

On-Edge Artificial Intelligence Architecture for Real-Time Bird Identification for Ecosystem Protection



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VICEPRESIDENCIA
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Y EL RETO DEMOGRÁFICO



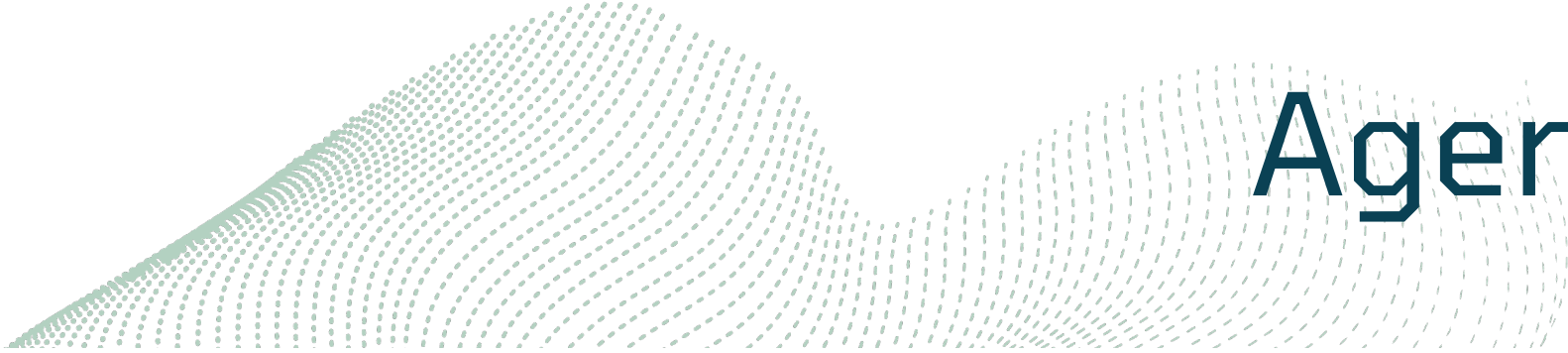
Plan de Recuperación,
Transformación
y Resiliencia



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1. **Introduction** – *Birds as keyplayers in ecosystems maintenance. Wind farms as a potential menace for protected species' survival rate.*
2. **Methods** – *AI and IoT architecture for birds-aware wind farms installation*
3. **Analysis** – *In Depth description of the IA4BIRDS software and hardware architecture*
4. **Results** – *Discussion and future work*

A decorative graphic at the bottom of the slide consisting of concentric, wavy lines in a light green color, creating a sense of depth and movement.

Agenda



Introduction

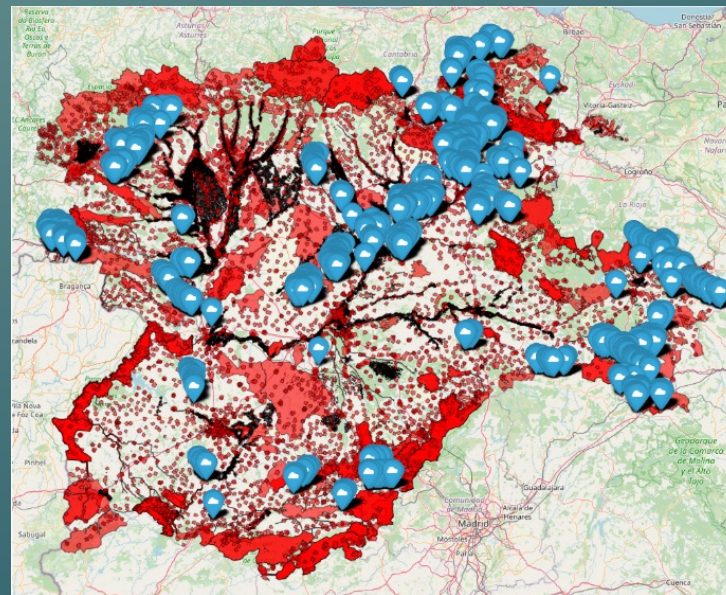


- At least 8,960 birds have died since 2020 in Spain after impacting wind turbine blades
- This is 60% of the birds officially killed by collisions with wind turbines since 2001 (14,922), which shows that the acceleration in the deployment of wind farms is triggering the loss of biodiversity.
- This numbers come from **human assessment** → does not consider predation of corpse and degradation

