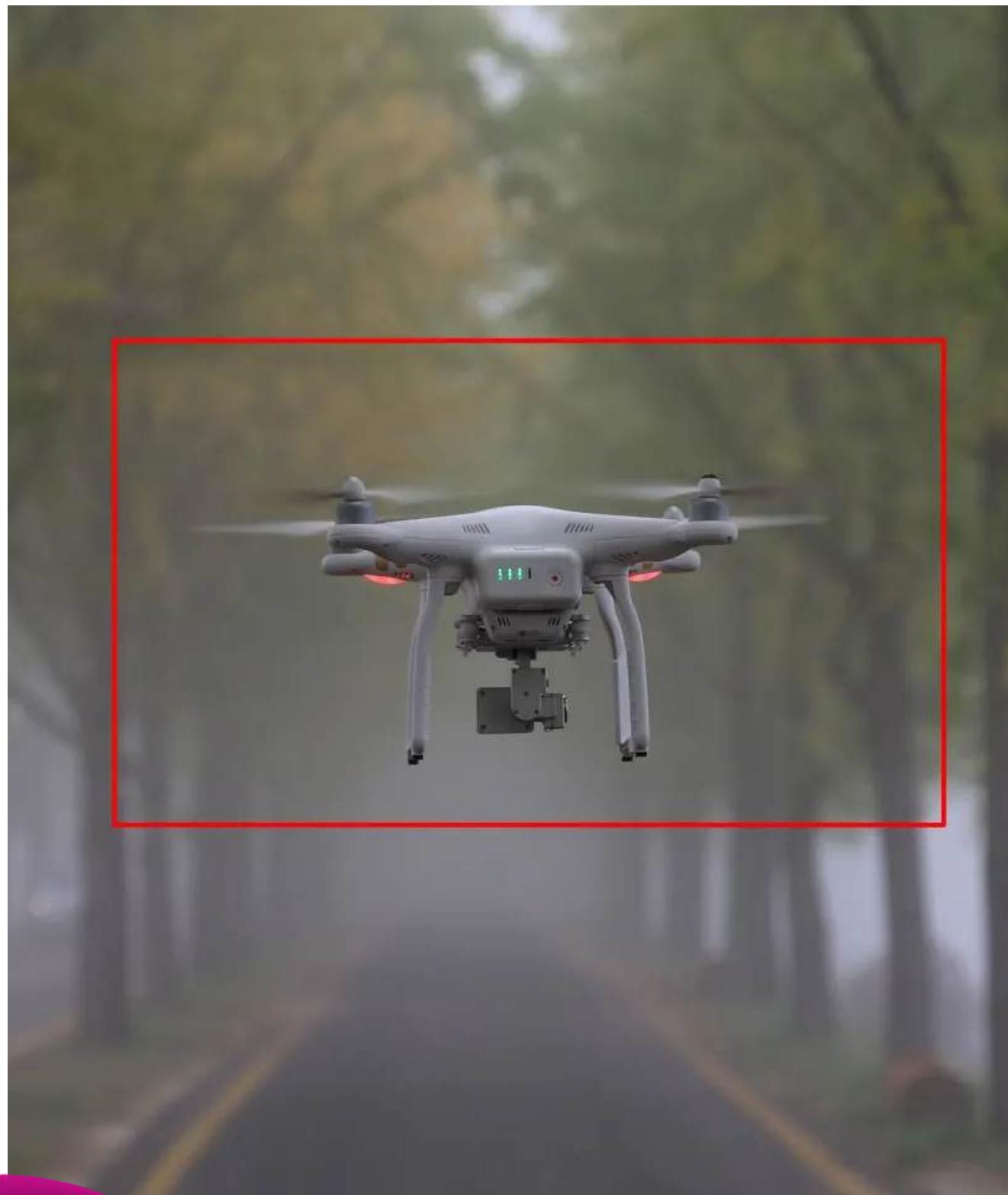


Placa HAT+ with AI Hailo accelerator

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

- • • •
- • • •
- • • •
- • • •
- • • •

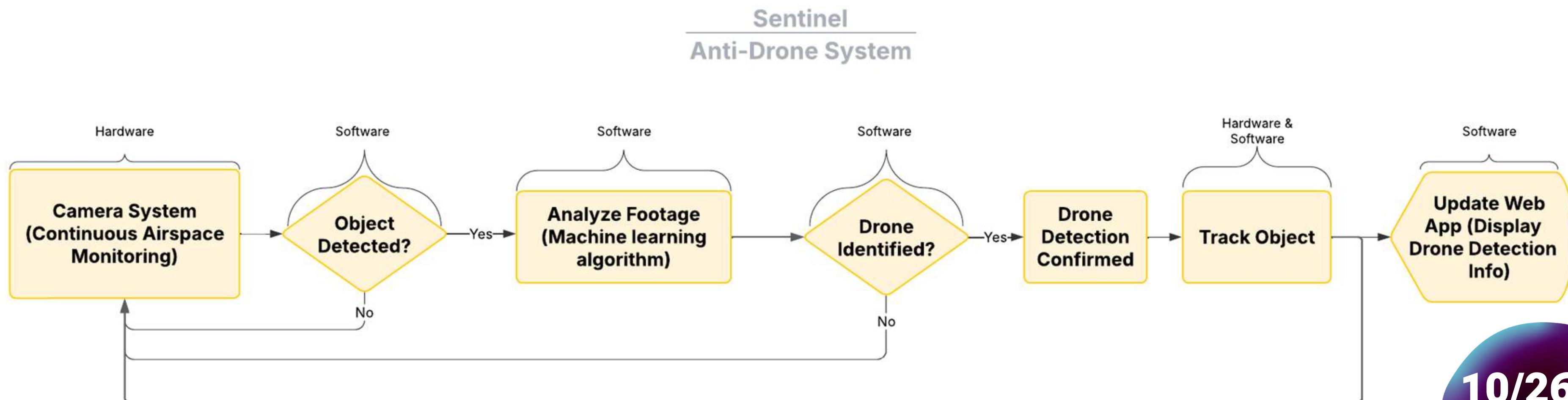
Machine Learning Algorithms

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

FLOWCHART



Technological solution flowchart



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



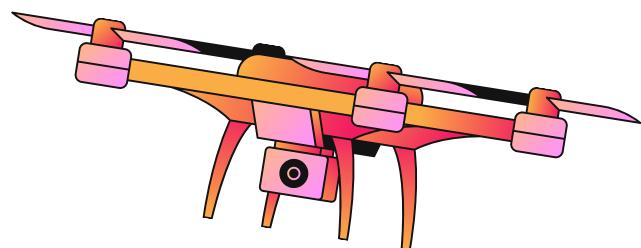
**Proactively
searches for any
UAV intrusions
across the entire
field of view**