Between 2 and 4 million wild animals (birds and bats) could be dying in Spain after being hit by the blades of wind turbines [1]

Sonia Sánchez-Navarro, David Gálvez-Ruiz, Jens Rydell, and Carlos Ibáñez "High Bat Fatality Rates Estimated at Wind Farms in Southern Spain," *Acta Chiropterologica* 25(1), 125-134, (3 August 2023)

Windfarms pose a serious threat to birds survival due to their location and its' installation does not take into consideration wildlife.



Goal

Create an architecture able to detect and monitor birds through On-Edge devices on wilderness settings.

Sound detection

AudioMoth
Microphone
AI Sound recognition
XenoCanto / E-Bird

Image detection

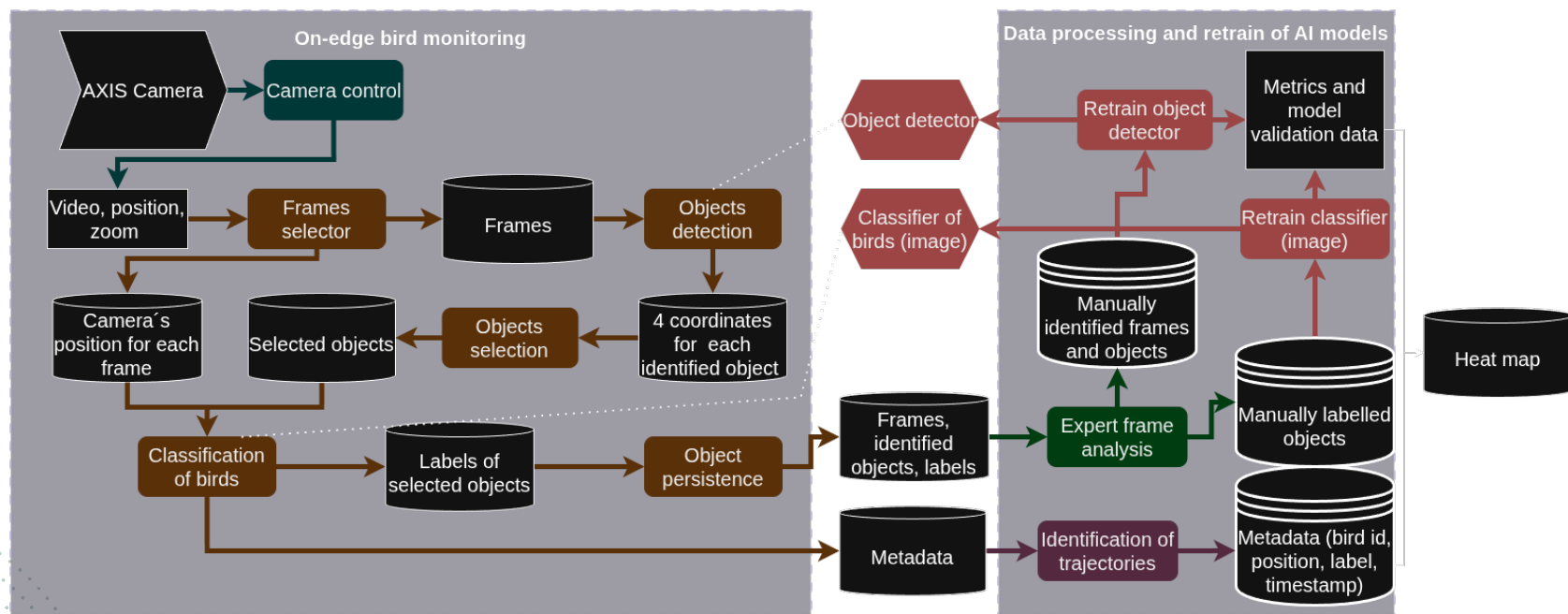
AXIS Q6625-LE PTZ
CAMERA
AI Image recognition
Custom dataset

Data Analysis and Integration

Public and Proprietary
Open-Source Data
Machine Learning



Methodology – video detection

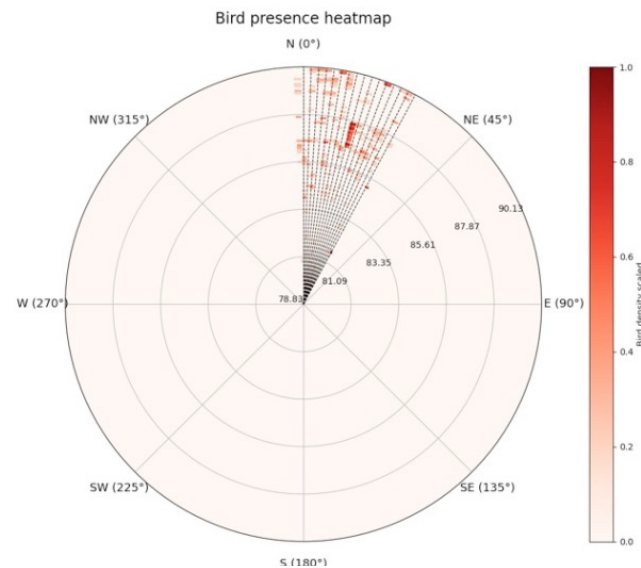


Methodology – video detection



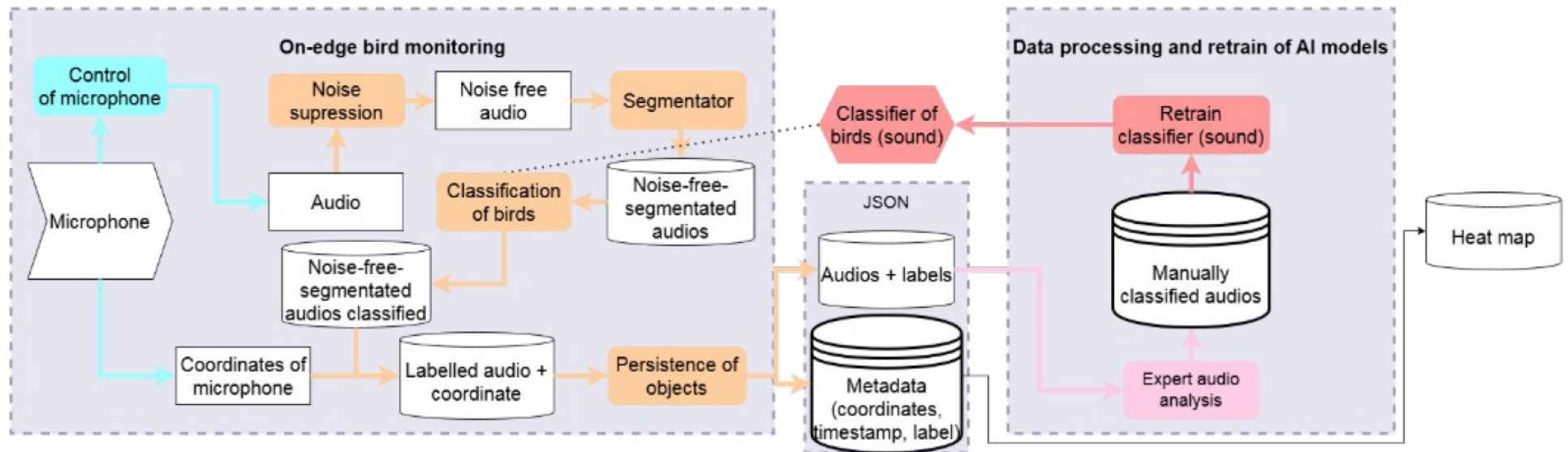
Birds on the sky heatmap

Capturing videos 24/7, detecting birds (YOLOv11) on the video and through azimuth and colatitude to train AI algorithms that create heatmaps of birds on the sky.