Detection Mode



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



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

Event: drone_detected
ID: -OSKNEJFqDvJBuYIVmDZ
6/9/2025 4:48:27 PM

Event: drone_detected
ID: -OSKN8aROWtTINIHYIYr
6/9/2025 4:48:03 PM



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



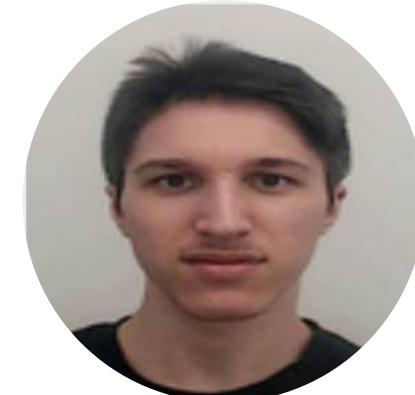
João Firmino

MLA Specialist
& Website developer



Afonso de Mello

Backend developer



Guilherme Luis

Poster Maker



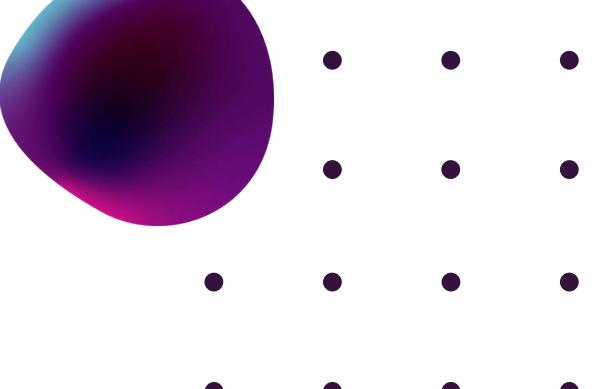
Francisco Rodrigues

Prototype designer



Rodrigo Sanguino

Video Maker





Tenente Coronel João Boita

Scientific Advisor - Air Force



Major Francisco Machado

Scientific Advisor - Air Force



Prof. João Felício

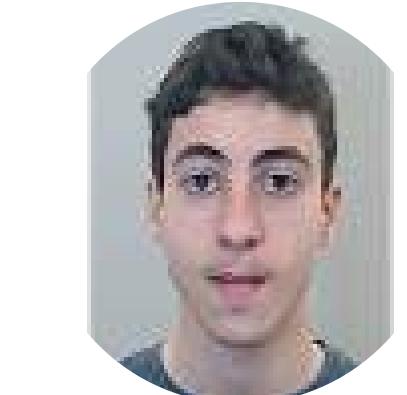
Coordinator

Advisors and Mentors



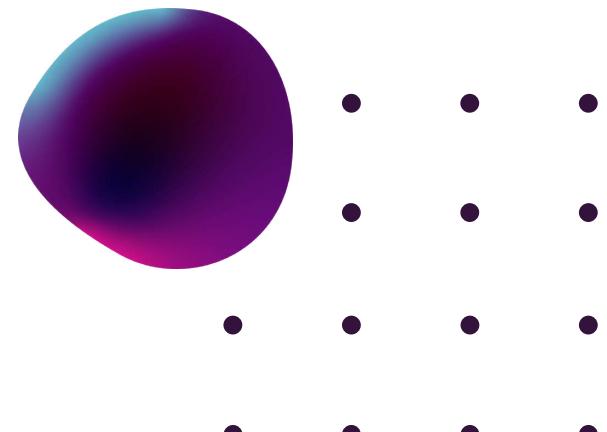
Prof. Emmanuel Cruzeiro

Co-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 | |



Portuguese Air Force

Expertize

THALES

Thales

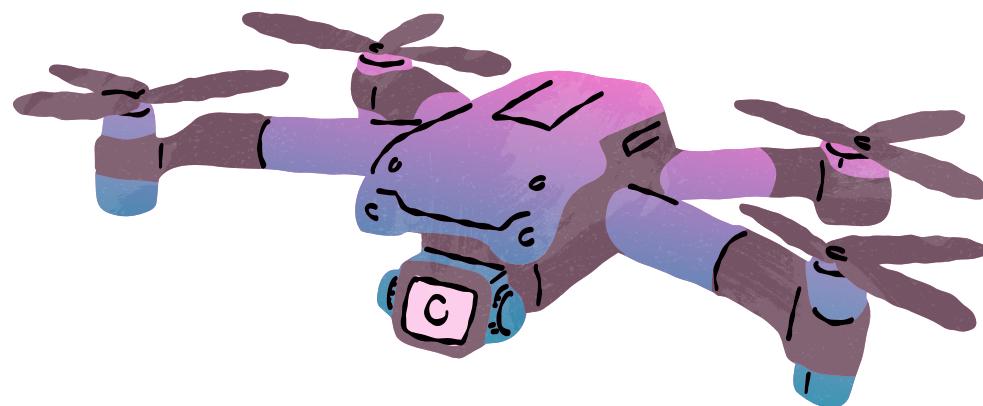
Know-How

MAUSER.PT
TUDO PARA
ELECTRÓNICA

Mauser

Components

Partners



-
-
-
-
-
-
-
-
-
-

THANK YOU



Website



Video