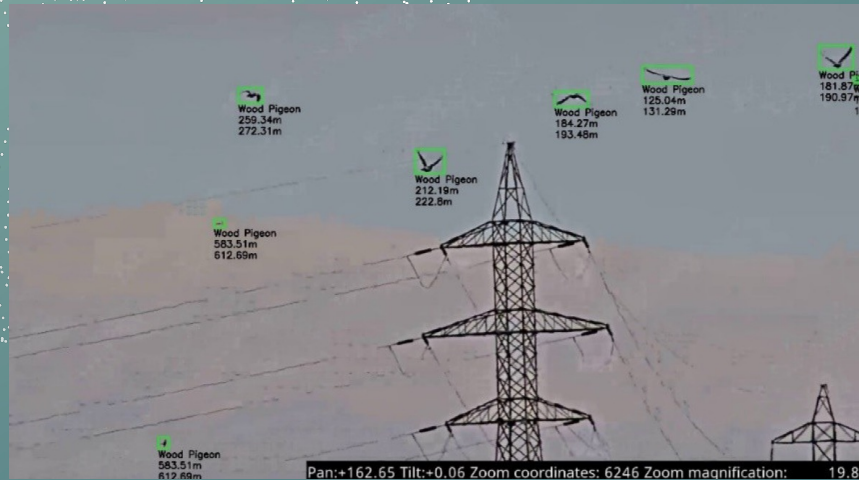




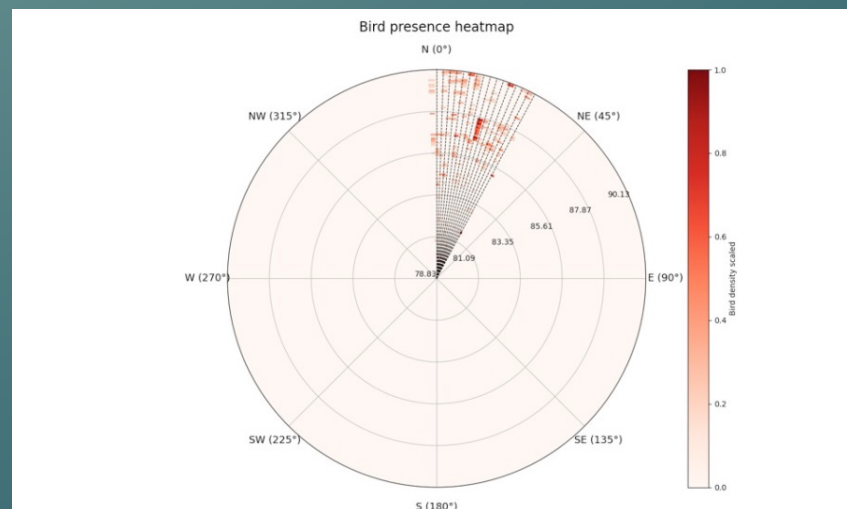
Methodology – sound detection



Results



- High precision on object detection
- Lower classification accuracy
- Distance estimation size-based



- Integration of image and sound provide tools for heat maps creation and wind-farm assesment
- Accurate representation throughout time of bird behaviour

Analysis and Conclusion



1.

Comprehensive Site
Assessment through
Data Integration

2.

Reliability of
Heatmaps and Model
Performance

3.

Limitations and Future
Improvements



Thank you!



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